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FOREWORD

Welcome to the 12th International Postgraduate Research Conference (IPGRC15), which is hosted by the School of the Built Environment, at the University of Salford, Media City Campus. The school currently has over 200 postgraduate Researchers engaging in Full Time, Part Time, Professional Doctorate, Split Site and online doctoral programmes, enjoying a vibrant and multicultural research environment with researchers from diverse backgrounds.

This conference creates a wonderful opportunity for researchers from Salford and other parts of the world to share their research interests, and outputs and to network and interact within a professional and friendly environment, with high profile academics and leaders within the built environment.

This year's conference brings together participants from a broad range of countries including the UK, Turkey, UAE, South Africa, Hong Kong, Iraq, Saudi Arabia,

The conference received over 141 paper and poster abstracts, and accepting 74 papers and 13 posters covering the following themes:

- Business, Economics and Finance
- Design and Urban Development
- ICT, Technology and Engineering
- People, Skills and Education
- Property and Project Management
- Sustainability and Environmental Systems

These themes bring to the surface the diverse nature of Built" Environment research, which contribute towards innovative, challenging and timely issues facing the construction industry and various stakeholders within academia and industry.

On behalf of School of the Built Environment, the conference Co-chairs & organisers, we wish you an enjoyable and fruitful experience and thank you and your sponsors for your attendance and for making this conference happen.

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Importance of Knowledge Capturing (KC) in the Design Briefing Process in the Construction Industry

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Abstract

Construction is a major contributor to UK GDP (directly 8.5% in 2008, rising to 10% overall when the entire value chain is considered) and a driver of historical GDP growth. The sector employs over 3 million people in a multitude of roles representing 8% of UK employment and a significant proportion of construction employees. The construction industry operates in stages and one of which is the pre-design stage. The pre-design stage is an important phase of the construction process because this is where the client brief is written up and major decisions are made. An effective client briefing process is important to the attainment of client objectives with respect to time, cost and quality for construction projects. Through a critical review of literature. Research shows that despite several research conducted in the area of knowledge management, it has unfortunately, not been matched by parallel empirical research on the processes, challenges and benefits of knowledge capture (KC) in the design briefing process within the construction industry. As a result of this, many projects end up under performing and not matching up to the expected goals and objectives highlighted by the client. This goes on to ascertain that inadequate attention given to the knowledge capturing process during the design briefing can be a major deterrent to the output of a construction project which can in turn lead to highly dissatisfied clients and loss of contract for some organizations. This paper presents the importance and likely barriers associated with knowledge capturing during the client briefing process and the impact poorly run design briefing process has on the output of a construction project.

Keywords:

Design briefing, Knowledge capturing, Requirement elicitation

1. Introduction

Inadequate time given to the briefing process is partly one of the major reasons responsible for the level of client dissatisfaction with the construction of buildings in the construction industry (Olusegun and Omodunbi, 2008; Bowen et al., 1997). The concept of briefing is regarded as being one of the most critical and important factors in determining client's satisfaction and project performance. Given the apparent importance of the briefing process for project success and the project teams' inability to properly ascertain the client's needs, the question arises: what factors militate against effective project briefing? The development of the design brief is a process of clarifying the objectives and requirements of a project from the client's perspective. One of the fundamental objectives of the requirement elicitation process in the design briefing stage is for clients to communicate to the design team and specialist consultants their needs and objectives in initiating the project (Bowen, 1999), the emphasis being on the objectives of the client rather than on the provision of solutions (O'Reilly, 1987). Proper and effective briefing is founded in the clear definition of the client's requirements and their communication of such to the design team. Recent studies (Lindahl and Ryd., 2007; Yu et al., 2006) show that the briefing process still poses challenges to the construction process and this is evident in the communication and information exchange between client, architect, consultants, facility managers, and the users of the facility. Although, client and user representation is considered to be a critical success factor of the briefing process (Yu et al, 2006), little attention has been paid to the actual process of engagement from a client perspective. Improper elicitation and documentation of briefs is often one of the reasons for dissatisfaction amongst clients when the information contained in it are insufficient to produce an accurate design solution. This shortcoming can manifest itself in the ultimately poor performance of the resultant building (Bowen, 1999). According to Salisbury (2013), inadequate requirement elicitation and documentation is probably the main reason why buildings have been wasteful of resources or defective in use. This inadequate briefing culture can arise from the nature of the parties involved in the briefing process or out of the design problem itself. Briefing has become a highly complex task, needing to match the increasing complexity of client organisations and the parallel complexity of building projects (Wapukha, 2013).

Lee et al., (2005) describe the construction industry as an essentially information intensive industry where most knowledge comes from the successful completion of projects. With the increasing pressure for competitiveness on construction organisations, it is necessary to capture, transfer and reuse project knowledge and use lessons learned from previous projects to improve project performance. Given the complexity of construction-related projects and client organisations, cross-boundary knowledge transactions are of growing importance and the onus on fragmented organisations to share knowledge to deliver client solutions is necessary. The reliance on project participants to share knowledge in order to succeed in project delivery has never been greater (Rebeiro, 2009). Thus, the need for Knowledge Management (KM) in the construction industry is fuelled by the need for innovation, efficiency, improved business performance and client satisfaction. In this knowledge driven global economy, knowledge itself can be seen as a commodity that offers the only 'true sustainable competitive edge'. If knowledge is effectively managed i.e. collected, structured and disseminated, it will bring significant benefit to organisations, with potential benefits to the wider construction industry (Gould & Joyce, 2009). Through a critical review of literature, this paper will investigate the importance of knowledge capturing (KC) in the design briefing process in the construction industry. Section two will be looking at the construction process and the place of the design brief in the constriction process. Section three will be analysing what the design brief is, what a brief is and what requirement elicitation is about. Section four will be addressing the importance of KC in design briefing in the construction process, drivers for the design briefing process and the challenges that exist in during design briefing. Section five concludes the paper with a summary of the importance of design briefing in the construction process and future research opportunities.

2. Construction Project Process

The construction process consists of all the processes that prepare for or result in a planned construction or renovation. The concept involves many different types of processes, core processes, administrative processes and public processes. In traditional construction process, the building process is divided into stages, concept, briefing, planning, production, and management of the finished building. The fundamental objective of creating these stages is to foster control, division of responsibility and cost management. In reality, the different phases have large overlapping areas during implementation. One of the fundamental and important tasks that are carried out at the initial stage of the construction process is the design briefing (Kamara et al, 2002). During the early phases of the building process, the briefing phase in the project conception stage extends into the design stage and construction stage; that is concept development phase/conceptualisation and even into the design and planning phase (Ryd, 2004).

In general, when a construction project is initiated, a Facilities Planning and Construction project manager is assigned to the project, and a building committee is formed to oversee the project development until completion (Kamara et al, 2002). The life cycle of a project involves the following phases:

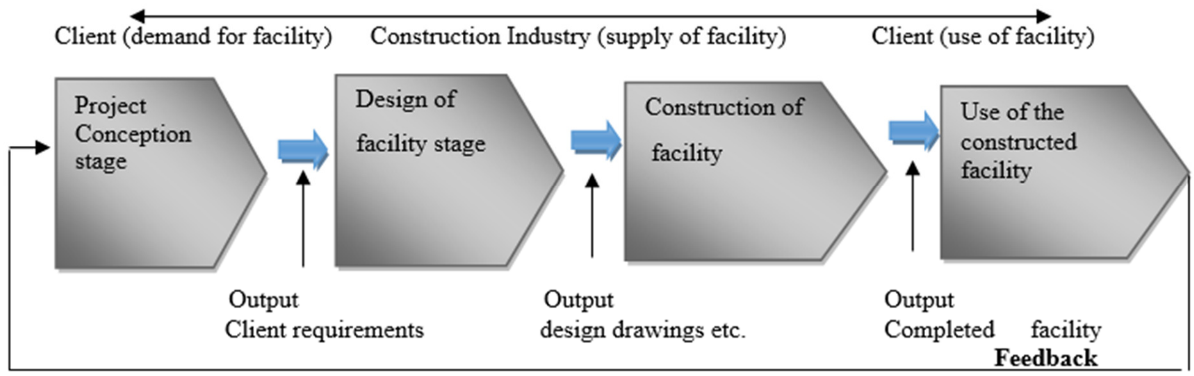

Figure 1 Simplified model of the construction process (RIBA, 2013)

These phases are common to all new construction and renovation projects; however, in smaller projects, the phases often become less formal, involve fewer individuals and may have a short schedule of only a few months. Large projects, on the other hand, may take years from the time they are envisioned to the time "move-in" takes place. The process shown in figure 1 typifies a simplified construction process in the construction industry; however, one of the first stages in the project conception stage is the design briefing process in which the client's objectives are identified and their requirements elicited by construction professionals, which is then documented and baseline before progress is made to the detailed design stage. The next section further buttresses what the design brief is and its impact in the construction life cycle.

3. Design brief

Briefing, also known as architectural programming in the USA and Asia, is the process whereby a client's requirement is clarified and the design team is informed of their needs, aspirations and desires, formally or informally (CIB, 1997). It creates a channel to convey decisions and information between clients and consultants such that a better understanding of their requirements and preferences at the project inception stage can be achieved (Jenkins et al., 2012). Smith and Jackson (2000) further posits that briefing is the process of capturing the purpose, objectives, intended use, requirements and desired qualities of a construction project, resulting in an output document: the client's brief. Furthermore, the brief provides the design team with data to commence their design, without the preservation of their artistic expression. Since the brief is the explicit reproduction of the client's needs, and serves as a guide and check list for the output of the various phases in the process, it has strategic value towards the end result of the project. Some other authors defined the brief which is a product of the briefing process, as a formal document containing the written instructions and requirements of a client for a building project (MacPherson et al., 1992; CIB, 1997; Blyth and Worthington, 2010; Kamara and Anumba, 2001 and Kamara et al., 2002).

Gould & Joyce, (2009) stated that at every first stage of a construction project, a brief is created. The brief is a document where the requirement of the building to be constructed is stated. Some of the properties of this document include the functions of the building, what particular spaces are needed and so on. Constructing excellence (2004) defined briefing as 'a process by which client requirements are investigated, developed, documented and communicated to the project board responsible for the construction'. These requirements need to be agreed and signed by the client before progress is made for design. Every project is preceded by a brief, though the quality can vary considerably. Good briefing is not easy to achieve, yet it has been suggested that improvements to briefing lead to clients getting better buildings Gould & Joyce, (2009). According to Salisbury (2013), the briefing process is composed of elicitation and communication of the client requirements and exists in two types, 1. Strategic brief: this is a document that communicates the overall project scope, aim and objectives; the key issues in this briefing are the success parameters, budget and programme, 2. Project (functional) brief: this is the functional statement and operational needs for the construction of the project. The development of the brief is the process of clarifying the objectives and requirements of a project.

There are two schools of thought relating to construction project briefing. One approach considers the brief as an entity in itself, which should be frozen after a critical period; hence briefing becomes a stage or stages in the design process (Yu et al., 2007; RIBA 2013). The second approach regards the brief as a live and dynamic document that develops iteratively in a series of stages from an initial global brief. Briefing is thus deemed an on-going activity that evolves during the design and construction process Yu et al., (2007). Different factors affect the way briefing is developed and carried out and these factors relate to the type of information that is required which depends on the nature of the project, size of client and the nature and skills of the design team (Morledge & Smith, 2013). Effective client briefing is now regarded as fundamental to the production of buildings which satisfy not just functional needs but also reflect user preferences in relation to the environmental qualities they create. Also, briefing has become a more involved process due to the increasing complexity of both client organisations and buildings themselves. One of the primary processes carried out during the briefing process is the elicitation of client's requirements and this process involves the use of certain knowledge capturing tools for the process to be effective.

3.1. **Requirement elicitation**

This is a process where professionals from the construction company meet with the clients in order to come up with the requirements. The professionals who may be involved in this process include; architects, development managers, engineers, project managers and quantity surveyors among other professionals. They used different methods of eliciting the requirements from the users such as interviews, workshops, evaluation of current facilities among others. The professionals will put together the requirements they have collected and come up with sketches and drawings. This drawings and designs are used to clarify the needs and requirements of the clients. If the clients are well experienced in the design process, they will come up with their designs and requirements for the project. This makes the process of collecting requirements easier to the construction company (Morledge & Smith, 2013). Requirements elicitation is all about learning and understanding the needs of users and client's with the ultimate aim of documenting the requirements and communicating these requirements to the design team. A substantial part of elicitation is dedicated to uncovering, extracting, and surfacing the wants of the potential client's.

Effective elicitation of requirements is arguably among the most important and highly recommended good design briefing practices (Morledge & Smith, 2013). Requirements elicitation itself is a very complex process involving many activities, with multiple techniques available to perform these activities. The multidisciplinary nature of requirements elicitation only adds to this complexity. Elicitation is subject to a large degree of error, influenced by key factors ingrained in communication problems. Despite the importance of requirements elicitation within the design briefing process, insufficient attention has been paid to this area in industry and software engineering research to date (Zowghi and Coulin, 2007). This session has been able to create an understanding on what design briefing is, the process involved in briefing and what requirement elicitation does in the design briefing process. For all this to make better sense, the next section seek to reflect the value and importance the design brief has on the construction process and in the delivery of overall performance in the construction industry.

3.2. **Importance of Design Briefing**

Briefing is a process of developing a deep understanding about the client's needs and it is a continuous interaction and involvement of the client where in this process, the role of professional team is very important. Through good briefing and grasping what the real needs are, client and construction professional can work more effectively and productively on project and make decisions confidently Given that clients can potentially affect the success of the project, and the importance of briefing to the attainment of client satisfaction, it must be noted that problem areas are often associated with the nature of the client. In the briefing environment, effective communication between the client, the user of the building, the design team, the contractor, and specialist consultants, is critical (Shanmugam et al., 2006). According to Murray *et al*. (1990), it is important to note that the client can assume responsibility for initiating, directing and maintaining effective communication during the briefing process. Clients, end-users, designers and contractors do not always have the knowledge, experience, skills and attitudes to enable them to interact as a team for the resolution of problems. In essence, unsatisfactory design solutions can result from ineffective communication between the client and the design team and one of the main factor behind communication difficulties is the nature of the relationship between the communicators (clients, professionals, users and procurement team) (Wapukha, 2013).

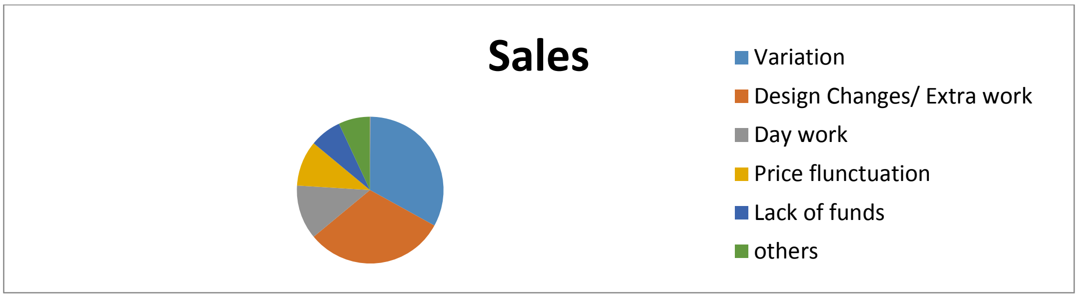

Figure 2: Breakdowns of Cost Overrun (Shanmugam et al., 2006)

Shanmugam et al., (2006) identified two basic factors that contribute to cost and time overrun, these are; Variations in construction projects and Design changes (which is as a result of changes made due to mistakes or client request). Figure 2 identifies some of the factors that are responsible for cost and time overrun and shows a percentage break down of the cost overruns. It can be seen from the above analysis that the significant cost overruns are mainly due to Variation and design changes. The sources of variations and extra work can be classified into client initiated variations and unforeseeable variations. The main reasons behind the higher percentages in variation and design changes or extra work are identified as changes during the construction stage which could arise as a result of improper management, ineffective communication and incorrect assessment of the design brief. Wapukha (2013) in his research study stated that one of the major problems confronting the global construction industry is the briefing of the client whom a project may encounter. The main reason why there is a problem with the clients, stakeholders and the design team is because not much attention is given to the needs of the clients. The process of acquiring what the client needs is very important and must be taken seriously. The impact of decisions made will affect the client because they are the end consumers of a given products. They are also going to be affected financially since clients may be the major sponsors of the project (Kelly, Male & Graham, 2008). Certain barriers do exist in the design briefing process and if these barriers can be exploited and overcome, they will be become an organizations strength and opportunity for better performance. The next session discusses the barriers that occur in the design briefing process.

3.3. Barriers to the Design Briefing process

Bowen et al., (1999) carried out a research to identify associated challenges or barriers that occur during the design briefing process, they were able to gather responses from different team members involved in the requirement elicitation process. They stated that often a lack of understanding on the part of clients about the design and construction processes could be a challenge. Clients are said to lack general experience; for example, being unfamiliar with local authority regulations and town planning issues. Clients frequently fail to provide a comprehensive listing of their project requirements. Also, clients do not fully understand their own roles within the building process, as well as legal and financial considerations. Insufficient time is devoted to the briefing process and, in some cases, briefing is prematurely initiated before alternatives have been analysed by the client. Instances of personality clashes, the vagueness of the brief, and the inexperience of the client, were cited as exacerbating factors. Other barriers to effective briefing include vagueness on the part of the client in terms of requirements, insufficient time being devoted to the briefing process, briefing team members being under-qualified for their roles, and inadequate guidance being given by the principal agent.

Some clients appear to be inflexible and reluctant to heed advice from their professional consultants. A lack of clarity with regard to communication networks between consultants is also perceived to be a barrier to effective briefing. A perceived lack of transparency in the briefing process was cited as a barrier to communication between professional and clients. Interesting further research might be indicated by this perception. Sometimes, clients do not participate in the briefing process due to their lack of knowledge regarding what they wanted, their lack of understanding of the briefing process itself and the roles and responsibilities of the professional team members. Barriers to effective communication between participants to the briefing process also appear to exist. The implication is that these barriers to effective briefing may impact negatively on levels of client satisfaction with their buildings (Bowen et al., 1999).

All the above identified challenges that exist in the briefing process need to be addressed properly and if exploited rightly, will develop as a major strength and opportunity for the project. During the design briefing process, knowledge is exchanged amongst the parties involved in the requirement elicitation phase that is the clients and the design team. However, for this knowledge to be properly elicited and documented, certain KM techniques are used to effectively clarify client's requirement and document them properly (Jenkins et al., 2012). One of the document produced in the design briefing process is called the brief, which is developed during the briefing process. This document needs to be signed and agreed between the client and the contractor before progress is made on the project. The next section sheds more light on what knowledge management is and how KC a subset of KM can effectively impact the design briefing process.

4. Knowledge Management

Organizations are coming to terms with the fundamental reality that most of the knowledge impacted or developed by some individuals either through experience, trainings and other modes of knowledge transfer mechanisms has been lost as a result of turnovers, which has created a gap in knowledge storage and exploitation. Some of these professionals move to different organizations having ingrained themselves with tacit knowledge as a result of years of experience, and this has widened the knowledge gap and created high level shortage in knowledge storage and exploitation hence the idea of knowledge management. The management of knowledge has received increased attention and interest as it reflects that academia recognizes the fundamental economic changes resulting from the availability of knowledge and how it affects an organization's performance strategy (Carneiro, 2003). Through KM, organizations seek to acquire or create potentially useful knowledge and to make it available to those who can use it at a time and place that is appropriate for them to achieve maximum effective usage in order to positively influence organizational performance (King, 2009).

In today's knowledge economy, knowledge is increasingly being considered as an asset that needs to be effectively managed to create added wealth to an organization (Lin and Lee, 2011). However, knowledge, unlike natural resources and other physical capital, is not depleted when it is used; but instead it creates an opportunity for further growth, refinement and marketability. Within the architecture, engineering and construction (AEC) industry, companies are beginning to realise the importance of capturing knowledge accrued on projects to improve the quality and effectiveness of future projects (Egan, 1998). In the construction environment, KM is a discipline that promotes an integrated approach to the creation and generation, capture and storing, sharing and communication, transfer and reuse of knowledge of a particular field obtained from projects experiences which has been previously undertaken. (Lin and Lee, 2011). Knowledge can be seen as a key source of advantage. Its importance has been recognized for a long time. Drucker (1995) wrote that "knowledge is the only meaningful economic resource". It follows that for organizations, individuals and society, the processes by which knowledge is created or acquired, communicated, applied and utilized must be effectively managed. Nonaka and Takeuchi (1995) identified two types of knowledge in knowledge management which are the tacit and explicit knowledge.

4.1. **Tacit and Explicit Knowledge**

In organizations, knowledge is often times embedded not only in documents or repositories but also in organizational routines, processes, practice and norms which brings us to the idea of tacit and explicit knowledge. Tacit knowledge, as stated by Polanyi (1966), is the fact that people tend to know more than they can usually tell. This type of knowledge resides within people and may be embedded in organizational and social processes, building cumulatively within the organization and it is however difficult to unravel and transfer between organizations. This body of knowledge further gained traction through the work of Nonaka and Takeuchi (1995) in The Knowledge-Creating Company which described tacit knowledge as a highly personal and hard to formalize knowledge which makes it difficult to communicate and share with others (Szulanski et al., 2004).

Explicit knowledge on the other hand is a type of knowledge which is codified, transferable and relieved with ease (Polanyi, 1958). This medium for communicating such knowledge includes documents, repositories, graphs, diagrams just to mention a few (Bhagat, et al., 2002). In transferring knowledge across organizational boundaries, organizations must solve 'the boundary paradox' - their borders must be open to flows of information and knowledge from the networks and markets in which they operate (markets which increasingly blur traditional boundaries), on both formal and informal bases, whilst at the same time the organization must protect and nurture its own knowledge base and intellectual capital. It is upon the dynamic preservation of the latter that survival depends. During the requirement elicitation process in design briefing, certain knowledge exists in the elicitation process and these knowledge needs to be captured effectively for better performance. The next sub topic discusses KM in design briefing.

4.2. **Knowledge Capture in Design Briefing**

KM during the briefing process follows the established generic system (Ibrahim et al., 2006), summarised in six processes (Turban et al., 2011) i.e. capture knowledge, refine knowledge, store knowledge, manage knowledge, disseminate knowledge and create knowledge as depicted in the figure 3 below:

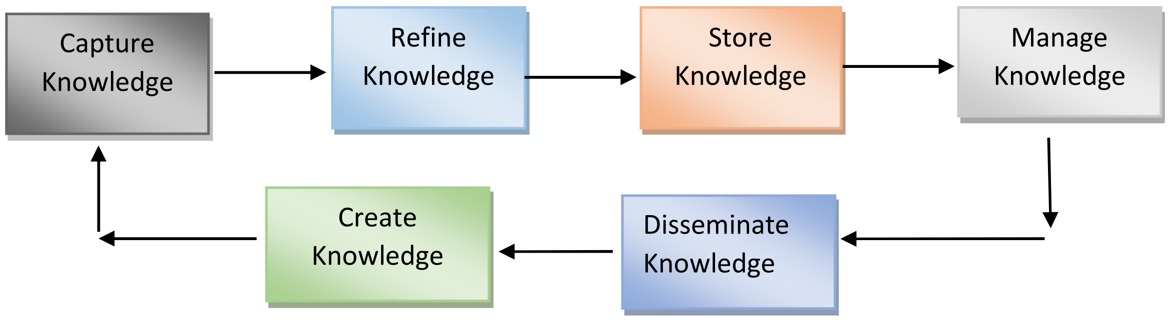

Figure 3. Cyclic Model of Knowledge Management System (adapted from Turban, 2001)

For the purpose of this paper, emphasis will be placed on the importance of knowledge capturing and elicitation in the design briefing process coupled with the fact that it instigates every requirement elicitation process in design briefing.

Hari et al (2005) defined knowledge capture as a process through which knowledge is recognised from its source, examined and in accordance with the organisation's strategy. Appropriate techniques and technologies are implemented to retain the knowledge, which is filtered, banked, disseminated and updated. Powers (2005) suggests that one of the first steps in capturing knowledge is to identify the critical knowledge that might be at risk in the organisation as a result of downsizing or retirements. Collison and Parcell (2001) put forth their views that knowledge capture means capturing know-how in such a way that it can be reused. There needs to be a link between capturing knowledge before, during and after an event, project or task has been executed; and in terms of accessing what has already been captured. Train et al., (2006) reports focus on efficiency and effectiveness to drag the construction industry out of its perceived low productivity growth. Interestingly, these reports acknowledge the need for construction industry to better manage knowledge that resides in the supply chain, with the clients and internally within construction firms.

Clients are becoming more sophisticated, insisting on better value for money, and demanding more units of construction for fewer units of expenditure (Egan, 1998). The demanded products are also becoming more complex, with increasing emphasis on environmentally friendly facilities. The fragmented nature in which the industry is organized means that efficiency in project delivery is less than expected, resulting in dissatisfied clients, and low profitability for construction firms (Hari et al., 2005; Carrillo *et al.*, 2004). In addition to the many initiatives that are being introduced to address these issues, the effective management of project knowledge is now seen as vital in enhancing project performance in construction projects. Becerra-Fernandez et al., (2004) defined knowledge capturing as the combination of knowledge elicitation and knowledge representation. During the design briefing process, knowledge elicitation is carried out by capturing client's requirements which is useful and important information from the users and this process represents the starting base of a good design brief. Certain knowledge do exists during the design briefing process and these knowledge must be adequately captured, elicited and properly documented for informed decision making for better performance. For the purpose of this paper, the researcher will focus on the impact of knowledge elicitation in the knowledge capturing process. The operational definition of Knowledge capturing for the purpose of this paper involves the process of eliciting and documenting the clients/users requirements during the design briefing process for the purpose of improve performance within construction projects.

4.3. Barriers to Knowledge Capture

Collison and Parcell (2001) suggest that knowledge capture means capturing knowhow in such a way that it can be reused. There needs to be a link between capturing knowledge before, during and after the event/project/task has been executed; and in terms of accessing what has already been captured. A few challenges have been identified through a thorough review of literature from the social and technology perspective for knowledge capture. Some organizations feel that the knowledge capture Return on Investment (ROI) figures do not generally add up, so knowledge capture initiatives are relegated to the level of a "luxury item", and therefore something to be considered in the future (Lee et al., 2005). This has made other organization adopt the "wait and see" approach with regards to the uptake of knowledge capture initiative. This approach has created a gap and a continued loss in vital knowledge capital and competitive advantage daily (Lee et al., 2005).

Some of the other barriers that occur in knowledge capturing is lack of capturing clients and (or) supply chain knowledge in an effective formal way. Most knowledge capturing processes are not given the adequate attention and formality required to make the process efficient (Achammer, 2009). Another barrier identified is the type of organisational culture encouraged for knowledge capture. If an organization does not create a suitable culture that supports knowledge capturing, this could demean the potency and power of knowledge capturing in an organization. Another identified barrier that occurs is that most knowledge capturing process does not consider wealth of techniques available to adequately capturing knowledge. During requirement elicitation in design briefing, several knowledge capturing techniques need to be identified and used in order to ascertain the effectiveness of such techniques. Lack of process for knowledge capture is another essential protocol that needs to be addressed as many KC process does not take into consideration the process involved in knowledge capturing. This should include a pre-process and a post process review process and should be adequately documented for reuse in the future. The benefits of proper KC should also be identified and spelt out to encourage the organization see the importance of properly capturing knowledge. Another challenge identified is the lack of time allocated to knowledge capturing process. The more time allocated to the knowledge capturing process, the more quality document would be produced from the process. This can be made possible by the support of management; however, lack of management support can also contribute to less effective knowledge capturing process (William and Walter 2014). Barriers to knowledge capturing in the construction industry shows that this could be a major deterrent to the progress of construction projects and delivery of quality output. The next section investigates the importance of knowledge capturing in the construction industry.

4.4. Importance of Knowledge Capture in design briefing

KC initiatives provide opportunities for organisations to innovate, improve project methodologies, cut costs, save design time and reduce time to market. Knowledge is a complex concept which consists of information and skills acquired through experience. Knowledge represents itself in truth and belief, perspective and judgments, expectations and methodologies and exists in individuals, groups and in organisations, in various forms. Capturing client's requirements using KC techniques during design briefing is vital for the competitiveness of an organisation as well as performance. The type of decisions made is based on the quality of information elicited from clients during the design briefing process (Hari et al., 2005). The Information Technology Construction Best Practice (ITCBP, 2004) suggests that discussions about knowledge management usually refer to the need to capture one or both of the different types of knowledge which are the explicit and tacit knowledge. Explicit knowledge is the very factual information that is relatively easily to document, i.e. a list of experts; telephone numbers, and details of previous contracts for a particular client; methods of repairing a common fault, and so on. Tacit knowledge is much harder to address. It refers to the more subjective approaches people take in situations where there may be no single right or wrong answer. Tacit knowledge is seen as one of the keys to why a particular organisation is successful.

Knowledge capturing in the design briefing process involves use of both tacit and explicit knowledge. One of the key benefits of knowledge capturing in the design briefing process is the ability to elicit requirements from clients which is knowledge embedded in the mind of the clients in relation to the anticipated building they have in mind and these requirements needs to be properly documented (explicit) in such a manner that the design team can produce quality designs. It has been identified that one of the major reason behind defective designs can be traced to inadequate time given to the briefing process and this can account for the high level of increased cost and delay in project delivery. Quintas (2004) suggests that knowledge capture could lead to better problem solving and higher client satisfaction and improvement in the design briefing process in the pre-design stage of construction projects. As a result, giving adequate time to the design briefing process can reduce the level of design mistake that occur in the construction process and also improve the quality of output produced at the end of the project. However, no matter the amount of time given to the design briefing process without the right knowledge capturing tools and techniques, it could most likely lead to a frustrating activity which could impact on the overall objective of the briefing process. This goes to highlight the importance of knowledge capturing in the design briefing process and shows that no matter the quality of knowledgeable professionals and client present at a briefing meeting, the knowledge management strategy used to address the process has a major significance on the productivity of the process.

According to Achammer (2009), the costs of briefing cost about 1.5% of the total life cycle costs of the project. However, this relatively small amount immensely influences the performance of the overall costs, which can rise up to more than 80% of the total life cycle cost. When a project commences, the costs for changes are still minimal, but as the project progresses, there is an increase with the cost of changes that occur to the project. This is why it is very essential to capture the necessary knowledge available at the early phase of the project by properly eliciting requirements and documenting them properly. One of the underlying challenges discovered is the lacking willingness of today’s clients and professionals to invest into the pre-design phase and this can be addressed by proper and adequate insistent communication between clients and professionals.

The intention of every client is to build an excellent and unique building. However, the definition of excellence is subjective and varies within the different decision makers and the planners transforming the wishes into the build reality. “There can´t be an excellent building without knowing what´s excellent”. The design briefing process uses several knowledge capturing methods to make these different pictures transparent and decreases the variety of diverse imaginations. The design briefing process provides the basic discussion and supports the development of clearly defined goals. Gould & Joyce, (2009) stressed the importance of involving the user (client) in the writing of the program because they have unique and specific requirements for that particular project. Client’s understanding may vary when it comes to building processes, as a result, those owners who seldom occupy themselves with building projects often need guidance and assistance from the professionals hired to produce the design brief (program) and the design. In such cases, the professional may need to take more initiative in involving the owner in the design briefing process. Conversely, owners that are more familiar with the building process do not need as much assistance since they are already familiar with other building projects. This does not, however, rule out the importance of design brief and effective requirement elicitation process. Once the decisions have been made in the pre-design stage, they cannot be easily changed in other stages. This means that early stages are very critical to the success of the project and it is vital that decisions are made cautiously. This is a stage that requires all the stakeholders' involvement, clients and expertise of the design team (Wapukha, 2013). The pre-design stage is the most critical phase in the construction decision making process, however, if the knowledge that exists between the professionals and the clients is not properly elicited and documented accurately, it may lead to deficiency in performance output and this can also lead to dissatisfied clients and a bad reputation for the organization.

5. Conclusion

The brief is the decisive interactive element in which the client's needs and requirements are translated and incorporated into the building process. If this process can take place in a way that strengthens and develops relationships in a positive way, there is every chance that the brief will also improve and strengthen the client's business activity. Today more and more professionals consider briefing to be an important factor for project success. Thus, it is important for practitioners to have a better understanding of the critical success factors for briefing and the interactions between them. Improper design briefing is a challenge to most of the construction projects. Without a proper communication strategy between clients, stakeholders and design team, the project output might experience failure and under performance. It is necessary and essential to ensure adequate design briefing at the conception stage of every construction process. The clarity of client's requirement and the proper documentation of the requirements in the design briefing process would most likely help construction projects improve performance delivery. This goes on to say that more attention should be given to the design briefing process in the construction process because of its importance in improved performance delivery. Capturing knowledge that exists in the design briefing process through elicitation helps in problem solving, managing change, increased performance, satisfied clients, higher bidding power, to name a few. The effective implementation of knowledge capturing could reduce costly mistakes and ensure improved services to clients. Knowledge capture enables organisational growth as a result of number of successful projects completed. Knowledge capture is not about a one-off investment. It is an investment that requires consistent attention over a substantial period of time, even after it begins to deliver results. More research effort needs to be targeted at improving knowledge capturing in the design briefing process and identifying effective knowledge capturing tools and techniques that are more efficient in the requirement elicitation process in the construction industry.

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A Theoretical Framework for Successful Physical Regeneration Projects involving Historic Assets and the Private Sector Development Community

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Abstract:

The use of heritage assets in regeneration projects is seen as a key urban regeneration initiative in the United Kingdom by central government due to their potential to regenerate derelict sites and stimulate economic activity in an immediate locality. However a plateau or fall in public and private sector investment and the abolition of quasi public sector Regional Development Agency organisations who were significant investors in heritage is affecting the current process of delivery of these projects. The researcher is a member of the private sector development community which has led to the desire to investigate the reasons why some regeneration projects involving historic asset's and the private sector development community are successful whilst others fail. The ontological and epistemological positioning of the research project is the adoption of a pragmatic ontological stance associated with mixed-methods research. A two-stage data collection strategy will constitute a first stage data collection method of semi-structured interviews followed by comparative case studies analysis. Data analysis will be achieved via content analysis where findings will be presented in a theoretical framework for use by the academic community, current practitioners and those involved with the development of public policy. The research paper will provide a justification for selection of this topic for doctoral study, include an overview of the proposed research strategy, update on progress to date and outline the steps required to complete the research project.

Keywords:

Historic Assets, Mixed Methods, Pragmatism, Theoretical framework, Successful Regeneration

1. Introduction

The use of heritage assets in regeneration projects is seen as a key urban regeneration initiative in the United Kingdom by central government due to their potential to regenerate derelict sites and stimulate economic activity in the immediate locality. (Communities and the Local Government, 2010). English Heritage, the government's statutory adviser on the historic environment, argues that there is a strong economic case for regenerating historic assets and that they can play a central role in achieving successful regeneration (Deloitte et al, 2013). Bullen and Love (2011) argue that there is growing acceptance that conserving heritage buildings provide significant economic, social and cultural benefits. Cleaned-up and recycled architecturally interesting buildings can lend character when senstively integrated into a development programme (Jones and Evans, 2008).

Examples of private sector lead delivery of heritage lead regeneration projects include the Fort Dunlop building, Birmingham where a 376,000 sq.ft former tyre factory was regenerated into a mixed-use commercial, retail and leisure development. The completed development has attracted £40 million of private investment with 2,000 people now employed at the site (Amion

Consulting, 2010). The regeneration of Gloucester Docks, a former derelict dockside has resulted in the restoration of 14 historic buildings and 12 hectares of derelict land. It has attracted £134 million of private sector investment delivering new retail, commercial, leisure and residential accommodation and delivered wider economic benefits including enhanced transport infrastructure and increased in visitor numbers to Gloucester town centre. (Amion Consulting, 2010).

The role of the private sector in delivering successful heritage lead regeneration is increasingly important. The move towards "neo-liberal" politics (Jones and Evans, 2008) resulted in a shift away from public sector delivery, to the private sector development community, who have been encouraged via policy and funding initiatives to engage and become lead developer in these projects. However a plateau or fall in public and private sector investment and the abolition of quasi public sector Regional Development Agency organisations who were significant investors in heritage, coupled with major changes in planning policy is affecting the delivery of these projects (Drivers Jonas et al, 2005). There were 1,400 heritage assets listed on English Heritage "Buildings at Risk" register in 2010 (Colliers et al, 2011).

Issues with the regeneration projects involving historic assets include the difficulty of estimating the costs of adapting historic buildings in comparison to new build projects and the perception that it more economical to demolish and reconstruct buildings than Treuse. (Bullen and Love, 2011). There are many challenges in securing investment in heritage assets and that generally they are not seen as a mainstream property investment by large financial institutions and property companies (Colliers et al, 2011). It has been claimed that it is considerably more expensive to re-use an old building than to create a new building (Jones and Evans, 2008).

2. The Proposed Research Problem

2.1. A Theoretical Framework for Successful Physical Regeneration projects involving Historic Assets and the Private Sector Development Community.

The research subject area is described above. The aim of the research project is to investigate why some regeneration projects involving historic assets and the private sector development community are successful whilst others fail and is guided by the following objectives:

1. Understand the evolution of the use of historic assets as a vehicle for regeneration.
2. Understand the current process of regeneration projects that involve historic assets and identify key factors of the process that affect project success or failure.
3. Investigate the role of private sector development community in these projects to understand what conditions are required to engage this community successfully in these projects.
4. Develop a theoretical framework as to why some physical regeneration projects involving historic assets and the private sector development companies are successful whilst others fail.
5. Verify the theoretical framework by completing comparative case study analysis of current regeneration projects involving historic assets.

In summary the intended focus is on gaining an understanding of why some projects involving the private sector development community to identify key drivers that contribute to the success or failure. The findings of the research project will be presented by way of a theoretical framework for use by academics, practicing professionals and those involved in the development of public policy in the subject area. This research paper will provide a justification for the chosen field of research, provide an overview and describe the key components of the research project, include an update of the researchers progress to date and outline steps required to complete the professional doctorate.

3. Research Rationale

The desire to complete this research project originates from the researcher being in employed in a development management role by a private sector development company since 2003. The role involved participating in regeneration projects involving heritage assets which proceeded to completion such as the Midland Hotel, Morecambe, (RIBA, 2010) whilst others, the Littlewoods Building, Liverpool have been stalled (Waddington, M, 2012). This places the researcher as an insider in that they have practiced in the subject area and due consideration is required to assess how this affects the structure of the research project.

4. Literature Review

An extended literature review was commenced at the outset of the project which included a review of current government policy, policy review committee minutes, academic and professional literature. The purpose of the literature review was to generate an understanding of the existing body of knowledge, to aid in the selection of research questions and to identify gaps in existing knowledge.

To summarise the findings to date of the literature review is that criteria for what comprises a historic asset is wide and varied and can be ‘all around us’ (Cowell, 2004) to include tangible and intangible items such as buildings, parks, streets, experiences, languages senses and memories. The value of historic assets in society was identified as an historical and cultural reference point (Mansfield, 2008, Wood and Muncaster 2012), however defining built heritage is described an as an increasingly broad category that embraces a diverse collection of phenomena (Tweed and Sutherland, 2007). Academic debate within the conservation community was focused on developing a holistic approach to the conservation and use of historic assets (Hudson and James, 2007; Burra Charter, 1979; Marquis, Kyle and Walker, 2004).

The definition of regeneration is wide and encompasses social, environmental and economic and not just physical transformation. There appears to be no single definition of what comprises successful regeneration where definitions vary according to each stakeholder perspective (Jones and Evans, 2008; Tallon, 2013; Rodney and Clark, 2000; Turok, 2005; Couch et al, 2003). Criteria for successful regeneration include good design, the project acting as a catalyst for further regeneration, the creation of a mix of uses in a locality and that the project requires no further public sector funding post project completion (Jones and Gripios, 2000; Inherit, 2007; Tallon et al, 2013; Deloitte et al, 2013; Guy et al, 2001; Adair et al, 1999; English Heritage, 2005).

Historic assets have been used effectively as a foundation for regeneration and play a central role in many towns and cities where the integration of these assets in regeneration areas has played an increasingly important and more successful role in regeneration schemes (ODPM, 2004) (Deloitte et al, 2013). The careful integration of historic assets provides a focus and a catalyst for change, creating significant benefits for local economies and communities helping to reinforce a sense of place in regeneration projects. The inclusion of heritage buildings can act as a focal point for a regeneration project that will attract tenants or occupiers seeking distinctive buildings providing economic, community and individual benefits to an area (Caschilli et al, 2011; Inherit, 2005; Orbasli, 2008; Jones and Evans, 2008)

There is evidence of private sector development community participation in the delivery of these projects who are attracted by the opportunity to generate a return on investment, to work with buildings of a high quality and to build relationships with public sector organisations (ODPM, 2004; Morley, 2002; Tallon et al, 2013). Some private sector organisations invest in regeneration projects due to the potential to achieve above normal profit levels where pockets of value can be identified (Adair et al, 1999; Bullen and Love, 2011).

The risks for the private sector of participation include hidden costs, uncertainty and the high costs associated with maintenance and restoration (Havard, 2008; Colliers International, 2011; Bullen and Love, 2011). Working with historic assets in regeneration projects is described as expensive to deal with by their very nature and considered as too complicated and difficult to work with, where owners and developers are nervous about protracted discussions concerning restoration and high maintenance costs (Deloitte et al, 2013; ODPM, 2004).

The involvement of public sector organisations as project partners appears to be important in that they can be sources of project funding and technical knowledge; however the review highlighted that these organisations are affected by a lack of resources and skills (Heritage and Regeneration UK Limited, 2009; Inherit, 2007; Jones and Gripios, 2000; HM Government, 2004). Creating effective partnerships appears to be a key factor to ensure commercial viability and attract private sector investment (Short and Kim, 1999).

There is a need to engage in effective consultation with the local community and key stakeholders to ensure progress is made on these projects. A poorly executed consultation process can cause significant delays and even result in the abandonment of regeneration projects (Clarke, 2001; Semple Kerr, 2000; European Commission, 2005). The involvement of an increasing number of stakeholders in the process has added to the complexity of the process with different stakeholders groups attributing entirely different sets of values to the same place and those values may be in conflict with each other (Aroaz, 2011).

An area of academic debate relates to the concept of value and the difficulties of measuring the concepts of direct and indirect and objective and subjective value have been highlighted (Lichfield, 1988), (Rypkema, 1992) (Tiesdall et al 1996). Finlayson, (2011) claims that conflicts arise among heritage stakeholders in terms of clashes of values and incompatible goals. It appears that the difficulty of estimating the true value of a project is affecting the delivery of these projects.

A diagram summarising key opportunities and constraints for the private sector development community developed by the researcher generated from the findings of the literature review is displayed below; listed by order of the key stages of a generic regeneration project involving historic assets as defined by Deloitte et al (2013). The diagram will be modified throughout the research project in light of the empirical research findings in stages one and two of the data collection and analysis.

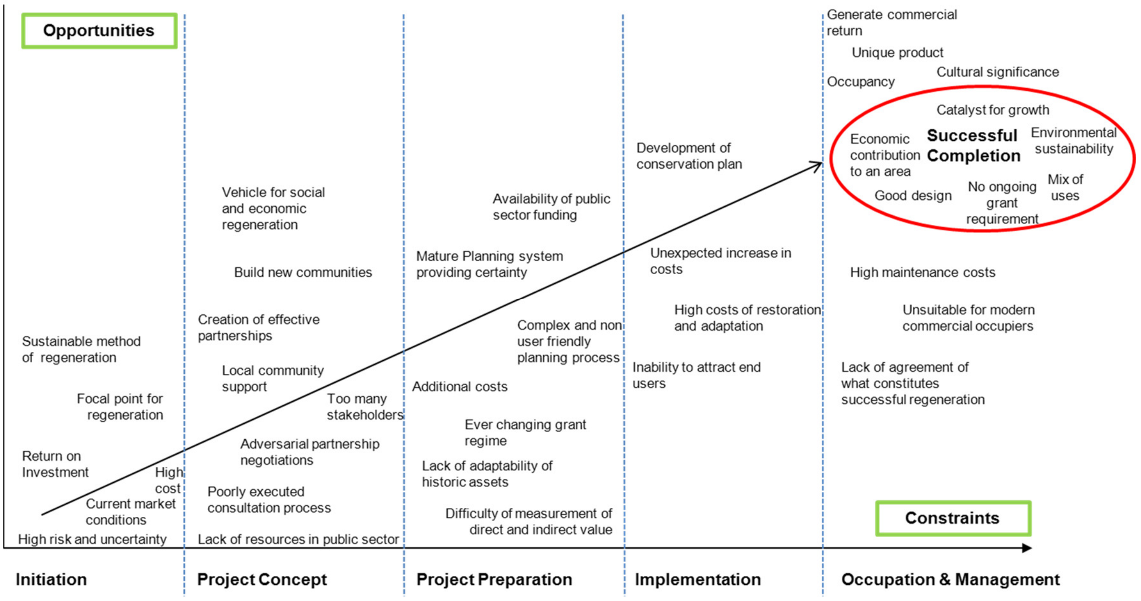

Diagram 1: Opportunities and constraints in the Regeneration Projects involving historic assets following completion of literature review

5. Contribution to knowledge

A review of academic literature revealed that the focus of debate concerns the delivery of a more holistic approach to conservation including how to broaden heritage definitions to recognise historic assets that do not afford listing status, the development and implementation of conservation management plans and the importance of public consultation in regeneration projects involving historic assets.

The researcher recognises the importance of the academic debate concerning the development of conservation policies that promote an active approach to conservation management as these policies contribute to the revitalisation and protection historic areas through sustainable and managed development in contrast to the development of policy purely concerned with the preservation of an historic asset. However the focus of debate does not provide all of the answers in relation to the aims and objective of the research project. Whilst it provides a framework for development that reduces the risk of loss of cultural significance it does not provide much guidance on the evolution of incorporating historic assets as a vehicle for physical, economic and social regeneration and particularly how the private sector views and how they can be involved in this process.

The research project when completed will provide a detailed insight into evolution of the role of historic assets as a vehicle for regeneration and provide an understanding of the perspective of these projects from a private sector development communities perspective. It will include an analysis of the current process of delivery and provide an overview of factors that attract or deter these organisations from participating in these projects. It will add to the body of existing research whilst exploring a new research frontier within the field of the built environment, namely the use of historic assets as a vehicle for regeneration and the role of the private sector development community in these projects.

6. Research Strategy

6.1. Ontological and Epistemological positioning

The ontological and epistemological positioning of the researcher in relation to this project is the adoption of a pragmatic ontological stance associated with mixed-methods research. Pragmatism offers the opportunity for the selection of multiple research methods to overcome weaknesses associated with adopting an "either or" approach (Creswell, 2007). It is focused on an explicit value orientated approach to producing practical research solutions to real world problems. It promotes the creation of theories that inform actual practice. It is also aligned with the focus of mixed methods research where using a "what works best" approach using qualitative and quantitative research methods in order to discover a workable solution is adopted (Johnson & Onwuegbuzie, 2004).

6.2. Mixed Methods

Mixed methods research has been defined as a research approach where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or languages into a single study (Johnson and Onwuegbuzie, 2004). Critics of a multi paradigm strategy believe that research paradigms are associated with fundamentally different assumptions and positions and therefore cannot be mixed (Bryman and Bell, 2007). Similarly Howe (1988) claims that quantitative and qualitative research paradigms cannot be mixed as they are positioned within incompatible ontological viewpoints.

Johnson and Onwuegbuzie (2004) reject the incompatibility argument and advocate a mixed methods approach, as they believe it is legitimate to adopt the use of multiple approaches in answering research questions rather than restricting or constraining researchers choices. Flyvberg (2011) argues that more often than not a combination of quantitative and qualitative methods will accomplish the task best. Mixed methods research is an evolving research strategy that is gathering support and momentum and has an established research community, (Tashakorrie and Teddlie, 2009), (Greene and Caracelli, 2007) and (Johnson & Onwuegbuzie, 2004).

6.3. Insider research

The proposed research setting is the field of regeneration involving the private sector development community, a field that the researcher has been employed as a development manager for a private sector regeneration company since 2002. The researcher is therefore native to the setting and this requires consideration given the potential impact on the research project and associated design.

Brannick and Coghlan (2007) examine the issue of insider research in detail and whilst critics of insider research such as Morse (1998), state that the roles of employee and researcher are incompatible as they place the researcher in an untenable position: Brannick and Coghlan (2007) highlight the benefits of a researcher practitioner and their ability to bring a rich knowledge and experience to the research problem. It is the researchers intention to undertake case study research with private sector companies where the researcher is not employed meaning that access to the required level of data and personnel may prove to be problematic (Havard 2008). Similarly Creswell (2007) states that it is important for researchers to have wide access to information in order to produce effective case study research. Nonetheless the researcher advocates insider research as it allows the research practitioner to bring experiential knowledge to the problem which traditional research methodologies may not be able to achieve.

7. Research ethics

Prior to commencement of the data collection phases of the research project, approval has been obtained from the University of Salford research ethics committee to ensure compliance with ethical regulations and committee codes of conduct.

Ethical considerations include informed consent being obtained from all participants (Yin, 2009) with an explanatory note describing the true nature of the research projects aims issued to interviewees prior to the collection of data. Research participants have been provided with as much information as will be needed in order to make an informed decision about whether they wish to participate in the project. (Bryman and Bell, 2007). Issues relating to confidentiality are a key consideration for this research project and the confidentiality of the participant must be honoured if requested.

All observations to collect data will be conducted overtly and collected systematically via structured data collection research methods. A period of reflection following completion of each phase of data collection has been completed in addition to maintaining a detailed set of field notes to ensure rigour and systemic recording of data collection (Baxter and Jack, 2008). All data relating to the research project is stored in a secure password protected online data storage facility.

8. Research Methods - Data Collection and Analysis

8.1. First stage Data Collection - Semi Structured interviews

A two-stage data collection strategy will be adopted for this research project where the first stage will involve the completion of semi-structured interviews with senior practitioners from stakeholder organisation's within the private sector development community. The purpose of the first stage of data collection is to corroborate the findings of the literature review and allow sufficient time to generate a theoretical framework.

The rationale and boundaries for selection was to engage with senior practitioners who have participated in a regeneration project involving historic assets in the North West of England during the period from 2008 to the current day. Fourteen practitioners will be interviewed as part of the first stage of data collection via an objective selection strategy which involved contacting local authority regeneration teams in areas defined as regeneration areas who were asked to identify personnel within the private sector development community who may be willing to participate in a semi structured interview. Interviewee's have been asked questions from a interview template which included a request to the interviewee to identify regeneration projects which may be selected for use as case study material to be studied as part of the stage two data collection process. A pilot study involving two interviewees following a period of reflection has been completed in order to ensure that the research instrument functions well and was an opportunity to iron out and remove and persistent problems from the interview questionnaire (Bryman & Bell, 2007).

The main outcomes of the first stage of data collection will be the generation of empirical data about the current process which will form the pre-cursor to the development of a theoretical framework. Additionally it allows the researcher to understand if a convergence or divergence of views exists between current practitioners in the research subject area and the findings of the literature review. Finally it ensures an objective method of case study selection method to be studied in the second stage of data collection.

8.2. **First stage data analysis**

Data collected during the first stage of data collecton will be analysed via content analysis, an objective and systematic from of data analysis applicable to analysing data such as semi structured interviews (Bryman and Bell, 2007). Computer assisted content analysis via NVivo computer software will also be completed. Content analysis is a systematic data analysis technique that collates valid inferences from texts into fewer content categories based on explicit rules of coding and themes (Hasbollah, 2014). Interview transcripts have been transcribed in their entirety by the the researcher into a document for each completed interview. Interviews will be coded by the researcher to allow for analysis of interviewees responses and to record information relating to the research questions. Notwithstanding that content analysis can be extremely time consuming and laborious (Robson, 2002), is reliant on the quality of information contained in the documents or transcripts (Bryman and Bell, 2007); it is a transparent, flexible and systematic data analysis technique (Bryman and Bell, 2007).

9. Progress to Date

The researcher has completed the first stage of data collection with fourteen semi structured interviews with senior practitioners have been completed where the data from each interview has been transcribed and the process of data analysis by manual content analysis and NVivo computer software has commenced.

9.1. **Second stage data collection - Comparative case study analysis**

Following the completion of the first stage of data collection and the production of the draft theoretical framework, the second stage of data collection is comparative case study analysis, using cases identified during stage one data collection. An objective of the second stage of data collection is to verify the draft theoretical framework using objectively selected empirical data.

Critics of case study research believe case studies are sometimes carried out in sloppy, perfunctory and incompetent manner (Bromley, 1986). Robson (2002) argues that even with good faith and intention, researcher bias and selectivity can emerge in case study research. However the researcher believes that case study research is an appropriate methodology in which to answer “how” and why,” questions in research problems (Yin, 2009). An aim of this project is to understand why some regeneration projects are successful whilst others fail. It is also a research method that has previously been used in the field to study building or construction processes (Sutrisna and Barratt, 2007; Hasbollah, 2014).

Two cases focusing on regeneration projects involving historic assets in the North West of the United Kingdom will be selected bounded by choosing one project considered to be successful and and one project that has been stalled or abandoned during the period 2008 to the current day. This will ensure that the research project captures relevant data relating to the current process of regeneration and that the research area does not become too broad (Baxter and Jack, 2008).

Data collection will be focused on the process of development within each project to generate an understanding of the specific process and characteristics of each development and identifying the similarities and differences in the cases (Baxter and Jack, 2008). The unit of analysis is the study of the current development process of these projects to identify key factors that affect the success or failure of the project. It will involve a study of the key actors, the context of the project, its vision, the interaction of the key parties and partners and an analysis of the outcomes of the project (Sutrisna and Barratt, 2007). The case studies will be guided by hypothesis generated following completion of the first stage of data collection, which are necessary to provide direction and focus to the initial stages of case study research.

Data will be collected via the research instruments of documentary and archival analysis, semi-structured interviews with project participants and key stakeholders, site visits and observations obtained where possible from information sources in the public domain such as local planning authority records. Quantitative data collected will include analysis of risk, development appraisal and investment analysis techniques employed these projects by private sector development community.

10. Theoretical Framework

An aim of the research project is to present findings by ways of a theoretical framework for use and application in the research project study area by academics, practicing professionals and those involved in the development of public policy. The creation of a theoretical framework will result in the creation of a tentative theory about the phenomena under investigation (Maxwell, 2013). A theoretical framework is considered to be a pre-theory (Parthirage et al, 2008).

Prior to the creation of the theoretical framework, the researcher has undertaken research into existing schools of thought within the established fields in the Built Environment, namely the field of conservation, regeneration and property development where an established body of theoretical knowledge exists. The purpose was to understand what theories or theoretical frameworks existed and how this may influence the production of the theoretical framework by the researcher. The researcher acknowledges there are other fields where theoretical knowledge exists such as the field of health and education and has not been referred to in this paper, however the researcher has chosen the fields which are directly related to the chosen study area.

11. Findings to date

Whilst the first stage of data analysis of the project is incomplete, for the purposes of this paper the researcher has provided a summary of the main findings to date. The majority of interviewees believed that the use of historic assets in regeneration projects was beneficial as they provided a reference point and touchstone for the local community to identify that regeneration was taking place in a particular area. These projects often involved the restoration of a local landmark creating a focal point for regeneration adding to the goal of placemaking and giving an area a distinctive identity. Private sector development organisations were attracted to these types of projects due to the opportunity to deliver deliver lean solutions that could extract value and provide a platform to build reputation and establish relationships with public sector partners. The ability to create value by acquiring assets at low acquisition values and to attract certain typers of occupiers who were unattracted to new build developments were also highlighted.

The major risks associated with these projects included a lack of appropriate skills and knowledge of those involved in these projects combined with a general lack of understanding of the complexity relating to delivery. It was confirmed that the high costs associated with these projects was a deterrent to some private sector developers who were reluctant to participate in these projects due to the high level of risk and inability to achieve the required levels of profit from these projects. It is clear from the data collected to date that these types of regeneration project are not attractive to all tyes of private sector developer and that only those with an ability to take on a level of risk were willing to participate. Other reasons that prevented private sector development involvement including a lack of availability of public sector funding, an inability to raise the necessary funding, the potential for delays due to protracted negotiations with local planning authorities and specialist interest groups and a high level of uncertainty due to the very nature of these projects.

The involvement of the public sector in these projects was highlighted as a key factor relating to the successful delivery of these projects which reiterated the findings of the literature review. The ability of the public sector to acquire sites, provide grant funding, technical expertise and information relating to the site and to negotiate internally with other public sector organisations was identified as strategy to reduce or mitigate the high level of risk associated with these projects.

The definition of what comprises a successful regeneration project was also further developed where interviewees identified that a successful regeneration project was a project that was a catalyst for further regeneration that attracts further investment, was financially viable and increased economic activity in an area, required minimal public sector funding post completion, revitalises public spaces and enjoys a high level of occupancy and remains in demand in the long term.

Following the completion of the first stage of data collection the researcher has updated diagram one to compare and contrast the findings of the literature review with the empirical research findings which is highlighted below in diagram two.

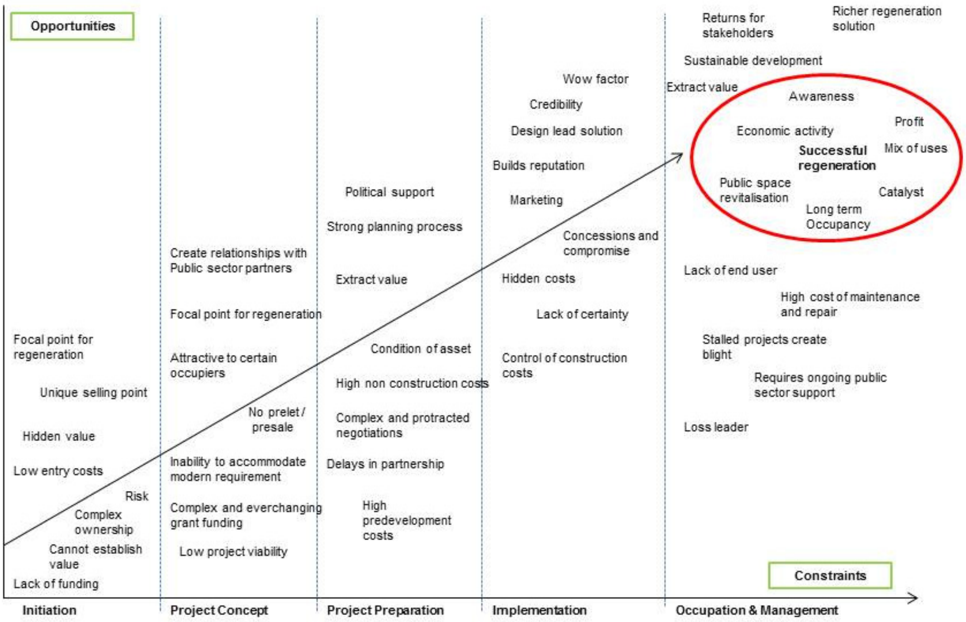

Diagram 2: Opportunities and constraints in the Regeneration Projects involving historic assets following completion of stage one data collection

12. Draft Theoretical Framework

The researcher has also produced a tentative theoretical using using guidance by Whetton et al (2001) namely that a theory or theoretical framework must contain a description of the factors to be involved in the thoery, provide an understanding of how these factors are related, what is the rationale that justifies the selection of these factors and for the the boundaries of the theory and data collected to date to be defined. The draft theoretical framework is shown below:

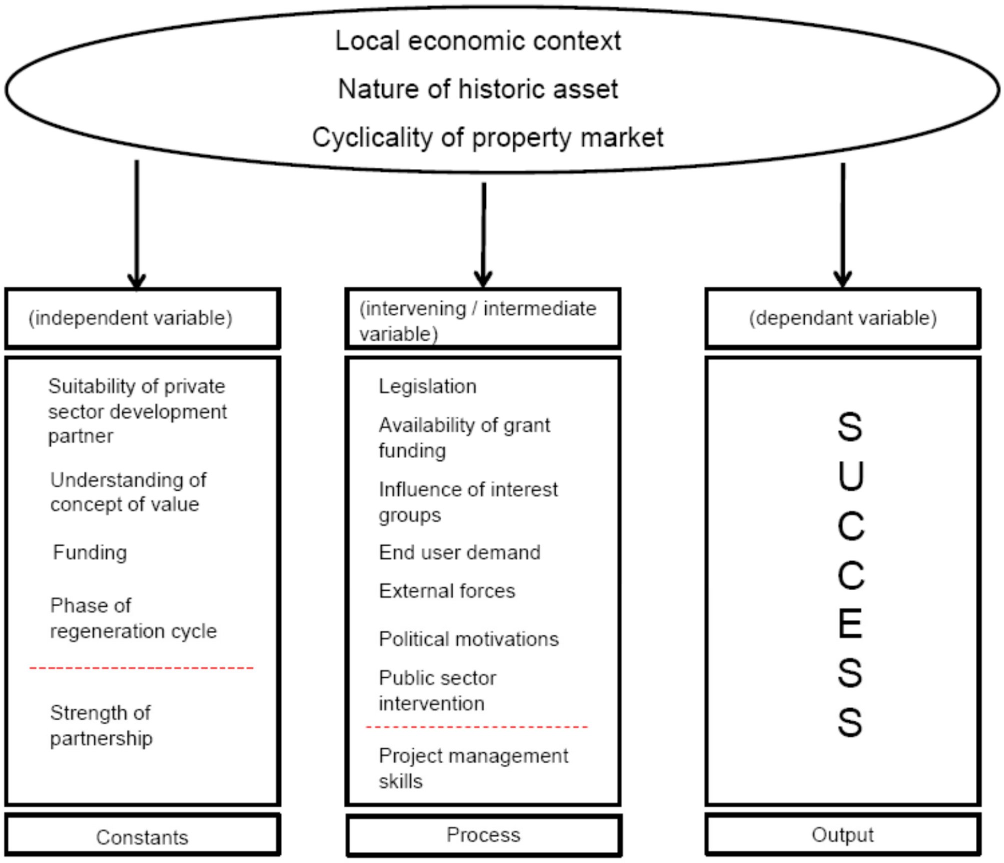

Diagram 3: Draft Theoretical Framework

Notwithstanding the criticisms of the application of theory and theoretical frameworks in the built environment namely that the there is a deep seated suspicion of the value of theory within the property industry (Koskela, 2008) and where it has been claimed that the creation of theory should be abandoned due to the stifling effect it has on practice (Thomas, 1997) the researcher supports the view that the lack of explicit theories or theoretical frameworks will the hinder the ability to facilitate teaching and learning of a particular subject (Koskela, 2008) and that the production of a theoretical framework can assist in defining a research frontier.

13. Positioning Statement

The researcher has provided a justification as to why the research topic is worthy of doctoral study, provided an overview of the research project and provided an outline of the research strategy. Progress and findings to date has been outlined where the next stages of the research project is to complete analysis of the first stage of data collection, finalise the draft theoretical framework, select the case studies to be used during the second stage of data collection, comparative case study analysis in order to undertake verification of the theoretical framework.

14. Glossary of Terms

- Historic Assets are defined as;

A building, monument, site, place area or landscape positively identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage asset includes designated heritage assets and assets identified by the local planning authority. (HM Government, 2012).

- Regeneration is defined as;

A comprehensive and integrated vision and action that leads to the resolution of [urban] problems and which seeks to bring about a lasting improvement in the economic, physical, social and environmental condition of an area (Roberts P, and Sykes, H, 2000)

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An Investigation of Critical Success Factors Associated with the Effectiveness of Transfer and Sharing Tacit Knowledge: In Context of Lean and Agile Construction Process

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Abstract

This paper investigates the critical success factors associated with the effectiveness of transfer and sharing of tacit knowledge in the both lean and agile construction processes. The literature review highlights ten critical success factors. Among those, 'Trust between construction organisations is identified as the foremost. Moreover, this critical success factor is followed by others such as, motivation, leadership capabilities, business strategies and organisational and individual's capabilities.

To validate the factors coined from literature review a systematic research methodology is adopted to collect quantitative data through the survey questionnaire. The data is categorised in ordinal scale to analyses in SPSS with Frequency and Kruskal-Wallis H test. In addition, Spearman's correlation analysis is run to investigate the further preceding and following factors. Nevertheless, an interpretive analysis is done to establish the essentiality of those factors based on the rank order.

The study highlights the predominant and correlated critical success factors. It concludes that, identifying the source of knowledge is the foremost critical success factor in Lean processes and further identification of the knowledge recipient in Agile processes. Moreover, trust between organisations is established as the second most critical success factor.

Keywords:

Construction Supply Chain, Transfer and Sharing Knowledge, Organisational Capabilities, Lean and Agile Construction Process

1. Introduction

1.1. Context and Background

In this context, critical success factors (CSFs) are the necessary factors whose absence hinders the effectiveness of sharing and transference of Tacit Knowledge in the both Lean and Agile construction processes.

The literature review mentions a broad range of factors that can influence the success of Knowledge Management (KM) implementation. However, no systematic work exists on characterising a collective set of CSFs for transferring and sharing tacit knowledge in the Lean and Agile process within the CSC. In recent years, many studies suggest to manage knowledge transfer and sharing within organisations and specifically in construction projects. Goh, (2002), Lin & Tserng, (2003), Bou-Llusar & Segarra-Ciprés, (2006), Narteh, (2008) and Martinkenaite, (2011), suggest a few of most relevant frameworks. To understand the CSFs of KM, this paper critically investigates those frameworks with a view to Transfer and Share Tacit Knowledge within construction processes.

1.2. Investigation of Existing Frameworks

One of the major challenges an organisation faces is to manage its knowledge assets (Goh, 2002). The framework from Goh (2002) emphasised that, a mean of driving the knowledge sharing and transfer is to encourage a problem seeking and problem solving culture within an organisation. The major three main factors that influence the problem seeking and solving are the leadership, high trust and collaboration between the employees. However, this framework also emphasis that the organisation must have a supportive structure of organisational design and reward system to encourage the employees to share knowledge and transfer knowledge. Furthermore, this concludes, while encouraging knowledge transfer and share, an organisation should ensure that both parties should have the absorptive and retentive capacity and must consider which type of knowledge should be transferred.

Afterward, the framework developed by Lin & Tserng, (2003) with the view of the implication of KM on lean construction projects with the IT based view of knowledge. This framework considers knowledge and information in lean construction comes from the project and outside project. Moreover, it shows the explicit knowledge comes from the activities and embeds within the project itself. On the other side, tacit knowledge is considered as the non-activity and non-project knowledge. However, this rejects the theory of the lean principles, as in lean thinking the tacit knowledge should be developed within the activities through a process.

The other KM framework by Narteh, (2008) focuses on the knowledge transfer within inter-firm collaborations. This framework claims to provide a deeper understanding of the characteristics of transferors and transferees. Moreover, this establishes interaction between them and portrays its influence through knowledge transfer across firm borders. This framework identifies two major sources of knowledge, organisationally embedded knowledge and cognitively or person embedded knowledge. The source of knowledge is the cognitive/individually embedded knowledge, because it is tacit and embedded in the people. Further, the knowledge transfer requires transferor and transferee related critical success factors such as the nature of knowledge to transfer, and individual and organisational capacity.

Recently, another framework by Martinkenaite, (2011) focused on an integrative framework of knowledge-specific, organisational and network-level antecedents and performance outcomes of transfer. The study highlights special attention to a mediating role of knowledge acquisition and emphasised on the enablers of inter-organisational Knowledge Transfer. In this framework, knowledge and organisational attributes and inter-organisational dynamics are seen as inputs of knowledge transfer, those outputs the new knowledge learned. Having analysed different KM frameworks this study identifies the main CSFs for transferring and sharing knowledge is Leadership, Business Strategies, Trust, Motivation, Training and Development of employees.

2. Evaluation of Critical Success Factors

Trust as a critical success factor leading the success or failure of construction projects is highlighted on both Egan (1994) and Latham (1998) reports. Weber and Carter (1998) defined trust as, the expectations that people have for others or themselves. Later, McDermott et al., (2005) said, trust is the willingness to rely on the actions of others and being dependent and compromising to their actions. Afterward, Khalfan et al., (2007), reveals that, trust is concerned about the way people communicate with each other. Furthermore, people need to be open, willing to share important information, being honest to reflect the real situation. Trust could only exist if this type of communication remains.

The study of (Khalfan et al., 2007; Lau & Rowlinson, 2011 and Ceric, 2012) all mentioned the different levels of trust. Those levels are given by Ceric, (2012) (Intra firm and Interpersonal levels) and Khalfan et al., (2007) (Strategic, Multi-project, project and task level). This reveals that, driving trust for all levels requires effective communication in construction supply chains.

In addition, study of Khalfan et al., (2007) highlights that, organisation's leadership support is an essential factor in the approach to building trust in construction. The role of senior management and leaders is needed to share and transfer knowledge. Since, Egan, (1998) reported that, committed leadership is required to drive forward an agenda for improvement. Later, Anumba et al., (2008) said that KM includes the importance of building trust through leadership.

Moreover, pre-implementation success factors of trust initiatives in an inter-personal relationship, Leadership and Business Strategies must be aligned at the inter-organisational level. This also requires the capability building of the organisations and individuals to deliver and innovate. The capability building helps to develop trust and share and transfer knowledge among them (Al-Hawamdeh, 2002; Yusuf, Sarhadi, & Gunasekaran, 1999; Egan, 1998).

3. Research Methodology and Limitations

Based on literature review, this study lays down ten (10) critical success factors. The study adopts a systematic research methodology to investigate those CSFs through quantitative data analysis. This study collects the data through a survey questionnaire. Firstly, a hypothesis is established for each CSF. The questionnaire is designed with five (5) point Likert Scale to capture the views of respondents. The data is categorised as ordinal scale and analysed in SPSS with Frequency and Kruskal-Wallis H test. Moreover, Spearman's correlation analysis is run to investigate the further preceding and following factors. Nevertheless, an interpretive analysis is done to establish the essentiality of those factors based on the rank order.

This study recruited project managers, executives, consultants, and other managers that are directly involved in the management of a construction project at every stage. As a result, the recruitment of respondents focuses on Tier (2) of CSC. Moreover, the archive data from ONS (2014) and BIS (2013-14) is analysed to establish the average employment and the proportion of construction managers and executives.

This calculates; the UK construction sector has (2.06m) employees on average in the last five years. Among those, 11% are managers and executives. This establishes a gross target population size of 2062500 (11% of 2. 06m = 206k) However, to fit the purpose of this research the respondents are required to have background and experience from disciplines such as Lean Construction, Agile Construction, Construction Supply Chain and Knowledge Management in Lean, Agile and CSC. Therefore, this investigation demanded to answer, how many of them would have background or experience or understanding of all four disciplines such as Lean Construction, Agile Construction, CSC, and KM in Lean, Agile and CSC? There is no such data found, which could answer this question. As the result, the question is asked on social media groups such as CIOB and Lean Construction Management.

Only a few responses are received. This concluded that there would be merely less than (<) 1% individuals who may have knowledge and/or understanding of Lean, Agile, Supply Chain and Knowledge Management. Having been relying on this, less than (<) 1% of 206k (Construction Managers, Directors and Executives) would be just 2062 units of population for this research. Furthermore, based on the assumption the total required sampling size is calculated as 324 units with the margin of error 5% and confidence level 95%. A hypothesis is developed for each variable based on the literature review. The level of criticality is set to 'Critical' for each hypothesis.

To contact the target population, 250 emails and other multiple channels (multiple websites) is employed to distribute the e-survey. The questionnaire respondents are kept untracked (This does not capture any personal information and IP address of respondents) to maintain anonymity of respondents. Therefore, it is not viable to focus on response rate, as it will not be accurate. Eighty-three (83) responses are received. Among them, fourteen (14) responses were incomplete and sixty-nine (69) are fully completed responses. To maintain the accuracy of data and to avoid internal error, unfinished responses are deleted from the data. A high level of internal consistency for this data is calculated as Cronbach's alpha (α) is 0.766.

The question is asked to draw in the answer based on the respondent's experience. Below table (1) exhibits the design of questionnaire and adopted techniques for data analysis.

Table 1: Question Design and Data Analysis Techniques

Main Question	What is the level of criticality of success factors associated with the effectiveness of Transferring and sharing Tacit Knowledge (a) in Lean Process (b) in Agile Processes?				
Hypothesis	The level of criticality of success factors associated with the effectiveness of Transferring and sharing Tacit Knowledge (a) in Lean Process (b) in Agile Processes is high.				
Likert Scale	Not Critical	Of Little Critical	Moderately Critical	Critical	Very Critical
Ranking	1	2	3	4	5
Data Type	Ordinal				
Data Analysis Technique/s	Reliability, Frequencies, Kruskal-Wallis H test and Spearman's Correlation Analysis				

4. Evaluation of findings from data analysis

Below table (2) is an outcome of the data analysis of this study while employing frequency analysis and Kruskal-Wallis H Test based on the non-parametric data analysis techniques. This table represents the critical success factors as variables (V1 to V10) for presentation purpose.

The data analysis establishes that, nine (9) out of those ten (10) CSFs observed to have the level of criticality is 'High'. The only factor, organisational capabilities to Transfer and Share Tacit Knowledge is observed as the level of criticality is 'Moderately Critical' in both Lean and Agile Processes. The null hypothesis for (V2) is rejected in Lean process because the data is not statistically significantly distributed based on Kruskal-Wallis H Test. As a result, this calculates the asymptotic significance (*p*-value) is lower than (below < 0.05). Similarly, the data is not found statistically significantly distributed for CSFs, Organisational Capability (V5) and Individual Capability (V6) in agile processes. This rejects the null hypothesis. However, frequency analysis for both the variables establishes that, Organisational Capability (V5) is 'moderately critical' success factor, and Individual Capability (V6) is a 'critical' success factor to Transfer and Share Tacit Knowledge in Agile processes.

4.1. Spearman's Correlation Analysis

The Spearman's Correlation analysis is run to investigate the correlation significance between the CSFs. This reveals the correlation statistics between CSFs to enable Transfer and Share Tacit Knowledge.

4.1.1. Correlation of CSFs to Transfer and Share Tacit Knowledge in both the (a) Lean and (b) Agile Processes

The most significant correlation (r_s =. 775) has been found among the identification of the source (V9) and recipient of Knowledge (V10). The second highest and positive correlation coefficient (r_s =. 595) is calculated among (V8) identification of type and (V9) source of knowledge. If finds the third highest correlation coefficient between (V8) identification of type and (V10) recipient of knowledge. Among the forty-five (45) correlations, a negative correlation is found between (V1) trust between organisations and (V9) identification of source of knowledge, calculated as (r_s = minus -042).

In Agile processes, the most significant correlation (r_s =. 719) is found among (V8) identification of type of knowledge and (V10) recipient of knowledge. The second highest and positive correlation coefficient (r_s =. 657) is found among (V9) identification of source and (V10) recipient of knowledge. The third highest significant correlation coefficient (r_s =. 651) is found among (V8) identification of type of knowledge and (V9) source of knowledge.

Table 2: Data Analysis of Critical Success Factors to Transfer and Share Tacit Knowledge in both the Lean and Agile Processes

NO	Critical Success Factor	Processes	Median	Ordinal Rank	Statistically Significantly Distributed	(*p*-value)	Accept or Reject (Null Hypothesis)
V1	Trust among the organisations in Construction Supply Chains	Lean	4	Critical	Yes	0.996	Accept
		Agile	4	Critical	Yes	0.674	Accept
V2	Motivation to share Tacit Knowledge	Lean	4	Critical	NO	0.012	Reject
		Agile	4	Critical	Yes	0.064	Accept
V3	Leadership Capabilities of clients and main contractors to encourage sharing Tacit Knowledge	Lean	4	Critical	Yes	0.254	Accept
		Agile	4	Critical	Yes	0.177	Accept
V4	Business Strategies aligned to Share Tacit Knowledge in organisations within Construction process	Lean	4	Critical	Yes	0.539	Accept
		Agile	4	Critical	Yes	0.562	Accept
V5	Organisations within Construction Supply Chain must have Capabilities to Share Tacit Knowledge	Lean	3	Moderately Critical	Yes	0.539	Accept
		Agile	3	Moderately Critical	NO	0.022	Reject
V6	Individual involved in construction process must be capable to share Tacit Knowledge	Lean	4	Critical	Yes	0.717	Accept
		Agile	4	Critical	NO	0.005	Reject
V7	Identification of process improvement opportunity by managers	Lean	4	Critical	Yes	0.286	Accept
		Agile	4	Critical	Yes	1.286	Accept
V8	Identification of type of Knowledge to Share	Lean	4	Critical	Yes	0.87	Accept
		Agile	4	Critical	Yes	0.735	Accept
V9	Identification of Source of Knowledge	Lean	4	Critical	Yes	0.054	Accept
		Agile	4	Critical	Yes	0.251	Accept
V10	Identification of Knowledge recipient	Lean	4	Critical	Yes	0.522	Accept
		Agile	4	Critical	Yes	0.603	Accept

4.2. Interpretive analysis of correlations among CSFs

The interpretive analysis of the rank orders of correlation coefficients between the CSFs reveals the order from the 'Highest Correlated Coefficient' to 'Lowest Correlated Coefficient'. This establishes the foremost and subsequent CSFs to enable transfer and sharing of tacit knowledge. The following assumptions are made in respect to 'highest to the lowest' correlation coefficient of named CSFs (V1 to V10).

4.3. Interpretive correlation coefficient rank orders of CSF's: Lean processes

1. In rank (1), CSF (V9) has a positive correlation coefficient with (V7), (V8) and (V10). Moreover, (V1) have a positive correlation coefficient with (V2) and (V3). This establishes that, identifying the source of Knowledge (V9) is the foremost CSF that highly required identification of type of Knowledge to Transfer and Share (V8) and further, identification of Knowledge recipient (V10). Similarly, trust between organisations (V1) demands motivation to Transfer and Share Tacit Knowledge (V2). Nevertheless, this demands leadership capabilities to encourage Transfer and Share Tacit Knowledge.
2. Following the (Rank 1), In (Rank 2), CSF (V3) has the positive correlation coefficients with (V1), (V4) and (V6). This establishes the assumption that, Leadership Capabilities to encourage Transfer and Share Knowledge (V3) requires aligned business strategies to Transfer and Share Tacit Knowledge in organisations (V4) and further requires capabilities of individuals to Transfer and Share Tacit Knowledge within the construction processes (V6).
3. In (Rank 3), CSF (V7) is correlated with (V4), (V8), (V9) and (V10). This highlights that, identification of process improvement opportunity (V7) is also an essential CSF to relate with (Rank 1) and assumption (1) with CSFs (V8), (V9) and (V10). This establishes that, before identifying CSF's (V8), (V9) and (V10) it is vital to identify the process improvement opportunity my managers (V7).

4.4. Interpretive correlation coefficient rank orders of CSF's: Agile processes

1. In rank (1), CSF (V10) has the positive correlation coefficients with (V7), (V8) and (V9) This establishes that, identifying the recipient of knowledge is the foremost CSF. This is highly correlated with the identification of process improvement opportunity. This needs identification of type of knowledge and further demand identification of knowledge source to transfer and share tacit knowledge. In addition, (V3) have a positive correlation coefficient with (V4) and (V5). This establishes leadership capabilities of clients and main contractors called for aligned business strategies and organisational capabilities to Transfer and Share Tacit Knowledge.
2. The rank (2) follows the rank (1). In this, CSF (V5) has a positive correlation coefficient with (V1), (V3), (V4) and (V6). This establish that, organisational capabilities necessitate trust between organisations and leadership capabilities of clients and main contractors in addition to aligned business strategies and capabilities of individuals involved in construction processes to Transfer and Share Tacit Knowledge. However, this also lays down that, capabilities of individuals expect identifications of process improvement opportunity are equally important factors. Furthermore, this demands the identification of type of Knowledge to transfer and share and source of Knowledge.

3. In (Rank 3), CSF (V1) is correlated with (V3), (V4) and (V5). This impersonates that, trust between organisations within CSCs is dependent of leadership capabilities and further aligned business strategies. This calls for organisational capabilities.

5. Conclusion

The results from this study are of course subject to a number of limitations. Firstly, this study integrates three different disciplines of Lean, Agile and Construction Supply Chain. Secondly, the recruitment of respondents is limited to the tier (2) of the CSC with further restriction to recruit respondents with experience and understanding of Lean, Agile, KM a CSC. Therefore, having that limitation forces this study to employ Likert scale design of the questionnaire to produce ordinal scale of data and consequently, to run non-parametric analysis. The analysis investigates the hypothesis through Kruskal-Wallis H Test that provides asymptotic significance to understand the significance of findings that establish if the number of response increases will remain constant.

Notwithstanding its limitations, the study obtained findings those extant knowledge transfer and sharing theories. This identifies the source of knowledge is the foremost CSF that is essentially required to identifying the type of knowledge to Transfer and Share. Furthermore, this calls for identification of the knowledge recipient in Lean Processes. However, in Agile Processes, the foremost CSF is determined to identifying the knowledge recipient. This further requires identifying the process improvement opportunity followed by type of knowledge to share and lastly identification of source of knowledge.

Furthermore, in Lean Process observes, trust between organisations as the second CSF that requires 'motivation' and further motivation requires identification of the type of knowledge to transfer and share. At the same time, motivation should be supported with leadership and organisational capabilities. Nevertheless, in Agile Process, leadership capabilities are the second most CSF that necessitates business strategies aligned and further desire organisational capabilities and trust between organisations. However, in rank three (3) of CSFs in Agile Process, pledged motivation as an important factor that also required backed up with leadership and organisational capabilities. In contrast, both the Lean and Agile Processes demands individual capabilities.

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Accuracy of Estimates in the Development Phases of Highway Projects: What Critical Cost Overrun Phase?

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Abstract

Accuracy in cost estimating under conditions of uncertainty, as is typical of most construction projects, is an issue of immense concern for clients, project managers, contractors, and all other stakeholders in construction works. It is an issue of continuing interest and has attracted a lot of scholarly attention from researchers and innovators. Accurate cost estimates are needed for planning and budgetary phases of road projects by highway agencies.

Highway projects have historically experienced significant cost overruns often rooted at the point of the decision to build. However the basis for assessing the level of cost overruns continues to elicit diverse opinions and has become a debatable issue in the literature, with some authors alluding to the estimate developed at the detailed design stage as opposed to the preliminary conceptual estimate as the true benchmark to be used in quantifying the level of cost overrun.

A survey of literature sources principally from scholarly articles and research programs undertaken by various highway agencies is carried out, with a view to identifying and defining the critical phase of development which should constitute the basis upon which investment estimates are to be predicated. This paper thus evaluates and synthesizes the theoretical basis of accuracy in estimating, outlines the nomenclature of the developmental phases of highway projects as evident in the literature and builds upon the argument raised by earlier authors: Wachs (1989); Simon (1991) and Flyvbjerg *et al* (2002).

Keywords:

Accuracy of Estimates, Conceptual Estimates, Cost Overruns, Development Phases, Highway Projects

1. Introduction

The development of accurate and reliable cost estimates in highway construction work has been a major focus for clients and contractors (Baccarani, 2004; Tan and Wakmasha, 2010; Asmar *et al.,* 2011). The cost performance of construction projects is emphasized by Baccarani (2004) as a key success criterion for project sponsors against the background that construction projects are notorious for running over budget. A practical index used for evaluating the level of accuracy of estimates is cost overrun (Bordat *et al.*, 2004; Cantarelli *et al.,* 2010). Cost overrun is the excess amount of money expended at the conclusion of a project in excess of the initial projected cost figure. Tan and Makwasha (2010) stated that in the cost estimation of road infrastructure projects there are three possible scenarios where '*ex ante'* (budgeted) cost figures either match or do not match with '*ex post'* (actual) cost figures as shown in Table 1

Table 1: Cost estimation scenarios

Ex ante = Ex post	*Ideal*
Ex ante < Ex post	*Under-estimation of funds leading to fund shortage*
Ex ante > Ex post	*Over-estimation of funds leading to fund surplus*

(Source: Tan and Makwasha, 2010)

Inaccurate estimates have being established in the literature to be a major source of cost overruns for highway projects which can lead to delays and even total project abandonment (Steven and Oberlender, 2003; Donell, 2005; Asmar *et al.*, 2011). Other authors have convergently stated that bridging the gap between *Ex ante* and *Ex post* estimates is a major challenge for most highway agencies (Ogunlana, 1989; Phaobunjong, 2002; Mahamid, 2011).

Evans and Peck (2008) graphically illustrated 3 project scenarios of project performance:

- An ideal project;
- An acceptable project;
- An unacceptable project.

The ideal project was defined as one in which the final cost coincides with the conceptual cost without reliance on contingency allowance. The acceptable project was defined as a project whose final outturn cost does not exceed the sum of the initial projected cost and contingency allowance.

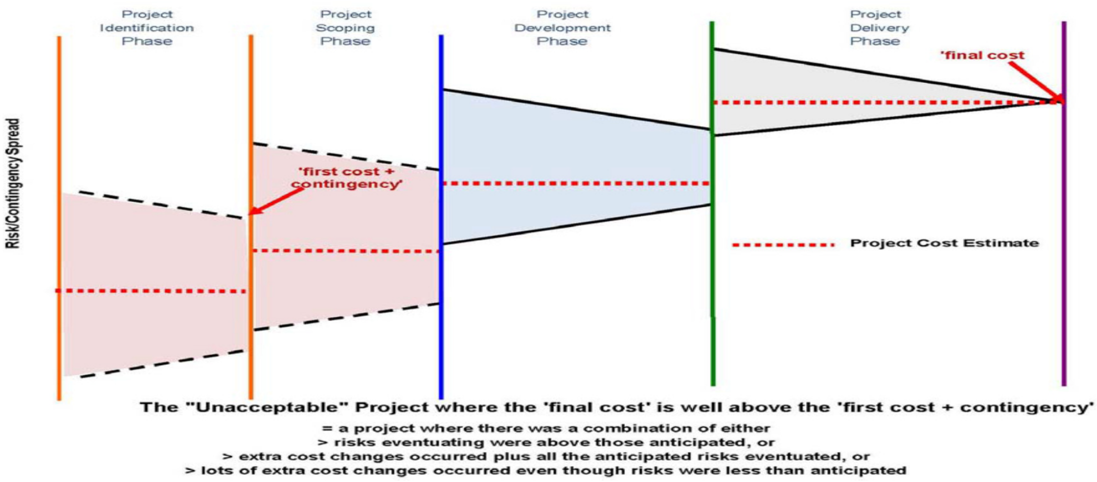

Figure. 1. Assessment of project performance based on cost overrun scenarios (Source: Evans and Peck, 2008)

An unacceptable project was defined as to be a project whose final cost far exceeds the initial cost plus the contingency allowance as shown in figure 1. They noted regrettably that this last project scenario was however the common trend in highway projects.

2. Literature Review

2.1. Accuracy of Estimates in Highway Projects: Scale of the Problem

Empirical studies show that time and costs are often exceeded (Flyvberg *et al.,* 2002; Bordat *et al.,* 2004; Baccarini, 2004). The widely referenced research by Flyvberg *et al* (2002) revealed a non improvement in the practice of cost estimation globally over the last century, with cost overruns remaining consistently on the high side for major transportation infrastructure projects. The authors revealed based on analysis of 258 projects infrastructure project costs sampled worldwide worth $90 billion, that 90% of projects were underestimated. Actual costs were on average 20% higher for road projects.

Several notable projects have been shown in the literature to have experienced cost overruns of huge proportions. Creedy (2006) reported that in the United States, a central artery tunnel located in Boston and popularly referred to as the 'Big Dig' was publicized to have incurred a monumental cost overrun of over 600% and attracted critical media exposure. The initial estimated figure of 2.6 billion US dollars in 1982 was shown to have escalated to above 14 billion dollars by 2002. Creedy (2006) also reported that in Australia, based on the Queensland Government's Road Implementation Program, most projects estimated at more than one million dollars had significantly exceeded their decision-to-build estimates.

The UK Transport and Road Research Laboratory (TRRL, 1999) in investigating the phenomena of cost overruns revealed an equally large range of cost overruns above 50% for six out of 21 projects carried out in developing countries. Two of these projects were in an upper range from 100 to 500%. Three and four projects respectively experienced overruns in a lower range of 20 to 50% and 10 to 20%. Also, the African Infrastructural Country Diagnostic (AICD, 2008) study of the performance of road infrastructure investment budgets focused on 24 countries in sub-Saharan Africa. The AICD findings corroborate those carried out by Flyvberg *et al* (2002) and also revealed that on the average, cost overruns were substantially higher in developing countries than in other developed countries with ranges of up to 700% evidenced in some of the analyzed contracts.

The ideal scenario of equality in *ex-ante and ex-post* (Tan and Makwasha, 2010) is what every project should strive to achieve. However this is rarely the case as most times project costs tends to overshoot initial budgets leading to delays and other issues. For Transportation Agencies, Alavi and Tavares (2009) posited that cost overruns can lead to adverse consequences, including:

- Disruption of plans, postponement, or cancellation scheduled projects to satisfy budgetary constraints;
- Reduction in project scope, resulting in projects that do not fully provide the service initially intended;
- Extension in construction duration until additional funds become available;

They thus concluded that an eventual misallocation of design resources creates false expectations with the public and other stakeholders. This is because any upward increment in budgeted figure set aside for a project means a corresponding deduction from funds voted for other projects. They reported that in 2002 the Virginia Department of Transportation (VDOT) had to postpone or cancel 166 projects due to lack of funding occasioned by cost overruns.

The occurrence of cost underestimation has been shown in the literature to be a pervasive trend in highway agencies. Inaccuracy of estimates expressed as cost overruns for infrastructure projects has therefore become a common global problem for Transportation Agencies with Federal, State, Regional, and local transportation agencies grappling with the discrepancy between budgeted costs and actual costs of projects they sponsor (Turouchy et al., 2001; Flyvberg *et al.,* 2002; Tan and Wakmasha, 2010).

2.2. **Cost Estimation in the Project Phases**

Cost estimates are projected throughout the various phases of a project development. These development phases have been outlined in the literature to portray how projects advance from inception to completion and how various cost estimation inputs vary (Phaobunjong, 2002; Chou, 2005; Tan and Wakmasha, 2010; Asmar *et al* 2011). It has however being noted by the researcher that in the literature various terminologies abound for labeling the development phases of projects, often leading to ambiguity as to which phase of development is being referred to as the initial phase. The following section summarizes the nomenclature of these phases as described by various authors.

Phaobunjong (2002) categorized the project development phases into: The Conceptual Phase; Design/Engineering Phase; Execution Phase. Figure 2 below is a flowchart representation of the estimation basis used for cost planning and control activity as depicted by Phaobunjong (2002).

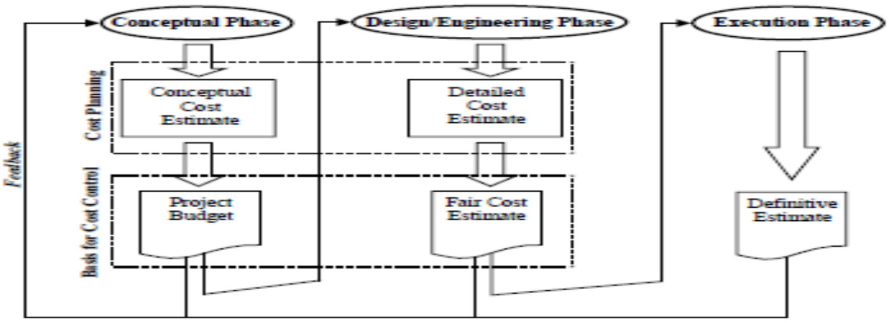

Figure. 2. Cost estimates in project planning (Source: Phaobunjong, 2002)

He discussed the estimation of complimentary estimates for each phase as the key element of cost control and management required in project development and noted that the principal costing activity in the conceptual phase constitutes the basis of planning and control of later estimates at the design and engineering phases. At this later point more elements become defined and the increased availability of project information leads to a revision of cost estimates which becomes the basis of procurement and construction.

Sabol (2008) used a similar 3 phase development configuration to graphically convey the degree of project detailing typical in projects as shown in figure 3. Though this was carried in respect of building projects and estimate types typically associated with different phases, an analogy can be drawn for highway projects.

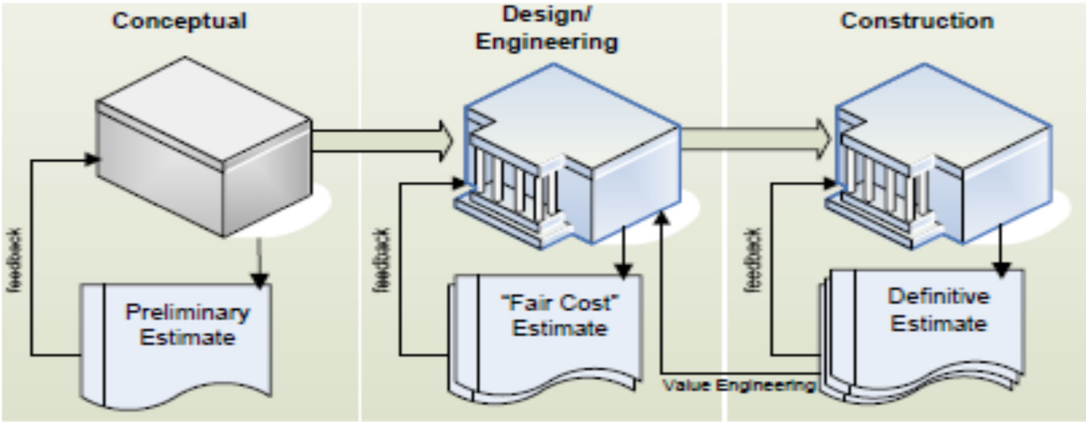

Figure. 3. Project Cost Estimating Process after Sabol, (2008)

Preliminary estimates as explained by Sabol (2008) are made from high level generic data pertaining to projects and are of particular importance during project finance sourcing. More detailed estimates made at the point of more comprehensive design details of project features, referred to as fair-cost estimates are of higher accuracy and are typically used at the contractual phase of projects for bid evaluations. At this point, essential features of a proposed project are identifiable. Definitive estimates are made when all engineering project details as to plans and specifications are complete.

Project information and development phases, specific for highway projects, are also discussed in the literature (Chou, 2005; Tan and Wakmasha, 2010; Asmar *et al.,* 2011). The identified phases as revealed in the literature are noted by the researcher as structured in recognition of the technical bureaucratic details and procedures requisite for obtaining funding approval often needed in public infrastructure projects.

Asmar *et al* (2011) outlined the following five stages in project development in the context of level of completeness of design details and the corresponding estimate type required at each phase of highway project development: Planning and scoping; Environmental process; Preliminary design; Final design; Advertise and bid. These phases as represented in figure 4, were outlined in relation to the typical project lifecycle for the Wisconsin Department of Transportation (WisDOT), to reflect the types of cost estimates produced and their typical ratios of design completion.The point at which approximately 30% of designs are complete is set to provide basic information to the agency on which to base approval and funding decisions; as well as to establish a project baseline cost required for budgeting in the proposed development.

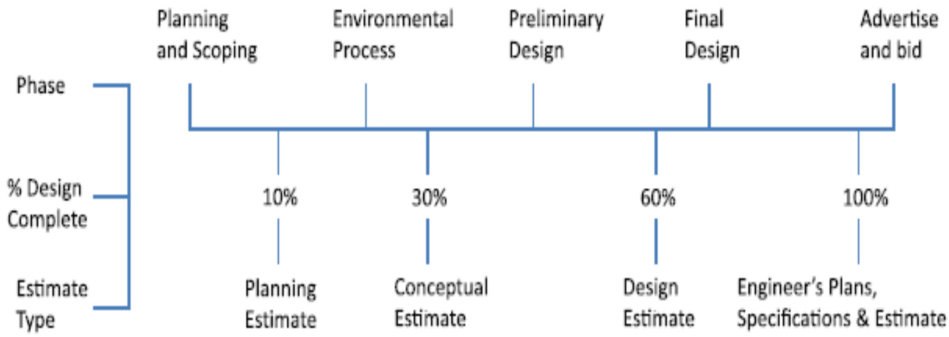

Figure. 4. Project development phases according to level of design completeness (Source: Asmar *et al.,* 2011)

Chou (2005) equally analyzed timeframes and the context of estimating for highway projects using a simplified illustration, as shown in figure 5, of the major stages of development of projects. He categorised the stages of project development in the context of the Texas Department of Transport (TxDOT).

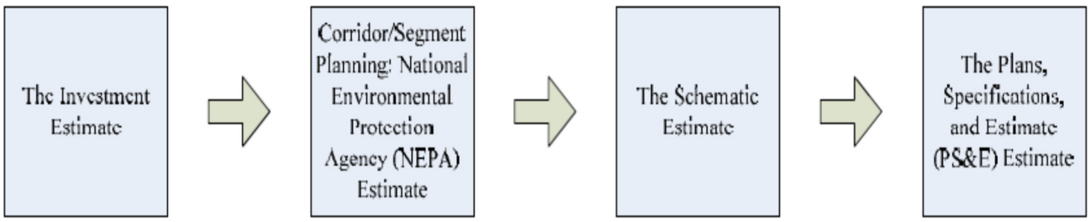

Figure. 5. Texas department of transport project development phases (Source: Chou 2005)

The first stage of project development for the TxDOT is the investment stage. This is the crucial initial point where a project is introduced into the departments long range plans, which are prepared to span a period of twenty years. The estimate at this point is prepared to analyse the feasibility of a proposed scheme, with high feasibility projects given higher priority. The projects then proceeds to the next phase where alternative layouts are compared for their environmental impacts. Subsequent to this, schematic estimates are then prepared which determine the funding requirement of projects. This is the point at which a scheme can be definitively described as a project with responsibility passing from planners to designers at the Plan, Specifications and Estimate (PS & E) stage.

Evans and Peck (2008) in a report evaluating estimating practices of Highway agencies in Australia labelled project phases as shown in figure 6 according to the Australian Federal Infrastructure's Notes on Administration: Project Identification; Project Scoping; Project Development; Project Delivery. This was done in the bid to create commonality in the phases of development used by all Australian highway agencies. At the Project Identification phase specific project cost data is unavailable and as such benchmark rates are used for the purpose of carrying out cost/benefit studies comparing project alternatives and not necessarily for budgeting purposes. An estimate which serves as a business case for the chosen alternative is subsequently produced at the Project Scoping phase.

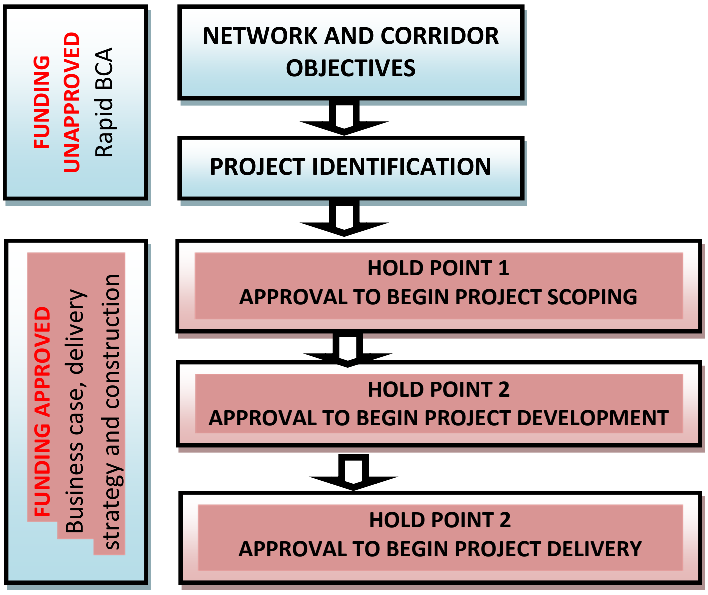

Figure. 6. Project phases in the Australian context (Source: Evans and Peck, 2008)

The Project Development phase entails detailed planning, including; environmental approval; land, acquisition; community consultation; and design preparation processes. The Project Delivery phase covers construction and commissioning, requiring periodic estimates in reporting progress and ensuring cash flow until project completion.

2.3. Accuracy of Estimates in the Development Phases

Despite the different nomenclature used to identify phases of highway development as depicted in the literature, the starting point or basis of estimation for any project is the one projected early at the initial planning/budgeting stage during which a business case is identified and investment decisions have to be made. These very early estimates labeled as conceptual estimates in this paper, however exhibit the greatest amount of uncertainty (Schexnayder et al 2003; Oberlender, 1998). Figure 7 shows the distribution pattern of estimated costs around the final costs as projected by Schexnayder *et al* (2003).

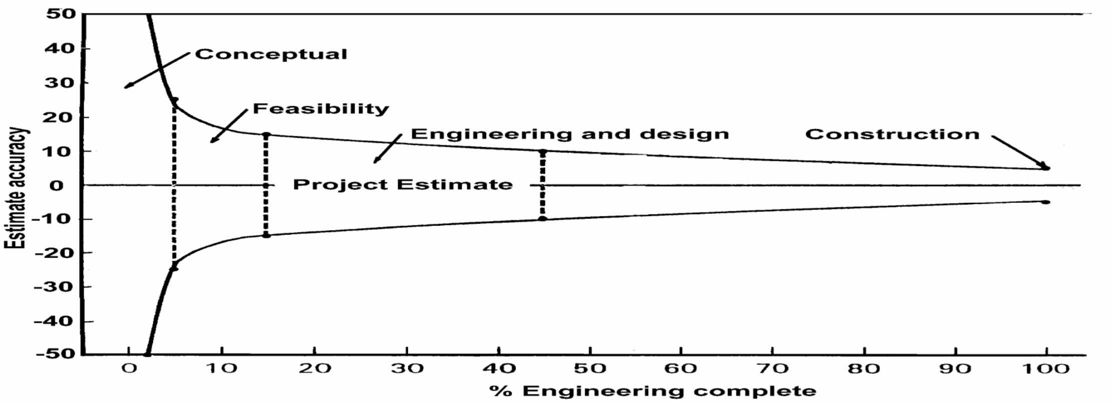

Figure. 7. Typical bounds of estimate accuracy in project development after Schexnayder *et al*., (2003).

The plus or minus 40 percent confidence range typically associated with these estimates as illustrated by Schexnayder *et al,* (2003) in figure 7, reflects the lack of definite project information. Turochy *et al,* (2001) opined that each successive phase of the project life cycle is more influential as the focus narrows on the amount each project will cost with a corresponding reduction in contingency allowance. Schexnayder *et al.,* (2003) thus stated that subsequent estimates are made throughout project design as continuing checks on initial cost expectations. It was further opined that the later estimates that are added are necessarily assumed to be increasingly accurate cost predictors. The confidence intervals thus diminish to the final definitive estimate which is expected to be within an accuracy range of + or – 5% of actual project costs symmetrically distributed around the actual costs.

Oberlender (1998) equally described that the accuracy range for a typical project usually shows a trumpet shape which is narrower as the project evolves, depicting the typical assumption that estimates tend on average to equal actual project cost with the level of uncertainty declining monotonically over the duration of project development.

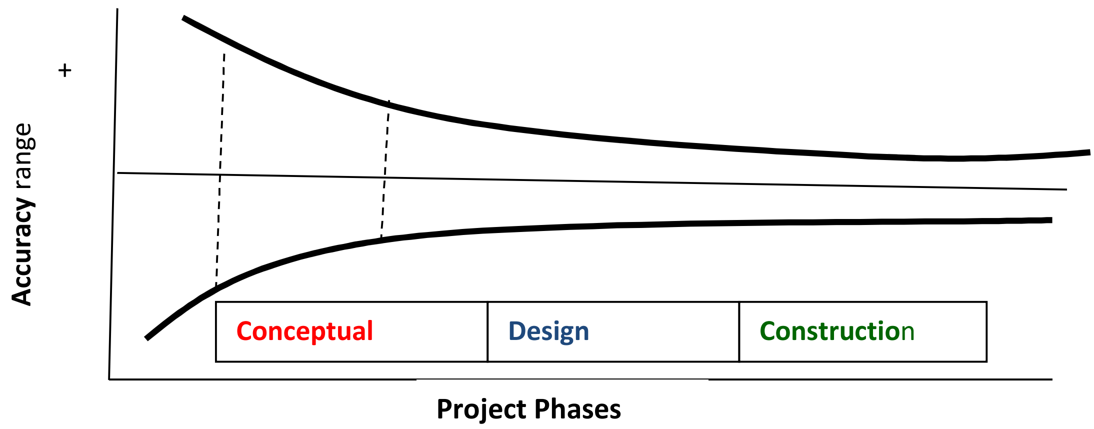

Figure 8: Accuracy Range in Distinct Project Phases (Source: Oberlender, 1998)

Several standards of best practice are also evident in the literature which define the level of accuracy achievable for estimates, based on the level of detail available at the various stages of project development: The Department of Energy (DOE) Guide (2011); The GAO Cost Estimating and Assessment *Gui*de, (2009); The Association for the Advancement of Cost Engineering (AACE, 1997). These standards serve to provide uniform guidance and best practices prescribing methods and procedures of estimating that can be used for varying levels of scope definition and detail.

Typically, the Association for the Advancement of Cost Engineering (AACE, 1997) developed a cost classification system, shown in table 2, based on the purpose and level of project definition in the preparation of cost estimates.

Table 2: AACE Generic Cost Estimating Classification Matrix.

Estimate Class	Level of Project definition	Typical purpose of estimate	Expected Accuracy range (variation in low and high ranges)
Class 5	0 – 2%	Screening or Feasibility	L:20% to -50% H: +30% to +100%
Class 4	1to 15%	Concept Study or Feasibility	L: -15% to -30% H: +20% to +50%
Class 3	10 to 40%	Budgetary, Authorization	L: -10% to -20% H: +10% to +30%
Class 2	30 to 70%	Control or Bid/Tender	L: -5% to -15% H: +5% to +20%
Class 1	50 t0 100%	Check Estimate or Bid/Tender	L:3% to -10% H: +3% to +15%

(Source: AACE Recommended Practice No. 17R-97, 1997)

From the guide typical conceptual estimates useful for budget authorization fall between class 4 and 3 on the scale of 1 to 5 with class 1 bid/tender estimates being the most accurate. The expected range of accuracy for such class 4 and 3 estimates is within a lower limit of -20% and an upper limit of +50% at a 10 to 40% level of project definition as shown in figure 9.

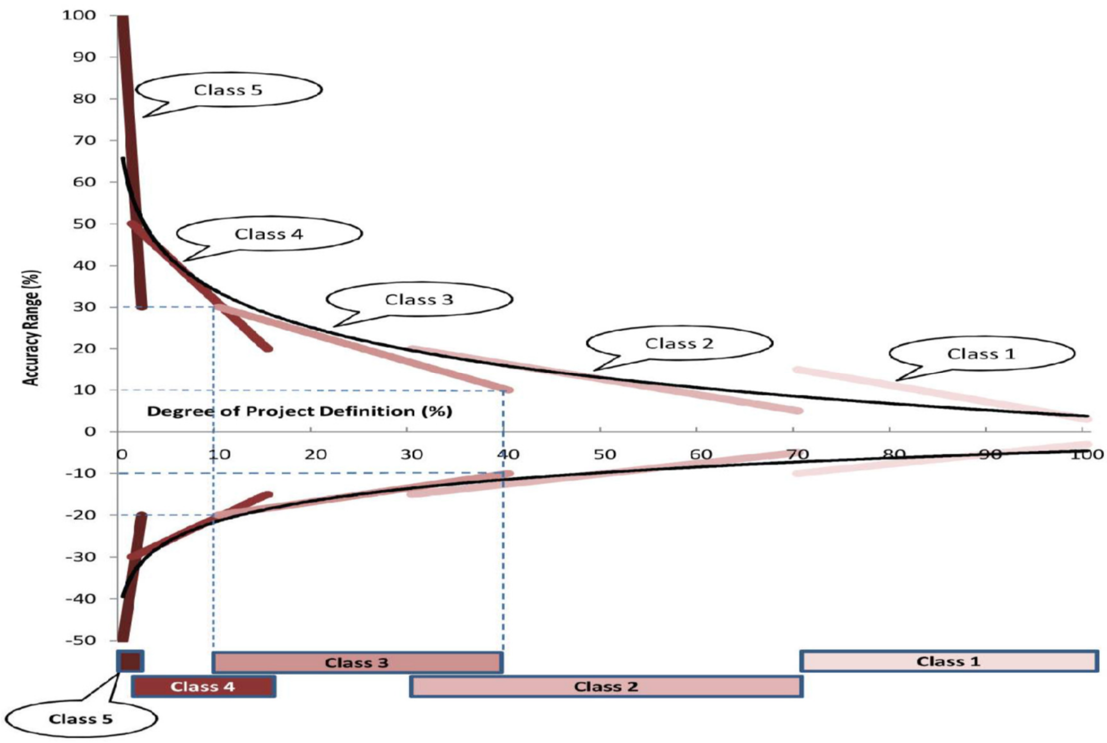

Figure 9: Degree of Variability in Accuracy of AACE Estimate Classes as Portrayed by the Department of Energy (DOE, 2010)

Class 2 and1 estimates on the other hand, often generated after detailed designs (70 to 100% project definition) used in bids/tenders, have a higher level of accuracy implied by the lower level of variability (+/- 3 to 15%) of estimates from the final cost.

2.4. **Accuracy of Cost Estimates: Critical Cost Overrun Phase for Highway Projects**

Cost overrun is measured as actual out-turn costs minus estimated costs as a percentage of estimated costs (Creedy, 2006). Actual costs are defined as real, accounted construction costs determined as being expended from the point of contract award to the time of project completion (Flyberg *et al.*, 2002). "*Estimated costs are defined as budgeted or forecasted construction costs determined at the time of the decision to build"* (Cantarelli *et al.*, 2010). The authors equally affirmed that the estimate designated by highway authority based upon which the decision whether or not to implement the project becomes increasingly changed to the estimate based on which a formal contract is awarded and up to point of project completion.

The literature shows a strong and still on-going debate on the basis to be used for estimating the level of cost overruns. Principally, project promoters are adverse to the adoption of the initial phase of highway project development which represents the time-of-decision-to-build as a benchmark on the premise that it constitutes an unfair basis for such assessment (Simon, 1991). Odeck (2004) was of a similar view and supported this stance stating that the estimate generated at the detailed design and specification should be the basis on which planning approval and funding for projects ought to be sought. This argument was raised in concordance with of the practice of parliament in the Norwegian context. The author recognized the highly challenging situation often resulting from project cost underestimation at the planning stages and outline proposal phases presented to the decision makers. He asserted that decision makers in evaluating the viability of projects are misled and will therefore base funding approval on this deceptive basis. His argument was thus that at the detailed design, the actual viability of a project will be known, and noted early enough by the decision makers who can then resolve to choose one of the following three alternatives:

- Not to implement the project at all;
- To implement the project in another form;
- To implement other project or projects.

He thus concluded that the detailed design stage should in effect be considered as the critical estimate phase to be logically used for assessing the level of cost overruns.

Several other authors have however argued otherwise, stating that the initial conceptual estimate is the most crucial estimate which should serve as a bench mark for assessing the level of cost overrun (Chou, 2005; Anderson *et al*., 2006; Creedy, 2006; Cantarelli *et al*., 2010, Tan and Wakmasha, 2010). Asmar *et al* (2011) states that an estimate at this stage is ideally needed to provide information to highway agencies on which to base approval and funding decisions as well as to establish a project baseline cost and budget. It was also noted by Sabol (2008) that the conceptual estimate represents the first point of effort made at assessing the potential cost of a project necessary to align decision-making.

Along similar lines of argument, key authors, Flyvbjerg *et al* (2002) in furtherance of the assertions of Wachs (1989) almost three decades ago, provided a strong justification in defense of this stance stating that:

> *"When the focus is on decision making, and hence on the accuracy of the information available to decision makers, then it is exactly the cost estimate at the time of making the decision to build that is of primary interest. Estimates made after the decision to build are by definition irrelevant to this decision" (p 4).*

The argument of these authors was rationalized on the following grounds:

- The impossibility of assessing how informed the basis for decisions are and the uncertainty associated with budgets.
- The deliberate concealment of project details and facts likely to reflect the true financial implications of a proposed project termed as '*Salami tactics*'.
- The need to have a uniform platform for consistent comparisons of projects.

The authors noted that this preliminary phase was also used for computing cost overruns as the international standard. In line with these assertions, Evans and Peck (2008) further went on to state that:

> *"The cost estimate produced at the preliminary phase is the first cost estimate in the life of a project that should be able to be relied upon for program purposes and taken forward through future phases" (p.18).*

This was stated against the background that for government funded projects budgetary allocation has to be voted out for a project after the identification of the proposed scheme from annual development budget. Other authors also reiterated that:

> *"Initial cost estimates are more useful in determining funding levels needed for long-range capital programs. This quantification of cost is the initial figure that allows the project to proceed to the next phases for final design and construction" (Schexnayder et al., 2003. p.8).*

Turochy *et al* (2001) thus stated that it is often thought of as the first estimate used for budgeting purposes and allocation of funds by highway agencies. Chou (2008) emphasized that the conceptual phase of cost estimation should be conceived as the most significant starting process to influence the fate of a new transportation project.

2.5. **Implications of Inaccurate Conceptual Estimates for Highway Project Delivery**

Very high conceptual estimates above the likely costs would mean insufficient funds for sponsoring other development schemes (Donnell, 2005**;** Tan and Wakmasha, 2010). This scenario where budgeted figures are greater than the actual project costs would imply an under-expenditure resulting in fund carry-overs between financial years and consequently funds not being efficiently utilized by the agencies. (Belli *et al,* 2001). The Freiman curve in figure 10 below describes the scenario of over-estimation as self-fulfilling prophecies.

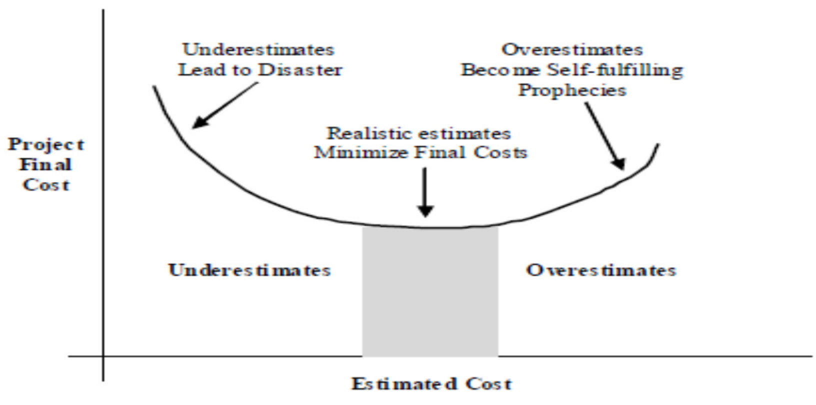

Figure 10. Freiman Curve Showing Estimating Scenarios (Source: Phaobunjong, 2002)

Conversely, very low estimates would imply that adequate funding is not voted out for a scheme and the progress of works would be stalled due this shortfall. Jameson (2007) was of the opinion that the bureaucratic challenge associated with gaining further approval of funds which is a consequence of the 'functional nature of public service institutions' will therefore slow down pace of project completion. CusWorth (1993) outlined the various phases that budgetary shortfalls emanating from inaccurate conceptual estimates have to go through before it can be accommodated in future budgets in figure 11.

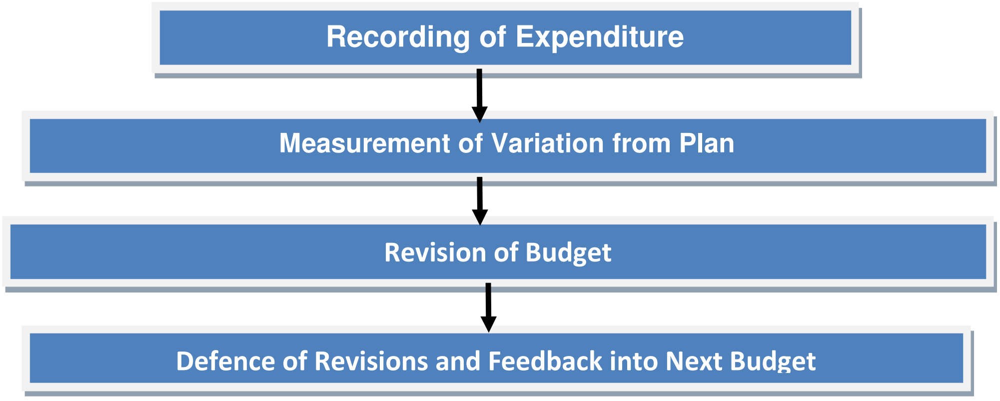

Figure. 11. Budgetary Implementation Phases (Source: CusWorth, 1993)

As such the bureaucracy associated with gaining further budgetary approval requisite to accommodate such cost overruns, can lead to lengthy delays. One of the earlier authors in the literature, Hall (1980) in congruence with the Freiman curve asserted that:

> *"Most of the planning disasters experienced in highway projects seem to be rooted with under-estimates at the preliminary phase" (p. 34.)*

The general consensus in the literature is that in practice, it is essential that estimates be reasonably high to have adequate funds to cover for any project cost but not to the detriment of other schemes (CusWorth, 1993; Evans and Peck, 2008; Tan and Wakmasha, 2010; Asmar *et al,* 2011). The collective views of theses authors emphasize striking the right balance between these two extremities for achieving accuracy in initial estimates for planning purposes.

3. Summary of Findings and Conclusion

The study has discussed the theoretical basis of accuracy in estimating. Accuracy of cost estimates has being shown to be defined relative to the phase of project development at which the estimate is being projected. The literature review however shows that there is no uniform nomenclature in the literature for labeling the phases of development and therefore different terminologies are evident. The level of accuracy increases correspondingly as projects mature through the developmental phases with the estimates produced at the earlier phase the most variable. Highway agencies thus place emphasis on this phase due to the 'Chain reaction' effect that this phase has been shown to have on the successful completion of highway projects. The spill-over consequence of this effect has thus being shown in the literature to manifest as 'cost overruns' in varying degrees of magnitude and impact for highway projects.

Most of the studies in scholarly literature as summarized in table 2, adopt this initial estimate as the basis of cost overrun evaluation, convergently emphasizing the need for accuracy and supporting their stance with very sound and logical arguments.

Table 3: Perspectives on critical cost overrun eestimate phase

Authors	Adopted Stance	
	Conceptual Phase	Design Phase
Hall (1980)	#	
Simon (1991)		#
Turochy et al (2001)	#	
Flyvbjerg et al (2002)	#	
Phaobunjong (2002)	#	
Schexnayder et al (2003)	#	
Odeck (2004)		#
Donnell (2005)	#	
Evans and Peck (2008)	#	
Tan and Wakmasha (2010)	#	
Asmar et al (2011)	#	

Source: Literature Survey

Having critically analyzed the arguments raised in the literature, the authors of this paper, conclude that it is the *'time of the decision to build estimate*' useful in budgeting for proposed schemes that should determine the degree to which the final project cost has '*run-over budget*' and not the latter phase estimates. However, the researchers note that the stage at which this estimate is made is dependent on the configuration of the development phases which are specific to highway agencies. Therefore in line with the objective of the study, this phase has being logically identified as the critical benchmark in estimating, requisite for assessing the level of cost overrun for highway projects.. The study tags it as the 'conceptual phase' for uniformity and specifically refers to the point of planning when the initial feasibility study has being concluded, and an estimate is needed based on a schematic outline design of the concepts of the project for budgetary authorization. The proper planning of highway development programs, as repeatedly emphasized in the literature, necessitates the accurate estimation of funds at the initial phase for projects to circumvent the occurrence of cost overruns.

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Game Changing on Assessing Healthcare System in Developing Countries

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Abstract:

Purpose: To explore the essence of game changing on applying joint venture approach for healthcare system improvement in developing countries Design/methodology/approach: Review of literatures and investigating various relevant concepts assist in exploring the factors affecting the successful implementation of Joint venture (JV) as outsourcing relationship for healthcare services in low an mid-income courtesies (LMICs). By leverage on indicators appears from survey finding and result analysis that asses me to discounted factors that more applicable to developed countries and give more close attention to factors related developing countries. Findings: My research findings indicates that the LMIC healthcare system would benefit from affiliation with leading technology partner for healthcare reform. The results support the view of LMIC healthcare systems needs to incorporate the implementing of JV model as outsourcing relationship for services improvement and knowledge transfer in LMIC healthcare systems that contribute in country economic growth, development and stability. My explored evidence support the views toward issues related to decision making and management control of JV to be established in different ways in comparison with developed countries. Conclusion: The findings presented in my research, help support views on expending the use of JVs as approach for improvement LMIC healthcare system. My research results provide support for need of the partner involvement in the joint venture as compared with your initial expectations at the time the business venture was formed. Also I shown evidence of international partner knowledge of the market and business practice will helps overcome culture difference and create added value to business and contribute in country growth and stability.

Keywords:

Joint venture, outsourcing, healthcare, low and mid-income countries, developing countries.

1. Introduction

World Bank defined the low and mid-income countries (LMIC) with gross national income of \$996- \$3,945 that based on the common used classification of countries by income per capita (World Bank classification, 2011). The increased burden of disease in LMIC cannot be overlooked, especially in the Republic of Yemen which has been selected in this research case study where mortality and morbidity rates are currently high and likely to increase. In terms of burden of disease, measured in disability-adjusted life-years (DALYs), chronic diseases were responsible for an estimated 49% of the total worldwide burden of disease in 2005 and 46% of the disease burden in low-income and middle-income countries (Abegunde *et al.,* 2007). In addition to that, number of changes are taking place in the epidemiological profiles of populations and the financing and organization of health systems that have increased the need to set health reform priorities. A variety of health reform efforts with varying approaches are under way in this cluster of countries as well (World Bank, 2010). Taken into consideration, the complexity of health financing arrangements in middle-income countries poorly supported and totally out of balance by geographic region and cultural context. This implies that the health systems in LMICs need much more efforts to address innovative approaches including joint venture (JV) model that could lead service improvement as outsourcing relationship.

Healthcare is a critical component of a country's economy both from the national and local perspectives. Economic shifts in a country can result in changes in demand for healthcare and in the delivery of healthcare. Over the long term, as populations grow there will be a growing demand for healthcare. This will call for better integration and efficiency of services, and improved legislative reforms affecting the financing and regulation of healthcare and its effects on economic cycles.

The main aim of this research to understand the essence of game changing on process leading to healthcare system improvement in developing countries, by provide a window of exploration for future research in the field. Furthermore, the important aspect of this research is that it employs a range of data collection methods and examines a number of different variables as determining factors effecting the implementation of joint venture (JV) model as outsourcing relationship for improvement of healthcare in LMIC.

This research cover's evaluation the impact of JV with experience foreign partner for the improvement of LMIC healthcare system. The study intend to expand understanding of means on how JV for LMIC healthcare system provide added value, reduce risk of environmental uncertainty and enhance local partner knowledge and experience. Also, will explor why the technology transfer in developing countries was found to much worse than expected.

The key elements that believe constitute a successful JV will be identified and why JV management capability plays an important role in the JV success will be further explained. In addition, a closer look to the inter-partner conflicts indicators by measure both the frequency and intensity of inter-parent conflicts, as and when they occurred. Finally, the conclusion will help widen the understanding of the determinants of JV performance by assessing JV approach, how the priority in developing countries has been shifted more toward addressing the need for improvement in quality and efficiency of health services. Also, will show how the decision making and management control of JV tend to be established in different ways in comparison with developed countries. Moreover, will demonstrate the international partner knowledge of the market and business practice will we overcome culture difference and create added value to business and contribute in country growth and stability.

2. Literature Review

Previous research has shown that JVs are created for different reasons in developed and developing countries (Banerjee, 2010)., Killing (2012) found that the major reasons for creating the ventures were, in a rank-order of importance: need for other partner's skills, needs for the other partner's attributes or assets, and government suasion or legislation. Keep in mind that the financial measures are not only used independently but also used to validate subjective performance measures. For example, Choi and Beamish (2004) confirmed the appropriateness of assessment of satisfaction with JV performance by showing its high correlation with return on assets and return on sales.

The cost saving factor has been one of main drivers behind to initiate any join venture which primarily based on the principal theoretical approach for explanation JV formation and development is based on transaction cost economics (Chou, 2011). Chou believes, TCE provides a solid foundation for firms to follow. Although, proponents of TCE argue that alliances occur because the sum of production and transaction costs associated with joint ownership is lower than that for sole ownership or market transactions (e.g., Kogut 1988a; Tsang, 2002; Robson *et al.,* 2013).

Without the development of new skills, the organization's ability to accomplish its work processes through the knowledge, skills, abilities, and competencies of its people is highly inevitable. Capability may include the ability to build and sustain relationships with your all stakeholders; innovate and transition to new technologies that is highly needed in any healthcare JV which will develop better healthcare services and work processes and meet changing health care, market, and regulatory demands. With this in mind, paying a close attention to constant upgrading and enhancement of individual and team-level skills and abilities, and enhancement of organization-wide expertise is found in most research plays a tangible factor in the success of any JV in all industries including the health sector. With a consideration that knowledge acquisition skills must be developed, and this requires time and the active involvement of managers (Tsang, 2002). However, all these factors found to be of upmost importance in LMIC healthcare and needs arising more with continuous advancement in healthcare standards.

In understanding that the knowledge transfer aspect is highly related to the goals of knowledge acquisition, technology transfer or exchanges. However, companies enter into JVs for a variety of reasons in addition to acquisition of technology and expertise. In broader prospective, to the need for better understanding of outsourcing in relation to Knowledge transfer namely, knowledge ambiguity as a mediator of tacitness, experience, complexity and cultural and organizational distance or closeness (Kakabadse, 2000). Not only that, knowledge transfer involves conveying and diffusing knowledge throughout an organization to leverage the ways it can be used to solve problems and strengthen performance (Phusavat, 2007). This implies, not only the need for the organization to decide on how knowledge be transfer during outsourcing process, but also to set an clear criteria how it will be best achieve life cycle of such relationship.

The successful JV performance requires to make sure all parties involved not only understands the basics of the agreement, but also understands the fine details, including goals, financial contributions, human resources and expected length of the deal most ignored aspects of any JV. the development of a JV relationship, and the JV agreement as the instrument that, together with the applicable laws of the host country, sets out the rules that govern the relationship between the partners and the formation, incorporation and management of the JV company as a separate legal entity (Lima, 2009). Specifically, the relationship oriented exchange behaviours as indicated by (Robson *et al.,* 2013) might even result in lucrative ends outside the original JV agreement.

One of the key elements believes constitute a successful JV is in having flexible structure. In joint venture, partners provided with great deal of flexibility in structuring their arrangements and determining their contractual rights and obligations. In addition to trust, knowledge acquisition skills must be developed, and this requires time and the active involvement of managers to be in top of their list in addition to manage their day-to-day operational activities (Tsang, 2002). Meanwhile, trust found to be highly reflected in the JV performance, as the firm trustworthiness is found to improve performance by reducing transaction costs resulting from the need for contracts, which are costly to write and enforce (Dyer & Chu, 2003). Some studies report that the consequence of trust in JV relationship effectiveness (Moore, 1998), while others report that trust influences a partner's intention to stay in a relationship (Ruyter, 2001).

The literature of international business shows that control is one of the biggest challenges that parent firms face when entering JVs (e.g., Geringer & Hebert, 1991; Busi *et al.,* 2010; Lou *et al.,* 2010), and plays an important role in JV successes, or failures (e.g., Groot & Merchant, 2000). Already more than 15 years ago, Geringer and Hebert (1989) proposed that future research should broaden the critical considerations and implications of control in terms of mechanisms, control extent, and control focus. More recently Barden *et al.,* 2005) have added to the debate and suggested that further research is needed to investigate the "fit" between parent firms' strategies and their control systems.

Recently there has been increased interest in research on control across organization boundaries as an alternative for outsourcing option. Outsourcing found to increase the monitoring and control costs (Sarkis *et al.,* 2011). As consequence, interest been developed for closer relationships between organizations for example, joint venture, long-term outsourcing relationships, licensing agreements and franchising arrangements (Håkansson & Lind, 2004). However, some scholars believes that much of the control problem in culturally heterogeneous JVs could possibly be resolved when the parent company understands the role culture plays in commitment inducement mechanisms (e.g., Le *et al.,* 2009; Ahiaga-Dagbui *et al.,* 2011; Miles *et al.,* 2014). Known that, the partners sometimes abuses the JV due to conflicting interest that leads to dispute between the partners. With such projections, this found to be one of the reasons leading the control mechanism to failure due to confusion and mistrust (Minh, 2013). For that, it would be worth researching if control of JV functioning in the developing countries differs from that of those located in developed market, and how this reflected in particular in critical services such as healthcare system.

3. Research Methodology

This study provides a methodical, analytical, and focused review of those empirical studies examining how the development of outsourcing plans based on JVs model contribute in the improvement of LMICs healthcare system. In addition, the study employed a qualitative approach to conducting the empirical part of the study because it is helpful when trying to develop knowledge by using questions approach. This study questioners around issues related to partner's level of influence, the JV journey during negotiation and operational stages, and measures to assist conflicts arisen between partners. At the same time, broad data collected about JV experience in both developed and developing countries with narrative review of particular experience in healthcare industry in journals, white papers, industry websites, and other sources. In addition, the discussion of finding with various industry experts. This enabled us to triangulate our finding to construct reliable interpretations (Yin *et al.,* 2007).

Research strategy as described by Collis and Hussey (2009) is a plan of how to structure the research in order to satisfy the research aim and objectives. There are a number of research strategies in social science research such as: experiments, surveys, historical analysis of archival information, and case studies (Yin, 2009). However, the choice of strategy is critical as each strategy depends on the purpose of the study, the type, and accessibility of the information required (Velde *et al.,* 2004). Meanwhile, Yin's (2009) findings indicate that the case study is the most appropriate strategy when the researcher has little control over the events and when the focus is on contemporary events. However, as in all approaches, the case study has advantages and disadvantages. Based on that, the case study approach has been selected to gain the depth of understanding of the information necessary to identify the implementation of the JV model as one of the outsourcing options that lead to process improvements in the healthcare system in low and mid-income countries.

The decision of data collection method is based on data triangulation approach that involves using different sources of information in order to increase the validity of a study, these sources are includes healthcare providers, policy makers, vendors, consultants and other stakeholders from both LMIC which determined by factors such as sample selections, availability to data sources that its usually lead by research questions that motivated by the research aim and objectives. Meanwhile, the case study can involve a single case study or multiple case studies

(Yin, 2009). This research adopted a single case study design since this approach can be used when the case is considered as unique. In this instance, Hamad Medical City (HMC) has been constructed as the prototype for the use JV model because of the outsourcing relationship that lead to process improvements in the healthcare system in the LMIC that can be replicated in other developing countries.

The survey questioners involved 292 participants 188 responded from LMIC healthcare providers, vendors and consultants. They were selected based on the three criteria's; First, deep knowledge of healthcare challenges and barriers. Second, understanding the needs of LMIC healthcare systems. And third, experience or interest in seeking JV model as of outsourcing options as a means of healthcare improvement. The questionnaire selected in this research to obtain data about attitudes and perceptions towards JV models as an outsourcing relationship in the improvement of healthcare. Since the research was exploratory, the questionnaire was issued to include a broad range of organizations, stakeholders, consultants, and vendors in the sample to improve the possible generalization of the findings and reduce the likelihood of company-specific performance effects. Those involved consisted of heads of departments and the managers of the various organizations.

The survey approach covers LMIC healthcare providers, vendors and consultants selected based on deep knowledge of healthcare challenges and barriers, understanding the needs of LMIC healthcare systems. And experience or interest in seeking JV as of outsourcing options as a means of healthcare improvement. This research uses a qualitative approach (Creswell, 2003) to explore issues related to outsourcing in a hospital environment. According to Leedy and Ormrod (2001), one purpose qualitative research can serve is to "enable a researcher to gain insights about the nature of a particular phenomenon".

Taylor and Bogdan (1984) explained that all researchers develop their own ways of analysing qualitative data. The qualitative data might be integrated at several stages in the research process: at the data collection, the data analysis, the interpretation phase, or a combination of phases (Creswell 2003). For that, scale items were adapted and adopted to capture the manager's perceptions and behaviours to operationalize the variables. Respondents were asked to rate their perceptions on five-point Likert scale (1 "strongly disagree" and 5"strongly agree'').

4. Result Review and Analysis

The questioners set up to evaluate the impact of quality in affiliation with experience foreign international partner will provide added value and reduce risk of environmental uncertainty. In addition to that, further questioners were carefully crafted to assist in evaluation of parent firms experience in the use of JV in order to develop clear understanding of the extent of both partners venturing experience.

Table 1: key elements constitute successful JV

Key elements	Priority
Trust between partners	1
JV formal structure	2
Partner's strategic compatibility	3
Partner's strategic compatibility	4
Communication between partners	4
Interaction between colleagues	5

In discussion of the most important determinations JV an question was raised to discuss in priority bases the extent the key elements that believe constitute a successful JV as shown in table 1, where most of respondents has been given more emphases to the importance toward trust between partners, JV formal structure and partner's strategic compatibility in comparison to less importance given by some respondents towered Interaction between colleagues, Composition of governing bodies and Communication between partners.

In review the trust between partners, the majority of respondents of 62 percent has been considering high degree of trust between partners is essential as a foundation for a robust and mutually constructive relationship. As the trust exists when one party has confidence in the reliability and integrity of their exchange partner (Morgan & Hunt, 1994). Which made it emerged as a central theme in international collaboration and symbolizes the strength of partners' ties (Li, 2007). Not only that, but also stabilizes the relationships between organizations, reduces the need for complex contractual agreements, permits open exchange of information and reduces transaction costs (Minh, 2013). From another angel the lack of trust can be seen in respondent's responses throughout the survey as the cause of unexpected issues and problems.

In looking into the effect of formal structure as selected to be the second priority that drives successful JV. Participants considered also the formal structure to be a means to set partner's rights and responsibilities. This because, it help define and follow JV goals, and provides a framework for building trust and problem solution. In the study, the respondent given majority of 52 percent for the importance of establishment of right JV formal structure as the angle of viewing through which individuals see the organization operation and commitment for success. This is been highly supported by Sampson (2003) whom considered that establishment of organization formal structure is the bases to deal with cooperation coordination problems the alliance structure. However, this does not prevent the needs for clearly define the vision, mission, values, strategy and structure of the JV need to support, encourage, and reward learning and the sharing of knowledge (Slocum & Lei, 1993).

Table 2: Key drivers behind JV success

LEAST IMPORTANT	MOST IMPORTANT
• Reducing risks	▪ Developing new skills
• Reducing costs	▪ Meeting healthcare requirements

In exploring the key drivers behind JV success for the improvement of LMIC health care system, table 2 indicated that the 72 percent respondent considered the developing new skills and meeting healthcare requirements has been playing a clear motive of priority setting activities that identifies its strength, weakness, gaps and opportunities in healthcare system which includes on top of that the capacity building which found by (OECD, 2009) it can help to strengthen the government's ability to perform its role in a fragile state and improve the state-citizen relationship by demonstrating government competence. However, from another stand the results has shown that cost reduction associated risk has been considered as a least important in developing countries which due to the fact that health services in these countries lacking the basic infrastructure.

Table 3: JV comparison with initial expectation

Activities	Scale %		
	Much worse than expected	As expected	Better than expected
Cost control	23	62	15
Business climate	19	65	15
Management capability	19	46	35
Technology transfer	31	46	23
Need for parent involvement	15	73	12
Customer service	19	50	31
Inter-partner trust	15	54	31
Inter-partner co-operation	16	68	16
Achievement of strategic aims	23	54	23

In assessing the activities of the joint venture for the improvement of quality of LMIC healthcare as compared with initial expectations as shown in table 3. The assessment of various activities of the JV was compared by using three scales; much worse than expected, as expected as and better than expected. The majority of participant with 70 percent indicated their satisfaction as expected. Similarly, this support the finding as more than half of JVs met or exceeded expectations (KPMG, 2009). Meanwhile, 19 percent gave outstanding support by interpreted their satisfaction better than expect and around 10 percent has considered less than expected satisfaction with overall JV performance. Which in turn, support (Rinaudo, 2003) reported finding of more than half of their companies' JVs met or exceeded at least one parent's expectations.

In the context of technology transfer, some scholars support the idea of firms are willing to establish partnership with foreign firms for various reasons; to increase their competitiveness, transfer technology, enter new foreign markets, benefit from new sources of finance and the government's financial incentives, and learn new management techniques (e.g., Demirbag *et al.,* 1995; Tatoglu & Glaister, 2000; Sehic, 2010). In that sense and in view of such high expectation from international firm, the survey results witnessed disappointment as majority of respondent by 31 percent believes that technology transfer was much worse than expected.

This is, in spite of management capabilities has received the highest score of better than expected by 35 percent that indicates short term gains has been observed will less emphases on long term objectives toward critical issues like technology transfer that will impact on JV stability and growth. Although many studies have acknowledged the substantial effect of knowledge and technology transfer on performance outcomes, however others weight it of less importance. In his studies Yin and Bao (2006) examine the effects of degree of technology transfer on both local firms corporate and human resource performances in inter-firm are still scarce. Nevertheless, the importance of further investigate the matter further on why partners in some instance become more protective of their strategic valuable asset and reluctant to transfer higher technologies.

Concerning the need for partner involvement, 73 percent of participants marked as expected the need for partner involvement in the JV as compared with your initial expectations at the time the business venture was formed. This possible due to the clear understanding of both partners of the long-term nature of strategic partnership provides a context to utilize their deep involvement in developing best practices and resources for business success. Meanwhile, in earlier in-depth interviews revealed similar insight stressed by (Karlsen *et al.,* 2003) into the importance for the local partner to enhance learning from other experience of dealing with other cross-cultural interactions toward ensure further successful wider involvement of inward and outward activities.

Interestingly, the participants has highly regarded better than expected the JV management capability been core competency very well positioned as compared with your initial expectations at the time the business venture was formed. That ultimately reflected on enhancement the capability of individual within the organization for better performance results. This stress on the fact, if the resources contributed by two or more JV partners are more valuable when combined than when separate, it stands to reason that there is a potential for substantial capability development. This creates two potential lines of inquiry concerning knowledge and capability management in JVs, the first deals with how newly developed knowledge and capabilities may be leveraged in JVs and potentially by the parent firms. The second deals with how to manage a JV that becomes more adept at creating value than its parent firms (Beamish *et al.,* 2009).

In most joint ventures there is a difference because in the developing world culture distance and political environment always play a critical role in the JV success. So there are times when they have to re-visit the established agreements to ensure business is stream lined with outcomes needed. The static kinds of agreements are hard to renegotiate but withstand the pressure of change. As a result, renegotiations are a growing to be an inevitable trend in international business and need an open mind and flexibility from both parties. In this regards, the question was clearly drawn toward the issues that have required renegotiation and required changes in the initial terms of the contract, that indicate 15 percent of participants strongly agree with revisit.

Obviously, assessing foreign or local parent firm's level of influence on JV strategy formulation is highly essential for both partners to appreciate that given that goals are the result of an early step in the strategy formulation process. Surprisingly this contradict with respondent feedback on the importance on not given any influence or advice at all during the strategy formulation. Furthermore, other participants express their satisfaction increased in view of limited participation in the formulation process. This is due to the fact, limited knowledge of the LMIC local partner and stretch of knowledge gap with international partner. This in confirmation with what anticipated in basic sense, the local partners needed the foreign partners for improving their management skills and strengthen their local presence.

Table 4: Factors that drives inter-partner conflicts

FREQUENCY	LESS FREQUENT	MORE FREQUENT
MORE INTENSIVE	• Partner's attempt to make changes in the terms of joint venture contract. • Partner's attempt to control key decisions in the joint venture. • Issues regarding hiring policies in the joint venture	• Issues regarding performance of the joint venture and criteria used to evaluate performance.
LESS INTENSIVE	• Separating the operations of the joint venture from those of the parent companies. • Division of benefits between the parent companies.	• Roles and functions to be performed by each partner in the joint venture. • Expanding the joint venture or maintaining it at a certain size.

In studying the literature concerning inter-partner conflicts in international JVs indicates that JVs in developing countries are vulnerable to a range of issues, including strategic level, tactical level, and operational level issues (Demirbag & Mirza, 2000; Käfling, 2009), by measure both the frequency and intensity of inter-parent conflicts, as and when they occurred. However, the relevant findings of the literature review and collected data presented earlier amalgamated, and transformed to a grid table 4, which indicates four main forms of factors that drives inter-partner conflicts in relation to the frequency and intensity scales.

The first form more emerges from the qualitative is related those conflicts that occur less frequently, but as they occur, their intensity is relatively high compared with other conflict areas Partner's attempt to make changes in the terms of JV contract, control key decisions in the JV and issues regarding hiring policies in the JV. However, the second form is related to conflicts which occur more often as compared with other conflict areas, and with relatively high intensity that includes These conflicts are more likely to be settled through board meetings in a JV or meetings between parent organizations that it's more toward issues regarding performance of the JV and the criteria used to evaluate performance. The third form, that can be drawn from both qualitative analysis results is related the type of conflict that appears to occur relatively more often but with less intensity in defining the roles and functions to be performed by each partner in the JV and expanding the JV or maintaining it at a certain size. Finally, the fourth form, related to conflicts that occur less often and with low intensity with regards to separating the operations of the JV from those of the parent companies and division of benefits between the parent companies.

5. Conclusion

The main aim of the research was to widen the understanding of the determinants of JV performance by assessing JV model as of outsourcing relationship that lead to process improvements in LMIC healthcare systems. The significance of the results finding indicates that the first priority in developing countries has been shifted more toward addressing the need for improvement in quality and efficiency of health services. However, the previous research over the last three decades, indicates that cost-savings and freedom to focus upon core business are still major reasons for outsourcing (e.g., Currie & Willcocks, 1997; Deloitte, 2005; Power & Bonifazi, 2006; Aramark Healthcare 2011a).

In view of limited or none experience local partners in most of developing countries, it was obvious that the structure of decision making and management control of JV tend to be established in different ways in comparison with developed countries. In that sense, the finding demonstrate that the foreign partner obliged the authority to appoint the key management staff and develop the managerial and control processes and setting the stage for implementation of plans.

In view of the common understanding that cultural differences seem to have a strong influence on JV operations. Similar culture is not always the most valuable resources in terms of effect on JV performance (Li *et al.,* 2001) or may not affect JV performance at all (Fey & Beamish, 2001). But the result finding support important lesson in having international partner knowledge of the market and business practice to create added value business and contribute in country growth and stability. As such, finding articulate the effective contribution of international partner in developing skills of local partner which in return will suppress any issues arises from culture difference and create a positive impact on JV performance. Also, in other part of the study the results validated the justification of satisfaction with deep partner knowledge of the market and business practice. In that situation, the finding shows no trace for partner's attempt to make changes in the terms of JV contract nor control key decisions in the JV.

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Evaluating the Impact of Gated Communities on the Physical and Social Fabric of Doha City

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Abstract

Gated communities developments are widespread in the Arabian Gulf region. They are mainly characterized by a focus on physical security measures such as gates, walls, guards, and close circuit surveillance cameras. Even though Qatar is considered one of the safest countries in the world, still one finds that this housing pattern is dominant in Doha city, the state's capital. With a high percentage of expatriates in the country, people increasingly choose to live inside the walls of these gated communities, called also compounds. Such compounds are provided by the private developers for the public and by companies and the government alike for their employees. Currently, small, medium, and large size gated communities divide the urban fabric of the city into scattered parcels of land. These parcels are filled with housing blocks that have single and inefficient land use in contrast to the traditional compact neighborhoods of the Doha city itself. This paper seeks to analyze the case of Dar Al-Salam gated community in Doha as means to understand the impact of gated communities on the physical and social aspects of the Doha city. The case of gated communities in Doha will be explored in the context of urban design theories such as: Jane Jacobs and Kevin Lynch prescriptive of successful neighborhood urban design and will take into account local incentives and context. The impact of gated communities on the cohesion of the urban fabric of the city will be evaluated with reference to set of indicators derived from theories of urban form advocating mixed-use, dense, diverse, integrated and connected urban development. The analysis of the case study is mainly based on observations of the physical features and the social behavior of residents of this community. In conclusion, the paper identifies the negative impacts of gated communities on the physical fabric and social cohesion in Doha. It calls on the planning authorities to actively address these negative effects and consider alternative models of urban developments that better serves Doha's particular urban needs for achieving social integration and livable city environment.

Keywords:

Gated communities, urban fragmentation, privatization, residential, community.

1. Introduction:

More than 120 gated communities were estimated to be located in Doha as per 2012 census (Qatar map, 2012), and their numbers are growing. The dramatic demographics, economic, and social changes that happened in Qatar during the last 20 years brought with it an increasing popularity of gated communities. The high percentage of expats in the country has resulted in ethnically and economically diverse and fragmented demographics in the city. Also, housing provision is typically an employer-based catering amenity exclusively to employee groups. These main factors act as a catalyst to increasing proliferation of gated communities. This condition raises many questions about the viability of this housing pattern:

What are the grounds for gated communities in Doha? Are they compatible with Doha's neighborhoods needs for physically and socially integrated and livable environment? And how do gated communities affect the physical and social fabric of Doha?

For long, scholars and observers have been arguing for and against the validity of gated community development pattern. On the one hand, advocates of this pattern describe it as pleasant, private, and safe. They claim that it creates a sense of togetherness and tight-knit community among their residence. Also, they have controlled traffic so children can safely play on the roads like their parents did in traditional neighborhoods where narrow alleys created a safe environment against car speeding threats. Moreover, they provide a lifestyle and higher quality standards of living with a homogenous social groups and thus exclusive amenities like swimming pools, children playgrounds, and other recreational facilities. On the other hand, this gating phenomenon is not without costs. They isolate individual neighborhoods from each other and from the city public spaces, divide the city urban fabric into islands of a single land use areas which lack the vibrancy of mixed-use and socially and economically diverse neighborhoods. They create lifeless, blank, windowless, walled streets between each other that lead to the loss of public life, limit people experience of the city, and consequently result in a highly unequal society.

Given this controversy, this paper will evaluate the urban performance of gated communities with reference to theories of successful urban and social fabric summarized in terms of mixed-use, dense, divers, integrated and connected fabric. Also, it will take a case study of a typical gated community in Doha to test the hypothesis that:

Gated communities are not compatible with Doha urban and social needs for integrated and livable environment. They negatively impact the city being one of the main reasons for physical and social fragmentation. They form large-scale private properties that divide the city into isolated islands, produce a highly unequal society, and lead to the loss of public life. These aspects of gated communities are relevant to erroneous modern urban design methods that negatively affect the urban living experience within cities. The spread of this development unit leaves no hope to overcome the urban planning crisis of our contemporary cities.

2. Contextualization:

For a better understanding of the theoretical perspective which frames the gated communities in Qatar a critical review of relevant scholarship about this global phenomenon is necessary. Surveying literature on the topic, there is plenty of academic research on gated communities done in the United States, Europe, South Africa and Egypt. Surprisingly, the Gulf experience has not been well documented and studied yet with the exception of few studies in Saudi Arabia. Main recurrent themes are identified and briefly summarized below to include in the **first section** the definition of gated communities, in the **second** gated communities around the world, and in the **third** problems of contemporary cities associated with the presence of gated communities.

2.1. **Defining gated communities:**

There is no comprehensive definition of gated communities since it is a wide and diverse phenomenon. However, common aspects center on having closed, isolated, privatized areas of the city that serve as residential plots with above-average amenities. In gated community literature, Researchers present different definitions of this phenomenon. However, most of which share common features. The following definitions introduced in this study is based on its relevance to the type of gated communities, compounds in local terms, spread over the city of Doha. According to (Blakely & Snyder, 1997) "Gated communities are residential areas with restricted access such that normally public spaces have been privatized". Similarly, (Touman, 2002) asserts that a gated community is an urban settlement surrounded by walls with several entrances. These entrances are controlled by gates with security agents guard them. Sometimes these gates are under video surveillance. The access to these settlements is strictly reserved to the residents and their visitors (Touman, 2002). These residential developments are usually equipped with recreational facilities, playgrounds, swimming pools and other basic amenities, which are exclusively accessible to residents, to ensure a certain level of lifestyle.

Teipelke explains the concept of gated communities taking an inclusive perspective. For him "It is the gate that is the focal point of the analysis – from an architectural, political, economic, or cultural point of view. The gate – by its function – separates the residents from the others. The gate – by its physical feature – is the starting and end point of the fence/wall often surrounding a gated community. The gate – by its symbolic meaning – is the entrance to an exclusive world in/next to the everyday life" (Teipelke, 2011).

2.2. **Gated communities around the world:**

The notion of gated communities is not new, the traditional city used to be surrounded by walls with a number of secured gates for defensive and security reasons. Many of the traditional cities were based on an enclosed form of social and economic solidarity and were closely-knit and homogeneous communities. In the late 20th century, this ancient urban type began to re-emerge in modern settlements, and rapidly grew in many countries around the world. According to (Landman, 2000), in the USA, as well as in some other countries in Asia and South America, a considerable part of the population lives in these settlements. An increasing number can also be found in Europe, the Middle East and in South Africa. However, they differ from country to country with respect to their characteristics, and in particular with regard to the different reasons behind their development, such as: security, ethnicity and prestige (Levent & Gülümser, 2007). For example in South Africa and some parts of the US the main reason for their emergence, as stated by (Touman, 2002), is the increasing crime rate in their surroundings. Some residents decide to run away from this "risky" environment and live in a safely closed gated community. In other parts of the US, they are designed mainly for the urban elite (Blakely & Snyder, 1997). While in Europe, the primary reason for gated communities is the seasonal use of houses in coastal zones. On the other hand, in major cities like London and Amsterdam they have become a fashionable trend (AJIBOLA, OLOKE, & OGUNGBEMI, 2011).

In Saudi Arabia, another type of Gated Communities can be found. The purpose of gated communities there are to provide their expat inhabitants with the same lifestyle exist in their homelands. So they can freely practice their daily activities, which are prohibited outside the gates because they contradict local traditions or simply against the laws of the land (Touman, 2002). Therefore, it is mainly occupied by expatriates whose residence is part of their work contract.

2.3. **Problems of contemporary cities associated with the presence of gated communities:**

Drawing on (Ghonimi, El Zamly, Khairy, & Soilman, 2011), the physical and social features of gated communities do not only impact their inner structure, but they also impact their adjacent areas, and collectively they effect the overall urban fabric of the city. Therefore, taking a look into some crucial issues that relate to the impacts of gated communities on our contemporary cities is relatively important.

Alessandro Aurigi in his book Making the Digital City claimed in the context of exploring the crisis of contemporary cities that "cities have gone to pieces, the city is not a whole anymore;

new edges are developing within the city itself 'Fragmentation' is probably the keyword when it comes to speaking about contemporary urban space, and this phenomenon can be observed in social life as well as the production of built environment" (Aurigi, 2005). An obvious example of this is the recent developments of gated communities that cause the physical and social spaces to break up into bits that seem independent and detached from each other. This is supported by (Ajibola, Oloke, & Ogungbemi, 2011), who outlined that "the rise of gated communities can lead to spatial fragmentation and separation in cities as a result of its security and financial implications. Gated communities give a sense of community, safety, security and social exclusion which lead to urban fragmentation and separation." Consequently, fragmentation can cause the city to be not a whole anymore; or a city anymore.

3. Method of investigation:

The research questions addressed in this paper will be on the grounds of urban theories concerning successful neighborhoods' urban design elements and local context of Doha city. The impacts of gated communities on the physical and social aspects of the city urban fabric will be evaluated and examined with reference to set of indicators derived from the literature of practical lessons learnt from mistakes by idealist planners and theories of the essential qualities of city grain that must be present to achieve a good urban environment such as mixed-use, dense, divers, integrated and connected urban fabric. It will also take the case study 'Dar Al Salam' gated community, as means to identify patterns and draw conclusion of a practical nature about Doha's urban and social fabric. Specifically, this case study has been selected to reveal the course of physical and social impacts of real practice of building gated communities in Qatar. The paper will analyze qualitative primary and secondary data. The secondary data was sourced from academic reports and books mainly through the internet in the form of word or pdf documents. While primary data was obtained through site analysis using the following data collection tools: walk through, observations, interviews and site reconnaissance. All were conducted by the author in the case study area in different days of the week to guarantee the accuracy of the results. The site analysis was done to cross check the good urban fabric indicators extracted from the literature to evaluate the impact of the gated pattern on the physical and social aspects of the study area and its surrounding. The collection of data was in the form of photos, drawings, and notes. Photos were taken from inside and outside the compound. Arial photos extracted from google earth were used too for mapping the study area and its surrounding. Moreover, number of interviews was undertaken with the residents of the compound to investigate the reason behind their choice to live there and their living experience within the walls.

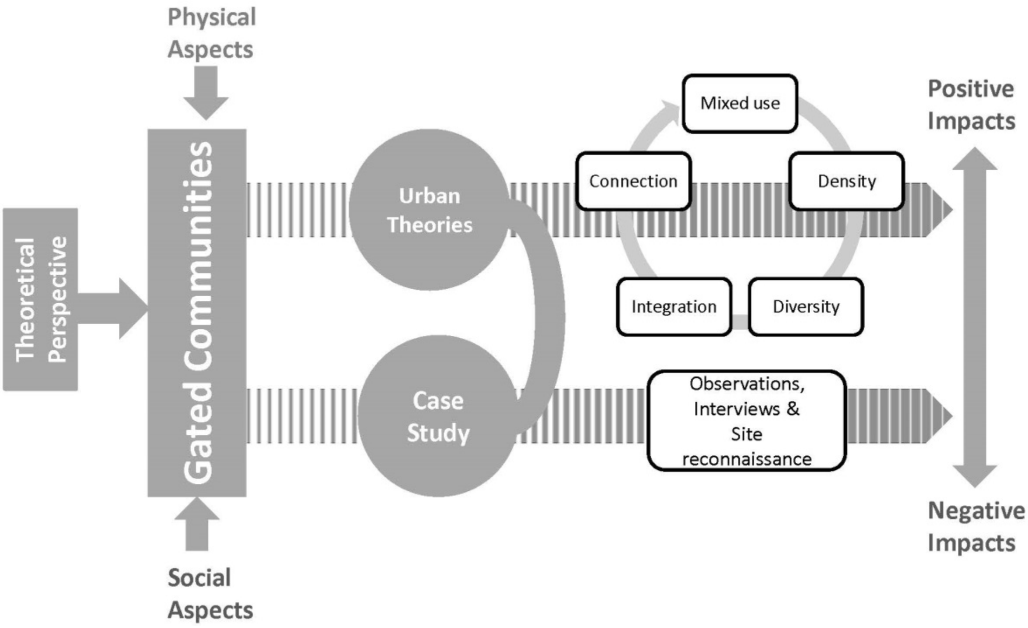

Figure 1. Framework of the research. Source: author

The paper is organized as follows: Section one includes the research theme, background and main argument. **Section two** presents the theoretical perspectives which frame the research investigation. **Section three** outlines the research methodology. **Section four** contains analysis and evaluation and the case study. Finally, **section five** concludes with the main findings and makes number of recommendations for future planning approaches to residential areas in Doha.

4. Gated communities' evaluation and analysis:

In order to evaluate the physical and social impacts of gated communities the following indicators have been developed with reference to practical lessons learnt from mistakes by idealist planners and theories. The indicators of mixed-use, dense, diverse, integrated and connected urban fabric. The **first section** will outline some theories for the successful physical aspect of the urban fabric, and then the **second section** will present the social aspect. The **third section** contains the local context with the case study.

4.1. **The physical fabric:**

In The Death and Life of Great American Cities 1961, Jane Jacobs describes the four necessary physical conditions for dynamic urban life: multifunctional neighborhoods, short blocks and connected street systems, varied age residential areas and a high concentration of people (Jacobs J., 2007). Also in the same book, Jacobs introduced the idea of eyes on the streets. "Dense, street-oriented residential buildings mixed with small-scale local commercial shops provide eyes on the street that keep the city safe" (Jacobs J., 2007).

Moving to Jacobs and Appleyard, they theorize, in their urban design manifesto, the essential qualities of city grain that must be present to achieve a good urban environment: "Livable streets and neighborhoods, a minimum residential density and intensity of use, integration of activities, buildings that define public space, and many different buildings and spaces with complex arrangements and relationships" (Jacobs & Appleyard, 2007).

The charter of the new urbanism, from Congress for New Urbanism (1996), with reference to the best qualities of the traditional neighborhood design, outlined number of guiding principles that focus on the physical spatial structure. One of the design principles in the scale of the neighborhood states that: "Neighborhoods should be compact, pedestrian-friendly and mixed-use" (Urbanisim, 2007).

From the few above mentioned theories, different criteria can be deduced in order to achieve the physical fabric that can provide integrated and livable environment in the city. These criteria include the following factors: having mixed use, compact, integrated, and high-density neighborhoods in place of single use, segregated, low-density settlements. Controversially, gated communities clearly represent large-scale privatization of vast areas of the city urban fabric. Large long walled blocks limit the continuity, accessibility, and affect the connectivity of the street systems. They are also characterized with low-density, single-use of inward residential developments. Creating lifeless, blank, windowless, walled streets around them that consequently lead to the loss of public life, limit people experience with the city, and reduce safety in the city as the notion of "eyes on the street" will not be applicable at all.

4.2. **The social fabric:**

In Uses of sidewalks contact from The Death and Life of Great American Cities, Jacobs describes how casual interaction with others on everyday urban streets leads to social cohesion and sense of belonging (Jacobs J., 2007).

Moving again to the urban design principles set in The Charter of the New Urbanism. One principle emphasized is that: "within neighborhoods a broad range of housing types and price levels can bring people of diverse ages, races, and incomes into daily interaction strengthening the personal and civic bonds essential to an authentic community" (Urbanisim, 2007).

Kevin Lynch in Dimensions of Performance from Good City Form (1981) describes the characteristics of good city form by linking the human values with the nature of the "good city". In this regard he suggested that: "Settlement is good when enhances the continuity of culture and the survival of its people, increases a sense of connection in time and space, and permits or spurs individual growth: development, within continuity, via openness and connection". (Lynch, 2007)

From the above mentioned views it is easy to note that the cohesive social fabric linked to diversity in housing types and the social groups, the interaction and connection between all kinds of people, and the integration and inclusion of the community. Thus, it rejects social segregation, separation, exclusion, and inequality. Taking that into account, gated communities which are characterized with having single housing typology with homogeneous socio-economic class of people, and act like borders that prevent the connection and interaction between individuals of the same society, will eventually weakened the civic bonds and sense of belonging, enhance social segregation and fragmentation, and consequently produce a highly unequal society and unhealthy neighborhoods.

Grounding on the above evaluation of gated communities, one can argue that they neither achieve the physical criteria of the successful physical fabric nor the social one. But, on the contrary, they represent the exact opposite of any good physical or social urban theory. Accordingly, gated communities negatively impact the physical and social aspects of the city urban fabric.

4.3. **Setting the scene: Gated Communities in Doha:**

Going back to the history of gated communities in Doha, it has been found according to (Mahgoub & Khalfani, 2012) and (Lockerbie, 2005) that the first compounds or gated residential developments found in Qatar were developed by merchants' families like Darwish and Al Manna in early or mid of 1940s. Then the idea started to flourish in the inner city, and a number of walled residential developments appeared inside the different freej. Later in the late of 1950s Qatar witnessed the arrival of foreign oil companies and the migration of the labor force. The accommodation of the labor force was provided mainly with gated communities housing type. As well, the oil companies were settled within newly developed gated settlements supplied with all the utilities as the city was not established enough back then to handle the increasing numbers of the population. The merchant took the opportunity and expand their work to make more profit through supplying the accommodation, which regarding the diversity of the newly comers, took the shape of gated communities. With the economic development of the state and increase of businesses that involved the migration of labor forces to Qatar, gated communities spread all over the districts of Doha. Moreover, construction companies and real estate markets contribute in the building and enlarging the numbers of these residential developments in order to make profit (Mahgoub & Khalfani, 2012)(Lockerbie, 2005).

Figure 2. Photo for the merchants gated communities on the sea front of Doha back in 1950 (Lockerbie, 2005).

Doha now is competing to become a global city, is this gated pattern of housing serving the city urban and social fabric positively? Are gated communities an appropriate development typology for Doha urban and social needs in terms of providing integrated and livable environment? What are their physical and social impacts on the city urban fabric?

Figure 3. Map of Doha showing the distribution of gated communities over the city (Qatar map, 2012)

First of all it is important to understand the basis of gated communities in Qatar. Beside of the reviewed historical facts for the initial reason behind its existence, it is vital to underline the contemporary reasons led to the spreading of this gated phenomenon in the state. As Qatar has a different experience from other countries around the world like for instance North America, Europe, or China, gated communities in the country have different roles, and different justifications altogether. The state of Qatar is considered one of the safest countries in the world with a low crime rate assessed by the U.S. Department of State in 2010. Therefore, the safety issue is most likely not the reason behind the popularity of gated communities within the city and its citizens. So why gated communities in Doha? What is the basis for them? If it is not the crime, it has to be another reason.

Looking into the grounds for gated communities in Doha, it has been found that, the increasing numbers of expats in the country result in shaping highly diverse demography of different cultures, which made people tend to isolate their culture in order to give the possibility for them to preserve various levels of freedom within theses gated developments. Another aspect is the employer-based provision of the housing system in Gulf countries. Each company offers certain privileges to its employees, and in order to make things manageable and to have these services as part of the package and the advantages which is offered through the contract, they have to make it exclusive. In this case, gated communities are not sought for security, but it is just as a part of the parcel of certain privileges offered to a group of people. In the wider perspective, these practical considerations gave justification for the presence of gated communities in Doha city but beside these practical considerations they have devastating effects on the city in large. Therefore, to place the research in a more informed position, a closer more defined approach was necessary to identify patterns and draw conclusion of a practical nature. Hence, a detailed case study of ‘Dar Al Salam’ gated community in Doha has been undertaken to reveal the course of physical and social impacts of real practice.

4.4. Case Study:

Dar Al Salam compound in Abu Hamor district is a typical example of gated communities in Doha in terms of its physical characteristics. It is surrounded by perimeter wall with two main entrances controlled by guards and surveillance cameras; the access is limited to residents and their visitors only. The population density in this development is much higher than other gated communities since it includes 320 apartments within two stories to three stories height buildings, along with 151 villas with a total population of nearly 1700. It also includes a number of amenities probably referring to its relatively big size and medium density; the amenities are more varied than what is usually available in other compounds. The provided amenities are namely: Swimming pool, two gyms, recreational club, club house, playground, female and male hairdresser salons, supermarket and one café.

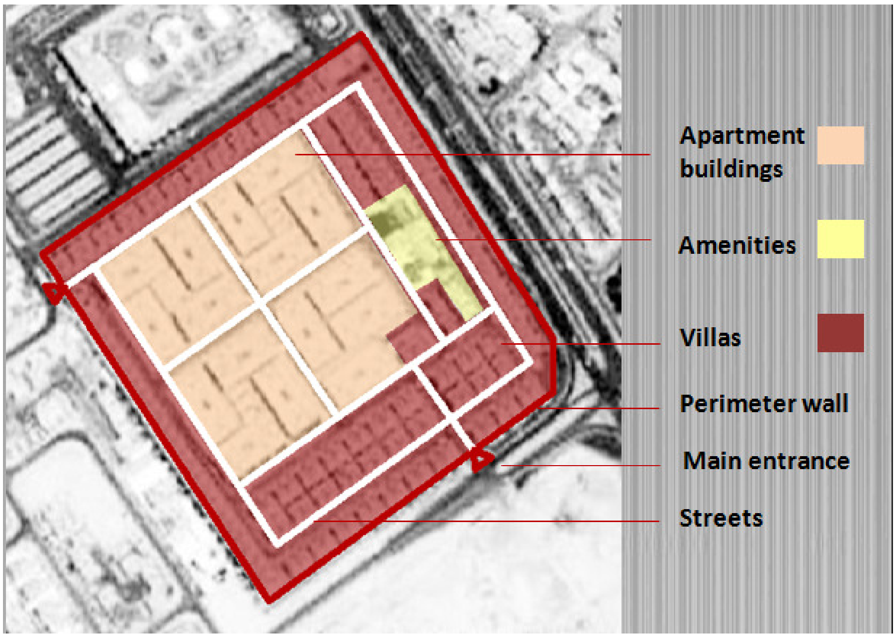

Figure 4. Dar Al Salam gated community Site Plan. Source: author

This development commissioned in 2011 was initially constructed to house employees of Qatar Airways. However, only part of it was leased to Qatar Airways, and the remaining were leased out to the public and some other organizations in particular cases. Forty percent of the residents only are living in the development as part of their employment contract. The Residents descend from different cultures and backgrounds, including some Qatari families.

Figure 5. Gated community entrances and perimeter wall. Source: author

The whole territory around the compound tends to be organized into zones more and more disconnected from each other. The residential developments tend to be designed as 'closed systems' of either gated communities or single family residence. The district is served with a small scale center that includes one shopping mall, a mosque, and a parking lot. Therefore, to some extent the area serves as a neighborhood but a dismembered one with a single-use, low-density, divided residential areas. And here lies the problem of gated communities in Doha. While around the world they usually exist on the outskirts of the city, in Doha they are in the middle of the city occupying the place what should have been a mixed-use, compact neighborhood structure.

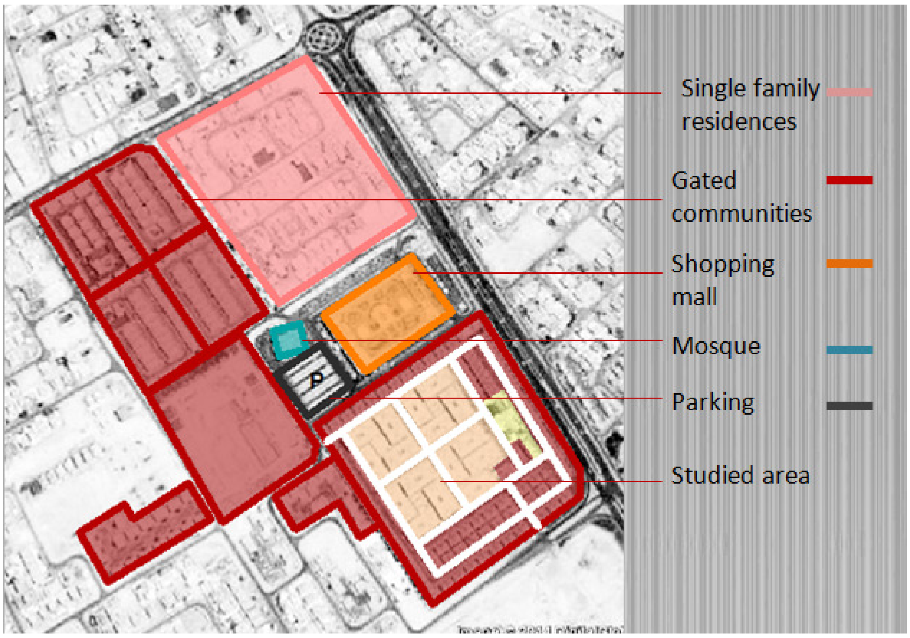

Figure 6. Dar Al Salam residential gated community and its surrounding. Source: author.

According to the social aspect, that is limited in this paper to measure the urban accessibility and the interpersonal relations and activities. The observations showed that the urban accessibility is very poor due to the presence of the perimeter wall and the controlled gates that disconnect the spaces and weaken people's interaction. This disconnection made the residents as well as the public take longer journeys to reach the surrounding areas mostly taking their cars even for what was supposed to be considered a walking distance. The observation results showed also the interpersonal relations and the activities inside the compound are insufficient, since the compound population more or less shares only the same working class with totally different backgrounds, lifestyle and personal preferences. A common 'outdoor room' for casual meetings between the residents is missed inside the compound and the activities are limited to some children playing in the playground and a group of people using the provided aforementioned amenities.

Beside of the evaluation of the physical and social impacts, some interviews were conducted with a number of residents in order to explore people choice to live in the compound and their living experience within its walls. The interviews gave an idea that most have chosen to live in the compound because they were looking for a sense of a community and security in the diverse, multi cultures city of Doha, as one resident reported: "I feel more secure here knowing that not everyone can pass by my front door specially with the mixed demographics of Doha neighborhoods". The extensive influx of diverse groups and the short-term stays are some of the reasons behind people's security concerns as they did not perceive the city as home. Another main reason was their search for a safe environment for their kids to play in the street, have friends and got a chance to experience the ‘city’. One resident elaborated: “I moved here because I was really tired of going back and forth across the city everyday looking for a place to entertain my kids, now I am more relaxed having my kids playing in the playground area with their new friends”. This explains the lack of proper neighborhood planning where the daily activities such as the neighborhood park or the kid’s playground are not in a close proximity of walking distance to every residential area if at all existed. Outside the gated community there is no hierarchy for streets, no safe streets, and no sidewalks. It is a car-dependent society, hence, cars are everywhere; as a result, people feel much safer knowing that they can walk and have their children play in a controlled space. The availability of parking spaces within the compound area was another aspect, as well. As one explained: “We chose to live here because it is easier to find parking areas for our cars and for our visitors’, outside it was a real problem for us”. Yet, another group of residents expressed that the main point that attracted them to live in Dar Al Salam compound in specific is the availability of apartments inside the gated community itself and not only villas which provided an option to have this standard of living for more families with lower income and subsequently provided for people of different income levels intermingle within their community.

Figure 6. Gated community child friendly environment. Source: author.

However, the sense of community provided in the gated development does not serve as a public life in any city sense. It is more various degrees of expanded private life. The lack of social connectivity in Doha city affects public urban space to be diminished. Conversely, the lack of a natural and casual public life in the city causes residents to isolate themselves from each other. Therefore, gated communities are a cause and consequence of the fragmented urbanization, the lack of proper neighborhood planning structure, the absence of community sense and the inefficiency of public housing.

5. Conclusion:

This research has critically evaluated the impact of gated communities on some of the physical and social characteristics of Doha urban fabric, by identifying and examining their effects on the ground of urban design theory as well as on the context of Doha through a local case study. As indicated by the study, gated communities are a powerful urban planning tool which went farther than zoning in several respects. They create physical barriers to public access and privatize what should have been city public areas. Consequently, they lead to the loss of public life and create fragmentation of space and society. With the increasing numbers of expats in Doha city, along with the absence of the notion of neighborhood structure in Doha urban planning, people sought out gated communities as a refuge from the problems of the city urbanization and as a search for stability in the time of these increasing demographic changes.

However, consequently with the domination of this development typology, Doha is becoming a city of walls! It is relevant to drive for 10 minutes in the streets of Doha seeing nothing but walls on both sides of the street. Therefore, it is important for planning authorities to understand the dramatic negative impacts of gated communities on the physical and social aspects of Doha urban fabric in order to actively address the problems. As a start, this research can be developed in the future to propose design guidelines and solutions that address the negative impacts of the current situation in the study area. These guidelines can be applied on similar cases of gated pattern within the city to contribute to the overall limitation of its negative impacts. Taking into account some lessons from the success factors of gated communities (sense of neighborhood, safe streets and child-friendly environment), and reflect them in the urban planning strategies to improve them and then start to construct the alternative model of future urban developments that will serve Doha urban needs to achieve integrated and livable environment. Moreover, it is important for planning agencies to work on the scale of the entire city rather than focusing on a particular community or piece by piece planning approach. The mixed-use, mixed-income, dense, integrated, livable neighborhood structure is an essential basis for any successful, healthy city urban planning, and it is missing in Doha city. Its provision will be strictly linked to the integration of all planning agencies to set planning legislation and design guidelines for planning at the city level.

The paper does not suggest that replace gated communities with another more efficient development units will automatically overcome the fragmentation of the city. Also concerted effort by many parties is required to solve the contemporary city problems and injustices. But it does mean that to build healthy, livable and integrated cities whose neighborhoods are segregated and whose people are divided among their selves, will make it much harder for our cities to overcome its crisis no matter how much effort is spent.

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Directional Zoological Signage Image PReferences An Inclusive Design Perspective

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Abstract:

When the design of directional signage takes into account both the needs of different types of end users and the nuances of a specific environment, this can greatly enhance a localised wayfinding system. This need for contextualised wayfinding design is particularly apparent within zoological gardens, as the presence of captive animals represents a distinctive challenge in terms of sign design. Equally, zoological gardens are visited by a wide range of people, including foreign tourists, hence the increased need for signage to be universally comprehensible.

Observations from four United Kingdom zoological gardens revealed that on-site directional signs display either text alone, or pictograms and text. This finding highlighted a missed opportunity in terms of depicting species-specific detail, as photographic imagery can offer an enhanced level of detail, when compared to equivalent pictograms. Importantly, from an inclusive design perspective, photographs can increase access to information.

Visitors at the Welsh Mountain Zoo were asked which of two directional sign designs they preferred, using self-report measures. One sign displayed a photograph and one displayed a pictogram. Results were recorded at three separate viewing distances. The experiment hypothesis was that people would prefer the photographic sign, due to its vibrancy and clarity. Quantitative and qualitative results from 219 participants show that overall the sign that displayed a photograph was preferred. This has indicated that in a zoological context photographs should be considered as a communication medium on directional signage.

Keywords:

Directional Signage, Inclusive Design, Photograph, Pictogram, Zoological Gardens

1. Introduction

Observations from four United Kingdom zoological gardens revealed that when imagery is displayed to convey a message on directional signage it is limited to the use of pictograms. Furthermore, there is currently no universal pictogram system specific to zoological directional signage, as each of the four sites visited either displayed their own unique pictograms, or text alone. Pictograms are not pictures; rather they are a type of symbol (Kjorup, 2004). They transcend language barriers allowing for global and universal communication (Herwig, 2008) and convey information through convention and consistency (Yule, 2014). Effective pictograms are simple to understand as they create associations of meaning, however, many do not share a visual similarity with the image they represent (Kjorup, 2004). A pictogram of a bus, for instance, is typically used to indicate a bus stop, rather than an actual bus. Similarly, a knife and fork pictogram is conventionally used to signify a restaurant, rather than cutlery (see figure 1). In a zoological context, animal pictograms represent animals within their enclosures. While some pictograms may be used to represent the enclosure of a specific species, others may be used to represent numerous enclosures for a specific genus or for multi-occupancy enclosures, which house more than one species.

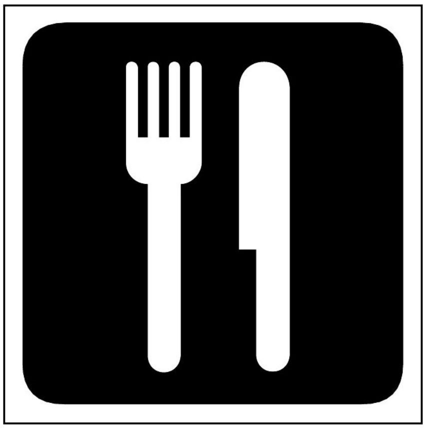

Figure 1. Royalty free pictogram

A consideration of contextualised pictogram use for directional signs relates to the broader topic of wayfinding. There are typically four stages in any wayfinding process: orientation, route decision, route monitoring, and destination recognition (Lidwell *et al*, 2010). Orientation relates to establishing where a person is in relation to where they want to go. Route decision is the selection of path to reach a desired location. Route monitoring is an ongoing process of reaffirming that a person is heading in the correct direction. Finally, destination recognition allows for confirmation that a desired destination has been reached. Landmarks and signage both function as wayfinding cues (Lidwell *et al*, 2010). In a typical zoological garden, many varying cues exist, such as litter bins and statues. The most obvious, in terms of its explicit function, is directional signage. Thus, the experiment focuses upon this type of perceptual cue as a suitable starting point for this novel research area.

The rationale for this experiment is based upon the argument that photographs can offer an enhanced level of species-specific detail when compared to pictograms, with reference to directional zoological signage. This is particularly relevant when species share a similar symbolic outline with others within their genus. For instance, a pictogram of a cheetah (*Acinonyx jubatus*) and a cougar (*Puma concolor*) look very similar, however photographs of these two animals look quite different. It is therefore clear that for people who cannot read supporting text, photographs can offer enhanced access to information.

Figures 2 and 3 illustrate the potential advantages photographic imagery presents. When viewing figure 2, most illiterate people would only know that the image represents a species of bear. Figure 3 would provide this group of end users with the knowledge that a brown bear (*Ursus arctosis*) is being represented, so both an illiterate person and an individual who can read the text on display would be privy to the same information, albeit in different formats. The point being made here is also relevant to tourists who visit zoological gardens from outside of the United Kingdom and may not be able to read English text. Frost (2011) notes the popularity of zoological gardens with foreign tourists.

Figure 2. Design by Michael David William Richards using a royalty free pictogram

Figure 3. Design by Michael David William Richards using photography by Mike Levin

Nobody could determine what type of bear the pictogram alone represents in figure 2, without resorting to guesswork. The fact that the pictogram is of a general bear and not a particular species, further illustrates this point. Therefore, there is little value in testing a person's ability to read this information from the pictogram, compared with their ability to read it from the photograph. For those people who cannot read English text it would not be possible to determine what kind of bear is being described from a text alone sign, unless they understood another language and the two words in both languages were similar. Equally there is little value in testing a person's ability to read a language which is not their own. 'белый медведь' means 'polar bear' (*Ursus maritimusor*) in Russian. The claim that it meant brown bear (*Ursus arctosis*) would sound equally plausible to most non-Russian speakers. Due to the redundancy of some similar tests described here, it was appropriate to test preference for this experiment.

The importance of providing imagery that increases access to information for people who cannot read supportive text links to inclusive design philosophy. Designing products and environments that are accessible to the wider population, irrespective of age or ability, is the basis of this philosophical position (Vaes, 2014). However, inclusive design is not just about accessibility in terms of needs, it also refers to aspirations (Clarkson and Coleman, 2015). This offers an additional reason why preference was utilised for this experiment as a vehicle to explore the topics under discussion.

Directional signage in zoological gardens is an under researched area; however, some existing literature and research is of relevance. Rees (2011) states that zoological imagery conveys directional information more effectively compared to text alone, especially for children and foreign visitors. His informed opinion further support the notion of exploring which imagery type is preferred. Shettel-Neuber and O'Reilly (1981) found that zoological garden visitors prefer following a suggested route, rather than one of their own choosing. Although dated, this again supports the need for further related research. Most other zoological signage research relates to enclosure signage. For example, Martin (2012) recorded average reading times, while Fraser *et al* (2009) documented preferences for enclosure signage content, finding that facts about diet were most interesting to site visitors.

No current literature specifically promotes the use of photographs on zoological directional signage, nor does it discuss why photographs have not previously been employed in this role. Tinkler (2013) does however note that photographs can offer high levels of detail when compared to other visual mediums, without making specific reference to signage. In addition, the Dementia Engagement and Empowerment Project (2013) states that when presenting images to people with dementia it is preferable to use photographs, rather than illustrations, as the latter can be difficult to interpret for some people. Figure 4 illustrates this concept. It shows a photographic toilet sign from the Woodlands Hospital in Salford, which provides services for people with dementia.

Figure 4. Photography by Professor Marcus Ormerod

Binder and Schöll (2010) have documented how farmers prefer photographs rather than pictograms as they relate to their concept of reality. Beyond this reference, related research is limited to contextualised pictogram comprehension, rather than preferences comparing both pictograms and photographs. Rother (2008) has recorded confused interpretations of pesticide pictograms in South Africa, while Dowse and Ehlers (2004) have documented inconsistent levels of medical pictogram interpretation, also in South Africa. Records of pictogram interpretation issues, such as this, further support the notion that alternative communication mediums should be evaluated and considered for use. In contrast, Banda and Sichilongo (2006) have observed that animal pictograms are easier for people to understand compared to abstract alternatives (such as the St. Andrews Cross) as their meaning can be logically deciphered.

To explore the issues mentioned within this introduction, an experiment was undertaken on-site at the Welsh Mountain Zoo. This paper details the results of the experiment. Visitors were shown two sign designs at three separate viewing distances; one sign displayed a pictogram and one displayed a photograph. They were then asked which of the two signs they preferred. The experiment hypothesis was that zoological garden visitors would prefer a directional sign that displayed a photograph rather than one that displayed a pictogram, as it would require less interpretation, offer an increased level of reality, and be more engaging. The hypothesis was based upon literature references to photographic detail (Tinkler, 2013) and reality (Binder and Schöll, 2010), and the aforementioned theory regarding an increase in species-specific detail.

Results show that most visitors preferred the sign that displayed the photograph. This suggests that directional photographic signs should be considered for use in zoological gardens, due to visitor preference.

2. Method: Design

The experiment took place at the Welsh Mountain Zoo, where two new signs were temporarily installed. Ethical approval was granted by both the University of Salford and the Welsh Mountain Zoo. Figure 5 shows the design that incorporated a pictogram, while figure 6 shows the design that incorporated a photograph. Both signs were designed as possible alternatives to an existing sign that was highlighted as being poorly conceived, from an access to information perspective. The main issues associated with the existing sign (as shown in figure 7) were that it relied solely upon text and did not display the international symbol of accessibility, which is typically used to denote an accessible route (Barlow *et al*, 2010). The new signs designed for the experiment were printed rather than displayed on a computer screen, using a material that did not cause glare. Glare can cause legibility problems, especially for many older people (Hillier and Barrow, 2014). Although printing increased costs it allowed visitors to analyse the signs in a real world context. It was hoped that this would make the experiment feel more tangible and stimulating for participants.

Figure 5. Design by Michael David William Richards using royalty free pictograms

Figure 6. Design by Michael David William Richards using royalty free pictograms and photography by Mike Levin

Figure 7. Photography by Michael David William Richards

The first independent variable in the experiment was the communication medium (pictogram or photograph), as this was under the researcher's control. The second was the distance at which the signs were assessed (three, six and nine metres), a factor also under the researcher's control. The dependent variable was the participant's preference for one of the signs, at each distance.

The experiment represents a single case, focusing upon one species. Clearly, given the context, many others could have been selected. The brown bear was chosen because a generic bear silhouette clearly illustrates the argument that photographs offer enhanced species-specific detail, when compared to pictograms. This argument is especially convincing when the brown bear is compared to the polar bear, black bear (*Ursus americanus*), or giant panda (*Ailuropoda melanoleuca*), due to clear physical differences, which are difficult to convey using pictograms. In terms of practicalities, the fact that the Welsh Mountain Zoo houses brown bears allowed the experiment to relate directly to a real enclosure. The popularity of brown bears with visitors was also of relevance. Some visitors may not have known what a spectacled bear (*Tremarctos ornatus*) was, irrespective of image choice.

Although the focus of the experiment related to the pictogram versus photograph argument, sign height needed to be considered during the design stage. The two temporary signs were positioned just above average eye height. The existing sign that the alternatives were designed to replace was not ideally positioned in terms of height. It was, and still is at the time of writing, positioned below average eye height. Mollerup (2005) suggests that directional signs should be positioned at average eye height unless there is a chance that numerous people will want to view a sign at one time, in which case it is sensible to position signs just above average eye height. Heiss *et al* (2010) add that signs are typically positioned at above average eye height when they are to be viewed from an extended distance. From an inclusive design perspective, positioning signs at just above average eye height means that the needs of the majority of end users are taken into account. However, it is acknowledged that some people will benefit from a reduced sign height. For example, Goldsmith (2011) notes that average eye height for a male wheelchair user is 1220mm, while it is 1650mm for a male non-wheelchair user.

Detailed guidance on reading distances for text based signs, which evaluates the relationship between text sizes and reading distances, is available. For example, Baines and Haslam (2005: 199) recommend *'a ratio of cap height to (minimum) reading distance of 1:250, so cap type that is 1cm high can be read 2.5 metres away'*. Literature does not however provide similar guidance for signage without text. It was not possible to adapt the rules for text-based signs to suit the needs of the experiment. A new calculation would be required to determine accepted reading distances and in turn analyse how distance influences the legibility of both pictograms and photographs. To begin to explore this topic in terms of preference, commonsensical distances were selected for the purposes of the experiment.

3. Method: Participants

Representative sampling was utilised, as all people taking part in the experiment were visitors at the Welsh Mountain Zoo. Therefore, their views were used to represent other zoological garden visitors. Those taking part had to be over 18 years of age. People who looked under 21 were not asked to take part, in an attempt to ensure that this rule was adhered to during the experiment. This stipulation eased the process as part of the ethical approval concerning both the University of Salford's and the Welsh Mountain Zoo's requirements. All people who took part in the experiment did so voluntarily and did not receive any form of remuneration for taking part. A total of 263 people were asked to take part in the experiment, with 44 declining to do so, leaving 219 results. It is recognised that the experiment presented a barrier for anybody who could not communicate, or could not understand a request to take part. It was also an exclusively visual experiment, meaning that some visually impaired people were not able to participate.

According to data provided by the Welsh Mountain Zoo's zoological director, Nick Jackson, the organisation received approximately 126,000 visitors during 2010 (Jackson, 2011). This figure provided an approximate daily population of 345. Through the use of this statistic as a population figure, it was possible to determine an appropriate sample size of 219 using an online tool provided by Creative Research Systems (2012). A chosen confidence level of 95% and a confidence interval of four were utilised to run the calculation.

4. Method: Apparatus and Materials

The primary apparatus required were the two signs on signposts, which were cable tied to fencing, while chalk and a tape measure were used to make floor markings relating to the three viewing distances. Visitors were provided with a pen and a clipboard to assist them in completing the response forms, which were stored in a folder following completion. Experiment materials included 219 Participant Consent Forms and 219 Experiment Response Forms. Figure 8 shows the experiment being undertaken during September 2012.

Figure 8. Photography by Richard James Evans

5. Method: Procedure

Visitor responses were gathered over four days during August and September 2012. Responses were taken from approximately 9.30am to 5.00pm each day. All responses were taken on-site at the Welsh Mountain Zoo. 58 responses were recorded on the first and second day. The third date provided 53 responses, and 50 responses were recorded on the final day to reach the desired target of 219.

Potential participants were approached and asked to participate when passing by the signs. People were not asked to participate again if they walked past the signs more than once, to avoid multiple sets of results from one person. All individuals taking part were asked if they preferred the temporary sign that displayed a pictogram or the temporary sign that displayed a photograph. Participants were first asked to state their preference at three metres, then six metres and finally at nine metres. They were also able to make additional comments on the topic. This allowed for the collection of qualitative feedback from prospective end users.

6. Quantitative Results

Table 1:

	3 Metres	6 Metres	9 Metres	Total Participant Responses
Pictogram	57	92	134	283
Photograph	159	123	81	363
Neither	2	2	2	6
Declined to State	1	2	2	5
Total Number of Participants	219	219	219	657

Table 1 shows all of the quantitative results. Table 2 shows Chi-Square tests for the three separate distances and for the total responses for the pictogram and the photograph. In all cases, the p value is less than 0.05. This means that the total responses and the differences in preference at each of the three viewing distances are all statistically significant. For statistical testing purposes, those that responded 'neither' and 'declined to state' have been removed, and this then necessitated the removal of one of the responses for 'photograph' at three metres.

Table 2:

		3 Metres	6 Metres	9 Metres	Total Participant Responses
Observed	**Pictogram**	57	92	134	283
Observed	**Photograph**	158	123	81	362
Expected	**Pictogram**	107.5	107.5	107.5	322.5
Expected	**Photograph**	107.5	107.5	107.5	322.5
	P =	5.65254E-12	0.034499692	0.000300847	0.001866938

7. Qualitative Results

This section presents what were deemed to be relevant qualitative results, following a process of directed content analysis. The process was 'directed' as it linked to the experiment's underlying inclusive design philosophy. Thus, additional comments, which were revealing in terms of signage preference, are included, while unrelated, unrevealing, and idiosyncratic comments have been omitted. Not all people who took part provided optional additional comments. In total 17 people chose not to do so. The qualitative results are as follows:

- 54 additional comments referenced the clarity of the photographic sign. For example, ‘it's clear what you are going to see’.
- 54 people stated that the pictogram sign was clearer when the viewing distance was increased. For example, ‘at a distance the pictogram stands out more’.
- 49 people praised the general clarity of the pictogram sign. For example, ‘it stands out a lot more’.
- 32 comments referenced the appealing nature of the photographic sign. For example, ‘it's attractive and nicer looking’.
- 24 people claimed that when viewing distance was increased the photographic sign began to blend in to the background. For example, ‘the photo blends in with the scenery at a further distance’.
- 20 people criticised the clarity of the pictogram sign. For example, ‘the pictogram could be some other animal’.
- 15 participants criticised the photographic sign, claiming that it was more difficult to make out from a distance. For example, ‘the photo is not as clear at a distance’.
- 15 people stated that the photographic sign was positive for children. For example, ‘kids wouldn't understand a pictogram’.
- Eight people referred to problems that the sun caused when viewing the photographic sign. For example, ‘the photo is difficult to make out in the sun’.
- Eight people stated that the pictogram was clearer for people with a visual impairment. For example, ‘people with visual impairments would find the pictogram easier to understand’.
- Six people said that the photograph was preferred, but only ‘close up’.
- Two comments referred to the pictogram sign as ‘boring’.
- One participant stated explicitly that had the photograph been displayed against a white background, it would have been selected at all three viewing distances.

8. Discussion

Although the pictogram sign was favoured at nine metres, the experiment's quantitative results show that the photographic sign was preferred at three metres, six metres, and overall. Furthermore, this overall preference for the photographic sign was significant, rather than slight. Discounting the responses for ‘neither’ and ‘declined to state’, approximately 57% of participants preferred the photographic sign, while around 43% preferred the pictogram sign.

The quantitative results also show that viewing distance significantly influenced preference. As distance increased, the likelihood of the pictogram sign being selected as a participant's preference also increased. Nevertheless, concerning the overall results, the experiment's original hypothesis has been confirmed. Moreover, numerous additional comments concerning clarity and appeal justify the rationale for the hypothesis. If generality is implied, zoological gardens should consider utilising photographic directional signs, depending upon intended viewing distances, should they wish to take visitor preference into account.

Qualitative results show that all positive feedback regarding the pictogram sign was of a practical nature. Specifically, these comments referenced clarity. Conversely, positive feedback about the photographic sign was both practical and referred to the sign's appealing nature. 54

people praised its clarity, while 32 people mentioned its general appeal. This suggests that had some of the practical problems concerning the photographic sign been addressed then it may have been chosen as a preference selection more often. For example, 24 people stated that the background the photographic sign was set against visually blended into the surrounding foliage. Had this not been an issue, preference selection for these 24 participants might have been completely different. Note that one participant stated explicitly that had the photographic sign been displayed against a white background, it would have been selected at all three viewing distances. While the photographic sign was certainly criticised, this only occurred due to practicalities, whereas two participants referred to the pictogram sign as boring, for no tangible reason. Although there are no direct references, existing knowledge partially supports what is being suggested. Research conducted by Day *et al* (2002) has shown that in regards to tourism marketing, people preferred animal photographs compared to images of natural landscapes, city scenes, and people. In fact, only photographs of beaches were more popular.

If a similar experiment were to be undertaken, it would be advisable to have the signs produced in a thicker material. Eight visitors complained that sunlight made the photographic sign difficult to distinguish. Observations at the time clarified that this was due to sunlight passing through the temporary signs and that the sunlight had less of an effect on the pictogram sign. Following such complaints, it was explained to participants that the signs were produced inexpensively to reduce costs and would never be used as permanent on-site installations. This finding suggests that had the signs been originally produced in a thicker material then the photographic sign may have been chosen more often as a preference selection.

Although additional comments from participants highlighted a number of practical issues regarding the photographic sign, both concerns about sunlight and the background the photograph was set against are possible to address. Conversely, there is an inherent problem with the pictogram sign, which cannot be addressed without fundamentally changing the sign to the point that it would no longer be a pictogram. 20 people stated that the pictogram sign could be confused for another animal. Comments included ‘it could be a pig’, ‘it could be anything’, and ‘it could be a polar bear or black bear’. One participant commented that a number of animals would be impossible to represent as a pictogram. Put simply, for these individuals it was not unequivocally clear that the pictogram represented a bear. This finding shows that for some visitors, bear pictograms do not specify genus, as effectively as bear photographs. The importance of this finding is clear, as the sole purpose of directional signs in zoological gardens is to specify which species or genus people are being directed towards. Further research could explore this topic in greater detail, by testing comprehension of various animal pictograms and photographs.

The influence distance had upon preference selection was further emphasised by the qualitative results. 54 people claimed that the pictogram sign was clearer when the viewing distance was increased. Equally, 15 participants stated that as the viewing distance increased the clarity of the photographic sign decreased. In addition, six people specified that their preference for the photographic sign only existed at a reduced viewing distance. Although the photographic sign was preferred overall, the influence of distance cannot be discounted. Had the experiment only been conducted at 9 metres, the results would show that the pictogram sign had been preferred. Thus, if the results of this experiment are considered to be generalisable, then zoological gardens should consider the influence of typical viewing distances when selecting appropriate imagery for directional signage.

The experiment's qualitative results are revealing, as although the photographic sign was preferred overall, and this preference was statistically significant, there were still a notable number of people who made positive comments regarding the pictogram sign. For instance, 49 people praised its clarity. While eight people claimed the pictogram sign was better for visually impaired people, without explaining why. If placed in a broader context, these additional comments suggest that zoological gardens will not be able to please all visitors when selecting either a pictogram or a photograph for directional signage. Existing research on pictogram comprehension for people with visual impairments has shown that pictograms are useful, but only if they are designed to draw attention to key information and remove fine detail (Katz *et al*, 2006). This concept supports the additional comments made by participants, regarding visual impairment. As around one million people in the United Kingdom are registered as having a visual impairment (Waterman and Bell, 2011), this is an important consideration for zoological gardens, and one that could be explored through future research.

With reference to another typically marginalised group, 15 adults commented that children would find the photographic sign easier to understand, presenting a specific subtopic, which warrants further exploration. This notion is also important from an inclusive design perspective, as it adds further rigour to the argument that photographs increase access to information for end users, irrespective of their age or ability. However, these comments were not made by children. Moreover, the participant's comments on this topic conflict with existing research. Hameen-Anttila *et al* (2003) found that when context is understood, children are normally able to understand common medical pictograms. As existing research relates to medical labels and no children took part in this experiment, further research involving children would be required to explore their interpretation of zoological pictograms. Undertaking such study would certainly be worthwhile, due to the high number of children who visit zoological gardens (BIAZA, 2015).

After data collection for the experiment had been completed, a potential imperfection in terms of conditioning was revealed. Each person who took part in the experiment provided an answer at three, six, and nine metres. If a similar experiment were to be conducted in the future, it would be prudent to ask each participant for their preference at just one of the three distances; for instance, 50 people could provide a preference selection at three metres, while 50 different people could answer at six and nine metres. The reason for this is that participants may have been influenced to repeat the answer they provided at three metres at the other distances in an attempt to appear consistent or they may have felt the need to change their answer at nine metres to provide what they thought might be the 'correct' answer. This may account for the number of people who did have a preference for the pictogram sign at nine metres only. This is a potential conditioning issue and may not actually exist. Running a similar experiment with a singular response approach could confirm if this issue had influenced the results. Undertaking a similar experiment at a different time of year could also prove to be useful, as it is possible that the time of year influenced data collection in terms of the visitor demographic.

In relation to statistical testing, interval ratings could be used on the participant response forms if a similar experiment were to be undertaken in the future. For example, a Visual Analog scale or a Likert scale. Doing so would produce interval or ratio data, so that data could be analysed more comprehensively using a parametric test. This would also reveal how much each participant preferred a particular sign, rather than that it simply was preferred. Utilising this approach would present the opportunity to show participants either a photographic sign or a pictogram sign in isolation, rather than by way of a side-by-side comparison.

To allow for greater generality claims, it would be useful to conduct similar experiments using images of different species other than the brown bear. The familiarity visitors have with a species may influence results; however, it has not been possible to explore this issue by looking at one species only. Future testing may imply that zoological gardens should consider utilising photographic directional signs for certain species, while pictogram signs are preferable for others.

9. Conclusion

In summary, the experiment's results show that visitors preferred the photographic sign overall. Significantly, the results also show that at nine metres the pictogram sign was preferred. The experiment was successful in exploring preferences for these two sign types at varying distances, yet it was restricted to only an analysis of brown bear signage. The experiment hypothesis was confirmed, as more participants preferred the photographic sign.

When placed in a broader context the results have real world implications. Depending on intended viewing distances, zoological gardens should now consider using photographic imagery and text on directional signs, rather than pictograms and text or text alone. Not only are they theoretically superior in terms of information provision, but in this instance they were also preferred by site visitors.

Qualitative feedback suggested that had the photographic sign design been modified it would have been chosen as a preference selection more often. These additional comments, coupled with the experiment's quantitative results, have been used to develop an end result or design solution to conclude the report. Figure 9 is a design that could be installed by the Welsh Mountain Zoo to replace the existing sign. Equally, it could be used by other zoological gardens. The new design takes into account the participant's overall preference for the photographic sign, while also addressing comments regarding the use of a white background, which contrasts its potential surrounding environment and the photograph itself.

Figure 9. Design by Michael David William Richards using royalty free pictograms and photography

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Walk-ability Potential in The Built Environment of Doha City

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Abstract:

In order to improve the quality of life, throughout history, humans had been establishing environmentally friendly settlements, which later grew into much larger units, some becoming modern day metropolises. Doha, like many other Islamic cities, grew organically as its population expanded. Due to the exponential growth of population in the State of Qatar, and the fact that majority of its residents live in Doha, walkability and connectivity have become major issues for such fast-growing urban development. Over the last three decades, both research and practice have provided substantial evidence confirming that walkability is essential for improving social integration, enhancing urban quality of life and maintaining physical health. Thus, walking remains the most important form of human transportation.

The purpose of this study is to examine the existing built environment of Doha City and analyze it in terms of its compatibility with the concept of walkability. Following the qualitative survey, aimed at identifying of indicators that can be used when analyzing walkability, it is shown that the planners should go beyond conventional methods, such as beautification and superficial development. The study findings indicate that these aspects can become useful only after thorough analysis of land use patterns, residential density, or transit-oriented development, which are useful tools in the evaluation of the built environment. Ideally, morphological studies focusing on the walkability dimensions, using Kevin Lynch and Jane Jacob's concepts as guidelines, should be conducted. Accordingly, city planners should establish the necessary guidelines for enhancing the public realm, as this would encourage walking and potentially transform Doha into pedestrian-friendly city.

Keywords:

Doha, Walkability, Connectivity, Urban Morphology, Accessibility.

1. Introduction

In the preparation for the Football World Cup 2022, Doha is undergoing extensive development in all domains of the built environment. The entire infrastructure of the city is being developed, incorporating the latest methods and technologies, all in accordance with the highest international standards. The process is akin to a big family house being methodically cleaned, fixed, and refurbished in preparation for a big feast. The 2022 Football World Cup is viewed as an opportunity to redevelop the existing city on solid foundations. Indeed, the city has missed out on several prior opportunities for proper planning due to its rapid and organic, rather than planned and structured growth. It is rare for any city to be given an opportunity to rejuvenate and enhance itself, while expanding at the same time. Therefore, planners and decision-makers responsible for the Doha reconstruction project are looking elsewhere in the world and in different realms for successful examples of establishment or use of norms and standards in city planning. The ultimate goal is to allow Doha to become a city of international stature. This vision, embodied by QNV’s (Qatar National Vision 2030) (General Secretariat for Development Planning 2008) four pillars, is interpreted by QNMP (Qatar National Master Plan 2030) into seven spatial and physical planning principles, namely quality of life for all, sustainability, environmental values, connectivity of people, connectivity of places, economic growth, and diversification. Indeed, achieving sustainability and walkability is one of the main goals of this initiative, as it seeks to improve the quality of life. Qatari people believe that they can do what others perceive as impossible. They are confident that, by integrating global values of the vast international community of foreigners who reside in the state with their local identity and principles, Doha can rise and become a significant city on the world map. Through observation of the existing built environment of Doha and the history of Arab/Islamic cities, it is evident that walkability is an important dimension of everyday life. Despite the harsh climate, people can comfortably enjoy outdoor activities during at least eight months of the year.

Yet, during such a rapid change, errors and omissions may occur. Consequently, akin to the oft-cited butterfly effect, this process of transformation can easily affect the city's morphology in an undesired manner. As a result, the city's walkability, and even its very identity, can be compromised. Public space requires far greater urban design considerations than what has been accorded to this date. Instead of looking at the public space as the leftover areas among profitable private developments, Doha, as the sustainable city of the future, has to create viable, climatically comfortable and pleasant spatial nodes. In particular, the aim is to ensure connectivity among various modes of transportation, places of relaxation, social integration, and interaction among its diverse demographic populations.

This study explores the walkability level in the built environment of Doha city, focusing on one of its neighborhoods, the Al-Markhyia. The aim is to answer the following pivotal questions: Can we consider Doha as a pedestrian-friendly city? Can Doha be considered as a ‘walkable’ city? In the event that the answers to these questions are negative, the potential for walkability in Doha will be examined. In other words, in an attempt to delineate successful principles for improving the built environment in the forthcoming redevelopment, the study aims to determine both positive and negative aspects of the urban design of the existing built environment. The goal is to respond to the specific question: Is it possible to develop Doha while ensuring that it remains a pedestrian-friendly city? However, before delving deeper into the subject matter, it is vital to consider and understand why people in the Gulf Region are hesitant to walk. Does a cultural perception prioritize movement of cars rather than people? Or, is the growing preference for motorized transport driven by the low price of fuel?

In the past, walking in Doha seemed to be common. The built environment of the old city of Doha, characterized by narrow streets, where walls of the traditional houses created shadows, as well as concentration of the neighborhoods close in proximity to the key necessities and facilities, are testament to the pedestrian realm and culture of the former city life. With the discovery of oil in Qatar and the commencement of its extraction for energy use, fuel became more affordable. At the same time, as oil trading replaced pearl diving-based economy, inhabitants transitioned from walking to using cars in their daily commutes. As a result, at the beginning of this new oil era, the city’s transformation was based on American style urbanism. As the city was re-planned, dependence on motorized vehicles increased. These arguments notwithstanding, culture seems to be a catalyst of walkability, rather than an obstacle to walking.

Extant research in this field advocates for the planners and the urban designers to establish new planning principles that consider quality of life, sustainability and walkability as the key elements. The aim of these principles is to define a set of guidelines that would enhance Doha’s public realm and encourage its habitants to walk, use public transportation, or ride a bike. These recommendations should also add value to the already established guidelines of Qatar’s sustainability rating system, GSAS. This cohesion would result in a better solution for a long-term city planning, where environmental impact would be reduced during the demolishing and construction stages. By using public transportation, walking or riding a bike, fuel consumption is significantly reduced and the CO_2 emissions consequently decreased. As it is widely recognized that CO_2 emissions are the main driver behind the climate change, their reduction requires a more global approach, even though the effects might be perceived as a local problem. It is possible to anticipate preservation of the local environment and create more social interaction, which could in turn boost the economy of the city (Abu Dhabi Urban Planning Council 2010).

2. Walkability in the City

Walking is defined as the basic and the most important form of human mobility. Empirical evidence suggests that walking improves both mental and physical health and increases social interaction among people, thus improving quality of life. Walking efficiently energizes public domain and helps build pleasant and energetic image of the city. Since walking affects the city at different levels, walkability should be encouraged and studied on different scales as well. The best-planned cities are those that encourage their habitants to walk more. Through the use of strategic layout, planned land use, and street layout that offers safe passage and is attractive to the pedestrians, walking can become not only an alternative, but rather the main mode of transportation. While walkability is directly affected by urban design and public life, mixed land use, connectivity, population density and proximity to major necessities and facilities are also its key determinants.

It is essential to understand the main principles of quality design of selected city's planners, such as Christopher Alexander, Jane Jacobs, Kevin Lynch, Alan Jacobs, and Donald Appleyard. Jacobs (2010) suggested that streets and sidewalks are the main public areas of the city. In her view, a well-used street is often safer than a park. J. Jacobs also identified the four physical conditions necessary for dynamic urban life, namely multifunctional neighborhood or district (to create and enrich social life), short blocks, varying age and the condition of buildings, and sufficient density (Hassan, Lee & Yoo 2014). Lynch (1960), on the other hand, defined the legibility of the cityscape as the ease with which its parts can be recognized and organized into a coherent pattern. He defined the 'imageability' as the quality of a physical object that gives an observer a strong vivid image. He further noted:

> *"The paths, the network of habitual or potential lines of movement through the urban complex,. .. The key lines should have some singular quality which marks them off from the surrounding channels: a concentration of some special use or activity along their margins, a characteristic spatial quality, a special texture of floor or façade a particular lighting pattern, a unique set of smells or sounds, a typical detail or mode of planting. .. . These characters should be so applied as to give continuity to the path. .. The very concentration of habitual travel along a path, as by a transit line, will reinforce this familiar, continuous image". (p. 96)*

For an urban environment to be deemed appropriate, it must successfully integrate various everyday activities, such as living, working and shopping, in reasonable proximity (accessible by walking) to each other. Properly planned public space promotes pedestrian interaction, as no public life can take place when residents are isolated in their cars. As Hassan et al. (2014) noted:

> *"In principle, mixed use, accessibility, community involvement and pedestrian realm, all required compactness and a certain number of populations that allow the society to interact and integrate. Alexander and A. Jacobs, as well as Appleyard, provide density*

figures promoting medium rather than high or low density. Jane Jacobs also supposed urban density rather than the suburb is required for creating a vibrant urban center". (p. 332)

Introducing and enhancing walkability in a city can result in a wide range of benefits. By reducing dependency on cars and endorsing walkability, the city can become more sustainable and 'livable', as air pollution, congestion, noise and vibration brought by heavy traffic will be reduced. Walkability also increases property and land value, while also yielding commercial benefit owing to a higher level of footfall. At the individual level, walkability is also highly beneficial, as it promotes health and improves one's quality of life. Finally, it also encourages integration among communities and improves social life.

2.1. **Walkability, an axiom of urban development**

Walkability is also a major element in contemporary urbanism, as it has been proven to be a vital element of **Smart Growth Principles** (Smart Growth Network - MD Dept of Planning, USA 1997). Indeed, according to Wheeler (2004), "one of the biggest challenges at a neighborhood level is making arterial streets more pedestrian-friendly and livable" (p. 200). Sustainable development of cities requires reducing travel distances for pedestrians, in order to make walking and biking easier and more practical (Litman 2012). Moreover, by reducing travel distances, the number of people on a given street increases, diversifying the range of activities they partake in, thus strengthening the sense of security. As was recently noted, "To foster the walkability, communities must mix land uses and build compactly, as well as ensure safe and inviting pedestrian corridors" (SGN n.d.). Promoting mixing and interaction among people of different ages, social classes, educational backgrounds, etc., is also one of the key principles of Smart Growth. Most importantly, diversity of a neighborhood's inhabitants can help increase its walkability, as it tends to create a complex array of distinct pedestrian fluxes. Thus, it becomes important to offer a range of different housing opportunities and choices, and to provide a variety of transportation choices (mixing transportation systems can actually increase walking frequencies in a neighborhood, rather than discourage it). Other Smart Growth principles also intersect with the notion of walkability. Strengthening and directing development towards existing communities, taking cost-effective development decisions, and encouraging community and stakeholders' collaboration in all development decisions are the basic elements of sustainable development that could help foster walkability in a neighborhood, whether directly or indirectly (Smart Growth Network 2003).

The walkability of a neighborhood is highly dependent on the residents' walking experience. In order to increase it, according to Abdul Karim and Azmi (2013), it is necessary to ensure a right balance between safety and security on one hand, and convenience, enjoyability and attractiveness on the other. Exploring work and leisure walking in relation to neighborhood walkability, in related researches such as Owen et al. (2007), has shown that street connectivity and proximity to retail are positively associated with walking for transport or as function, but not walking for recreation. The relationship is also stronger for weekly frequentation than for weekly minutes of walking, as more-walk-able neighborhoods required shorter walking trips to reach a destination than did less-walk-able neighborhoods.

Consequently, walkability in any given city should be measured based on the specific variables that are pertinent to the study of the human behavior of its residents.

3. Walkability and planning regulations in Qatar

Walkability is a rather vague concept that is endorsed by nearly all of us, despite lack of its precise qualitative and quantitative evaluation. In addition, as walkability is rarely defined in operational terms, when attempting to develop policies and regulations, the concept proves rather challenging. In the early 2000s, Qatar started working on defining operationalizing the dimensions of public realms, including walkability. At this time, the department for Municipal and Urban Planning was formally established.

Presently, macro-scale policy approach to city building and spatial planning in Doha is dominated by the expert international firms, with the contribution of local urban planning teams. As a result, the situation on the ground is significantly different and somewhat contradictory to the design plan. In order to consider the nature of realization of urban public spaces within the context of a wide range of city building settlements, a typology of new urban landscape should be outlined and discussed in relation to the city's vision and should include the main micro units, such as the existing neighborhoods.

The development plan of the new mega projects in Doha, such as Lusail City, The Pearl Qatar, and Msheireb downtown, also included a master plan study with guidelines for the public realms with consideration of walkability. However, these projects have not yet been integrated within the existing urban fabric of Doha, nor are there any considerations of the relation between existing built environment and the city's morphology.

3.1. **Walkability in the history of Arab and Islamic cities**

According to a well-known Arabic proverb, walking to the mosque is highly rewarding, and the worshippers who will have the greatest reward ('Hasanat') are those whose houses are further away. In the examples of Arab/Islamic cities, as a response to the aforementioned quote, it is evident that mosque was built in the heart of each neighborhood. Neighborhoods would then organically grow around the mosque and a number of such concentrated neighborhoods would merge to form a city. The city's morphology and its urban spaces, including dead-end streets and small open areas within housing compounds, known as Baraha, were considered as a continuation of the domestic space and were thus under the care of the residents. The hierarchy of the streets and the walkways, with consideration to the transition from public to semipublic, semipublic to semi-private, and semi-private to private spaces, are principles that encouraged walkability and integration of the social domain.

The urban morphology of Doha, like other Islamic cities, was developed considering walkability as the main mode of mobility and interaction among communities. Accordingly, certain physical qualities were deemed necessary for functional walkways. Walkways primarily provide access to adjacent amenities and allow travel on foot from one place to another within and throughout surrounding neighborhoods. The main qualities of good walkways are safety, offering warmth or sunlight when it is cool and shade and coolness when it is not, comfortable space for pedestrian traffic, and a healthy social atmosphere.

Additionally, the best walkways are characterized by the transparency at the boundaries, where the public realm starts to be less public, often when a semi-private or a private property meets the walkway. In such instances, one can see or have a sense of what it is that defines the street and the public realm. In particular, one senses an invitation to view or get to know, even if only imaginatively, what is behind the walls surrounding the private spaces. This is where a sort of tension is formed between the public and the private realms.

4. The Research Method

The proposed methodological approach assists in analyzing the current function, form, unity, and accessibility of Al Markhiya Neighborhood and Khalifa Street. Rather than conducting a quantitative survey, the main analysis performed in this study is based on extant theoretical studies, prior experiences, and synthesis. Gathering and analyzing these data sources is intended to provide a better understanding of real specific problems of the area of interest for this investigation (Al Markhiya neighborhood and Khalifa Street). The findings yielded are expected to convey a vision for the pedestrian's mobilization and enhancement of the public space.

5. Introduction to the context

Al Markhiya neighborhood and Khalifa Street environment is vital to the neighborhood's success as a place for living and working, as well as a commercial destination for visitors. The provision of high quality spaces in the town center, and the neighborhoods surrounding this area, is essential for improving the quality of life for people who inhabit and use these spaces. The area is facing two major streets—Khalifa Street and Al Markhiya Street. These streets are primary spaces for public interaction and activity in Doha. Despite currently being highly important to the daily lives, these streets have lacked refurbishment and good management. Consequently, in number of places in this area, streets and public spaces have been neglected and have become unhygienic, unpleasant and unsafe. This has created problems that go beyond appearance and function, affecting the attitudes and perceptions of the people living around and using our city center. The main issue is that most residents do not perceive their living environment as safe. Indeed, it is apparent that these neighborhoods have been developed for car use, without any consideration for pedestrians (Jacobs 1995).

Given the extent of this problem, it is essential to identify those responsible for addressing it. In other words, is it the responsibility of urban designers, architects, planners and government officials to prepare and implement well-designed, well-ordered and well-maintained neighborhoods, streets and public spaces as an expression of user friendly, secure and easy to get around, well used and safe neighborhoods?

Al Markhiya neighborhood is located in the middle of Doha city and connects city's east part with its western regions. This results in a major flow of commuter traffic between the Al-Dafna area and the Education city, via Khalifa Street; and between south of Doha and Qatar University area via C-ring road. Moreover, major road networks, such as C ring-Al Khor, and D ring-Al Shamal, are crossing through Khalifa Street. Khalifa Street is considered as an arterial road of the city of Doha, connecting major transversal roads. In addition, it is a major road, serving the main surrounding developments.

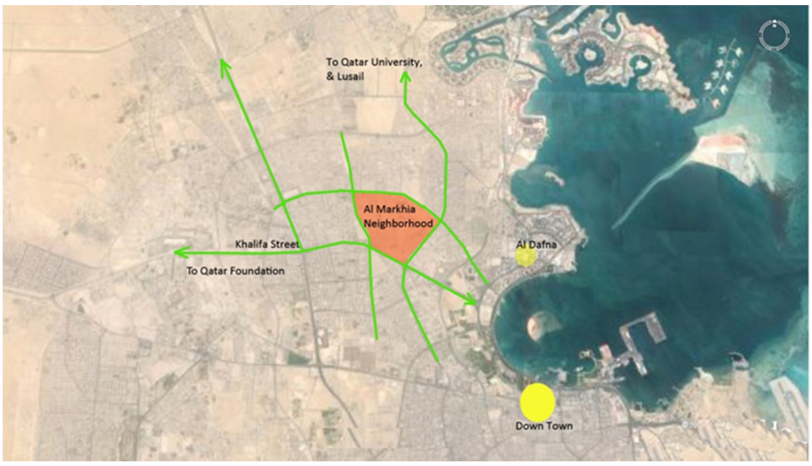

Figure 1. Case Study Location

5.1. **Findings:**

While the older urban values of density, mixed use, walkability and sustainability became objectives that required concentrated efforts and creativity of urban designers, owing to its strategic location, Al Markhiya always had a great potential to be a unique and self-sustaining neighborhood in Doha. A commercial frontage at Khalifa Street enables the area to achieve a small-scale integrated community. Walkability and economic vitality, along with connectivity and accessibility, enhance both social and economic value of the area. Most importantly, as they evoke the feeling in the residents that they belong to the place, they increase their sense of personal responsibility for its public spaces. Therefore, this neighborhood can be considered as respectful to the traditional fabric of the city with privileges of continuity, walkability, small-scale enterprise and amenities.

However, from another point of view, the problem of walkability in the Al Markhiya area may be a direct result of municipality's failure to invest in infrastructure and refurbishment of landscaped areas.

The aforementioned problems are also evident in the wider Doha city. Problems appear on a variety of urban scales, ranging from land use management to the details of the sidewalk design (comfort, presence of benches, bins, pedestrian crossings, etc.).

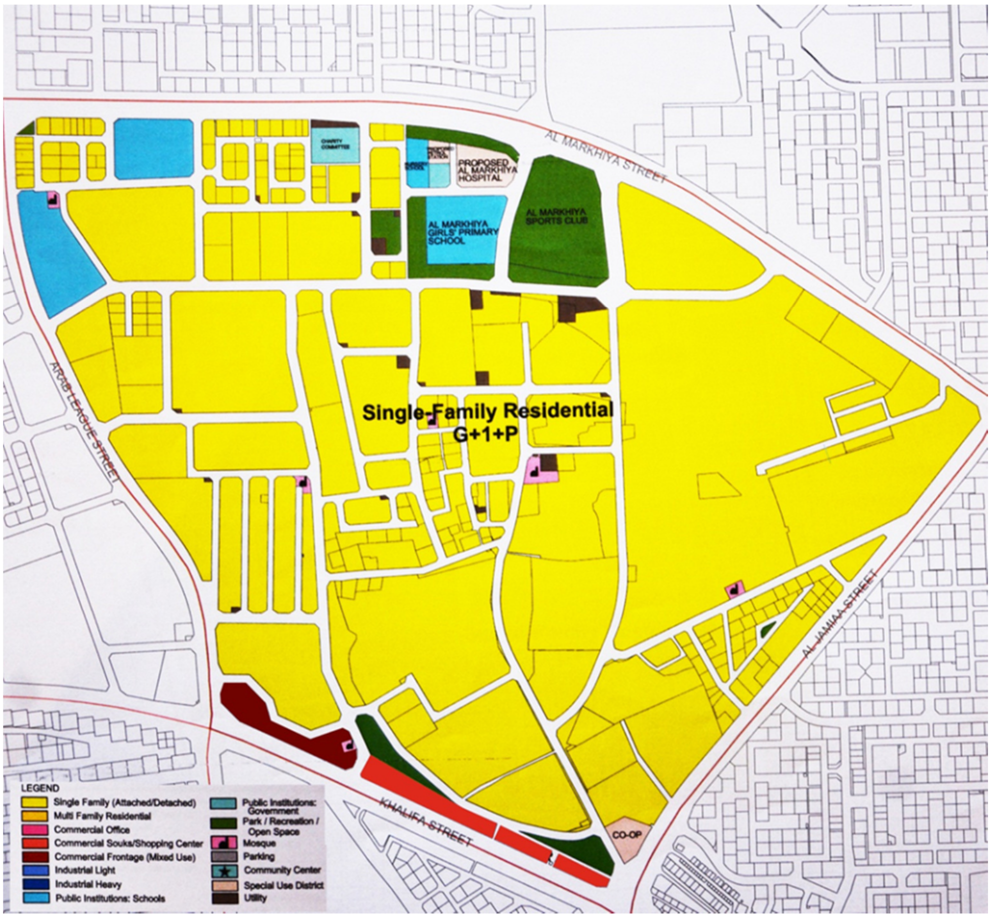

Figure 2. Current Land Use

Figure 3. Solid and Void showing the morphology of the neighborhood
The ideal area block size in the Al Markhiya ranges between 100 m and 400 m

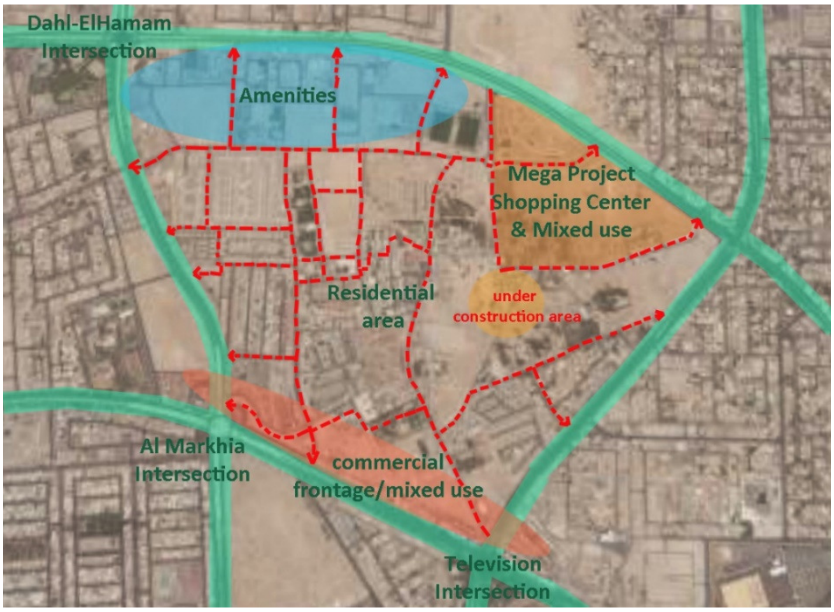

Figure 3. Solid and Void showing the morphology

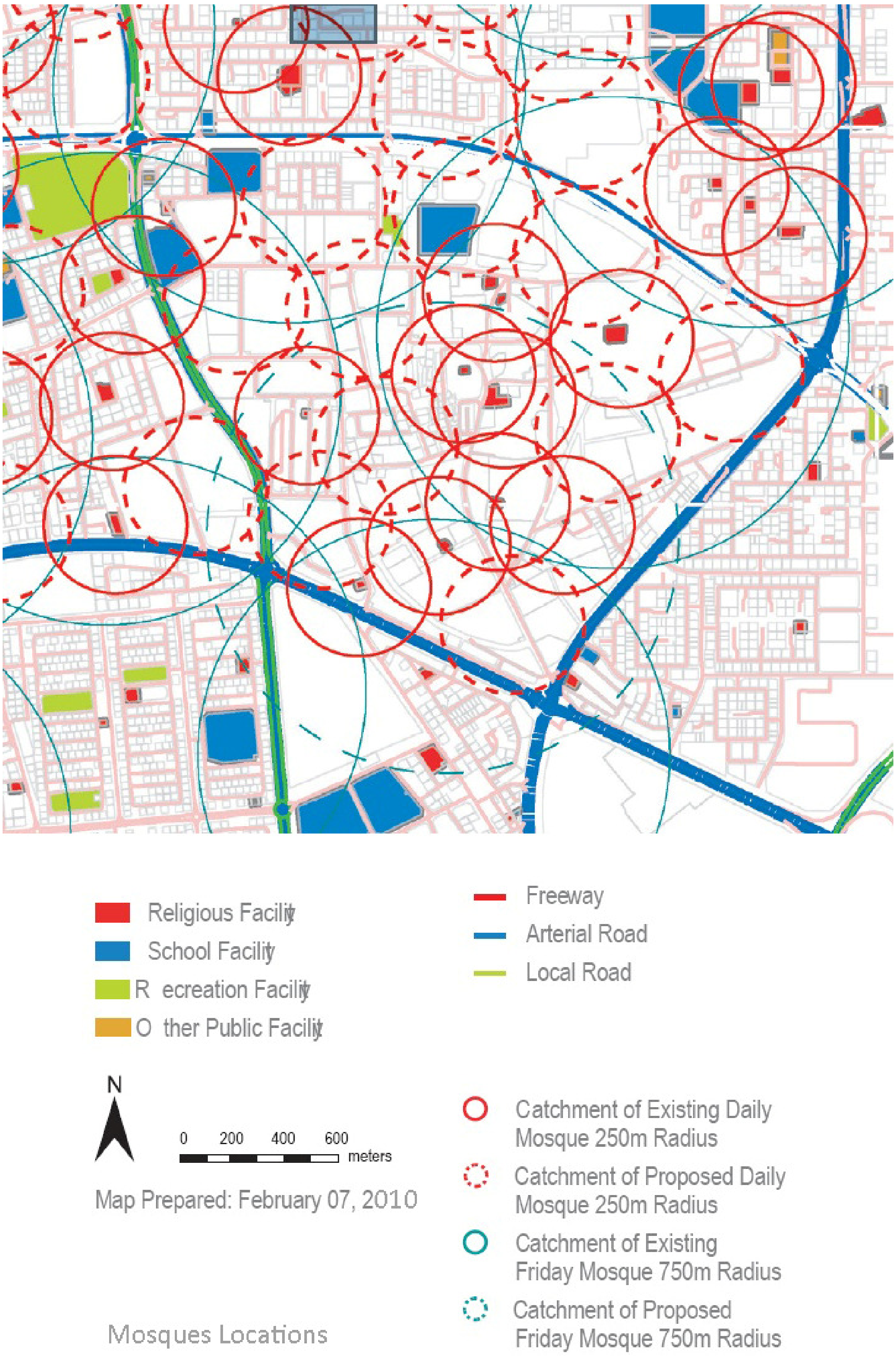

Figure 4. Map dated 2010, showing the proposed and the existing mosque locations in Al-Markhiya neighborhood, alongside vital amenities (mosques with retail) in the neighborhoods, *Source: Draft Qatar National Framework 2032*

To analyze and properly asses the area of interest, the built environment variables have been tabulated, and were examined alongside the site maps and photos.

Figure 5. The 6. Site Images

5.2. **Synthesis:**

5.2.1. Site Assessment

Table 1 outlines the measurable urban variables that can assist in the assessment of the walkability potential in the synthesis of the proposed studied area. These elements are based on Jane Jacob's principles and are divided into two categories—K. Lynch's 'legibility' and 'imageability'. Each element under the heading "The Criteria" is rated in percentages based on the assessment performed during the site visits.

Table 1. Indicators and Scores
10 indicates " very poor" while 100 denotes "very good" rating

The Criteria	The definition	Score Ranking (10-100)
"Legibility"		
Connectivity/ Permeability/Proximity	Increasing shortcuts, or rather avoiding detours, eases the task. It also reminds users of the proximity of a given destination and offers a more human scale territory.	90-100
Accessibility/ Convenience	These notions are related to the idea of practicability of the public space. Better understanding of the public space layout and greater comfort can encourage walking.	80-90
Safety/Security	While these elements are obvious, they could depend on very subtle details, especially within the large-scale urban layout.	90-100
Land Use	'Mix-ability' of land use should acquire a certain balance. Too much mixed land use may be unmanageable, whereas too little may tend to 'zone' functions in different areas. Land use should be considered within a human scale.	80-90
Residential Density/ Amenities Density	This notion correlates with the previous criteria. Good balance between residential and amenities density (i.e., services, work, retail, etc.) provide clarity to a neighborhood, hence increasing its accessibility and attractiveness.	50-60
Walking Pattern	The very purpose of a walk can change its pattern, its rhythm and pedestrian's behavior. Streets can be evaluated using a ratio between how many inhabitants use them for service purpose and how many use them for leisure.	70-80

The Criteria	The definition	Score Ranking (10-100)
"Imageability"		
Street Character	Evaluation of the street attractiveness, its presence and how strongly it can imprint into a person’s memory. Balance between 'strong' streets and 'weak' streets gives rhythm to a walk.	60-70
'Enjoyability'	'Enjoyability' can be considered as a consequence of the other elements defined in this table. It is, however, an important variable that could make walking in this or any other street the purpose itself.	50-60
Public and Social Behavior	Only human interaction can bring public space to life, whereby greater interaction results in more life. Public relations in a given space can be measured by evaluating the health of the interactions, their nature and purpose, their circumstances, etc.	50-60
Quality of Urban Design	Urban design's main aim should be comfort. The number of benches available, the distance between bins, density of flora, sidewalk width, materials utilized, water management, etc., all play an important role in increasing comfort. Thus, all these elements should be taken into consideration when creating a unique design aiming to foster a pleasant image of the city.	50-60
Serendipity	Defined as 'fortunate happenstance' or 'pleasant surprise', serendipity is notion of haphazard occurrences and unpredictability. How pleasant it would be to meet an old friend when walking to the local supermarket? This sort of haphazard gives a more human or natural air to public space and it can be provoked through intelligent and thoughtful urban layout.	50-60

6. Discussion and results

The qualitative surveys conducted on the study site, along with observations and analyses of photographs, lead to the several important deductions discussed below.

The amenities and commercial shops in the built environment are sufficient and convenient enough to support a healthy lifestyle in the neighborhood. The existing neighborhood is characterized by considerable diversity in this sector. Amenities and commercial shops are well distributed and provide a good balance between centrality and accessibility. Indeed, two main areas can be easily identified: the commercial frontage of Khalifa Street, which runs along one of the four sides of the neighborhood, and a mixture of amenities and commercial areas at the boundary of the north side of the street.

The density of an area is closely related to walkability. High residential densities are usually characterized by a dense network of 'destinations'. These areas support the presence and proximity of local shops, services, and public transport. However, Al Markhiya neighborhood lacks high residential density, as all housing units in that area are single-family homes. Most housing in the area is grouped into compounds and building blocks. This arrangement decreases the integration among residents living in different compounds. However, there are many vacant and unused land plots in Al Markhiya, which could have been temporarily transformed into green areas. As this valuable initiative never took place, they are presently unusable and contribute to a lower density.

The streets are designed for cars. As a result of the design favoring motorized transport, scales are inappropriate for pedestrians and the navigation and signage are aimed for cars only. Most sidewalks are neither properly designed nor enhanced enough for a pleasant walking experience. Limited mobility of disabled and old people has not been taken into consideration in many areas. No shades or street furniture is provided. It is unsafe to walk on sidewalks in Doha in general, as many of the roads are under construction. The contractors are not sufficiently aware of the need to secure alternative pathways. However, it is also possible that the authorities are not strict enough to curb such pedestrian-unfriendly practices.

As previously noted, Al Markhiya neighborhood was not considered when Doha Metro was planned, as there are no planned Metro stations in the studied area (Qatar Rail 2011). On the other hand, there are two existing bus stops that could facilitate longer commutes that are impractical for walking.

7. Conclusion

The study presented here outlined some indicators that can be used to examine the walkability level in a neighborhood. This case study was conducted in Doha city, and the analysis findings revealed that the studied area scored higher on the legibility scale than on imageability. This leads to the conclusion that, by increasing the residential density in the neighborhood, walking opportunities would increase. However, in order to increase the imageability score, it is necessary to enhance the public realm and work on the architecture of the buildings. It is apparent that compounds and extensive palaces discourage walkability in this neighborhood, because there is no transparency, no ‘imageability’, and in turn no enjoyability. On the other hand, the results reported here also reveal that it is possible to achieve walkability in Doha, and Gulf Cities in general, by adopting Western concepts, such as those proposed by Jane Jacob. Moreover, Smart Growth frameworks also provide opportunities to transform the city into a more pedestrian-friendly environment it once was. It is possible to formulate guidelines that are compatible with the existing built environment in the region. Finally, while this study has provided some significant suggestions, it is, as any other research of this type, affected by several limitations. Most importantly, the results reported in this study were derived from a study of a single neighborhood and should be viewed as a first step towards developing the entire city. Thus, while they cannot be generalized, they can serve as a foundation for future work in this area.

Indeed, the following recommendations can be made:

- The planners should aim to encourage walkability by prompting a model inspired by the past that is compact, mixed-use, diverse, transit-friendly, and takes into consideration a hierarchy of buildings and places, all in order to promote face-to-face social interaction (Inam 2014)
- The best way of thinking about urbanism and the material city is through focus on the formal qualities of the city by default rather than as an afterthought.
- The planners are requested to ensure environmental sustainability, safety and personal security in their proposed planning design, planning guidelines and building regulations. In addition, they must establish guidelines for improving accessibility for all, connectivity, and walkability. Their designs should also enhance the sidewalks and pathways and provide furnishings on the streets.
- There is a need for a Transport Strategy that clarifies the government's support of the pedestrian zones. Moreover, it is essential to offer an affordable, integrated, safe, responsive and sustainable transport system. As a broader objective, such a strategy should enhance economic, social and environmental integration and development.
- The planners are required to protect and promote public health.
- The planners should assist economic development.

Acknowledgment

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Re-visiting the Polemics of the Modernist Planning Paradigm: Challenges of Sequencing Transit Infrastructure Supply and Major Housing Development in Global South Cities

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Abstract:

As the Modernist Planning approach remains deeply entrenched in urban planning in the global south, new evidences of sub-optimal outcomes influenced by the implementation of the Master Plan paradigm are emerging. The framework provided by the Master Plan approach has long been criticized for being rigid, static and non-responsive to the dynamics and complexities of development in most global south cities. This has been linked to disjointed, fragmented and un-coordinated sequencing of implementation usually imposed from provisions of the Master Plan. As it still is for most global south cities, the planning system in Abuja, the new Federal Capital City of Nigeria has remained dependent on a Master Plan (modernist planning) prepared in 1979. Like many components of the plan, proposed dedicated rail and bus transit-way system with high density development abutting its corridors has remained on the shelves awaiting implementation for over 30 years. While the rail system is held in abeyance, the proposed high density housing has overtime systematically been replaced by extensive low density housing development tagged *'Mass Housing', which in principle negates* the objective of optimizing transit operations through landuse and transport integration. The comprehensive review of Master Plans usually required to accommodate change dynamics has not been the case in Abuja in the last 30 years for many reasons including cost. But it also raises further concerns on the lack of suitability of the Master Plan approach resulting from flexibility considerations. The prevailing uncoordinated sequencing of spatial developments along the transit corridor reservation in Abuja and the implications therein has explanation in the inadequacies of the Master Plan paradigm that needs further elaboration.

This paper explores the disconnect in the provision of low density housing developments along designated transit corridors in the Federal Capital City Abuja contrary to the provisions of the city's Master Plan and the implications, and how this situation may have been influenced by the Modernist Planning paradigm. The paper relies on qualitative data sources (urban planning documents and plans, archival records of maps and satellite imageries), physical surveys and observation, interviews and Focus Group Discussion (FGD) sessions with practitioners of relevant institutions. These data sources were triangulated to generate arguments that are consistent with the suggested linkage between sub-optimal urban planning outcome and the use of the Modernist Planning paradigm. The paper concludes by recommending for a paradigm shift towards a strategic, outcome focused, context-specific and flexible approach that is generated from situated experiences of rapidly urbanizing cities of the global south.

Keywords:

Modernist Planning, Master Plan, Sequence of development, Transit Infrastructure, Major housing development, Global south cities

1. Introduction

Despite lengthy debates about the need to re-evaluate the relevance and usefulness of the Modernist Planning paradigm, several studies have explicated evidences of how the Modernist Planning approach has not only remained deeply entrenched in urban planning in the global south, but how it has continued to produce undesirable consequences. The compendium of studies by the UNHSP (2009) provided evidences that show how global south cities have remained stuck to the vestiges of this modernist planning paradigm, and how urban planning outcomes have remained sub-optimal. With the continued application of the modernist planning paradigm which is characterized by restrictive bureaucratic practices, weak sectoral integration, spatial and functional differentiation of uses, and technocratic-driven processes, urban planning outcomes resulting from its application have generally not been optimal (Nadin, 2007, UNHSP, 2009).

In view of the unprecedented trend of urban population growth in global south cities (UNHSP, 2008), the rigid, static and non-responsive features of the Master Plan approach has made response to the complex and dynamic trends of growth difficult to achieve. This is also linked to the challenges of disjointed, fragmented and un-coordinated sequencing of implementation usually imposed by the Master Plan. The implications include the delayed implementation of fundamental infrastructure development, urban sprawl, and traffic congestion.

In consonance with the existing situation in most global south cities, the planning system in Abuja, the new Federal Capital City of Nigeria has remained dependent on a Master Plan prepared in 1979 (Razak, 2013). Like many components of the plan, the proposed dedicated rail and bus transit-way system with its abutting high density development has remained on the shelves awaiting implementation for over 30 years. The proposed transit infrastructure has been designed to traverse the city passing through sector and district centres (FCDA, 1979) while high density housing development within the sphere of influence of the transit stations are to generate ridership for optimizing transit operations. While the rail system has been held in abeyance, the proposed high density housing has overtime systematically been replaced by extensive low density housing development tagged *'Mass Housing', which in principle negates* the objective of optimizing transit operations through landuse and transport integration.

The comprehensive review of Master Plans usually require to accommodate change dynamics associated with population growth has not been the case in Abuja in the last 30 years due to bureaucracies and funding challenges. These are also further concerns on the lack of suitability of the Master Plan approach.

This choice of Abuja as case city is for several reasons, including primarily its use of the master plan paradigm to guide growth. The city enjoys a central geographic location, is an economic hub and enjoys rapid population growth. In this paper, it is established that the prevailing uncoordinated sequencing of spatial developments along the transit corridor reservation in Abuja and the implications therein has explanation in the inadequacies of the Master Plan paradigm. The disconnect in the provision of low density housing developments along designated transit corridors in the Federal Capital City Abuja is contrary to the provisions of the city's Master Plan and the implications, and how this situation may have been influenced by the master plan paradigm is focus of the discussions.

2. The Blueprint and the Modernist Planning View

The pre-World War II planning in Britain largely concentrated on a plan-led design with a strong emphasis on physical and blueprint Master Plans. This approach illustrating the spatial configuration of an ideal city has since guided and dominated planning theory and practice through to the middle of the 20th century (UNHSP 2009, p.206; Taylor 1998, p.5-17). Consequently, Modernist Planning ideas have shaped the development of major cities in the global north region which comprises of North America, Western Europe, developed part of East Asia and Australia was later exported to the global south region which comprises of Africa, Latin America, developing Asia, and the Middle East.

Since the beginning of the 21st century, the urban planning systems and institutions in the global south have continued to be shaped by the relics of the *off-the-shelf* Modernist Planning paradigm (UNHSP 2009, p.59*f*, and 77). This planning model is a technocratic, top-down model and characterized majorly by restrictive bureaucratic practices, single use zoning, and the predict and provide engineering solution of the building and expansion of highways (Jacobs, 1961, UNHSP 2009, Newman and Kenworthy, 2000, Nadin, 2007).

The Modernist Planning approach has often been criticized on the grounds that it over-emphasizes the broad physical elements of a city, the plans resulting from its application are not situation-specific, and are easily out-paced by the trends of city growth (UNHSP, 2009).The blueprint approach has also not been able to address the specific dynamic complexity that faces the rapidly urbanizing global south cities. In addition, it is self-evident that the static blueprint and end-state documents are inappropriate for addressing the challenges of the dynamic nature of cities. Nadin (2006), Shaw and Lord (2009), Allmedinger and Haughton (2010) argued that spatial planning and strategies should go beyond the traditional landuse planning and the task of refusal or approval of planning permission, but to focus on the coordinative role of joining-up government to better realize outcomes by considering integrated policies for the development and use of land. With an increasing need for effective response to the trend of urban population growth, and to mainstream sustainable urban development strategies into the growth agenda of global south cities, these existing planning tools may no longer be relevant.

3. Sequence of Transit Development in Cities

The focus of this section is to show literature and empirical evidences of the order and sequencing of transit development and the implications, and to further illustrate how cities shaped by the Master Plan approach are often faced with the challenge of incongruent sequence of developments. The vision plan of a city in practice usually shows the linkage / integration between landuse and transportation networks, and therefore defines the framework for a city's development. The examples of strategic vision plans that integrate landuse and transport networks at the city, city-region or metropolis level are discussed / reported in the studies of Calthorpe's neighborhood scale TOD site design (Calthorpe, 1993) (UNHSP 2013, p.93), Stockholm's "necklace of pearls" (Cervero and Murakami, 2008 p. 23) and Copenhagen's "finger plan" (Cervero 1998) (Suzuki et al. 2013 p.4).

The common underlying strategy of sequencing is a focus on linking clusters of housing and employment with transit infrastructure ensure that these developments and the transit system are functionally related while also ensuring that the development of the transit infrastructure precede the housing development. Therefore, in line with the city's vision plans, the designated transit corridors for channeling the city growth are defined early in the planning process with the transit infrastructure built in advance to spur growth along the designated growth axes. These evidences therefore show that the appropriate sequence of transit infrastructure development in a city is to have transit system to precede and shape other landuse developments.

However, evidences of global south cities where the application of the Master Plan approach has occurred show that the sequencing of transit infrastructure development is commonly missed because of the rigid and static features of the Master Plan approach, and as well due the slow response to the rapid urban population growth, and low level of priority and financing for transit infrastructure development (UNHSP, 2009, Razak, 2012). As a result, while the implementation of the transit infrastructure are usually held in abeyance, the development of low density housing along transit corridors have occurred with such spatial character that is usually not consistent with the optimization of landuse and transit integration.

4. Methodology

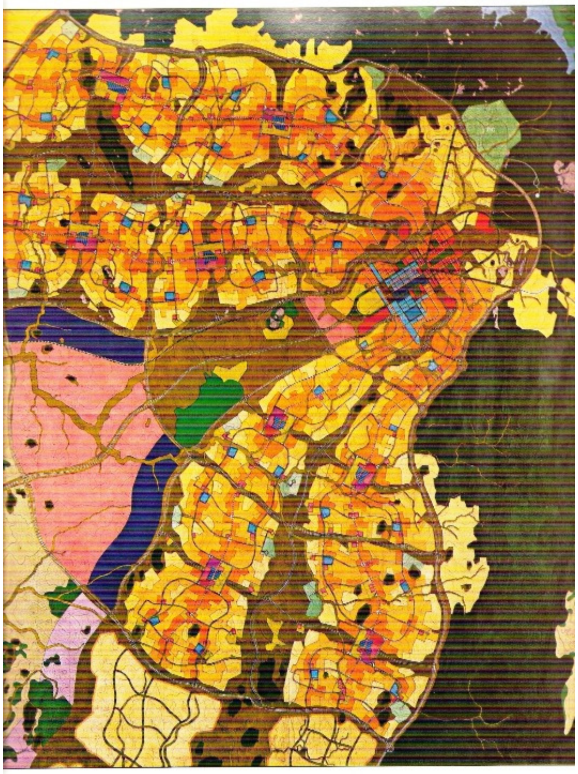
Data for the study was collected from Primary and Secondary sources. The Primary data were acquired from direct personal observation, photo recording, and interview sessions. The interview sessions were held with purposively selected urban planning practitioners with in-depth insights of public/government establishments such as the urban planning Departments of the Federal Capital Development Authority (FCDA), Satellite Towns Development Agency (STDA), FCT Transport Secretariat; private consulting firms and the academia. The total number of interviews conducted was 30.

Primary data from Authors' field survey of the character of the existing housing development within the half-mile radius sphere of influence of an LRT station was used to corroborate the spatial analysis of archival records of satellite imageries of the area. Secondary data were also collected from urban planning documents obtained from the FCDA Urban planning department which included the Abuja Master Plan. The contents of the Abuja Master Plan document were analysed in order to reveal the provisions of the planned transit development and the character of developments along its corridors. The data set were analysed to show a comparison between the density prescribed in the plan and the current density of developments along the transit corridors. This was to explain the role of the modernist planning approach in influencing the uncoordinated sequencing of transit infrastructure developments and the need for an alternative approach.

5. Results and Discussions

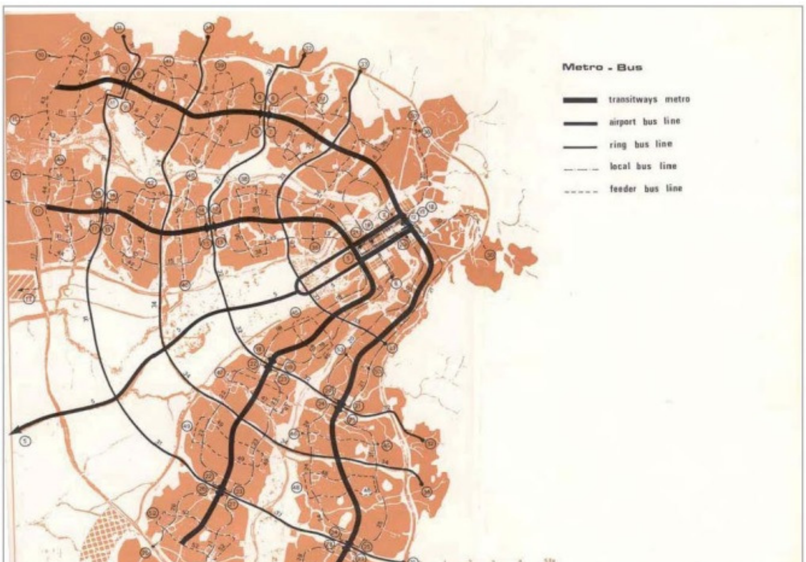
5.1. Provision of the Abuja Master Plan as it relates to Transit Infrastructure and Development along its Corridor

The Abuja master plan was prepared in 1979 by IPA with a follow up Transportation Plan by Sofretu Amana Osot of France prepared in 1981. The provisions for transit infrastructure included LRT network running through the spine of the city. This included planned residential and employment areas especially in the transit hubs in the city, sectors and some district centres as illustrated in figures 1 and 2.



Source: Adapted from The Abuja Master Plan, p. 70, FCDA, 1979.

Figure 1: The Abuja Mater Plan showing the pathway of the Transit way



Source: FCDA/Sofretu, Amana, Osot, 1981.

Figure 2: Abuja Transportation Master Plan showing Transit Network within the Core-City (FCC)

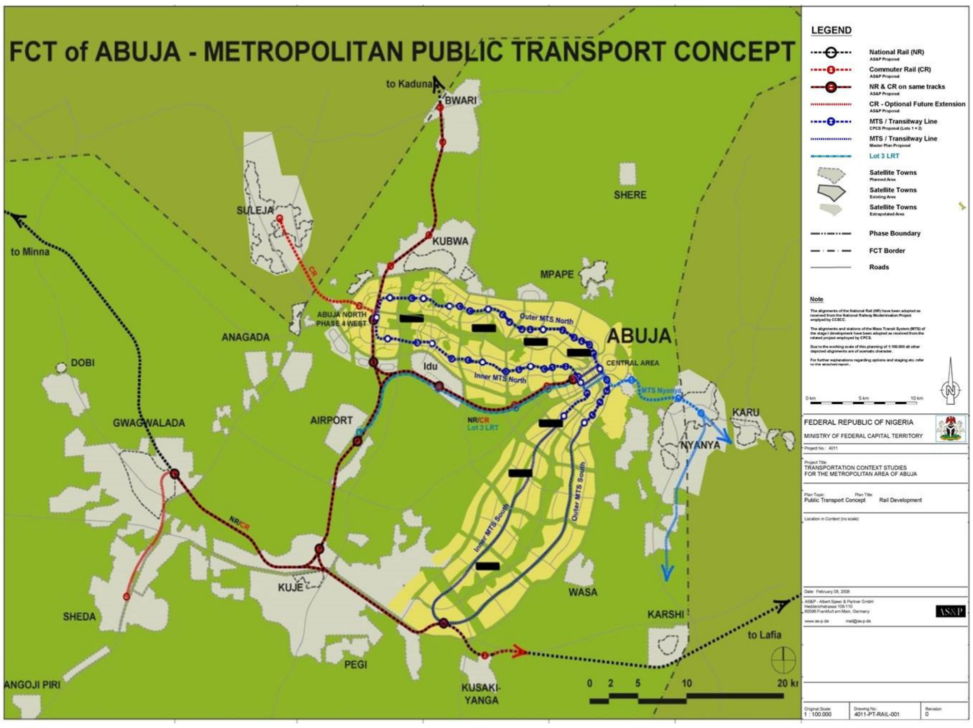
The provision of these plans as regards the development of the transit infrastructure has remained largely unimplemented. In 2006, the city authority/administration recognized the need to give priority to transit infrastructure development and the Abuja Metropolitan Public Transport Concept plan was subsequently prepared by Albert Speers and Partners of Germany (see Figure 3 below). However, since 2006 to-date only 2 Lots of the entire LRT network has been commissioned and to-date (2014) progress of work is about 30% to completion. Within this period (1979 – to date), development along these proposed transit corridors have been characterised by low density residential developments which is unlikely to support the optimal operation of the LRT when completed.

5.2. The Sequence of Transit Infrastructure and Developments along its Corridor

As described above, with the LRT infrastructure remaining largely unimplemented, and with the housing developments along these corridors being predominantly low density, the sequence of transit infrastructure development proposed by the Master Plan has been altered. In comparison, this situation is consistent with the findings in the studies by Calthorpe (1993), Cervero and Murakami (2008 p. 23) and Cervero (1998) which argue for the development of transit ahead of other landuse (residential) developments, the challenges of inappropriate sequencing in Abuja is therefore evident.

5.3. Physical Observation of the character of existing Development along the Transit Corridor

In line with the proposition of the LRT network proposed by the Abuja Metropolitan Concept Plan (See Figure 3), the LRT network and the stations located along its corridors form the basis for the selection of the station used as the case study.



Source: FCDA/Albert Speers and Partners, 2008.
Figure 3: FCT-Abuja Metropolitan Public Transport Concept

Figure 3 shows the network of the LRT system and the 12 stations proposed along its corridor. Figure 4 shows the satellite imageries of the spatial character of developments within the half-mile sphere of influence of the LRT station in Garki II District. The physical character of existing housing developments along the corridor of the LRT was captured during a physical survey and presented in Figures 5 and 6.

Source: Google Earth, 2014.
Figure 4: Satellite Imagery of Garki II District, Abuja

Source: Authors' Field Survey, 2014.Source: Authors' Field Survey, 2014.
Figure 5 and 6: An example of the character of development within the sphere of influence of the LRT station within Garki II District, Abuja

Figure 5 and 6 shows the predominance of single dwelling units along these corridors with some dotted multiple dwelling units. This therefore, depicts the character of housing-density along the transit corridor.

5.4. Spatial Analysis of the Comparison of existing Density and prescribed Density of Development along the Transit Corridor (Especially LRT)

The comparative analysis of existing and proposed development density along the transit corridor is made in this section. This is based on the spatial analysis of the satellite imageries for one of the selected proposed LRT station located in Garki II District and the physical observation of the existing character of development within the quarter of a mile radius sphere of influence of the LRT station (See Figures 7).

Source: Authors' Analysis (2014).

Figure 7: Satellite imagery of the LRT station showing its sphere of influence and the spatial character of development around it.

Analysis of these imageries and physical observation shows the predominance of single dwelling units along these corridors with some dotted multiple dwelling units. The density analysis shows an average of 17.77 dwelling units per hectare. The density specification along an LRT station according to the studies of Pushkarev and Zopan (1977), Dittmar and Ohland (2007), Guerra and Cervero (2011) is put at 36.08 dwelling units per hectare. The comparison of these density levels is reported in Table 1 below.

Table 1: Comparison between existing and prescribed density levels around transit stations

Size in radius (m)	Land Area (Ha)	Existing density around transit station		Prescribed density within TOD		Savings realizable from each zone (Dwellings)	Savings realizable from each zone[c] (Land Area in Ha)
		Prescription on Densities[a] (Dwellings Per Ha)	Number of Dwellings realizable from each zone	Prescriptions on Densities[b] (Dwellings Per Ha)	Number of Dwellings realizable from each zone		
400m	50.272	17.77	893	36.08	1814	921	51.83

Source: Authors' Analysis, (2014).

Notes:

[a] Sourced from the Abuja Development Control Manual and Physical Observation

[b] Sourced from Synthesis of TOD Standards (Pushkarev and Zopan, 1977, Ditmmar and Ohland, 2007)

[c] This is obtained by dividing the value of the savings realizable from each zone (dwellings) in column number 8 by the corresponding value of prescription on densities (dwelling per hectare) in the exiting situation as stated in column number 3.

Findings from Table 1 above show that within the 400m radius (quarter of a mile) of the intense zone of the sphere of influence of an LRT station, there exists a gap between the existing and prescribed density levels. The gap represents the deficit in the existing level of density and indicates a shortfall in the level of density required around a transit station. In percentage terms, the existing density level would need to be leveraged by 103.51% to achieve the required prescribed density levels.

5.5. **Interview Data from Relevant Practitioners**

In order to provide corroborative evidences to the identified challenges of sequencing that appear to inhibit optimal outcomes from the implementation of the Abuja Master Plan and the need for reforms, relevant practitioners were interviewed in order to gain insight into their opinions on this matter.

Some of the questions asked included; whether the practitioners agree that the sequencing of the development of transit infrastructure and housing development along the transit corridors is uncoordinated; and whether they can attribute the situation to the adoption of the Master Plan approach for Abuja. An additional question was what areas of reforms are required to overcome the challenge? The findings are discussed in the following section.

5.5.1. Uncoordinated Sequencing of the Development of transit infrastructure

Analyses of the opinion of the respondents from the interview sessions indicated consensus (86%) of opinion on the uncoordinated sequencing of the development of transit infrastructure along the corridors of the LRT in Abuja. The narratives in terms of the challenges of sequencing of development resulting from the interviews with practitioners were polarized along two lines. On the one hand, practitioners in the government establishments appear defensive of the Master Plan approach, and opined that the plan and its approach was flawless; and that the challenge of the plan is only attributed to the shortage of finance and political interference in the implementation of the Master Plan. On the other hand, practitioners in the private consulting firms and the academia opined that the application of the Master Plan approach has long outlived its usefulness in the face of the complex dynamics that face global south cities which include rapid urban population growth and the related impacts of increasing demand for mobility and housing. They opined that challenges implicit to the Master Plan approach are far beyond the challenges of sequencing of infrastructure development but also ramify wider implications of its static and rigid features.

Further, the disposition of the practitioners in the government establishments charged with the task of shaping cities indicate that these practitioners appear stuck with the Master Plan approach and do not see the need for a shift in the current approach. This finding is consistent with the studies by UNHSP (2009) which posits that notwithstanding the complexity and dynamics of the challenges facing global south cities, majority of these cities have remained stuck to, and continue to be guided by the vestiges of the Modernist Planning Paradigm and its Master Plan approach. It may therefore be safe to posit that reforms are required in order to shift these global south cities from the 20th century urban planning approach, towards a pathway that recognizes the complexities and dynamics of 21st century challenges and able to yield optimal urban planning outcomes.

5.5.2. The need for reforms to the existing Master Plan approach

In order to achieve a shift and reform to the existing challenge of uncoordinated sequencing of the development of transit infrastructure in Abuja, the opinion of the relevant practitioners were further investigated. The pattern and the themes emerging from the interview sessions with the relevant practitioners on how and what is required to achieve the required reforms is illustrated in the tree map below in figure 9.

Source: Authors' Analysis (2014).

Figure 9: Factors needed to achieve Reforms to the existing Master Plan approach

Evidently, the themes on the required solutions and reforms emerging from the opinions of the practitioners include need for a new strategic urban planning approach, enabling legislations, sectoral integration, stakeholder engagements, Political will, capacity building, and stakeholder engagement. While it is important to learn from global experiences on best practices to reforming the urban planning system, it may be appropriate to recognize these themes emerging from the opinions of the practitioners as important component of the reform, as these will make the resulting urban planning approach to be context-specific and home-grown to recognize the peculiarities of the city in question and produce optimal outcomes.

6. Conclusions and Recommendations

The results of the analyses show that the sequence of the development of transit infrastructure has been uncoordinated as it is evident that housing has already been developed along most of the transit corridors even before the construction of the transit system commenced. In addition, the density of the existing housing development along the transit corridor has been identified as below the levels required to either optimize transit operation or justify the investments in the transit system. This situation suggests that this sub-optimal outcome is linked to the ineffectiveness of the framework and implementation of the Master Plan, and therefore provides the premise to argue for a reform to the existing Master Plan approach. This reform may include a new approach that reverses the rigid, static nature of the Master Plan towards a strategic and flexible planning approach that is capable of responding to the dynamics and complexities facing global south cities. The new reform should demonstrate the capacity for context specificity to recognize existing peculiarities, and also lead to the achievement of coordinated and appropriate sequencing of development in other to realize optimal outcomes.

The area of further studies at this time may be to investigate what specific institutional reforms are required to either leverage existing planning approach or shift to a new planning approach such as the *Spatial Planning approach* that can permit the needed flexibility that best responds to the complex dynamics of global south cities, and as well avoid the challenges of uncoordinated sequencing of development and its related impacts.

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Expatriate Housing and the Social Fabric in Dubai

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Abstract

Dubai is the most populous city of the United Arab Emirates (UAE) and also a major trading and business hub in the Middle East. With increased job and small to medium sized business opportunities in recent years, Dubai is emerging as one of the most sought-after destinations worldwide.

The fast track growth of the trading, construction and real-estate industry in the UAE has opened significant employment opportunities with tax free income for the expatriate population. As expatriates are migrating to Dubai in search of better career opportunities and life-style, housing is the major concern for them. Indians residing in Dubai are the largest expatriate community with a population of 2.6 million which constitutes 30 percent of the total population.

This Pilot study is based on quantitative data analysis to understand the social fabric, housing and community neighbourhood amongst Indian expatriates living in Dubai. The study identifies and discusses various ‘determining factors’ that influences housing and space preferences which make community neighbourhoods socially sustainable amongst Indians residing in Dubai.

Keywords:

Built Environment, Culture, Dubai, Expatriates, Indian Expatriates in Dubai, Housing, Neighborhood, Social sustainability, United Arab Emirates

1. Introduction

1.1. Migration Patterns in the Gulf-States and City of Dubai:

Globalization has influenced the dynamics of the cities which have been centers of urban change. Cities indicate migration patterns worldwide due to the emerging global economy impacting their dynamics.

David Held, a leading theorist of globalization, has provided the definition of Globalization, as process (or set of processes) which embodies a transformation in the spatial organization of social relations and transaction-assesed in terms of their extensity, intensity, velocity and impact-generating transcontinental or inter-regional flows and networks of activity, interaction, and the exercise of power (Global Transformations (Polity,1999), as stated by Koser (2007).

"Urban studies have examined extensively the ways in which globalization was forcing cities to change considerably, but often they did not pay attention to the role of migrants as agents of urban change. They have been considered to be a part of the city human landscape" (Martinello, 2012, p.364). The role of the migrants has been important in the contribution of urban and regional restructuration. Martinello (2012) refers to Anthropologists Nina Click Schiller and socio-anthropologist Ayge Caglar who emphasize that there is a missing dialogue between urban studies and migration studies. With the advent of globalization, migration studies have become important to understand the process of Urbanization. Malecki & Ewers (2007) state that the Gulf Region has become the most urbanized region in the world, with over 90% of the population living in urban areas except in Saudi Arabia.

Migration is a charactersitic aspect of the Gulf States, and the discovery of oil changed the pattern of migration as before oil discovery were the employment of seasonal workers for the Pearling industry. Historically the British Empire had series of treaties from 1820-1960 with the Sheikhdoms of the Gulf which preserved the exclusive British presence on the Arabian shore of the Gulf. The rulers of the Gulf States and the British Government signed the Nationality Clause that requested all the oil companies to employ local nationals and to employ foreign workers if more skills were required. While the managerial jobs were offered to British Nationals, skilled and semi-skilled workers were employed from the Indian sub-continent. (Errichiello, 2012, pp.294-395,403).

This was an advent of the migration process in the Gulf which transformed the cities like Dubai with respect to economic, social and cultural characteristics. The number of migrants who emigrated from their home countries in search of a tax-free income and various available job opportunities increased over the period of time. Pacione (2005), states that urban economy of Dubai was boosted during the twentieth century when Dubai become a main port for transfer of goods from India to Persia, as well as when various trade activties emerged. Further the discovery of petroleum after 1960, revolutionised the economy of Dubai as major infrastructure activities were undetaken and this witnessed a huge influx of expatriate population as Dubai became a trading and business hub of the Middle East. Today it is to notable to see how Dubai has grown from a fishing village towards becoming a global city (Elsheshtawy, 2010).

UAE's shift as an oil dependent nation to that of a global business hub dwelling into diversified sectors like real estate, tourism, world-class sporting events, finance and construction was an important stage. The Foreign regulations were streamlined in the government economic policy reforms. As per the 2005 census, the UAE population was 4.1million with 20% UAE nationals and 80% of expatriate population. An overall lifestyle of the population has given rise to emerging places of entertainments like retails, malls, hotels, and has attracted global attention to the emirate, with its liberal policies. Hence UAE exemplified a varied model wherein the economy is based on market driven forces and in terms affects the entire population statistics, with the availability of job opportunities and the growth in various sectors, (Grant, Golawala, & Mckechnie, 2007). There has always been preference of workers coming from neighboring Asian countries rather than Pan-Arabs due to manageability, cost of labor and comfort ability to work. The total number of Indian expats has always been highest in comparison with the other Nationals from Phillipines, Pakistan, Bangaladesh etc.

The Dubai Statistics Centre, Population Bulletin, indicates that 1,944,200 was the total population of the city of Dubai and indicates trend in increase of temporary residents with highest number of Indian Nationals amongst the expats (DSC,2011). Dubai is a unique example of a city with over 200 nationalities residing as a transient population.

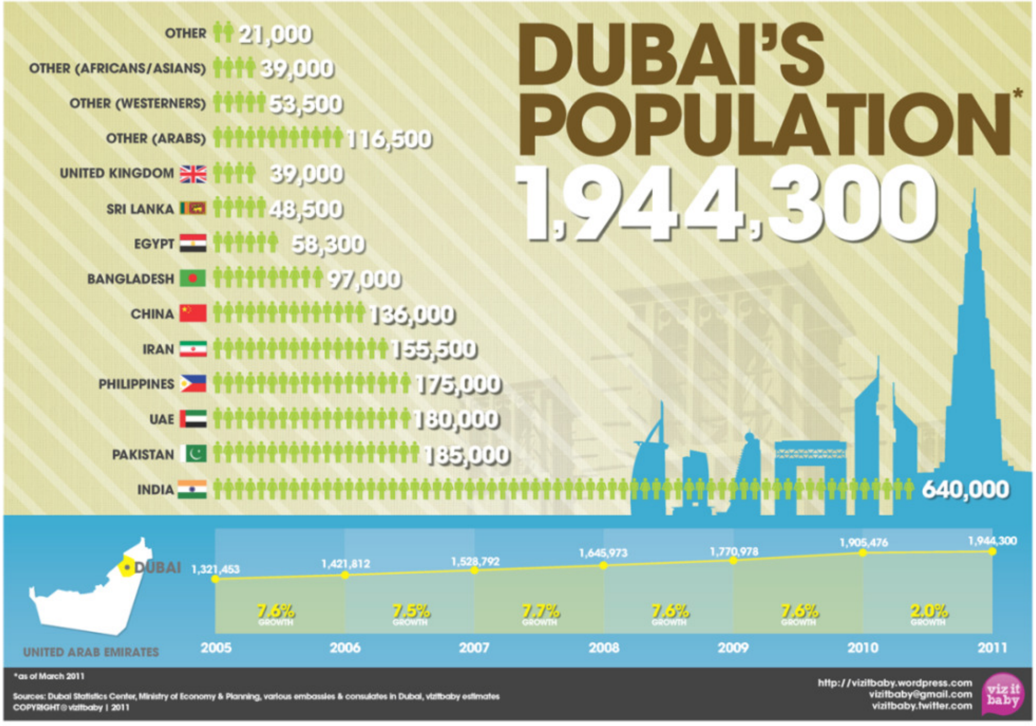

Fig 1 : Dubai's Population, 2011(Source : Dubai Statistical Centre, 2011)

1.2. Expatriate Population & Housing:

As stated by Pacione (2005), the urban development of Dubai has seen Four Phases as indicated in Table 1.

Table 1: Phases in Urban Development of Dubai

Phases in Urban Development of Dubai	Key Areas
1900-1955	This was the slow growth of population, concentreated in areas of Deira, Al Shindaga. The inhabitants lived with extended families in "barasti" houses made of palm fonds, with narrow walkways
1956-1970	The First Master Plan was executed prepared by John R Harris and Partners with road network, emergence of town centres and zoning. Houses were built with maximum utilisation of the plot which were owned by the inhabitants or at disposal of the ruler. The owners converted their land into buildings with rental apartment which were occupied by the expats.
1971-1980	Period of Planned suburban growth with infrastrucural development of bridges connecting Old and New Dubai. Emergence of main Sheikh Zayed Road, with development of commercial and financial centre of city.
1980 onwards	Rapid growth of urbanisation. 1993-2012 was introduced Dubai Urban Area Strategic Plan for future requirements of residential, industrial and commercial uses. Launch of Mega projects and allocation of land for Housing.

The rental housing has always been a preferred mode of Housing for the transient expatriate population because of temporary nature of the residency status which is related to the labor contract. The requirement for Housing of the expatriate population has always been increasing and in the Structure Plan of Dubai Urban Area, (Parsons-Harland Bartholomew & Associates, Inc.,1995), there has been mention of a requirement of housing for expatriate population over the years to come. During the period of 2002 onwards when Dubai experienced a large boom in the construction field, showcasing mega-structures on the world map, the concept of freehold properties was launched, and this was the time when expatriates started investing in the property market. The expatriate population has been seen specifically higher in certain areas of the city which are easily accessible, with availability of facilities and affordable, this is also an area of study of the paper.

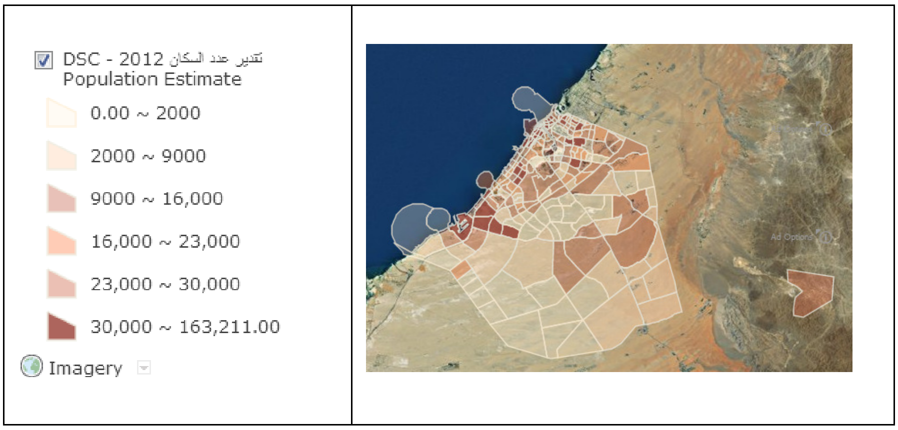

Fig 2 : Map of Dubai with Population Estimate (Source : Dubai Statistics Centre, 2012)

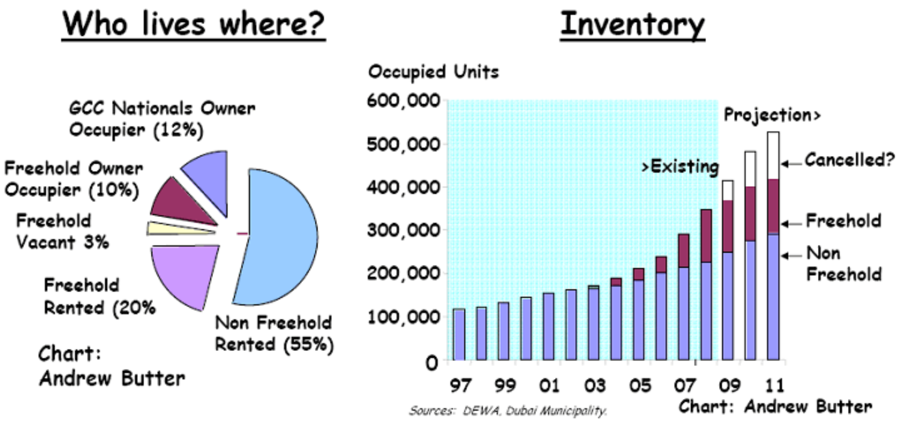

Fig 3 : Occupancy of Residents in Dubai, (Source : DEWA, Dubai Municipality)

GOVERNMENT OF DUBAI

مركز دبي للإحصاء
Dubai Statistics Center

المباني حسب النوع* - إمارة دبي

Buildings by Type* - Emirate of Dubai

Table (02 - 02) جـــدول

Type of Building	2012	نوع المبنى
One Storey Building	2,049	مبنى مستوى واحد
Multi Storey Building	11,135	مبنى متعدد الطوابق
Floor Area Ratio Building	357	مبنى نسب طابقية
Private Villa	53,396	فيلا خاصة
Investment Villa	18,861	فيلا استثمارية
Arabic House	8,904	بيت عربي
Establishment Building	6,357	مبنى منشآت
Industrial Building	823	مبنى صناعي
Other**	5,543	أخرى**
Total	107,425	المجموع

*Inventory of buildings and housing units and establishments
* حصر المباني والوحدات السكنية والمنشآت

** Includes (Shed - Sandaka - Caravan)
** تشمل (الشبرة - الصندقة - كرفان)

Source : Dubai Statistics Center
المصدر : مركز دبـــــي للاحصاء

Fig 4 : Building Types in Dubai, (Source, Dubai Statistics Centre)

As shown in Figure 4, majority of the residents live in rental apartments that are controlled by the real estate developers. Today, as Government of Dubai is supporting mega projects that add to global image of Dubai and plans for sustainable and competitive urban development for 2020, estimating a population upto 3.4 million, there is a requirement for community facilities and affordable housing areas which would be addressed with policies and guidelines, and detailed land use plan in the upcoming phase-5 of the Urban Master Plan as suggested by at the Dubai Municipality.

The main agenda at the Urban Agenda 2020 conference, Mr.Najib Saleh, head of planning research section at Dubai Municipality and head of Dubai Urban Plan 2020, stated that Dubai has crafted its economic vision 2020, and to now fulfill that goal of being a global business hub and economic centre, the strategy is to prioritize the needs of its citizens and build on these whilst being socially equitable and environmentally sustainable, as well as being economically driven. To ensure the continued growth of the emirate, its important to construct a liveable city that is totally modelled around the needs of the people that inhabit it through intelligent urban mapping and efficient design. He revealed that at the core of the Dubai 2020 Urban Master Plan lies the vision for integrated land use with the provision of housing and community facilities for all sectors (Todorova, 2014).

2. Concept of Neighborhoods and Social Sustainability:

(Kauko & Amato, 2012, p.50) refer to the glossary of the recent book edited by Holt-Hensen and Pollock (2009), for the definition of neighbourhood which is as follows : "Diffuse concept, but often connected to physical planning traditions by which neighborhoods are planned around the local servies such as schools and shops, and delimited by traffic barriers or open space from other neighborhoods. A more social definition is based on the idea that a neighborhood is an area in which the inhabitants have a certain knowledge of each other or know that they live in the same area".

Neighborhoods have usually been promoted as natural areas, or expressions of a naturalistic human need for community. They have often been posited as having a life independent of the forces, institutions and policies that shape them. And yet, for all of the importance that has been accorded them, neighborhoods have been viewed as fragile, always on the verge of disappearance, (Madden, 2014). The migration patterns of the cities influence the settlements of the Neighborhoods in cities with transient population. The migrants choose to plan new roots and as they migrate and adapt to their new surroundings. The Housing choices of immigrants are dependent on various parameters including lifestyle, length of stay in the country, affordability, accessibility, as well as social, cultural connects.

(Agrawal, 2008, p.43), states that "Neighborliness is an expression of societal strength". He explores a study about faith-based ethnic communities and neighborhoods in the Greater Toronto Area, Canada, The study includes case studies, survey from 4 neighborhoods with interviews of residents. The enclaves that develop around places of worship, and are inhabited predominantly by congregants of one faith who may or may not be of a single ethnic origin. He summarises that the selection of neighborhood which defines the social and physical characteristics relates to the level of satisfaction of the residents which has been instrumental to co-relate to the social fabric.

Why do people prefer to settle in particular Neighborhood?, is an important question in urban planning. Are affordability, accessibility, schools, proximity to relatives or friends, or religious places of worship important in considering choice of neighborhoods? The paper looks at aspects of Neighborhood that connects to the community who have come from various backgrounds but at the same time looking for a strong connect to social life in relation to socio-cultural and economic backgrounds.

According to the Anthropologist Neha Vora, who has conducted ethnographic studies, "Dubai is experienced as an extension of the sub-continent for all the residents of the city".

The density of the Indian presence is such that many of the neighborhoods are the ones in which the Indianness is most common. She has identified the preferences of the Indians who prefer to reside with their own communities and is seen in the old areas of BurDubai, Dubai Creek and Deira and describes the Indian population as legally "temporary guests" who have been residing in their second, third and in some cases fourth generation", (Vora, 2008).

According to a study by Elsheshtawy (2010) Dubai’s forgotten spaces and the residents have a major role to play in this migrant city. The indicative statistics with regards to the immigrant community shows that there is a relation between social geography as low-income groups are seen concentrated in some areas which relate to the housing conditions, land use and character of population. The historical narrative about the city ends by identifying spaces in traditional neighbourhoods which are not known and yet constitute the essence of the city.

Housing studies are going to be important to address various issues of social sustainability, a more socially responsive Architecture and Urbanism. Eastaway and Winston identify indicators for a good quality of life for a sustainable housing. They quote Hodge's (1997), 29 approaches to develop conceptual framework towards sustainability. The indicators of sustainable housing are sustainable land-use planning, affordability and quality access to green space, housing affordability, high standards of energy efficiency in use of dwellings, high quality of residential environment Hence various aspects for housing with relevance to resident satisfaction are also important in assessing the overall scenario for a socially-sustainable housing. (Winston & Eastaway, 2007).

"Social Sustainability is about people's quality of life, now and in the future. Social sustainability describes the extent to which a neighbourhood supports individual and collective well-being. It combines design of the physical environment with a focuse on how the people who live in and use a space relate to each other and functions as a a community. It is enhanced by development which provides the right infrastructure to support a strong social and cultural life, opportunities for people to get involved, and scope for hte place and the community to evolve"(Dixon & Woodcraft, 2013, p.475).

The aspects of Housing Design are equally relevant with regards to the social fabric. Ahmed Khalal, discusses on Community-relevant problems of the design of High-Rise Residential Buildings including social withdrawal from residents, crime, safety concerns. His study covers examples of 3 initiatives taken to overcome community-related problems in the design of high-rise buildings:Herzog & de Meurons approach : "Houses stacked in the sky", TR Hamzah & Yeang;s approach :City-in-the-sky", and Steven Holl Architect's approach ; Linked Hybrid". The "Fareej" which is a smallest unit of traditional Emirati Settlements is proposed by Abu Dhabi Urban Planning Council (2010) to be adopted for futuristic housing plans of the UAE. The spatial design and patterns of fareej makes the neighbourhood a comfortable zone, now how the vertically" apply the traditional is a question, which is a main aim of the research done by the author. The research proposes for a seven-point theoretical framework that include, design for a mixed-use development, the design for social connectedness and integration, design for security and privacy, the design for user-responsive houses within the residential towers, and finally the residents involvement in design and the management for high-rise development, (Ahmed, 2012). Housing Design therefore requires guidelines to have a more socially sustainable design for community level.

(Palich & Edmonds, 2013, pp.3-4) states that as per report completed by the Young Foundation in 2011, commisioned by the Homes and Communities Agency, there are four key elements identified to build new communities that will be successful and sustainable in the long term. They were Amenities and social structure, Social and cultural life, Voice and influcence and space to grow.

3. Research Methodology

The Pilot study presented in the paper is based on the secondary data analysis and primary research.

The study uses secondary data analysis to understand and compare dynamics of migration and housing patterns in some of the cities. Secondary data analysis focuses on the migration patterns, influx of expatriates, emerging neighbourhood and housing patterns in Dubai.

The Literature Review focuses on:

A. Migration Patterns in Gulf-States and city of Dubai.
B. Expatriate Population and Housing
C. Concept of Neighborhood.

The secondary data also includes statistics from Dubai Municipality, Dubai Statistical Centre and Indian Consular services. Primary data was collected though self- administered survey questionnaire. Survey was administred amongst 20 target respondents randomly selected in Dubai to gain insights on social fabric, neighbourhood safety, interaction with neighhours, available amenties and facilities, health care and community facilites. The Statistical Package for Social Science was used for the Quantiative data analysis.

4. Pilot Study:

The importance of Pilot studies are often been highlighted by researchers in order to carry out the testing of the main study. Pilot Studies are conducted before the main study is carried out.

They develop and test adequacy of research instruments, assess the research protocol, techniques if effective and also assess logistical problems in proposed methods. The role of Pilot studies is imortant to estimate variabiity in outcomes to help determine sample size, collect preliminary data and plan resrouces for the main study. (Teijlingen & Handley, 2001). The aim of the Pilot Study was to understand the connect between housing, community neighbourhood and the social fabric of the expatriates.

4.1. Quantitative Data Analysis:

The Pilot Study involved 20 respondents of Indian Nationality, who were identified randomly through various locations in Dubai in proportion to the areas in Dubai according to the density of population. The Data Collected was coded before the Analysis. The respondents that were of Age Groups 18 years and above involved Male, Female, individuals who have been residing in Dubai from less than a year to more than 40years and were were from various income groups. The Survey Questionnaire measured various Indicators in terms of General Information, and an overall experience of their Neighbourhood and housing units. The Quantiative data analysis was done with use of Statistical Package for Social Sciences.

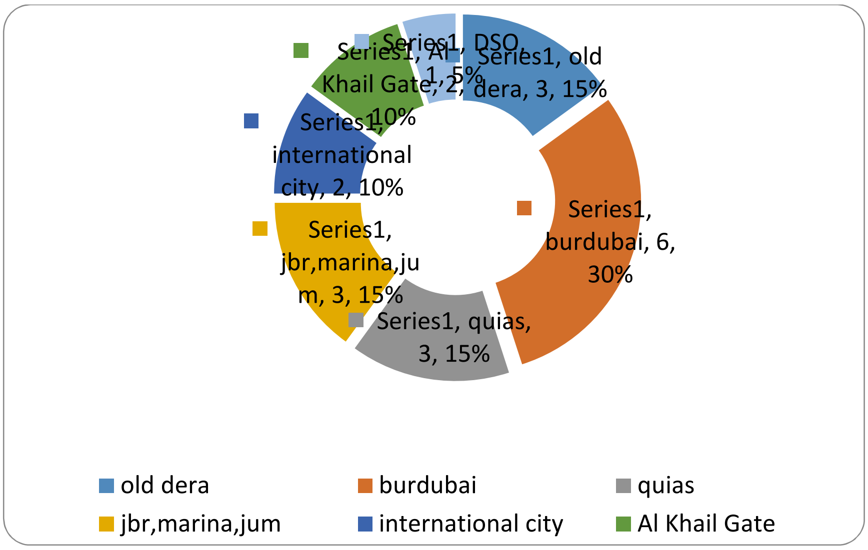

Fig 5 : Location of Respondents

4.2. Findings :

The Reliability Tests were carried out using Cronbach Alpha, and the value was less than 0.7. Hence the Test was reliable.

Table 2: Reliability Statistics using Cronbach Alpha

Cronbach's Alpha	No. of Items
0.674	12

Table 3: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Safety of Neighbourhood	41.3000	48.537	.335	.666
Interaction with Neighbourhood	43.1500	34.976	.651	.580
Availability of Facilities like supermarkets, laundry, etc in nearby vicinity	41.2500	49.987	.097	.677
Does the neighborhood have green areas like parks, or other landscape zones	42.2000	38.379	.609	.600
Community_Facility	42.8500	35.608	.575	.597
Health_care	41.3000	48.326	.373	.664
Ventilation_light	42.6000	37.411	.558	.604
Planning	42.4500	39.103	.514	.616
Premise_Parking	41.7000	45.695	.293	.658
Are community facilities like clubs, meeting areas, activity centres in nearby vicinity	42.7000	46.011	.185	.674
Social_life_satisfaction	43.6000	39.516	.396	.639
Better_social_india	42.0000	62.000	-.717	.779

In the analysis done for housing environement satisfaction level, use of 5-point Likert scale ranging from 1 very dissatisfied to 5 very satisfied evaluates the degree of housing environment satisaction for the respondents, the variables are derived from the objective of the study, (Odum, 2015).

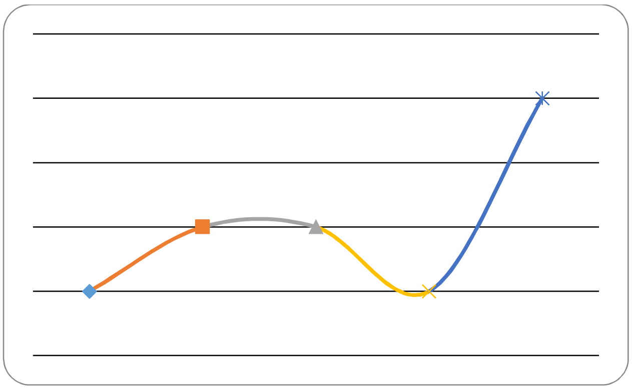

Fig 6 : Preferrences of Location

It was interesting to see how the respondents made choice of the location for their residents and maximum of them preferred for the accessibility, affordable rent as well as near to work place.

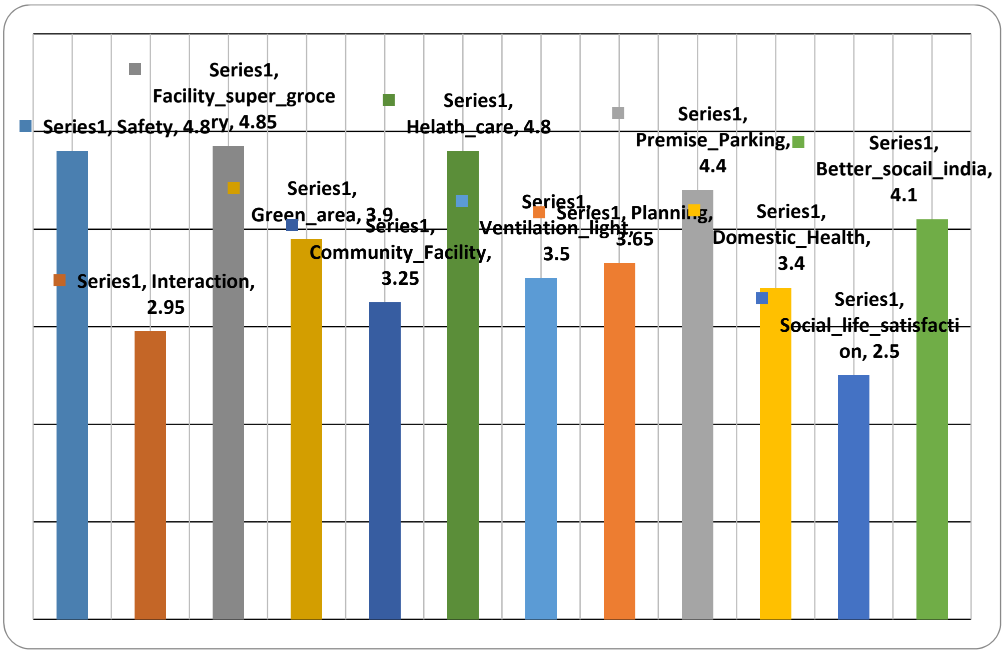

Fig 7 : Satisfaction Levels of Neighbourhood

With regards to the 12 Indicators for the various parameters of the Neighbourhood, almost all felt that the Neighbourhood was extremly safe with ample of facilities in terms of Health care, supermarkets. The only parameters which were low on scale were related to social aspects of interaction with neighbours, social life, which they felt was better back in India.

4.3. **Limitations of the Pilot Study :**

The Pilot Study analysed various parameters of the social fabric of the expats with various determining factors related to choice of housing, neighborhood patterns, to understand the social connect, physical experience of personal and public spaces.

After doing the Pilot study it was concluded that the research shall also have Qualitative Analysis to understand people's experiences and opinions of the Neighborhood through semi-structured interviews. This can further explore on concept of social sustainability as discussed in the literature review.

In area of research of Built environment which involves cognitive and affective as well as behavioural components, merits of both qualitative and quantitative methodologies are suggested to counteract any weaknesses that enhance the reserach (Amartunga, Baldry, Sarshar, & Newton, 2002). "Mixed Methods research is a research design with philosophical assumptions as well as methods of inquiry. It focuses on collecting, analyzing and mixture of both qualitative and quantitative approaches" (Creswell & Plano Clark, 2011).

The rationale that has led to use of Mixed Methods in the Research to take the advantage of both the Quantitative and Qualitative methods. The Quantitative research that includes questionnaire survey with face-to face gives people's opinion in a structured way and is analysed through a statistical output. The Qualitative research provides valuable insights on what people think, why they think it. It's all about people to give their opinions so that a researcher can understand the motivation and feelings, as face-to-face interviews would be easier to understand in-depth feedback, and giving more insight of attitude and behaviour.

Social Research takes benefits from both Quantitative research which can be analysed using statistics and Qualitative research allows better understanding of situation to understand experiences of people (Meer & Gabler, 2011).

5. Summary and Conclusions :

The paper attempts to analyse the social fabric of the Neighbourhood with the context of the expatriate population and Dubai. The results of pilot study of Quantitative Data Analysis provides indicators in terms of the experience of the community neighborhood, housing which will giv an opportunity to understand the final study in the research further.

In future when the Qualitative Analysis is done as a continuation of the research it will give more insights to understand the concept of social sustainability as discussed in the paper.

The paper also looks at aspects that would contribute knowledge to prepare for housing policies for a socially sustainable city not only for Dubai but also for various other cities in the Gulf Region, that cater to a large expatriate population.

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Bioinspired Design Material: A Multipurpose Case Study

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Abstract:

Since the discovery of oil, air conditioning systems, artificial lighting and the evolution in building materials many aspects in design process have been developed differently, particularly after the industrial revolution in a way that is capable of changing the essence of long intertwined relationship between the quality of architecture and the idea of sustainability. However, the built environment cannot be improved without applying the principles of biomimetics strategies and sustainable development within the design process. Therefore, it is up to architectural design and technology to learn from the past and shed the light on the technological role in order to avoid compromising the future demands while sustaining the present needs.

Nevertheless, this claim calls for the need of a large scale sustainable solutions to protect against the surrounding environment, and to insure indoor visual comfort at the same time. One of these solutions is that a modern opaque facade is required to be a multilayered structure that adopts a multi-layer technologies, and modern transparent envelopes in order to meet specific requirements.

This is a review paper which looks into identifying the generic aesthetic and functional characteristics of design material. In addition, this paper gives an allude of the importance of sustainability within the role of biomimetics innovative strategies as a solution to enhance the overall quality of design by combining aesthetics and functional aspects. It will therefore identify the characteristics of bioinspired material design specifications that can be integrated into architectural design process.

Keywords:

Bioinspiration, biomimetics, biomimetics development, Sustainability, Sustainable development.

1. Introduction and Background

According to Pulselli et al (2007), quality is one of the crucial requirements that has an important role in both whether in design process, or the construction of buildings. At the same time, quality has an integrated relationship with environmental changes and sustainability through its role in energy conservation, minimizing the greenhouse gas emissions and ensuring proper comfort conditions. For instance, Boeri and Longo (2013) noted that there are a large number of schools in Canada and the United States that suffer from a high consumption of energy which in return affects the architectural quality and building performance at the same time. Thus, in order to have an adequate design building, there is a necessity to fulfill the criteria of sustainable design in a way that ensures an adequate technical standards to all aspects of design.

Equally important, De Meester et al (2009) discussed that sustainability as a concept is strongly connected to the building process within its all phases such as construction, use and waste of buildings. In addition, the idea of sustainability is based on a multi-dimensional concept with a wide perspective that includes all the different developmental elements in relation to environmental issues such as economic growth, well-being of population, environmental quality, etc (Brundtland and World Commission on Environment and Development, 1987).

In this sense, Wiscomb (2010, 2012) noted that a growing desire to have a sustainable built environment where the use of energy is efficient has developed an innovative design process lies within the complexity of architecture. An architecture where the surface of a building is not just an abstract but also a mix between technology and design elements. This claim could be achieved through an overlap between *biological* models in nature and *architectural* patterns in a way that introduces an integrated relationship between visible and embedded technological elements, as an attempt to improve the quality within the relationship of form and function. In the same meaning, from a sustainable point of view Roaf et al (2009) argued that the building envelop is known as a third skin that plays an interactive role between indoor and outdoor conditions. For example, a glass of highly performing standards can have a profound impact on the control of comfort parameters in indoor spaces in terms of temperature, and illumination.

Equally relevant, Jorna (2006) argued that sustainable innovation is thought to be part of the biomimetics multilayered scientific system. These multiple systems can interact and provide complex patterns. Moreover, Gruber et al. (2011) explaind that biomimetics is a concept based on practical observation to models in nature. An observation that looks for every detail related to biomimetics strategies, analogies, processes, and mechanisms in a way that collectively examines the relationship of form and function.

In addition, biomimetics in its multilayered complex system is thought to improve and cater for technological innovation by applying profound scientific principles (Stachelberger et al., 2011). For example, Gruber et al. (2011) argued that the technical aspects can be integrated into the building technology as a whole process, or it can be integrated in a way that is limited to the use of one part such as a biomimetic surface structure like the "Lotus" paint which is known for its self cleaning properties. This type of paint is a substance based on the “Lotus-effect” patent of Prof. Wilhelm Barthlott, and it was developed by STO company in 1999. Nevertheless, Kuhlmann (2011) argued that not all aspects of biomimetics approach could be part of the design process due to lack of clarity in certain outcomes which may not serve aesthetic qualities.

From a slightly different perspective, Gruber and Imhof (2007) argued that through billions of years, nature has managed to evolve perfectly to its needs. So when engineers, designers and architects get inspired by nature, they often come up with productive ideas that are both efficient and reliable as well. Accordingly, Gruber (2011) argued that the word bioinspiration has been used more instead of bionmimetics, yet still seen in a more general perspective that does not have the defined background which outlines the specific strategies and methods necessary for the design process. Moreover, bioinspiration still lacks the clear specification to be directly taken as an approach into biological strategies.

This paper will provide a review of the literature regarding the quality of design and its integrated relationship with sustainability whether in a man-made world or in biological models; it will highlight the relationship of biomimsetics strategies with the role of technology. The aim is to collectively improve the quality and flexibility of design. This claim is achieved through the interpretation of information transfer between architectural design and biological models in order to identify the characteristics of material design specifications that combine both aesthetic and functional design aspects.

2. Literature Review

2.1. **The Role of Sustainability In Design**

Sustainability acquires an integrated balanced relationship with social, economic, environmental elements since the construction process along with the uses and wastes of buildings have an impact on the environment. Equally relevantly, Costanza and Patten (1995) referred to sustainability as an ongoing process of survival or persistence. However, Critics argue that it is useless to adequately define the concept of sustainability because it casts the problem with more than one prediction of what will last, and what we want to last. Besides, it lays other complications that question what systems, subsystems, or the characteristics of that system, and for how long. For instance, in biological fields, sustainability is the process of living in order to survive and reproduce by avoiding extinction.

Moreover, from an economic point of view, sustainability means a situation that is against instabilities and discontinuities since it avoids major disruptions and collapses. At its base, sustainability caters in particular for longevity while in general it concerns temporality. The problem of sustainability is similar to the fitness in evolutionary biology where the state of sustainability can only be made after the fact. For example, an organism only in its living state confirms that its off springs will survive and in return add to future generations. Therefore, most of sustainability definitions are predictions of today`s actions intertwined with the hope of reaching sustainability state (Costanza and Patten, 1995). According to Kohler (1999), the aim for obtaining the state of building sustainability is to improve functional quality and durability by reducing material throughput.

Literature findings show that the idea of "sustainability" can be found in many different fields. For instance, biological models always develop mechanisms and structures by using minimal resources to achieve maximum performance where the bad model disappears and the best model wins by its balanced relationship between mechanisms and structures with the surrounding environment (Beukers and Van Hinte, 1999, Vincent et al., 2006).

Therefore, in order to identify combined aesthetic and functional aspects of design element, sustainability is important to set the boundaries for design qualities by improving the flexibility of material design specifications aesthetically and functionally. This claim can be achieved through a number of applications in the industry which are deeply rooted with biomimetics innovative technologies.

2.2. **Biomimetics: Synonyms and Definitions**

This section discusses the application of biological mechanism in industry through the implementation of biomimetics innovative technologies in a way that enriches both aesthetic and functional aspects of design element to produce a material of similar qualities.

There are various synonyms and definitions that support each aspect of biomimetics inspiration. According to Hollington (2007), the word biomimetics is similar to the meaning of bionics, biomimesis, biomimicry, and biognosis where all these words are synonyms used in different parts of the world relating to developments based on the inspiration of functional aspects of biological atructure. According to Benyus (2002), the idea of biomimcry is to learn from it instead of copying it; Ammitzbøll et al. (1991) noted that nature is the main provider of raw material in a way that enhance the survival process of human during the extreme environmental conditions.

There are rare applications for biological mechanism in the industry. For example, there is the Lotus Effect inspired textile which enjoys the quality of stain resistance properties that makes it more environmentally convenient than the use of conventional coatings and finishes (Slater, 2003). However, (Kapsali and Dunamore, 2008) argued that although the biomimetic innovation has produced new functionalities in both functional and performance in the textile sector, this approach is still in its infancy or not developed enough to have a strong presence in the industry.

2.3. Biomimetic Development between Aesthetic and Functional Aspects

Having looked at the definitions of biomimetics as a base for inspiration from nature, it is time to identify the aspects of such inspiration. Therefore, this section explores the aesthetic and functional influence of biological models on design aspects.

Kapsali and Dunamore (2008) noted that the field of biology, on one hand, is always inspiring as a rich source for aesthetic aspects for every culture and era. The aesthetic influence can be seen in the design of textiles and structural patterning through the countless examples of elaborated design patterns like in flowers, insects and various animals. On the other hand, Ellison (2013) argued that the idea of biomimetic is to use the natural biological model as a guiding source of inspiration in the science and engineering development of new materials through a detailed observation to the natural systems. Notwithstanding, the main focus is to clarify the relationship between structure and function of the natural system in a way that makes it applicable to be used in engineering.

In this sense, biomimetic developments are developments inspired by biological structures through the interpretation of information transfer which focuses on the functional aspects of biological mechanism into man-made design where there is no direct influence on the aesthetic aspects (Hollington, 2007), as shown in Figure 1.

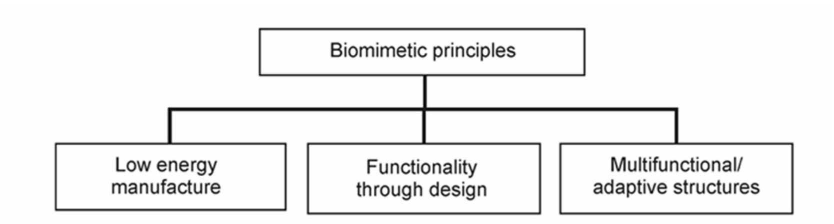

Figure 1 illustrates the idea of how biomimetic depict natural models as a rich source for sustainability and clever design (Kapsali and Dunamore, 2008).

Literature shows the different views that cater for the inspiration of biological models. Hence, the main aim of this paper is to create an understanding of the conceptual framework that takes into consideration both aesthetic and functional aspects of design. Therefore, the second part of the literature review will focus on the various models which will lead to identifying the characteristics of material specifications that combines both aesthetic and functional aspects of design process as a whole.

2.4. **Differences between Biological Material and Man-made Material**

This section explains the difference between biological models and man-made products in a way that links between natural resources and energy in terms of material.

According to Beukers and Van Hinte (2005), the optimal use of minimal resources is a conceptual link to energy in both nature and engineering as well. Moreover, Benyus (1997) explained that the word energy equals money which, at the same time, embraces the relationship between environmental cost and the consumption of natural resources during the construction process of man-made products.

In terms of material, there are differences between the production of biological material and the production of man-made material. The engineering system of biological materials does not require too much energy to deliver their functional properties while conventional engineering of man-made designs involve too much energy to deliver the needed functional properties like stiffness, strength or elasticity (Benyus, 2002, Vincent et al., 2006). For example, in nature there are only two polymers protein and polysaccharide which offer a wide range of properties depending on their structural variations. In contrast, the man- made material requires 300 polymers to produce new properties (Vincent et al., 2006). For instance, insect cuticle is made from chitin and protein and can demonstrate a multi mechanical properties which can be stiff or flexible, opaque or translucent, depending on variations of polymer assemblage (Vincent, 2012). In contrast, man-made materials obtain a multifunctional quality through the application of composite technology in which the property of one material is added to another to create a material of two or even more properties. For example, the breathable, water and wind resistance systems in textile technology for clothing sector that can be achieved through a composite pattern made of three individual layers laminated together to create multifunctional qualities useful to material design properties (Hollington, 2007).

Therefore, although both man-made products and biological models can provide a multifunctional quality like stiffness, strength, elasticity, or flexibility whether it is opaque or translucent, Yet biological models spend less energy to produce their own material properties because of the clever relationship they maintain with the surrounding environment along with the fact that biological models use less components to achieve their functional needs. Furthermore, man-made materials need to the application of composite technology to provide the required multifunctional properties.

2.5. **Modern Material and The Building Envelope**

This section provides an insight for the relationship between modern material and building envelope from a sustainable point of view that caters for material specifications depending on the role of technology and biomimetics inspiration.

According to Canavale et al (2010), the need for a building with modern material have increased, particularly, after the industrial revolution that works in contrast to the traditional concept of the massive walls where the idea of external envelope has developed into the use of a light building envelope in terms of transparency, lightness, thinness, and re-cyclability such as steel and glass. For instance, according to Macleod (2008), one of these envelopes is the glass coating which has been used since the second half of XXth century. Equally as importantly, Martinu and Poitras (2000) stated that 70% of glass coating combines between functional in terms of antireflective, low-E, solar control as well as decorative coating.

Canavale et al (2010) argued that this claim calls for the need of a large scale sustainable solutions to protect against the surrounding environment, and to insure indoor visual comfort at the same time. As a result, there is much discussion about a definition that takes into account all the aspects of sustainability, or sustainable development and other related concepts (Pezzey, 1990, Costanza, 1992, Pearce and Atkinson, 1993). According to Segnestam (2003), the interest of sustainable developments has started since the early 90s by many countries and international organizations. In addition, Kohler (1999) argued that sustainable development is the same way as delivering a sustainable built environment which can be divided into three dimensions: 1) Ecological sustainability, 2) Economical sustainability, 3) The social and cultural sustainability, as shown in Figure 2. Ecological sustainability is more familiar in terms of resource and ecosystem protection taking into account the energy and mass flows in time and space. In this sense, according to Cole (1999), economical sustainability concerns investments and use costs. The social and cultural aspects of sustainability combine comfort and health protection, and preservation of values, which is one of the main motivations behind any conservation projects.

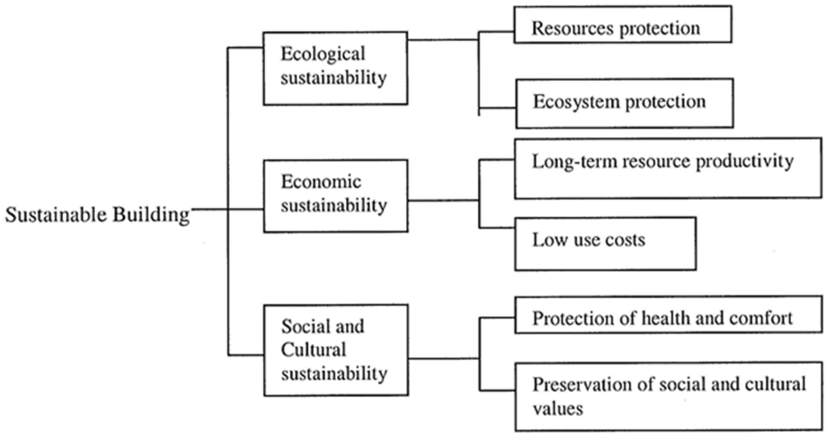

Figure 2. Illustration of the three dimensions of sustainable building (Kohler, 1999).

According to Du Plessis (2007), the essence of sustainable development is to avoid the environmental and/or social deterioration in a way that does not exceed the environmental limits but by managing complex relationships including the role of technology and balancing between the needs of humans and their environment in order to sustain the existence of both modern and future mankind at the best possible quality. Still though, according to Kua and Lee (2002), it is not a fact that applying the technology within the three dimensions would guarantee total sustainability. For instance, by applying the aspects of both ecological and economic sustainability, this may have an effect on the quality of social and cultural sustainability.

This section demonstrates a system of complex, balanced, and integrated relationships between surrounding environment and building process through sustainable development and its integrated aspects in terms of ecology, technology, economy, social and cultural aspects. Therefore, it is necessary to to provide an understanding of sustainable solutions in terms of the characteristics of material specifications.

2.6. **Applications of Bioinspired Material: Material Characteristics ` Requirements**

Having looked at the literature findings in sections 2.4 and 2.5,, this section will identify the requirements for the characteristics of material design specifications. It will demonstrate examples of mimicking useful biomimetics strategies as part of the interpretation process of information transfer between natural models and man-made material.

According to Bar-Cohen (2005), biomimetics is an approach based on the observation of design patterns in nature using the tools of abstraction to mimic the good strategies of natural models against the changes of the surrounding environment. For example, the moth eye has a distinctive surface layer with a nanoscale pattern of conical protrusions that serves an effective antireflective quality where light reflection is reduced to zero which in return optimizes the small amount of light available at night, as shown in Figure 4.

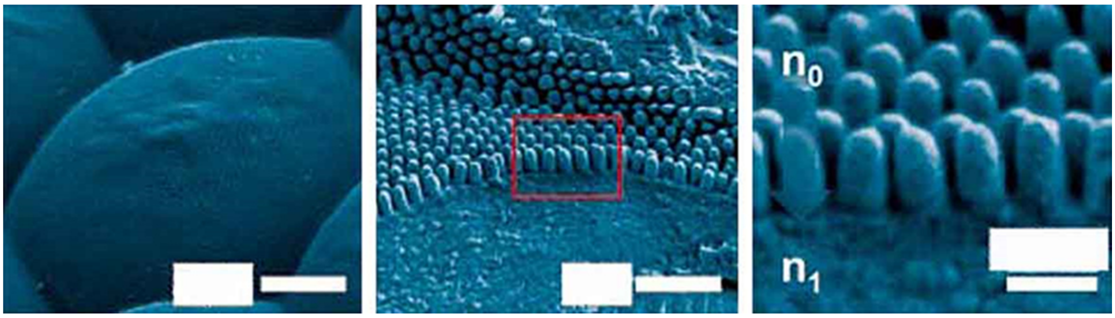

Figure 4 illustrates Progressive ESEM magnification of the moth-eye surface morphology (Focus on Materials, Max Planck Institute for Metals Research Stuttgart, p. 1) (Cannavale et al., 2010).

Equally relevantly, Canavale et al (2010) argue that mimicking biological strategies is one of the solutions in which a modern opaque facade is required to be a multilayered structure that adopts a multi-layer technologies, and modern transparent envelopes in order to meet specific requirements. For instance, the application of antireflective glass coating in building engineering and construction industry is suggested for shop windows, control towers, museum glasses, advertisement panes. In addition, according to Duyar and Durusoy (2004), antireflective glass coating has multipurpose applications in all aspects such as architectural, optical and electro-optical systems in telecommunications, glass lenses, eyeglasses, medicine, military products, lasers, mirrors, and any kind of display. Pettit and Brinker (1986) argue that antireflective glass coating is also used in solar energy conversion systems like photovoltaic cells and solar thermal systems, and even the transparency of glass has an important role with the efficiency of cell itself.

The quality of ARCs relies on two key elements: material refractive index and film thickness (Chartier, 2005). Moreover, ARCs uses transparent under layer material such as glass and plastic where polycarbonate and poly methyl methacrylate (PMMA) are important optical layers. This claim is because transparent substrates suffer less severe reflective loss than other materials like silicon or semiconductor materials. More important, there are two types of ARC. One is the single layered ARC which is widely used. However, there are problems that weakens the use of it due to the high tensile growth stress and the poor mechanical properties along with the fact that materials with low refracted index are rare (Kennemore and Gibson, 1984, Schulz, 2006).

Therefore, this issue can be dealt with by having a multilayer coatings; nevertheless, multilayer ARCs also have problems related to high fabrication cost and limited material selection. Another issue is that the fixed thickness affects the coatings which are both narrowband and a narrow field of vision in a way the delivers a suppressed reflection (Chattopadhyay et al., 2010). Notwithstanding, there are examples of biological models in nature that can provide solutions to the coatings problems. Again, Nocturnal moths have eyes with a misconstructed cornea in a way that provide excellent broad band antireflection which are made of a hexagonal array of non-closed-packed sub wavelength pillars forming a grating that surpasses reflection of visible light, as shown in Figure 5.

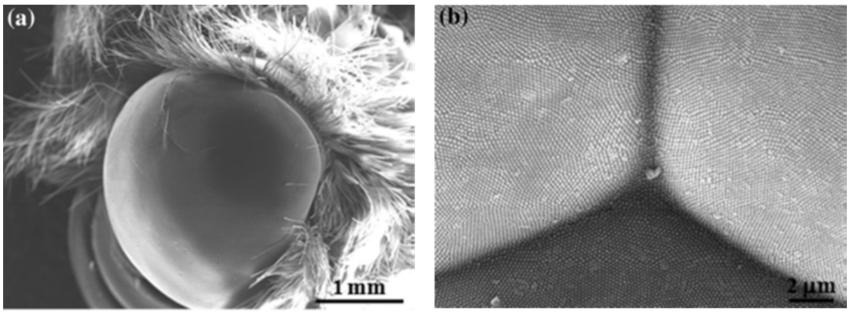

Figure 5 demonstrates images of a moth eye(Clapham and Hutley, 1973, Rahul et al., 2012, Boden and Bagnall, 2008).

This section discussed the material characteristics in terms of thickness, transparency glass or plastic, single or multilayered coatings inspired by biological models as well as the limitations in an attempt to improve the quality of material specifications through the mimicking of useful biological strategies in nature.

3. Methodological Approach

This paper is part of an ongoing PhD study that is conducted in four stages:

- Stage I- This stage is focused on understanding the qualities of aesthetic and functional characteristics of biomimetic materials and identifying the main factors that would affect both the individual and overall quality of material design specifications.
- Stage II – This stage entails qualitative data collection in order to identify the layers of an integrated architectural design pattern that combines both aesthetic and functional aspects.
- Stage III – This stage entails the development of an interface which cater for the quality and flexibility of design as well as the sustainability of the built environment.
- Stage IV – This stage entails the evaluation of the interface.

This paper only focused on the first stage of the research by identifying the characteristic of bio-inspired design material.

4. Main Findings

This paper only draws on some of the findings from literature as summarised in the following section.

1. An overlap between *biological* models in nature and *architectural* patterns is an innovative design approach that introduces an integrated relationship between visible and embedded technological elements, as an attempt to improve the quality of design within the relationship of form and function.
2. The quality of design plays an important role through its integrated relationships with the sustainability state.
3. The idea of sustainability is based on a multi-dimensional concept with a wide perspective that includes all the different developmental elements in relation to

environmental issues such as economic growth, well-being of population, and environmental quality.

4. Sustainable innovation is thought to be part of the biomimetics multilayered scientific system. These multiple systems can interact and provide complex patterns.
5. Biomimetics in its multilayered complex system is thought to improve and cater for technological innovation by applying profound scientific principles.
6. The field of biology based on the biomimetics innovative strategies is an inspiration to provide solutions for design problems in both aesthetic and functional design aspects.
7. Although the biomimetics innovation has produced new functionalities in both functional and performance in the industry, this approach even with the role of technology is still in its infancy or not developed enough to have a strong presence in the industry.
8. Adapting biomimetics strategies depend on a mimicking process between biological models and man-made world. Accordingly, it is important to realise that a clear and adequate interpretation process of information transfer is important for the mimicking process to succeed taking into consideration the role of sustainable development and technology in terms of material.
9. The production of multifunctional natural biological material properties requires less energy and less materials while the production of multifunctional man-made material properties requires more energy and more material as well as the application of composite technology
10. One of the solutions of material characteristics is that a modern opaque facade is required to be a multilayered structure that adopts a multi-layered embedded technologies, and modern transparent envelopes in order to meet specific requirements such as in antireflective glass coating whether it is a single or multilayered coating made of glass or plastic.
11. The literature findings identify the characteristics of bioinnspired material design specifications in a way that combines both aesthetic and functional aspects. This claim takes into consideration other qualities in terms of stiffness, flexibility, strength, elasticity and transparency, texturing, and coatings.

In conclusion, these characteristics will improve the quality and flexibility of architectural design as well as the sustainability of the built environment by delivering the characteristics of material design specifications in a way that combines both aesthetic and functional aspects.

5. Conclusion and Future Work

Reviewing the literature showed that both biomimetics and sustainable developments are important in the interpretation process of the information transfer between biological and man-made material specifications. In addition, technology plays an important role in the implementation of biomimetics innovation in design process. The characteristics of bio-inspired material design specifications will be delivered in a multilayered design element with an integrated relationship between visible and embedded technological systems such as Antireflective glass coatings which depends on a transparent under layer like glass or plastic. In the same way, the transparency is important for the efficiency when it is used with solar energy conversion systems like photovoltaic cells in a way that clearly combines both aesthetic and functional aspects. Such characteristics will visualize the main features of a digital prototype that improves the quality and flexibility of design as well as the sustainability of the built environment.

This paper has identified the characteristics of bio-inspired material design specifications through multi-layered design element with embedded technological systems. These findings will contribute to the development of a digital prototype which will be used as an educational demonstration for practitioners to see the added aesthetic and functional aspects of bio-inspired material design specifications.

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Using Design Science to Establish a Specification for Refugee Shelters

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Abstract

Many countries have accommodated refugees in different forms of shelters in order to meet their basic needs. However, studies have shown that most shelters are constructed from canvass materials and are not meeting the needs of refugees in desert conditions. This paper explores the methodology that will be required to produce a new specification for refugee shelters that can be fulfilled by designers, planners and refugee organizations. Determining the research method is a crucial step to enable researchers to provide specifications. However, many organizations such as UNHCR, NCR, IRFC are conducting shelter and settlement projects that follow empirical methods to establish solutions for refugees by observation and measuring phenomenon through actual experience and evidence, whereas Design Science goes further by seeking change, improvement and the creation of new worlds. The aim of this research is to create a better refugees shelter by providing specifications through design science method. The research question is "can Design Science be viewed as a valid methodological approach to investigate a new specification for refugee shelters in desert conditions?" Design Science can produce a solution to practical problems of general interest while maintaining the rigour of an empirical study. Exploring the Design Science approach offers an opportunity to present a proposition, discover sources through a stakeholder survey, to both temporary housing professionals and refugees, to find a better way to resolve the difficulties of refugees in harsh environmental conditions which is existing in desert (hot- dry) climate with a camp in Jordan as case study for field work.

Keywords

Artefact, Design Science Process, Refugees' Shelter, Research Method.

1. Introduction

1.1. Background of the research

This paper discusses the effectiveness of using Design Science as a method to investigate the research outcome of providing a new specification for a shelter to accommodate refugees in desert climate. Recently, providing better shelters for refugees has been a major concern at both local and international levels. Finding practical solutions that improve comfort while requiring less time to construct and minimize costs have been considered by the UNHCR and other agencies (United Nations High Commissioner for Refugees [UNHCR], 2007). The UN report in 2013 for the Middle East showed that there were 60 UN camps accommodating 4.8 million registered refugees. However, there is still a general lack of attention from the national and international communities to meet the challenge of accommodating refugees' needs beyond the provision of tented encampments.

In order to provide security and safety for refugees, they need to be sheltered in the quickest time possible and should be accommodated in secure and protected shelters in the host country.

Sphere's handbook (2011, cited in Bulley, 2014) states that shelters are necessary to offer security, safety and protection from the climate changes and to ill health and disease. There are three main challenges to accommodate refugees: political regulations, economic issues and social dimensions (Shelter Centre, 2012). Overall, these barriers have a direct influence on the living conditions of refugees inside and outside their shelters. The objective of this research is to prescribe a new specification for providing better dwellings to accommodate refugees.

1.2. **Previous Practices of Accommodating Refugees**

Researchers such as Davidson, Lizarralde, & Johnson (2006), Turnquist, & Rawls (2012), Fallahi, & Hadfi (2010), Arslan & Cosgun (2007) and Quarantelli (1995) have discussed the challenges of refugee settlements. They explain that these challenges include the need for rapid establishment, low cost per unit, and being mindful to protect the environment. Many countries like Turkey, Japan, Iran, and China have experienced different disasters such as Earthquakes, Tsunamis and war-related displacement and have needed to offer large numbers of displaced people adequate accommodation.

Displaced people need to be housed in emergency or transitional shelters, or permanent shelters (Shelter Centre, 2012). The difference between these depends on the requirements in terms of both time and cost. The UNHCR would usually provide tents to secure and protect people in the first instance although it can offer prefabricated shelters to meet more complex or challenging living environments. However, regardless of whether the shelter is an emergency such as a canvas tent or temporary such as a caravan made from prefabricated materials, other considerations are then built into the design of the encampment. (Abulnour, 2013), built from local materials, or manufactured materials, whether they utilize local skills or require installation using advanced technologies from different countries.

Emergency shelters are often provided as tents which can last for up to two years if facing changeable weather (Jabr, 1989). After such time, refugees can be moved to semi- permanent or permanent prefab shelters. The former may also be canvas constructions or made of locally supplied materials and built using refugee labour (Corsellis & Vitale, 2005). Some shelters are made from manufactured units; many studies have investigated the problem of providing dwellings to refugees. A variety of strategies have been employed to do this, such as applying pre-disaster programmes or post-disaster programmes, "while the formal industry relies on standardization, repetition, the use of new materials and a single technology, the informal sector takes full advantage of variety, multiplicity, recycling and combination of technologies" (Lizarralde & Root, 2007, p.2068). However, the drawbacks of these informal sectors can lead to conflicts with the local community which is unregulated and without planning strategy, health protection considerations, sanitation, sewage and other factors common to the responsibilities of formal organisations. Formal organisations will typically adopt design management and urban planning strategies when supplying refugee shelters (Lizarralde et al., 2007).

In Japan, a unique example used design technology which is called Sectional Compact Emergency Shelter (SCES). The design of such proposal stranded on mobile power for shelter under great disaster, where "Dr. Okamura et al. developed the Sectional Compact Emergency Shelter (SCES) for victims' usage, which is moveable and can be easily set up in a short time" (Tanaka & Kato & Noriyasu et al., 2006, p.437). The performance of the shelter is enhanced by being movable and can be easily stored where there is supplied electrical power and waste-heated water that can be used for heating floors in winter times.

In Iran, an architect Nader Khalili thought that it was possible to provide shelters made from sandbags filled with nearby material with labour supplied by the local community (Abulnour, 2013). The main drawback of this way of building is the limitation in terms shelters shapes and they can be difficult to dismantle after use.

The response to housing people following major earthquakes and storms has been described in countries including Greece, Italy, and the Philippines. In 1986, Kalamata city, a port in Greece, faced an earthquake that damaged 32% of buildings and the prefabricated units were delayed and were provided after they were no longer needed. The justification for using such units was that after the first use they could be transferred to storage, but the cost of storage and the poor conditions after the first usage made such units inefficient (Johnson, 2007). In the Philippines, there has been experience of building 'core shelters' following the aftermath of typhoons (Diacon, 1992). The Core Shelter technical design refers to a connecting roof with walls to resist strong winds and could be applied with roof trusses to secure the unit. In Turkey, the government offered a strategy and planning program. Japan proposed prefabricated unit industries. The shelters provided after the Turkish earthquake in 1999 which struck north-western Turkey did not meet the refugees' needs as they were built of prefabricated concrete slab units which did not recognize the recovery program in the long term, they also turned out to be overly expensive and not responsive to need, this refers to inadequate shelter offered by government in order to secure and settle people in short period of time. The UNHCR (2014) tried a project in Burkina Faso which tested the design of different types of tents. These included Dome tents, Hexagonal tents and Umbrella tents. The tests considered levels of ventilation, insulation, space, culture, resilience of weather conditions in different climates. The resulting report stated that the test guided the development of a design of the dome tent which leads to certain technical specifications. In addition, the UN, in association with the Swedish furniture company IKEA, presented a project to develop the specifications of shelters as a product based on design technology incorporating light materials, minimum technical requirements and low costs. Table 1 lists some the existing shelter designs that are provided by different programs and organizations for refugees. These have been evaluated by the American Red Cross, the International Organization of Migration, the Oxfam project, UNHCR, UNICEF, the Norwegian Refugee Council and others. This work is derived from the Shelter Project (2009) with other international institutions, which is an institutional collaboration between UN-HABITAT and IFRC (International Federation of Red Cross) in different regions that have had disasters which lead people to move to another location searching for safety, security and stability.

Table 1: Recent Refugee Shelter Accommodation

Region or Country/ Year/ organization	Shelter construction	Implemented method	Project timeline
Afghanistan/ conflict disaster/Qala camp/2009/Pakistan Administered Kashmir	Tent then transitional shelter	Materials Supporting implementation (Prefabricated structure)	4 months, three phases; provided tent, construction start and construction completed
Gaza (Palestine)/Conflict/ 2008/UN	Repairing houses	Urban organization method	13 months; Five phases; early recovery reconstruction plan, project implementation, and assessment start.
Region or Country/ Year/ organization	**Shelter construction**	**Implemented method**	**Project timeline**
Georgia/conflict/2009/NGO	Repairing houses/ Permanent /core housing	Design functioning implementation	7 months; Five phases; draft of shelter strategy, registration community, policy change, start construction and project completion
Rwanda/conflict/2008/ UN with local government	Permanent / core housing	Material implementation/	14 months; Eight phases;
Somalia/conflict& drought/2009/ NGOs	Transitional shelter	Material implementation and Urban upgrade	11 months; Four phases; Planning recruitment, procurement, construction complete, and project complete
Sri-Lanka/conflict/2007/ NEO	Core shelter	Planning implementation	Three years; families return, project start, core shelter complete, and complete the rest of core shelters
Bangladesh/2007/cyclone Sidr/ International organization	Core shelter and repairing	Repairing shelter implementation	22 months; Six phases; assessment, test shelter, technical review, shelter construction, toolkit distribution, and project completed
India/ Earthquake/2001/ NGO with local organizations	Transitional shelter	Design implementation to reduce masonry falling	10 months; Three phases.
Italy earthquake/2009	Shelter construction/ permanent housing	Design implementation(modular housing unit)/long life program	12months, however it is a small program for100 families

Region or Country/ Year/ organization	Shelter construction	Implemented method	Project timeline
Peru/ earthquake/ followed with tsunami/2007/NGO with non-government organization	Self-build Transitional shelter	Design implementation (using existing local structure and long life material), demandable shelter	3 months; three phases assessment, shelter prototype, funds, and project completed
Sri Lanka/2004/ Tsunami/ national government	Construction Transitional shelter to bridge the gap until reach permeant one	Design and construction implementation	9 months; Three phases; prototype shelter, shelter materials, shelter complete
Uganda/flood/ 2007/ International organization	Traditional round shelter	Design and local material implementation	The government started concrete block housing which is expensive comparing with traditional houses/ less attention to individual needs
Bangladesh/conflict/1975/ CUNY center	Shelter and camp planning	Materials and planning implementation	4 years; 6 phases which are: displacement into camp, design shelter, field testing of prototype, consulting, and construction period and evaluation
India/conflict/1971/CUNY center	strategy planning housing and materials supporting	Planning organization method by three phases which are meet basic needs, sustainable upgrading and camp.	9 months; Three phases;

Each of these temporary housing solutions did not have clear methods that guided the suppliers to offer shelters that would meet refugee preferences. Most shelter construction is provided quickly as an emergency response to a disaster and there are no comprehensive methods that lead to the design and planning of shelters as defined by the user. In the following section the paper will investigate the possible methods that can be used to develop these specifications, and will then focus on the preferred methodology, Design Science.

2. The Application of Design Science to Determine Shelter Specifications

Design Science (DS) originated from the field of information systems or IS. It is a group of analytical techniques used to perform research directed at solving a real world problem.

“Design Science research is yet another "lens" or set of synthetic and analytical techniques and perspectives (complementing the Positivist and Interpretive perspectives) for performing research in IS” (Vaishnavi & Kuechler, 2004, para1). DS has originality in the areas of IS and developing and maintaining knowledge that would be supported by establishing a new world design. The approach centres on the development of an ‘artefact’ which can be manifested as a model, idea, system, specification, or other representation that can be presented for consideration by potential users. Johannesson & Perjons (2012) writes that ‘the goal of Design Science as a scientific study is solving a practical problem that people face from a point of general interest and establishing the solution through developing an artefact. To create an artefact the researcher should formulate the problem statement, determine the stakeholders’ goals and evaluate the proposed artefact. While some researchers define DS from a solution oriented point of view, others draw upon natural science or social science as their methods of investigation. Peffers et al. (2007) developed the methodology within DS that contributes to IS research by offering a framework to carry out research and present a mental model.

There are five main steps in the DS process. These include explicating the problem, defining requirements, establishing the solution that is presented in the design artefact, and demonstrating and evaluating the artefact (Johannesson et al., 2012). DS is primarily exploratory research that helps researchers to understand the reality of the problem from two views; the current state and the desired state.

The explication of a problem develops the context for the artefact. For this research the problem is that refugees’ shelters are not meeting human needs and inadequate specification of provided shelters which are not suitable to meet physiological and psychological requirements. Refugee shelters have been built to date and are currently being offered by international organizations and donors but they lead to complaints about the difficulty of conducting daily activities and protection against the climatic conditions (desert climate). “These include publications by UNHCR, Medecins sans Frontieres, Sphere and Shelter project. However, these are limited in size and scope” (Manfield & Ashmore & Corsellis, 2004, p.371). In addition, time and cost are two factors playing a vital role in producing shelters. Thus, organizations and donors’ main concern were to settle a great number of refugees in determined time and cost regardless of standards besides the challenges of climate conditions.

This is why DS is popular in many fields such as engineering, architecture, computer science, program management and others. Simon, (1996 mentioned in Geerts, 2011) summarised this advantage when they describe DS as a way to see ‘how things ought to be’ in order to attain goals, and to function.

3. Justifying the Use of Design Science to Establish the Design Specification

DS seeks to create something new and then to evaluate it. This can be sub-divided into levels (Holmstrom, 2009) as follows:

- To explore new solution alternatives to solve problems.
- To explain this explorative process.
- To improve the problem-solving process.

Explanatory research has a different emphasis that tries to understand a phenomenon which already exists or out there as shown in following table. Table (2) compares exploratory and explanatory research perspectives.

Table (2): Exploratory and explanatory research Exploratory Research (adapted from Holmstrom, 2009)

	Exploratory Research (Design Science)	Explanatory Research (Theoretical Science)
	The phenomenon "artificial phenomena" have to be created by the researcher	"Out there"
Data collecting	Created, collected, and analyzed	
End product	Solving of a problem	Explanatory theory, prediction
Knowledge interest	Pragmatic	Cognitive/theoretical
Disciplinary basis	Engineering, fundamentally multidisciplinary	Natural and social science, primarily unidisciplinary

The significance of DS to the development of a design specification is best summarised by Johannesson et al., (2012) who state that while design is a process for developing something to solve a problem with a single interest, design science objectives are about creating and developing a knowledge with a general interest through its process. Although it may appear that exploratory and explanatory methods are similar as both of them are creating something to solve a practical problem, the solution addresses very different audiences. Design is a process to find a solution appropriate for a certain group of individuals or local practice while DS is a method based on creating a new artefact that will influence the wider issues that will be of more general interest. Simon (1996, cited in Vaishnavi and Kuechler, 2008) stated that natural science is a body of knowledge about objects or phenomena which describes the way of interacting together while science of the artificial is a body of knowledge about man- made objects called artefacts to meet desired goals and interest. In other words, DS is about creating something new not as a design routine.

Therefore DS is an ideal method with which you solve an important problem that can have a widespread impact at a global level. Many countries around the world are suffering from this problem in a variety of ways including economic, political, and even planning organizations. Saunders et al. (2009, cited in Hanid, 2014) state that the DS perspective contributes to academic management research for developing and establishing valid knowledge that supports problem solving as general interest in the field, and design research should solve the problem in an effective way by explicating the problem, defining the current state, and defining the desirable state.

In this regards, the difference between design and design science is mainly to address three obligations that presents the aim of providing new knowledge for general interest requires in DS project to establish using exact research methods. The knowledge must relate to existing one to emphasise that the proposed result is original, and the new outcome must be evaluated by researchers and experts.

4. Applying Design Science to the provision of a specification for better housing for refugees

A specification is a guide to satisfy an expressed need. It is "guidance on the content, layout, preparation and management of all types of specification. Specifications are routinely used throughout the manufacturing, construction, process and service industries" (British Standard, 2001, p.1).

The artefact in such research is a specification based on certain criteria that will be articulated from a combination of evidence from the literature, and evidence collected from refugees and disaster management professionals. The specifications are the details that can execute and deliver the criteria for the construction of refugees' shelters as determined by users' needs and professional opinion. These views will in turn be influenced by design functions, and the surrounding environment. In addition, the specification will be cognizant with human needs including health requirements and services by appropriate spaces, ventilation, and sanitation for daily activities.

Specifications therefore refer to the elements or requirements that help in building a better shelter. This will allow designers creating effective structures to meet refugee expectations where sharing understanding will be established between the design environment and designers, so the suggested specifications will meet the following requirements:

1. Functional efficiency.
2. Performance of shelter elements.

Creating a specification artefact for refugee shelters is a key step that will lead to the subsequent steps of demonstrating and evaluating what will take place in the field.

4.1. Phase One: Explicate the Problem

Explicating a problem is about investigating a practical problem; i.e.an undesirable situation which is presented by people practices (Johannesson et al., 2012). The practical problem for this research can be expressed as function absence of methodology approach that valid to provide adequate shelter for refugees'.

In such research, the causes that contribute to the problem will be presented as positive solutions by developing specifications, which is the artefact. Specifications will be formulated by certain criteria that investigate refugees' needs. The criteria includes comfort, security and safety, sense of the place, flexibility, modularity, stability, control, durability, and available on demand. Furthermore, the lack of integration between the manufactured design of shelters, environmental aspects and cultural practices of refugees leads to the root causes of the problem.

This phase will be informed by a literature review which leads to a deep understanding of the problem and suggestion solutions. De Rocha (2011) states a literature review contributes to gaining a deep understanding of the problem by formulating the theoretical background. To understand the practical problem, field work research will support understanding of the current state and investigating the desired state in order to start developing an artefact.

4.2. Phase Two: Requirement definitions and outline of the artefact

It is specific to the function and construction of an artefact that the solution is connected with the environment. Johannesson et al., (2012) states the requirements will help to address the function and construction of the artefact and also the relation with the environment. In this case, the requirement is to specify details to build a suitable shelter in certain climate which meets desert conditions in this research enable refugees to adapt to camp life and carry out daily activities. The specifications will detail performance and efficiency of the structure to protect and facilitate the occupants during their stay.

The activity here is based on the explicated problem. It should use the descriptive knowledge that clarifies the requirements of the artefact which are important for stakeholders.

In order to define the requirements of an outline artefact, it is necessary to include the characteristics of the problem, the framework of the solution, details of the way previous researchers have addressed the same problem, the technological opportunities, and the stakeholder's needs that will lead to the establishment of the criteria. Furthermore, variables such as different dwelling configurations, topographical variations, cultural variations and the microclimate will mean that one basic design may not suffice for every camp; this guides the designer to the direction of multiple solutions. The following field strategy has been adopted to facilitate the creation of the outline artefact:

1. Survey; This will identify the whole requirements and needs of stakeholders through face-to-face interviews. The research will conduct semi structured interview with refugees to understand a practical problem in the first and second phases. In depth interviews will take place with manufacturing experts such as prefabricated companies, academics, and involved organizations. The purpose of this phase of design science is to develop specifications for refugees' shelter. In this stage, sampling will be selected depending on deep knowledge of improving shelter specifications and experience on refugees' studies.
2. Observation; The researcher will observe refugee camps situated in desert conditions. Jordan is an ideal location for this work as it is a country that matches the climatic criteria and has a long history of accommodating refugees. The researcher will observe the way that existing refugee agencies deal with accommodation issues which are raised by those dwelling in existing camps.

Methods used to collect data will include interviews, questionnaires, and focus groups of refugees who will be asked to meet regularly to identify an extensive list of functional and social requirements. In addition, organizations such as the UNHCR, UN, and UNCIEF will be asked to explain the current accommodation strategy and the potential for improvements in the future.

4.3. **Phase Three: Develop the Artefact**

The specifications for suitable shelters for refugees will be based on the observations and survey data collected at the outline stage.

The research will formulate certain criteria that will establish specifications by describing the refugees' shelters quality requirements through the design elements, orientation of the shelters in the camp context and social/cultural features. The specifications will grasp the criteria of the existing refugee shelter process by considering what users need or want from their shelter and in what context, such as human activities and living conditions. Additionally, specifications will be discussed in relation to performance and describing requirements under each criteria, divided into: control, safety, comfort, stability, being available on demand, modularity and flexibility, duration, and sense of place. Thus, each criteria will address a number of specifications that are criteria led, which include; describing criteria related to weather impacts such as temperature, humidity, sun radiation, conditions inside the shelter, mechanical utilities such as insulation of heat and water isolation, sanitation, design elements of the shelter such as measurements of openings (windows and doors), construction regulations of materials, supply energy, health security such as air pollution, sense of place such as space organization inside and outside the shelters within its context. All the previous research considerations will be investigated comprehensively and set as specifications in order to establish a shelter that meets refugees' needs.

4.4. Phase Four: Demonstrate the Artefact

To demonstrate an artefact, it is necessary to validate the artefact design in the work field. This will be achieved by returning to the stakeholders that were canvassed in the outline phase. This will serve to validate the artefact, or to point out deficiencies leading to amendments and a further iteration of the process.

5. Conclusion

There is a need to construct better shelters for refugees in desert climate conditions. A lack of guidance or a comprehensive strategy to provide better shelters for refugees that focuses on their needs is also not in evidence. In addition, there is a need for new methods to investigate a solution to this problem based on user needs and local conditions. This method should be problem oriented. The advantage of Design Science would seem to fulfil this requirement as it is a comprehensive way to solve a real world problem of accommodating refugees.

In short, the paper will provide specifications that offer an organized flexible structure; shelter would be easily built and dismantled to meet refugees' needs in desert climate. The research will investigate the validity of design science as methodology approach comparing to other methods to develop an adequate refugees' shelter that used empirical research instead.

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Has the UK Government Construction Strategy delivered?

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Abstract:

Given the constant publication of industry-level reports advocating change and improvement, it would be reasonable to assume that the construction industry is failing to meet the demands of its clients. The Government Construction Strategy was published in 2011 and alluded to a different approach by setting out a strategic implementation plan, rather than just an exposition of the industry's woes. This paper assesses whether the strategy has achieved its strategic aims and reflects on the wider implications of influencing change at an industry level. Consideration is made of the forces restraining change in construction, including historical influences on the structure of the industry and how competition takes place in construction. It raises questions about who should lead change within the industry and at what point does change become common practice. The opportunity for further research contemplates the key initiatives of the Government Construction Strategy, such as building information modelling, as well as the potentially significant issue of social value and whether change will occur. Therefore, should further research identify a tipping point for when best practice becomes standard practice?

Keywords:

Cost Reduction, Government Construction Strategy, Intelligent Client, Leadership, Procurement Reform

1. Introduction

The performance of the construction industry has regularly been highlighted to be in need of improvement in a succession of government-sponsored reports dating back to the end of the Second World War (Murray and Langford, 2003). The *Government Construction Strategy* was published in May 2011 with the aim of reducing construction costs by up to 20% by the end of this parliament (Cabinet Office, 2011). The strategy acknowledges that full value is not received from public sector construction and endeavoured to change this with a different approach from the previous government-sponsored reports. This raises the questions as to why change has not previously happened and whether this strategy would be any different.

This paper was written as an assignment forming part of the Professional Doctorate at the University of Salford. The structure of the paper takes its lead from Mann and Clarke (2008) where the approach to writing a research paper involves three stages; firstly considering what a paper is about; secondly, further questioning what is it really about, before finally challenging what is it really, really about? It is at this point that some focus can be drawn on the possible focus for a doctoral study. More specifically, with the end of the parliament in May 2015, this paper will assess whether the *Government Construction Strategy* has achieved its primary aim. Further, it will consider the factors influencing change, for example the forces constraining change within the industry, whether change occurs at an industry-level, who should lead change and what role, if any, the state should play. Reflecting on how an idea becomes an initiative that evolves into common practice within an industry, the paper concludes with an explanation of the focus for further doctoral study.

2. What is this about? The Government Construction Strategy

There has been a litany of government-sponsored reports on the construction industry, so many in fact that a whole book was written on the subject, *Construction Reports 1944-1998* by Murray and Langford (2003). In 2008, construction reform was again the subject of a government committee investigation resulting in the publication of the report *Construction Matters* (BERR, 2008). The comprehensive report engaged many stakeholders within industry and included numerous recommendations, principal amongst which was the creation of a Chief Construction Officer. It was deemed inappropriate to create the post of Minister for Construction due to the inherent instability of such posts, whereas this role was perceived to require an individual to serve a term in office and ensure consistency across governmental departments.

Figure 1: Thirteen Themes of the Government Construction Strategy (Source University of Westminster unpublished works)

Paul Morrell was appointed the UK Government's first Chief Construction Advisor in November 2009 with the remit to improve the value of public sector construction and reduce carbon in its creation. For the latter objective, Morrell chaired the Innovation and Growth Team and presided over the publication of the *Low Carbon Construction* report (Innovation and Growth Team, 2010) with its plethora of sixty-five recommendations. Significant amongst these recommendations was the need to reform procurement. It also highlighted that the UK Government was lacking a coherent strategy on construction and hence, in May 2011, the *Government Construction Strategy* (Cabinet Office 2011) was published. Considerably shorter in length than *Low Carbon Construction*, the strategy concisely set out the aim of reducing construction costs and carbon in the current parliament through thirteen identified themes (**Figure 1**). A detailed implementation plan included specific actions, timescales and measures, and was to be overseen by the Government Construction Board. In this approach, the strategy could be seen as radically different to the previous construction reports; whilst those reports were not short on advice and recommendations they did not contain such specific action planning.

The *Government Construction Strategy: One Year On Report and Action Plan Update* (Cabinet Office 2012a) was published in May 2012 reporting on the progress of the implementation of the strategy. In achieving the principal objectives of cost reduction, the report indicates savings of £72m on capital costs and £279 on whole life costs for new contracts awarded in the previous 12 months. The report states the key priorities for achieving cost reduction are focused around Building Information Modelling, a transparent pipeline of work, procurement reform and developing the government as an "intelligent client". Moreover, it was evident significant work was being undertaken with six separate task groups established with the specific requirements to support the delivery of the *Government Construction Strategy* (Cabinet Office, 2012b). A summary of the outputs and current status of the task groups formed as part of the *Government Construction Strategy* is given in Table 3.

Table 3 Status of Government Construction Strategy Implementation Task Groups

	Task Group Name	Outputs	Current Status
1	**Procurement Lean Client**	Procurement and Lean Client Report (Cabinet Office 2012c) Trial Project Case Studies (Cabinet Office 2014b) Procurement Guidance (Cabinet Office 2014c)	Merged with IUK Trial Projects still on-going
2	**Lean Standards**	Lean Standards Report "Delivering Value, Fair Payment and Health, Safety and Occupational Health"	Disbanded
3	**Soft Landings**	Numerous outputs available via on BIM Task Group (http://www.bimtaskgroup.org/gsl/)	Merged into Task Group 5
4	**Data and benchmarking**	On-going reports (Cabinet Office 2014a)	Reports uploaded to Gov.uk
5	**Building Information Modelling (BIM)**	Significant outputs on standards and guidance. (http://www.bimtaskgroup.org/resources/) Also facilitator to numerous spin-off groups/hubs focused on different sectors in relation to BIM	On-going
6	**Performance Management**	Delivering Excellence in Construction (Cabinet Office 2012d)	Presumed disbanded

Further formal progress of the *Government Construction Strategy* does not appear to be publically available apart from updates on cost reductions (Cabinet Office, 2014a). "The overall cost reductions declared by departments for 2012/13 and 2013/14 were:

- In-Year 2012/13: £447m on an expenditure of £2.4bn (15.6%)
- In-Year 2013/14: £840m on an expenditure of £3.5bn (19.6%) " (Cabinet Office 2014a)

Whilst each task group has produced outputs and activity is still on-going, it is unclear how further progress of the Construction Strategy is being coordinated and reported. As previously mentioned, the author was Academic Partner on the trial project of the Supply Chain Management Group (SCMG). A case study of this project was published (Cabinet Office, 2014b). Despite the empirical evidence indicating that the objectives of the *Government*

Construction Strategy, namely cost and carbon reduction, were achieved by the SCMG, (in addition to many other benefits), wider adoption of the approach has proved significantly more challenging. It is this issue of adopting perceived better practice that will be explored in more detail in the next section.

Paul Morrell was appointed as Chief Construction Adviser, initially for a two-year term in office; however this was extended for a further 12 months ending in November 2012. Peter Hansford, who had overseen the publication of the *Infrastructure Cost Review*, was appointed and started as Morrell's successor in December 2012. Hansford's initial responsibility focused on the production of another report, *Construction 2025* (BIS, 2013), one of a collection of industrial strategies[1] setting out how government and industry should work in partnership for the benefit of the country. Whereas the *Government Construction Strategy* was focused on the public sector, Construction 2025 had an industry-wide remit. Furthermore, whilst *Construction 2025* contains targets and strategic intent, unlike the *Government Construction Strategy* there is no definite implementation plan. The Construction Leadership Council[2] was established to oversee the implementation of *Construction 2025*. As Wilkinson (2014) indicates "it is not entirely clear what the relationship is between the *Government Construction Strategy* and *Construction 2025*, or between the Government Construction Board and the Construction Leadership Council". Further investigation has revealed that the Government Construction Board is still active and is separate from the Construction Leadership Council (Dammers, 2015). A principal reason for creating the post of Chief Construction Adviser was to provide leadership and coordination in matters affecting the construction industry (BERR, 2008). It was perceived that the Chief Construction Adviser would be a better solution than a ministerial post, yet the lack of clarity over the relationship between the Government Construction Board and the Construction Leadership council could raise concerns over the leadership and coordination of construction.

Moreover, in 2013, Ed Vaizey, Minister for Culture, Communications and Creative Industries, called for a review of architecture and the built environment. *The Farrell Review* (Farrell, 2013) was subsequently published in 2014. It contained a recommendation that a Chief Architect position be created, similar to the Chief Construction Adviser as well as a leadership body similar to the Construction Leadership Council. Whilst consultation took place with both the current and former Chief Construction Advisers, the concern is that another review of built environment leadership was deemed necessary and again calls into question the coordination across government departments by the Chief Construction Adviser. Further investigation is necessary to identify the motivation for *The Farrell Review*; however an initial proposition would be that the architecture profession was not effectively consulted in the production of the *Government Construction Strategy*. Indeed a review of the *Government Construction Strategy* indicates that whilst reference is made to design and designers, there is no specific reference to architects. A key challenge for reform within the built environment has been the fragmented nature of both the professional and supply chain constituents. It would indicate further challenges with coordination and leadership.

As the end of the current Parliament draws near, it is difficult to find a concise assessment of the current status of the *Government Construction Strategy* and determine whether its key objectives have been achieved. It would appear the incumbent Chief Construction Advisor has focused on *Construction 2025* rather than the implementation of his predecessor's strategy. Whilst, it is evident that the strategy has engaged a great number of people within the industry, a significant number of outputs have been produced and further work continues with the BIM

[1] https://www.gov.uk/government/policies/using-industrial-strategy-to-help-the-uk-economy-and-business-compete-and-grow
[2] https://www.gov.uk/government/groups/construction-leadership-council

Task Group and Infrastructure UK (2012, 2014), the question is whether the laudable aspirations of the strategy will achieve the desired long-term sustainable cost and carbon reduction?

This section has considered progress of the *Government Construction Strategy* since its publication in 2011. Whilst there is limited evidence to support a conclusive response to the achievement of the strategy's principal aims, there has nonetheless been a substantial volume of work produced in the form of guidance and case studies. Moreover, work continues in a number of areas. However, concerns could be inferred with the ongoing coordination and leadership of construction matters within government. Was the creation of a Chief Construction Adviser more appropriate than a Minister for the Built Environment? Furthermore do government-sponsored reports influence the desired changes, and if not, why not? Similarly, the same questions could be asked of the volumes of best practice guidance that are generated. Which further queries whether construction is different to other industries; is construction industry resistant to change; or does it change, but just not in the way envisaged?

3. What is this really about; industry change?

The complexities of influencing change within construction were the extrapolated as part of the CIB Priority Theme Revaluing Construction (Barrett, 2005) and demonstrated in Figure 2. Whilst it is acknowledged that the figure is not particularly legible, the figure does convey the challenge of understanding the twenty-two different restraining forces to construction reform. Significantly the study engaged with five countries and concluded the issues faced by the UK construction industry and also experienced in other countries.

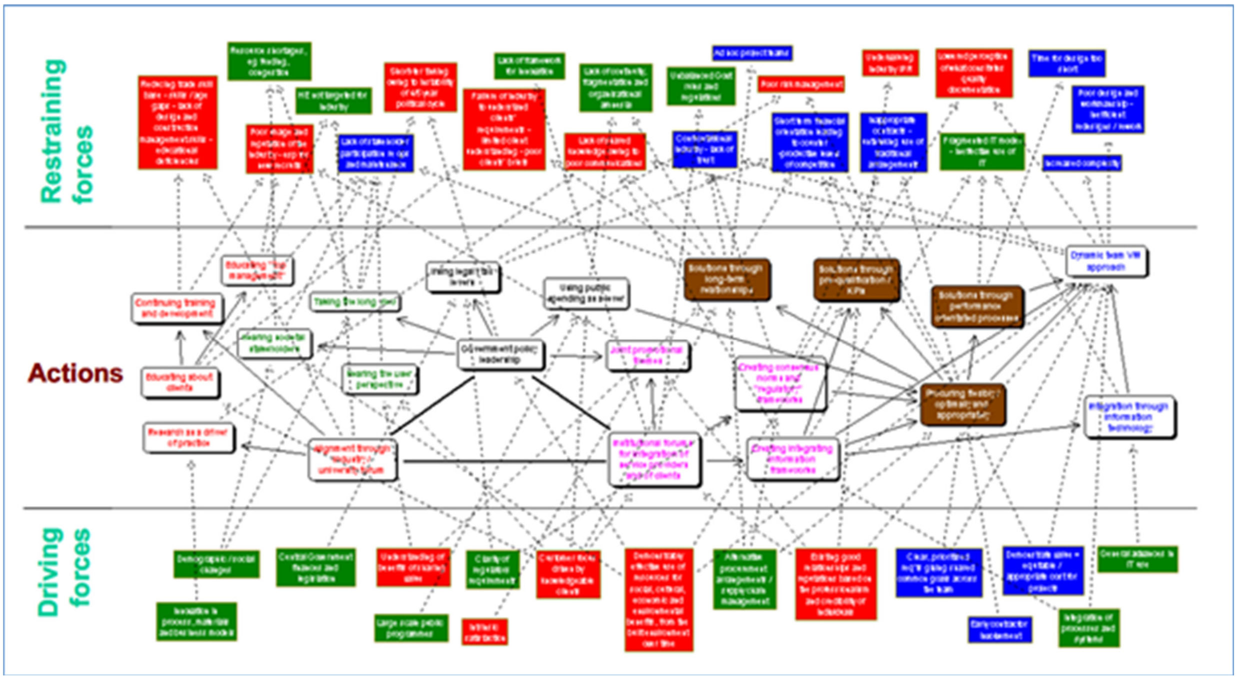

Figure 2: Complexities of Revaluing Construction (Barrett, 2005)

The principal output from Revaluing Construction is delineated in the infinity model (Figure 4) as seven interconnected areas for change and the basis for a global agenda for change. The key point is the recognition of how the industry needs to look in on itself and understand how to improve performance, but also take an outward looking perspective on how it is perceived within society.

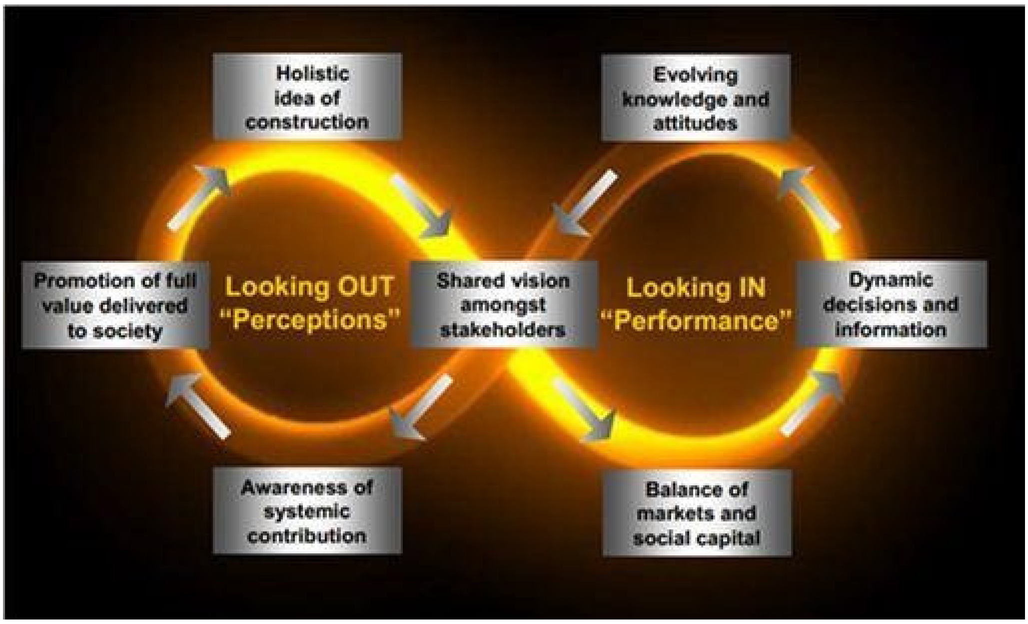

Figure 3: Infinity Model (Barrett, 2005)

An analysis of construction improvement is provided by Green (2011a). In *Making Sense of Construction Improvement*, Green endeavours to explain why construction might not have improved as much as desired citing, inter alia, the change in working practices with greater emphasis on sub-contracting and self-employment allied to changing procurement methods as contributory factors. Moreover on the demand side, the impact of the changing nature of government, with increased privatisation and outsourcing strategies, has resulted in a lack of planned stability for construction workload (Green, 2011b). Green's rationale for the lack of improvement in construction is reinforced by the business model used by most construction companies Smyth (2005). Competition is fought at two levels, firstly on production costs and secondly on management costs, with work generally won by submitting the lowest tender. Such an approach has led contractors to look to minimise risk by pushing it down the supply chain, promoting the use of sub-contracting as the dominant approach to managing production. Moreover, the minimisation of overheads becomes a disincentive to engage in value-adding activities such as research and development.

Green describes the principle of codified best practice, initiatives such as lean thinking and supply chain management, and implies these initiatives are promulgated by consultants as 'sensemaking narratives' that bolster their own self-identity (Green, 2011b). Moreover, the implication is drawn by Green that those opposed to the perceived best practice are ignorant and hence resistant to change. It raises the question as to whether the initiatives implicit within the *Government Construction Strategy*, such as building information modelling (BIM), will suffer the same fate. As a quick aside, whilst in the role as academic partner on the aforementioned SCMG trial project which had its focus on trialing a new procurement method, the author asked the trial project committee whether BIM was being implemented. The response was unanimous in rejection of such an idea, providing a perfect illustration of how a group intent on exploring change in one area can also be so resistant to change in another.

Significantly, Green concludes with reference to *Never Waste a Good Crisis* (Wolstenholme, 2009), a review of the *Rethinking Construction* ten years on. *Rethinking Construction* is one the seminal government reports that influenced the construction reform agenda. Green indicates there is reluctance within *Never Waste a Good Crisis* to "direct any criticism at *Rethinking Construction",* however the conclusions were that nothing had changed (Chevin, 2009). The construction industry was still predominantly as it was in the 1990s and many of the same problems persist. *Never Waste a Good Crisis* provided its own analysis of the blockers to progress before proposing its own themes for future action and quick wins. It is not immediately apparent what progress, if any, has been achieved as a result of *Never Waste a Good Crisis*.

Reviewing *Rethinking Construction* (1998), *Accelerating Change* (2003) and *Never waste a Good Crisis* (2008), the question is whether there is an inherent presumption that there is a solution that fits all construction. Cox et al (2006) contend that the diverse nature of construction requires a level of adaptability which a prescribed and formulaic solution does not afford. They surmise that there is a need to segment the industry's demand characteristics to determine where the solution will and will not work. Furthermore, the relative power of the buyer and supplier determines the operational and commercial outcome as well as a party's ability to influence change. Cox et al propose clients employ a strategic procurement approach to ascertain their power position relative to the supply chain and devise their own appropriate procurement solution. An initial assessment of more recent guidance on procurement would indicate that further options are recognized and that the one solution fits all approach is inaccurate (Mead & Gruneberg, 2013, Infrastructure UK, 2012, 2014). Moreover, the strategic direction proposed for Constructing Excellence (Rowden, 2013) (**Error! Reference source not found.**) would appear to incorporate the principles advocated by Cox at al. .

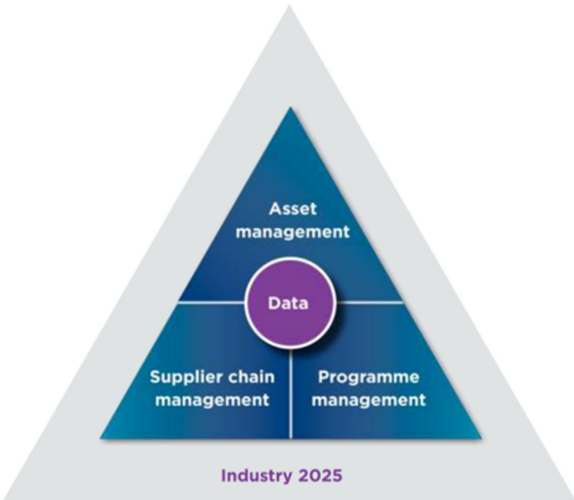

Figure 4: Rowden's Vision for Constructing Excellence

A central tenet for industry reformers appears to be predicated on the principles of partnering, or, as it is now more commonly referred to collaborative working. Here again, Cox (1999) contradicts the premise that collaborative working is (always) the appropriate solution. Cox implies that a "business is about appropriating value for oneself; it is not about passing value to customers unless circumstances decree that this is the only option available". In other words, why collaborate when there is no need. Therefore it would seem relevant to understand whether the supply side of the industry is resistant to change towards a more collaborative approach to working because there is no business imperative and profit is generated from the current mechanisms for procurement and its associated inefficiencies. Hence, is it more incumbent on the client, generally in a more a dominant power position, to be the lead influencers of change?

With the emphasis of the *Government Construction Strategy* focused on the public sector, another area to consider is the role of the state as an instigator for change. Mazzucota (2011) argues that the "entrepreneurial state" can play an influential role in innovation citing examples of how the technology involved in the iPhone is due in a large part to the state. Mazzucota contests that state is often seen as risk averse, yet it has the power to influence positive change. This is evident from evolution of the SCMG, which was the result of the National Change Agent programme (Sibilev, 2005), initiated by the Office of the Deputy Prime Minister in response to the Gershon Efficiency Review. Further investigation may be considered pertinent to assess whether the solution of the SCMG is in part due to the changing nature of government referred to by Green.

Another perspective to consider is the process of managing change. Since there has been such a large volume of work focused on understanding the problems of the construction industry, why has the industry not changed? Is that change does not occur at an industry level, but at an organisational level and initially probably at an individual level. This opens the discourse to investigate areas such as how does new ideas emerge to become a new way of working and subsequently the common way. Is there a process for managing change, and if so, has been applied within construction?

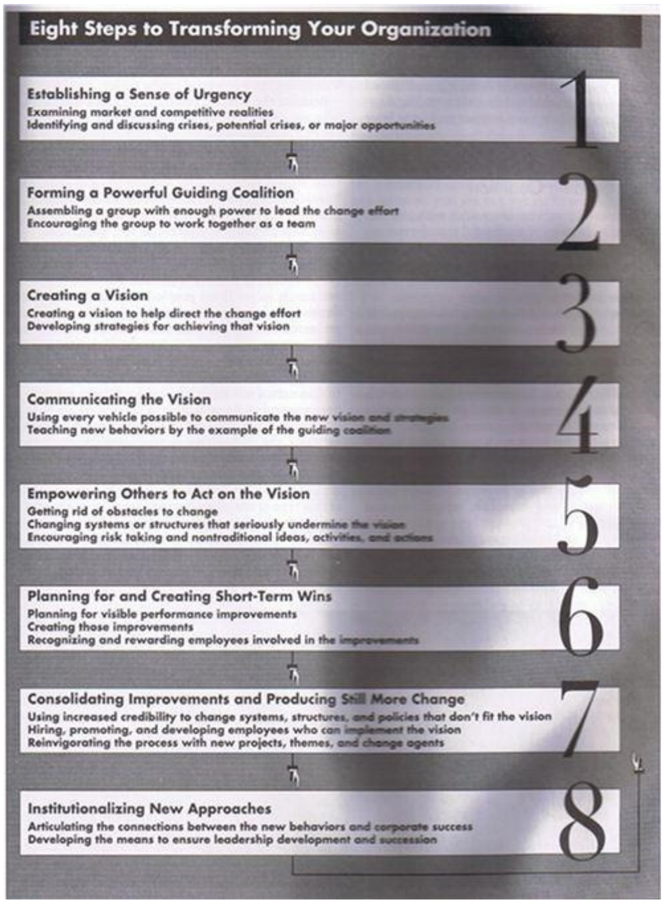

Figure 1: 8-step process to change (Kotter 1995)

Dr John Kotter is a leading exponent of research into transformational change and published a seminal article setting out an 8-step process to managing change, **Error! Reference source not found.** (Kotter, 1995). Whilst there is a large body of research into managing change, further study would need to be carried out to assess whether any have been applied to construction. However, Kotter's model has been used by the author, who contends that there are aspects of this model to be seen within the implementation of the *Government Construction Strategy*. These are essentially steps 1 through to 6, with the trial projects demonstrating step 6: "Creating short term wins and visible performance improvements". Regardless as to whether the strategy achieves its strategic aims by end of the current parliament, the issue could be to explore whether the strategy's implementation plan has a lasting effect and Step 7, "Consolidating improvements and producing still more change" and Step 8 "Institutionalising New Approaches" can be realised. However, Kotter places significant emphasis on the role of leadership in not only setting the vision and direction, but also in ensuring change is established as the new way of operating. Given the concerns highlighted in the previous section with regards to the leadership of the *Government Construction Strategy*, doubt could be raised over its lasting legacy.

This section has highlighted that construction is understood to be complex, involving the interaction of many interconnected forces and hence influencing change is not straightforward. If the plethora of government-sponsored reports present persuasive arguments for change, why are new reports still being written? It questions whether the proposed changes have had any lasting effect. The presumption of these reports is that there is a one-size fits-all solution, although given the diverse nature of construction this is argued to be unrealistic. Instead, the basis for devising an appropriate solution is to recognise the different demand characteristics of the industry and ascertain the relative power position of buyers and suppliers. Change is unlikely to occur on the supply side if there is no business imperative to do so and hence is it the demand side, clients with the more dominant power position, who should lead change?

In terms of the process of managing change, the argument is to consider how change is instigated to achieve a lasting effect. It is presented that Kotter's 8-step process to change could be a useful model to follow. Indeed, it is possible that the implementation of the *Government Construction Strategy* could be following the first six steps of Kotter's model. However, doubts were raised over the ongoing leadersip of the strategy's implementation as well as questioning whether it is endeavouring to influence change at an industry level, not an organisational level, where change is perceived to more likely happen. Notwithstanding this, government can be an instigator for change as demonstrated by the National Change Agent initiative that was the foreurnner for the Trial Project for the SCMG.

Whilst a further review of work by amongst others Barrett and Green may allude to greater understanding of what change is required, it would also seem apparent that there is no shortage of initiatives promoting a better way of working. Indeed, the *Government Construction Strategy* has four principal threads of change, namely, procurement reform, introduction of building information modelling, soft landings and the intelligent client. Hence, it could be argued the solutions are already known, it is more about understanding how to implement the change. Therefore are the issues: a) to explore why change is not embraced; b) assess whether the same mistakes repeated time and again, and if so, why are lessons not learnt? Can construction demonstrate any principles of learning organisations (Senge et al 1994) c) when does good practice become adopted by industry? Is it more an organisational issue, rather than an industry one and hence about leadership, culture and possibly behavioural economics?

4. What is this really, really about; how to influence change to become common practice?

Rethinking Construction (Egan, 1998) was heavily influenced by changes that had taken place in the automotive industry[3]. The report promoted amongst other things the ideas of partnering with the supply chain and the principles of lean and what, as previously mentioned Green (2010) refers to as codified best practice. The question is whether there are lessons from how

[3] not entirely surprising given the chair of the task force, Sir John Egan, had previously worked as chief executive of Jaguar Cars

the automotive industry adopted change? Initial investigation highlights that whilst there are differences between automotive and construction industries (Gann, 1996, Crowley, 1998), it is possible that the most significant instigator of change in the automotive industry was a research project investigating the future of that industry. The research was undertaken by Massachusetts Institute of Technology, funded by the industry and published in the book The Machine that Changed the World (Womack et al, 1990). Whilst lean production theory appears to be the principal initiative that resulted from this work, the research project involved a study of comparative performance between all the automotive companies and their individual production facilities. It looks as if this transparency over performance enabled the automotive companies to appreciate their differences and to seek an alternative approach. Hence, is the catalyst for change an organisation's increased awareness of its comparative performance, and if so, how is performance compared in construction either by clients or contractors? Given this, it would seem understandable that a key aspect of *Rethinking Construction* was to establish a movement for change that incorporated effective performance measurement.

Rethinking Construction initiated the creation of the Construction Best Practice Programme (CBPP) and the Movement for Innovation (M4I). Initially funded by government and the forerunners for Constructing Excellence, both initiatives sought to collate and share industry best practice. To date more than 600 demonstration projects have been recruited to share their innovations and learning. Therefore there is a significant source of available information on projects for others to learn from and compare their own performance. The question is how has the industry learnt from this body of knowledge? Constructing Excellence and more recently Glenigan have collated key performance information on the industry from data supplied by those companies willing to share information. Whilst there are tools available for comparative performance, but a major downside is that performance data is not collated for all projects and actors within the industry. Moreover, there is a potential inherent bias in any comparison, as only those companies that are willing to share and, presumably, performing well provide data. What does appear evident is that performance management is required. Indeed, there was a task group on the subject as part of the *Government Construction Strategy* implementation. However, the brevity of the resulting report *Delivering Excellence in Construction* provides limited understanding as to questions such as: What data is required to be collate data? Should data be collated for all projects and at what level, project or organisation?

Another argument is that change will occur due to some disruption in current business operations. Often it is a disruptive technological solution of which there are many examples, most notably the internet. Does construction have a disruptive technology on the horizon? Is it building information modelling? Even disruptive technologies would appear to comply with the law of diffusion of innovation (Sinek 2009). This law states that to for idea or innovation to achieve mass-market acceptance requires between fifteen to eighteen per cent of the market to tip the system in favour of the idea or innovation. Whilst this may be predicated on mass-market products and goods, Sinek does cite the influence of other examples such as the civil rights movement. The premise is that a population is broadly categorised into innovators, early adopters, early majority, late majority and laggards – those who never change. Does this present a model for researching the construction population? As previously mentioned, given that the *Government Construction Strategy* is focused on the public sector, can it be categorised in this way? Moreover, it raises questions with the author to consider how ideas and innovation are currently diffused within construction and whether sufficient understanding is made about influencing the early majority. The implication is that innovators and the early adopters already understand and don't need influencing, but if the early majority are not identified and not engaged in the debate, they will not be persuaded.

5. Conclusion

This paper started with a focus on the *Government Construction Strategy*, the latest in a long line of government-sponsored papers advocating change to construction. The premise was made that the approach adopted by the *Government Construction Strategy* was different to previous reports by concisely articulating the problem and proposing an implementation plan to address the key issues. This approach was later identified to be in line with the Kotter model for change. A summary of the progress of the strategy was provided and highlighted the significant volume of work undertaken and the documentation produced. The question was posed as to whether the laudable aspirations of the strategy will achieve its desired aim for long-term sustainable cost and carbon reduction. Moreover, will the industry change?

This question was debated in the next section. Evidence was presented that depicted the industry as a complex web of interconnected forces restraining change to occur. Moreover, the industry's resistance to change was highlighted to be due to structural forces within the supply chain as well as the dominant business model promulgating sub-contracting as well as a disincentive to invest in development. An alternative perspective was presented in the form of strategic procurement; here the argument is that the supply side are unlikely to change if there is no business imperative and implies it is incumbent on the demand side with a more dominant power position to be the lead influencers of change. The role of the state was also raised with the principle of an entrepreneurial state as positive instigator for change and citing the example of one of the Government's trial projects as evidence. The section concluded with reference to the aforementioned Kotter model for change and highlighting that the *Government Construction Strategy* could be seen as following the first six steps; however it is the final two steps that relate to achieving sustainable change and doubts were raised over whether this was achievable particularly given the concerns over the ongoing leadership of the strategy. What is more, given that solutions appear to be known, why has change not been embraced and, even it does, at what point does it become common practice?

The third section considered how to influence change to become common practice. The catalyst for significant change in the automotive industry was indicated to be transparency over the comparative performance of all companies and their individual production facilities. Hence the debate considered whether such approaches should be more rigorously deployed within construction. Another principle presented was the law of diffusion of innovation, questioning the approach by construction to influence the early majority in order to achieve mass-market acceptance of the any change.

Hence, the focus for further doctoral research would appear to be the need to concentrate on understanding change within construction. Does change even need to happen? Given the overwhelming number of reports imploring change, one can only presume the answer is yes. Is the change promoted appropriate? Who should influence change, the demand or supply side?

With respect to the first question, is change needed, the *Government Construction Strategy* does present a different proposition by urging for the industry to achieve cost and carbon reduction. In this respect, the argument is not so much the industry has to change, but how does it achieve this aim; however the answer still predicates the need for change. The strategy does provide strategic direction, with the implication that if the client, i.e. the public sector, is clear on what needs to be delivered, the supply chain will develop the appropriate solutions. Moreover, it highlights the importance of the intelligent client principles referred to by the Procurement and Lean Client Task Group and questions whether further study would be beneficial to assess the maturity of the public sectors clients. However, does the principle of the supply chain developing appropriate solutions contradict the argument presented by Cox? Cox argues that suppliers will not change unless there is a business imperative; in which case how does the demand side create that business imperative? Is it the demand side that has the dominant power position to be the instigators of change? Further investigation is necessary of Mazzucota's principle of the entrepreneurial state to assess whether public sector clients could adopt this approach. All three points, creating the business imperative, instigating change and being less risk averse are incorporated within the intelligent client maturity profile and all demand strong leadership.

The strategy's implementation task groups have produced a considerable number of outputs, including inter alia the aforementioned intelligent client profile, standards developed for BIM as well as the case studies of the procurement reform trial projects. Hence is the issue to explore how these ideas are being diffused into the industry?

There is an issue to explore with regards to the continued leadership of the *Government Construction Strategy,* given the prominence the incumbent Chief Construction Adviser has placed on the Industrial Strategy for Construction: *Construction 2025*. Whilst the *Government Construction Strategy* can be seen to align with Kotter's model for change, the achievement of its strategic aims and its lasting legacy is dependent on completion of all steps. Failure to do so, will mean change has once again not happened and the industry will not have learnt the lessons of the past.

To that end, it is considered prudent that further study should focus on whether the *Government Construction Strategy* can have a lasting legacy. Focusing on local government, the intention is to assess local government's awareness of the *Government Construction Strategy* and its adoption of the strategy's four principal streams; procurement reform, the intelligent client, building information modelling and soft landings. Moreover, to assess the diffusion and take-up of the guidance and best practice, with the aim to identify the tipping point in local government for when best practice becomes common practice.

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ID 096

Evaluating Perspectives of Olympic Legacy in Modern European Olympic Architecture (1948-2012)

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Abstract:

The Olympic Games are the World's largest International Mega Sporting Event, and its principal philosophy is to promote human health and wellbeing through sport, culture, art and education. Sebastian Coe told the Olympic conference in 2005, that legacy is epicentral to the Olympic Games, stating "legacy is probably nine-tenths of what the process is about: not just 16 days of Olympic sport". However, the legacy of the Games has become a complex construct with external influences that are difficult to control and standardise amongst different nations and cultures. There are several existing examples of negative legacy outcomes from Olympic host Cities in the 20th and 21st Centuries. For example, much of the construction for the Athens 2004 Summer Olympics now lies abandoned despite being structurally sound; whilst all bar one of the Rome 1960 Summer Olympic Venues remain in use to date. With the rising economical and societal costs of hosting the Olympics, it is with increasing importance that legacy outcomes need to be improved. Public opinion regarding the current status of the Olympic buildings in Athens is testament to this. The post-event dereliction of the Olympic Stadia has divided public opinion over whether Athens should have staged the Games in the first place; and placed the management of the project and it's planning and execution under scrutiny. The aim of this paper is to evaluate perspectives of legacy in the context of the Summer Olympic Games. It will make a contribution to a broader PhD thesis examining the architectural and structural legacies of the Modern European Architecture of the Summer Olympics post-World War II. This supports the existing base of knowledge, first by focusing on the field of Architectural Design, which is currently underreported and, second, recording the current legacy situation, which is progressive and changing over time. The scope of the thesis encompasses all Summer European Olympic Cities from London 1948 to London 2012, thus providing a broad spectrum of Olympiads to examine and scrutinise, from which a greater understanding of what makes an Olympic City successful or unsuccessful in terms of 'Architectural Legacy' can be formulated. The focus on Europe allows for fairer social and economical comparisons to be made, and the exclusive assessment of the Sumer Olympiads allows for the fairer geographical and environmental appraisal. The disparity between the Summer and Winter Olympics is beyond the remit of this thesis. With the first and last post-War Olympic Games both being held in London, the idea that legacy changes and develops over time is strongly supported. It is anticipated that this PhD will generate further, developmental research questions that draw attention to the importance of legacy research and the requirement to improve legacy outcomes via the medium of Olympic Design. Long-term, this will impact upon the prevalence of positive Olympic legacies in future host cities of the Games, by developing regeneration strategies that better satisfy the IOC's aim to "promote a positive legacy from the Olympic Games", and improve the future for the wider community post-event. Legacy is a reportedly difficult concept to define due to its multifaceted nature; and the aspiration of seeking to improve Olympic legacy without understanding first the

characteristics and complexities of the construct would be an unmanageable assignment. This paper aims to feed into the thesis by evaluating perspectives of Legacy in relation to Olympic Design.

Keywords:

Architecture, Legacy, Olympic, Regeneration, Sustainability

1. Introduction

"Legacy is probably about nine-tenths of what the process is about: not just 16 days of Olympic sport"

-Sebastian Coe, (2005)

(In: UK Government & Mayor of London, 2013).

The Olympic Games is the Worlds largest International Mega Sporting Event, and a symbol of antiquity with an important historical legacy shrouded in mythology and predating Ancient Greek civilisation, (Girginov & Parry, 2005). The International Olympic Committee (IOC), (2012), and the Olympic Museum Educational & Cultural Services, (2013), define the Modern Olympics as a platform to marvel the incredulity of the evolution of the human body, make good relations between nations, and provide the host country with the opportunity to showcase, (via the media of contemporary architecture), its modernity, economical stabilization, and social cohesion as a nation, to a global audience. The World Olympians Association (WOA), (2014), defines the notion of Olympism as "a philosophy of life, exalting and combining in a balanced whole the qualities of body, will and mind. The summer Olympics are a leading example of a city-based mega-event that has proliferated over the last 150 years: whilst hosting the Games meant little more than assuming responsibility for provision of the necessary competition venues in the early days, the host City has now become a stage that serves as the focal point not only for the Olympic festivities but also celebrations that spread beyond the confines of the stadium, making statements of prowess and modernity that involve large scale investment to afford inherently expensive stadia, the accompanying elements of urban regeneration, and the adaptations to the infrastructure of the city required to accommodate the ensuing influx of tourists, (Gold & Gold, 2007). The Games have remained a (relatively) short-term, high profile occasion in terms of the main event, but they have established a long-term environmental impact through new construction and urban development that has made legacy concerns an increasingly more important aspect of staging the Olympics, (Hiller, 2006).

This paper, is the outcome of a broader, in-progress, PhD research project on the legacy value of modern Olympic architecture in Europe, which will, through the re-reading of some of the most significant post-war editions of the Olympiads, illustrate the historical progress of Architectural design, and the ensuing legacy outcomes over a specific timeframe, (1948-2012), designated to capture their legacy impact regionally and internationally at various phases of their existence. The 64-year journey of the post World War II Olympics in Europe, beginning in London (1948), culminating in London (2012), and including all of the European Olympic sites in-between, encapsulates the fluid and evolving process of legacy, documenting impact over the specified period of time. Considering the architectonic language and cultural characteristics of Olympic design in its broadest, most holistic sense of being, this research represents the challenges faced in Olympic architecture whilst simultaneously preparing for the international event and the future impact on the local community; a complex relationship to construct in terms of design strategy. Conceivably resultant of such complications, the body of research that makes reference to Olympic legacy is plentiful, but an initial assessment of literature suggests that there is limited direct reference made specifically to Architectural design in research. This paper explicitly evaluates the concept of legacy as a multifaceted construct that is difficult to define; and is further complicated in its application to the field of Architectural and Olympic design because of the all-encompassing, holistic approach that is incorporated in this field. The driving concept behind this paper is that without understanding what legacy actually is, quantifying how a design legacy has become a success or failure becomes a significantly more difficult task to undertake, because the contributory factors that underline design legacy are not implicit.

2. Historical Context

The Modern Olympics are grounded in the construct of the 4-year Olympiad begun in Ancient Greece. Although its origins pre-date historical records, it is thought to have originated around 776BC. When the Olympic Games began, the event lasted for only one day, but, over time as they grew in popularity; new events were included and competitor numbers increased, and in 684 BC the Olympics became a three-day event. By the 5th Century BC, the Games were extended again to cover a period of five days, until 393 AD when Emperor Theodosius decreed the elimination of all Pagan activities and abolished the tradition of the Ancient Olympics. The Olympic Games were resurrected in Paris in 1911 by Pierre de Coubertin, "to create a way of life based on the joy of effort, the educational value of good example, social responsibility and respect for universal, fundamental, ethical principles", and promote international harmony, (WOA, 2014). Having withstood two world wars, and several large-scale international political events, the objective of the Games, to bring people together to celebrate community through the joy of Olympic Sport remains mostly intact. Since the 1980's, the attraction of hosting sporting mega events has grown, because of the opportunity it offers to address multiple agendas; including social, cultural, economic, developmental, and global status at an increased rate due to the cash injections that accompany winning the bid as a host, (Horne, 2011). The urban edifices created as a product of the event enable exploration of architecture and urban planning to communicate a specific urban image as intended by the host city to be projected internationally, (Muñoz, 2006). But the attraction of hosting the Games is also subject to opposition and acrimony in response to primarily political agendas and shortcomings of previous host cities. The significant capital expenditure to the Government derived through taxes and external funding, that accompanies the delivery of the Olympics, emphasizes the significance of legacy incorporation into the planning of the event. The scope of the PhD is solely focussed on the Summer Olympiads to reduce potential geographical, climatic and cultural and poliitical differences between the Winter and Summer games.

3. Relevance of the Research

Legacy has been a deliberated matter in relation to Olympic Architecture and Urban Planning since the inception of the Modern Olympics in 1911, when Pierre de Coubertin advised that Permanent Stadia should not be constructed with the intention to host future events when temporary buildings would satisfy Olympic demand, (IOC, 2000). According to Agha *et al*, (2012), legacy "has played an important role in the evolution of the Olympic Games as they have exploded in size, scope and cost over the past thirty years", but despite this speculation, it remained undefined in the Olympic bid criteria until 2007, when it was outlined in Rule 2, Article 14 of the Olympic Charter that the role of the International Olympic Committee (IOC) is "to promote a positive legacy from the Olympic Games to the host cities and host countries", (IOC, 2007, p.15; IOC, 2013). This followed the International symposium on Legacy of the Olympic Games 1984-2000 in Lausanne in 2002, when it was identified that Legacy was 'fundamental in the understanding of Olympism in society', (IOC, 2002). But according to Kassens-Noor, (2012), the motivation to create legacy in host cities has merely established a culture amongst hosts to create extravagant expenditures in order to outperform previous Olympics, without necessarily demonstrating consideration for the future of the City after the event. And this is unlikely to change whilst the Olympic Organising Committee remains under the scrutiny of the media, who are critiquing the minutiae of their organizational strategies. Resultantly there is little incentive to focus on legacy generation. The first real shift towards developing some accountability for the legacy promises made during the Olympic bid process was the 2009 Olympic Games Global Impact project, generated by the Olympic Games Knowledge Management committee and the Sydney Organising committee set up in 2005 to provide a vehicle for host cities to learn from one another; but literature suggests that there has been little follow up from which to initiate this process, (Agha *et al*, 2012).

Sporting mega events have the potential leverage to benefit a great number of people over a long period of time. The Olympic Games have long provided opportunities for nations to signal emergence or re-emergence on the international stage: and over the last 25 years, the allure of hosting mega-sporting events has increased significantly, (Horne, 2011). According to Hiller, (2006), City leaders view the Olympics as an opportunity to accomplish items on their urban agenda, and this prospect upsurges the desirability of running as a host city. Although the primary purpose of the host City is to serve as a location to stage the sporting events of the Olympic Games, there is much more at stake then merely providing a venue for competition. According to Muñoz, (2006), the urbanization of the West during the 20th Century is attributable to major world events such as the Olympics: and Horne, (2011), states that the hosting of a major event enables symbolic and national construction to take place, in a timeframe that may otherwise have been impossible. However, this is not always a welcome method of development. Policy requirements for rapid regeneration in the Olympic agenda may require, for example, land acquisition, dispersing community groups, and creating a sense of bitterness generated by poor handling of the situation in some situations, (Davis & Thornley, 2010). Some suggest that the relationship between the Olympic Games and the long-term goals of the city has actually been neglected, (Hiller, 2006); and large public costs and regressive impact on quality of life for disadvantaged communities in the host city heavily challenge the (often) projected vision that Olympic Games Developments in Cities are beneficial for all, (Cook & Ward, 2011).

The IOC symposium on legacy in 2002 had little impact on the type, co-ordination and relevance of research into Olympic legacy that might be able to inform and influence future bids and future Games planning. Despite promises made during the bidding process, there are recognised pitfalls in the existing frameworks for evaluating Olympic and Paralympic legacies; and although the IOC produced a framework for evaluation based on the legacy categories of Preuss (2007), and Gratten & Preuss (2008), there is less emphasis on following through with legacy planning whilst under media scrutiny to ensure the smooth running of the event, and more emphasis on the opportunity to showcase the spectacle of the Olympics itself. The size and scale of Olympic Infrastructure is not always compliant with future urban requirements, (Hiller, 2006). If an Olympic Park is not successfully reformed after the Games, it easily transitions from spectacle to 'public embarrassment', economical burden or abandoned eyesore. Architecture is about power, glory, memory, identity, and eternally changing form, (Horne, 2011), and the inability to transition appropriately between roles demonstrates a poor communication or lack of strategy in design.

4. The Construct of Legacy

To engage in positive legacy outcomes in post Olympic host countries and cities, it is first important to understand what legacy actually is and how it is applied to Olympic development; the urban regeneration that occurs at a much faster rate than would be permitted in normal circumstances due to the cash injections resultant of winning the Olympic bid. The aspiration of seeking to improve the Olympic legacies generated during the planning and conception of Olympic building without understanding first the characteristics and complexities of the construct would be arbitrary. Despite its classification by the International Olympic Committee, (2002), as *"a multidisciplinary and dynamic, local and global concept, existing on a regional, national, and international level";* research suggests that there is actually no simple or satisfying definition of legacy, (Preuss, 2007; Agha *et al*, 2012), because of the difficulties that occur in attempting to define the construct, (Davis & Thornley, 2010). Gold & Gold, (2008), identify the concept of legacy as extremely vague, and Dickson *et al*, (2011), established that many 'definitions' of legacy are actually categorizations. Cashman, (2003), catalogued legacy into the following categories: economic; built and physical environment; information and education; public life, politics and culture; sport; symbols; memory and history. But later, in a subsequent publication, assembled the 'categories' under the headings of sport, economics, infrastructure, information, and education, (Cashman, 2006). Chappelet, (2008), reaffirmed and added to this definition, also considering urban & social effects as impacting factors. Preuss, (2007, p.211), however, rejected the common categorisations in literature and defined legacy as 'irrespective of the time of production and space, legacy is all planned and unplanned, positive and negative, tangible and intangible structures created for and by a sport event that remain longer than the event itself'. Davis & Thornley, (2010), saw these very same aspects of legacy as characteristics of the construct that make it difficult to evaluate or quantify: according to their research, the short-term & long-term, tangible & intangible; direct & indirect; foreseen & unforeseen; and positive & negative legacy potentials are part of the major difficulty encountered in contributing to the dissemination of the construct of legacy, rather than making sense of the issue.

5. Architectural Context

Olympic Architecture provides the opportunity for architects and engineers to demonstrate innovative design. Within Olympic Architecture, legacy has a clear conceptual significance defined by literature. However, the difficulties involved in defining that construct are amplified by the mere definition of architectural design, as more than a collection of buildings, a landscape, a city design, an object, a style or methodology, a plan, a structure, a fluid process, or a design… it is all of those things, and more, (Hoffmann *et al*, 2015). Architecture is a multidisciplinary profession that unifies the component positions of multiple areas of study to become a coherent whole. It is not based solely upon one discipline, but it is a multifaceted subject comprising of the social, economical, and sentimental values incorporated in the holism of urban planning, geography, engineering and design with multiple meanings and connections. Frank Lloyd Wright described Architecture as "a record of life as it was lived in the world yesterday, as it is lived today, or ever will be lived…that great living creative spirit which from generation to generation, from age to age, proceeds, persists, creates, according to the nature of man and his circumstances as they change", (Brooks Pfeiffer & Nordland 1988). Building design, and the sociological perspective of human behaviour in relation to the built environment, a major component of everyday life for all, plays a key role in Olympic development: construction of facilities large enough in size to host an event on the scale of the Olympics is a conflict of interest with design for community use, but the two must be integrated for Olympic design to be endorsed as successful on the post-event urban agenda. Event structures create lasting legacies in the city, but also present dilemmas and challenges, (Hiller, 2006).

6. Olympic Strategies

Olympic buildings are designed to present architectural and engineering challenges to the construction industry, aspiring to create innovative, iconic buildings that set new standards in terms of technology and materiality, (Cresciani, 2008); but even in Architectural terms, Olympic legacy comprises much more than this. There are multiple components within the holistic field of Architecture and Urban Planning that fit the notion of legacy when incorporating its values and concepts into the urban environment. Sustainability, regeneration, heritage, and reuse are all architectural terminologies integrated within the discipline of architectural legacy, each with a niche perspective that contributes to the model of legacy as an all-inclusive idea. For example, the Olympic Stadia in Athens remain structurally sound, but their derelict conditions are due to their remote and unlinked location in comparison to the city, and poor geographical and infrastructural planning.

Figure 1. Getty Images (2015) (The beach volleyball Olympic Venue in Neo Faliro, Athens)

It was during the course of the 20th Century that Olympic Villages began to lose their ephemerality in favour of creating more permanent edifices: and the temporary use of military barracks and camps to complement the city's hotel accommodation was replaced by new construction and urban regeneration, to insert a programme of multifunctional spaces incorporating, accommodation, entertainment, rest and leisure, into the fabric of the city, (Muñoz, 2006). David & Thornleu, (2010), suggest that the history of cities utilizing the Olympic Games to create longer-lasting legacies that benefit the community began in Rome in 1960 where the upgraded transport infrastructure continued to support and promote City function after the Olympics had ended. Indeed the infrastructure of London 1948, (dubbed the austerity Games after a 12 year hiatus resultant of World War II), ceases to exist at all; but because of the economic climate and post-war rationing, no new venues were built for this event and athletes were housed in existing accommodation; a theme that followed into the subsequent 1952 Games in Helsinki on a lesser scale. When the Olympics returned to Europe in 1960, the Olympic Village in Rome became a post-war showpiece, delivering post-Games housing that remained inhabited throughout the decade, but by the 1980's had fallen into decline. Pier Luigi Nervi, the engineer responsible for the design and construction of four of the major buildings of the 1960 Olympics, pioneered urban placemaking in the city, (Buxton, 2012). Nervi's Palazzo Della Sport in Rome, built for the 1960 Summer Olympics, has sustained a purpose and occupancy throughout the ages, but, whilst some Stadia have burgeoned over time, others have suffered abandonment and disuse; Helliniko Olympic Complex, beach Volleyball Arena, Aquatics Centre, and Softball Arena constructed in Athens for the 2004 Olympics were lying derelict by 2008 after geographical and cultural factors inhibited their continued use, and hosting the Olympic Games reportedly contributed to the collapse of the Greek economy; causing animosity amongst Greek citizens, (Kissoudi, 2008). A study by Cresciani & Forth, (2011), identified threats to the resilience of large iconic structures as factors of poor design, change in public perception, change of use, and structural attack; and concluded that resilience was "the ability of a structure to withstand threats and continue to function", demonstrating durability, performance, and accepted standards over time. They suggested that adaptability of space is demonstrative of resilience and key in legacy development: building that is designed to be adapted for community use after the event minimises potential heritage forfeiture. Sustainable regeneration in Olympic cities is not only a contextual layer of site-specificity, but the outcome of a strategy to respond to and overcome the widely criticised journey from investment and design to waste and ruination that has been observed in many Olympic Games Developments of the past, (Davis, 2014). With the aim to part-recycle the London 2012 Olympic constructions, the London Legacy Development Corporation (2012) promoted their legacy plans as 'a legacy for sport', 'a legacy for the community', and 'a legacy for the environment', encompassing all of the holistic aspects of legacy and urban planning, and the subsequent effects of human behavior and wellbeing resultant of environmental change and the associated lifestyle adaptations. London 2012 has been heralded as the first Olympic City to really encourage positive legacy planning and subsequent analysis, however, quantifying fruition of proposals will not reach completion for some years yet and research into the land acquisition process of the London 2012 Olympic Site has shown that the process of relocating the existing community in the Lower Lea Valley resulted in a complex and unevenly distributed array of outcomes in the short-term, despite the projected benefits of the proposals overall, (Davis & Thornley, 2010).

Figure 2. Pas Qui, P. (2014) Palazzo della Sport, Rome

7. The Evaluative Process

It is the IOC that has shaped the environment in which the change in the role of stadium architecture has been prompted by wavering public opinion and concerns about the environmental impact of the Olympic Games, (Horne, 2011), but whilst the Olympic Organising Committee remains responsible for delivering the Olympics under the scrutiny of the media, who are critiquing the minutiae of their organisational strategies, there is little incentive to focus upon the generation of legacy; or longer term strategies employed to ensure that the urban regeneration permitted in the build up to the Games are also insightful enough to consider community use post-evernt, (Agha *et al*, 2012). Mourney, (2014), reported that the UK has been the first nation to even attempt a comprehensive legacy review, but, IOC assessments of legacy focus on tangible indicators and, it has been suggested by some that these do not actually provide the whole picture, (Davis & Thornley, 2010). The 2009 Olympic Games Global Impact project marked the first shift toward developing some accountability for the legacy promises that are made during the Olympic bid process, Agha et al, (2012). The Olympic Games Knowledge Management (OGKM) committee was set up in tandem with the Sydney Organising Committee in 2005 to provide a vehicle for host cities to learn from one another, (Kassens-Noor, 2012), but literature suggests that there has been little follow up from which to initiate this process.

8. Conclusions

As demonstrated by the examples above, Olympic legacy is a multifaceted and complex, holistic discipline, that is subjective and difficult to define. There is a sufficient body of research to identify specific aspects of the construct of legacy and piece together the properties of the concept to develop a better understanding of its application to Olympic Design, but it invites further contribution to provide a more in depth enquiry into the intricate sequence of component parts that assemble to compose an inclusive notion of ‘legacy’.

The challenge posed in designing for the Games is that the Architecture should complement both innovative design and future community opportunities; but the two are conflicted by nature, and currently, the legacy outcomes produced by urban regeneration strategies for the Olympics are inconsistent and insufficient. The public investment involved in hosting the Games validates the necessity for further investigation to improve legacy outcomes, and this research has identified that improving legacy outcomes would be a desirable achievement on multiple levels.

As a component of the broader PhD thesis, this paper underpins the foundations from which the complex construct of legacy can be cultivated into a valuable philosophy that is supportive of design strategies employed in Olympic regeneration to produce more favourable legacy achievements during future Olympiads.

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Figure References

Figure 1. Getty Images (2015) The beach volleyball Olympic Venue in Neo Faliro, Athens. Available from: http://www.news.com.au/sport/more-sports/athens-olympic-site-in-ruins-10-years-on-from-2004-games/story-fndukor0-1227024073167

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The Significance of Community Development in the Success of Brazilian Social Housing

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Abstract:

This paper aims to investigate the relevance of place to community development in a Brazilian model of social housing. It emphasises the difference between place and space, and the outcomes of approaches and strategies based on these two concepts. The paper is part of research for a PhD, which aims to propose methods for improving the quality of social housing in the city of Campo Grande. The necessity of undertaking this research is due to the fact that the housing developments are located at the periphery of the city, far from the centre, and composed only of housing units without the infrastructure to meet community needs. Furthermore, they are built without a regional identity. It appears that the social housing programmes have been responsible for the construction of houses, without producing homes. The research aims to find a theoretical framework that reconciles the existing strategies with proposals that should be incorporated for the creation of homes. For this theoretical framework to be developed, it has been necessary to carry out an investigation about principles of community, which are presented in this paper. It identifies the main elements that comprise a community and categorises them into a taxonomy. It furnishes the interpretations of different scholars about the inherent elements, which are locality and size, common bonds, social interaction and sentiment of attachment. In addition, it presents the social variables that encourage development of the feeling of belonging and sense of community, and discusses the significance of these notions. The importance and possibility of intentionally creating the sense of community in people is also asserted.

Keywords:

Social Housing, Community Development, Placemaking, Urban Planning

1. Introduction

The work presented in this paper results from early stage research for a PhD. The aim of the research is to propose methods of improving the quality of social housing development in the city of Campo Grande, Brazil. The necessity of proposing a new model of development of social housing has arisen after an analysis of the current model being developed in the city. Social housing is located at the periphery of the city without the necessary services and infrastructure to satisfy community needs. Moreover, the dominant technical standard established by the government for the design is producing very similar houses throughout the country of approximately 8.5 million km^2 and 200 million inhabitants (IBGE, 2014), without any regional distinctiveness (see figure 1). Moreover, the houses do not appear to be meeting user needs as ad-hoc changes are often made by families when they move in (Reis and Lay, 2002). Provision of a certain number of units each year, rather than consideration for the people who will live there; cheapness of construction; and lack of effective regulation for the use of land, have proven to be amongst the principal causes for the current model of social housing development

(Bonduki, 2008). As a consequence, it has led to the production of houses, without creating homes.

Figure 1 – Social housing development in Campo Grande.
Source: City Council of Campo Grande (2012).

The research aims to find a theoretical framework that expands the existing strategy for social housing in the city with the strategies that should be incorporated for the creation of homes, i.e. moving from merely space-based, to people-based and place-based community development (see figure 2). At present, residential estates do not create a sense of place or community attachment for their residents. The importance of placemaking and sense of community have been investigated, and it is this investigation that will be presented in the paper.

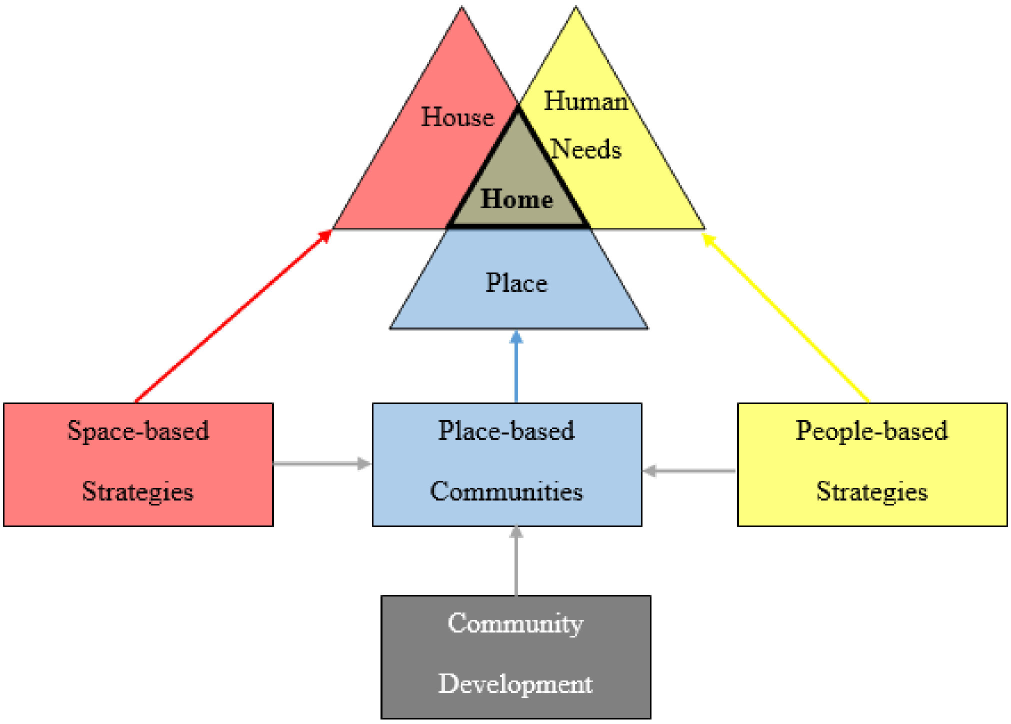

Figure 2 – Diagram of the theoretical framework proposed in the research.

2. The Dichotomy between Place and Space

Space can be defined as a volume contained by boundaries (Low, 1992), but it can only be considered a place when it is experienced by an individual or community (Cresswell, 2004; Rapoport, 1977; Trancik, 1982). Place can be understood as a setting of physical attributes with activities that create meaning (Relph, 1976). The physical attributes of a place can be influential to people's behaviour and actions (Canter, 1977). According to Agnew (1987), place is a space with social, economic and cultural characteristics, creating a sense of place for people, related to territorial identity. Sense of place varies from one individual to another. Each person has his or her own conceptualization of place (Canter, 1977; Relph, 1976). Avarot (2002, p. 202) identifies sense of place as 'a human need, essential for well-being and feelings of safety, security and orientation, and a remedy against feelings of alienation and estrangement'. Thus, place can be understood as an intersection between space and people (see figure 3).

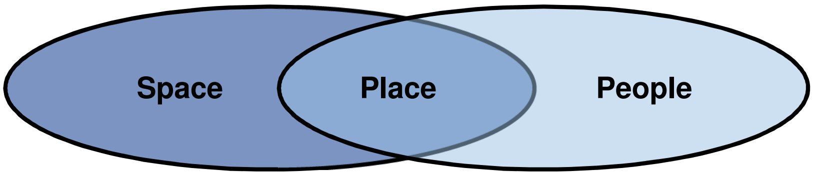

Figure 3 – Place as the intersection of space and people

2.1. Placelessness

While scholars, such as Harvey (1993), Massey (1997) and Watts (1998), discuss the significance of place making; others claim that changes in the society, such as globalisation, communication and mobility, have led place to become an irrelevant issue (Beatley, 2004; Giddens, 1991; Meyrowitz, 1985). This causes what Relph (1976) has deemed placelessness. While a place has different meanings to different people, placelessness is where an environment is meaningless to any group or individual. Relph (1976) blames mass production for the emergence of placelessness. In modernist urbanism (Avarot, 2002), the concern with emotional attachment to a place was considered a romantic and nostalgic anachronism (Arefi, 1999). Therefore, placelessness is a consequence of space-based strategies, as it focuses only on the physical environment, without consideration for meaning and experiences.

In contextual architecture and planning, it is fundamental to recognise the importance of place. When architects and planners do not consider the meanings that a location can have to certain individuals or groups, they are likely to generate anonymity (Gans, 1968; Gustafson, 2001; Seamon, 1979). Moreover, place can have a vital relevance in the development of community. Successful communities are those ones in which their members expound a feeling of belonging. In the case of communities based on a specific locality, they have place as the congruent element in the development of sense of community. For a better understanding of this issue, an investigation about principles of community has been carried out.

3. Principles of Community

There are numerous interpretations for the term 'community'. The form in which this theme is approached varies from one discipline to another. Crow and Graham (1994) give an example comparing the research led by the anthropologists and historians. Whilst anthropologists study the importance of symbolic envelopes around communities (Cohen, 1985), historians focus on how communities are created and sustained. Even within specific fields, such as sociology, the definition of the term community varies from one sociologist to another. There is an agreement amongst some scholars (see Bell and Newby, 1971; Crow and Graham, 1994; Hillery, 1955) that the conceptualization of this subject remains open to multiple interpretations. The meanings proposed by sociologists may be ambiguous and contradict each other, or they can be similar but still not identical (König, 1968). Nevertheless, it has been possible to identify four major elements that comprise a community. The elements are locality and size, common bonds, social interaction and the sentiment of attachment.

3.1. **Locality and Size**

The existence of a shared geographical area is emphasised by scholars within the sociology discipline as a possible element for the formation of community. Mention of the presence of a common place can be found in the studies of community by a number of pioneers, including Kaufman (1959), Sussman (1959), Tonnies (1887) and Warren (1971). While some authors, such as Gusfield (1975), König (1968), and Willmott (1986), consider locality as a possible basis for the formation of community, others such as Sussman (1959) and Warren (1971), argue that a shared place is the necessary element. Sussman (1959) also agrees with Kaufman (1959) and Tonnies (1887) the notion that a community is formed by a small-scale locality, which can be exemplified by a village structure (see figure 4).

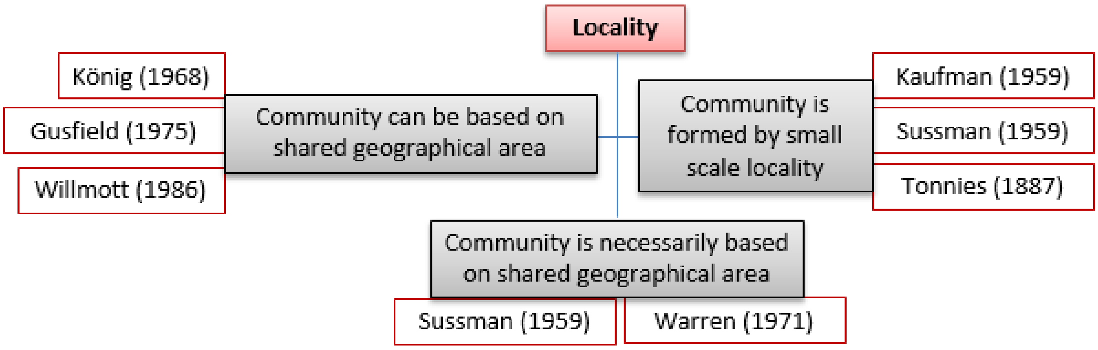

Figure 4 – Diagram of views of sociologists who relate community to locality.

This concept is related to a simplified vision of community, with the belief that its members will necessarily have social interaction with each other (Kaufman, 1959; Sussman, 1959) and present homogenous cultural characteristics (Weber, 1921; Tonnies, 1887). However, this argument has been contested by other authors for being a 'romanticized' (Brint, 2001, p. 2) form of analyzing communities. Therefore, community would not necessarily be small, such as a village, but could also be composed of a large-scale locality, such as a city (Durkheim. 1897; König, 1968) (see figure 5). Despite the divergences amongst scholars, Hillery's (1955) work points out that there is no evidence for any author to deny geographic area as an element of community.

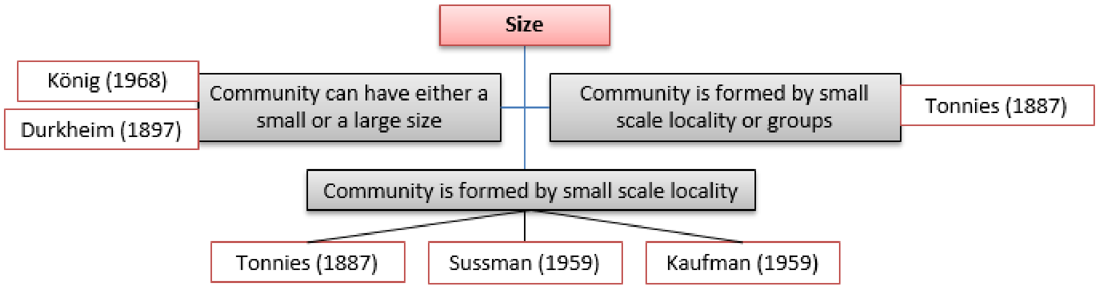

Figure 5 – Diagram of views of sociologists who relate community to size.

Residential areas, such as neighbourhoods, can be considered as a type of community based on locality. They meet the requirements to be considered a community as defended by authors such as Warren (1971), who states that community is the set of social units combined with systems that has the locality as a reference. They can also be considered as communities through the interpretations presented by authors such as Cohen (1985), Suttles (1972) and Tonnies (1957), who affirm that they can be formed by people who have a locality with physical or symbolic boundaries in common. Golab (1982) and Warren (1981) have as common vision that neighbourhood is composed of people who share the same locality and, according to Halman (1984, p. 13), 'within a larger urban area, where people inhabit dwellings and interact socially'.

3.2. Common Bonds

Although the word community is often associated with locality, the place and the capacity to support particular types of social relationship are not straightforwardly related (Crow and Graham, 1994). Common interests, attachments, beliefs, values or other shared experiences that people have between themselves can all generate a sense of belonging and form the basis for the structure of a community (Brint, 2001). In modern society, with easier mobility, communities based on interests and independent of location, are even more usual than the ones based on locality (Durkheim, 1893; Wellman, 1977). This analysis suggests a division between communities based on geographical area and those based on common bonds. Gusfield (1975) terms these two types as territorial and relational. In summary, territorial communities are formed by people who share a locality. It can be, for instance, a neighbourhood, a town or a city. A relational community does not depend on territory. Instead, it is formed by people who are connected by interests independently of location. Relational communities can be, for example, a group of fans of a band (Brint, 2001) or people who are connected professionally (McMillan and Chavis, 1986). According to Willmott (1986), the territorial community relates to people who are linked by sharing geographical locations, such as living in the same residence or neighbourhood. Willmott (1986) refers to relational community as an interest community, defined by common interests and characteristics that might connect people, such as sharing the same religion and ethnic origin. These two types of community may overlap. For instance, people who belong to a territorial community may also present the same ethnic origin and religious belief. They may also form an interest community. The importance of distinguishing between the types of community permits the notion that a community can be formed without its people sharing geographical situations (see figure 6).

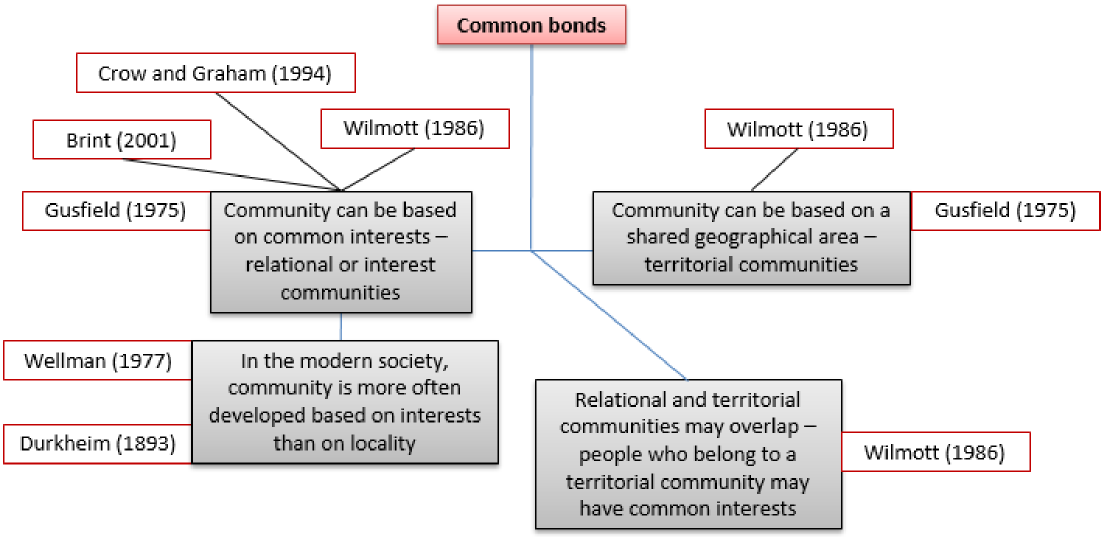

Figure 6 – Diagram of views of sociologists who relate community to common bonds.

3.3. Social Interaction

In addition to shared locality and common bonds, social interaction is another characteristic identified by Hillery (1955) in the composition of community and considered by scholars as an important element. Some researchers, such as Hallman (1984), Kaufman (1959) and Sussman (1959), state that community exists when people interact with each other and have the aim of meeting individual needs and achieving group goals. Tonnies (1887) also affirms that community is made up of social interactions. As he believes that community is necessarily small, he relates the small size to a consequent frequent interaction between the members of the community. Brint's (2001) research confirms that members of geographical-based small communities tend to present relatively frequent interaction. Nevertheless, other studies, such as Kearns and Parkinson's (2001), suggest that people who live close to each other, do not necessarily interact (see Figure 7). The level of social interaction can be the main element of influence to the extent of both sentiment of attachment and sense of community.

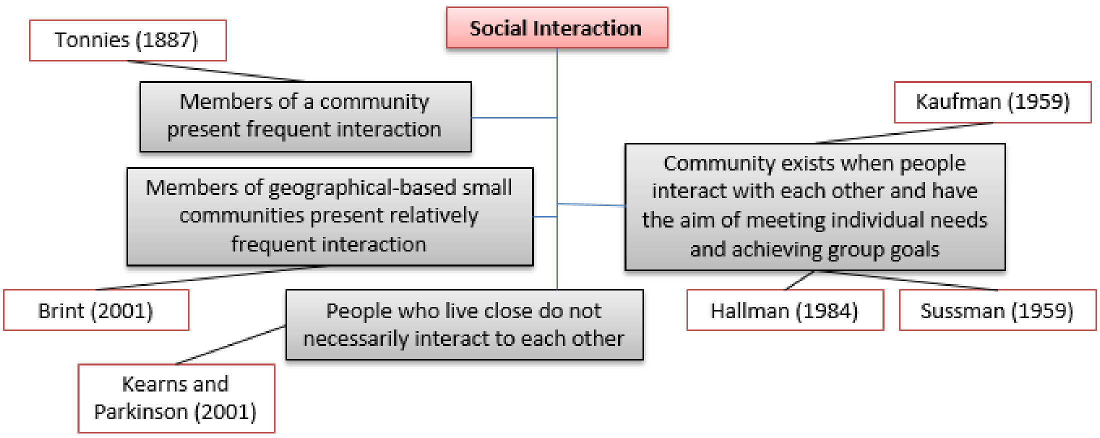

Figure 7 – Diagram of views of sociologists who relate community to social interaction.

3.4. **Sentiment of Attachment**

The interpretations for sentiment of attachment to a community vary from one author to another (Fischer, 1977), but it can be understood as when the individual has the feeling of belonging to a place or group and recognises the existence of this feeling (Lee and Newby, 1983; Willmott, 1986). The scale of interaction and sense of attachment of an individual can vary through the influence of a range of social variables (Scannell and Gifford, 2010) that exist in communities. König (1968) lists - form of land settlement, location, size, age, gender, ethnicity and family size as some of these variables. The interaction of these characteristics can comprise the social system of a community. The social system is related to people who recognize the characteristics of their relationships with others, such as their limits and their 'differences from other similar relationships' (König, 1968, p. 28). This type of structure of relationship is crucial for the existence of social and cultural identity in a community.

In the case of geographical communities, such as a neighbourhood, the feeling of belonging to a place can be, amongst other characteristics, related to the length of time that the individual has lived in the locality. People who have lived longer in a place tend to have more chances of presenting stronger sentiment of attachment (Hunter, 1975). Length of residence was found in Kasarda's and Janowitz's (1974) research as the variable with the most significant impact on the level of interaction of people within their community and their sentiment of belonging. Riger and Lavrakas' (1981) investigation points out that, as well as the length of residence, there is a range of other factors that influence the level of interaction and sentiment of attachment to the community, such as presence or absence of children at home (Doolittle and MacDonald, 1978), being home owner or tenant (Fischer, 1975; Keller, 1968) and age (Forrest and Kearns, 2001). Other studies also point to social class (Schulman, 1975), gender (Ellen and Turner, 1997; Rollero and De Piccoli, 2010; Tartaglia, 2006) and income (Lupton, 2003) as influential elements to the scale of social interaction and feeling of belonging to the community.

Mobility could be responsible for the differentiation of levels of social interaction and sentiment of attachment among people from different ages, gender and income. As the elderly and mothers with young children have less chances of mobility, they are more likely to need and want local ties with their neighbourhoods (Riger and Lavrakas, 1981), while young singles do not tend to develop attachment to the place (Fischer, 1977). Poorer people have greater limitations on mobility for economic reasons, which lead them to limit their networks to those in closer proximity (Wellman, 1977). This statement adds to Forrest and Kearns' (2001) proposition that a neighbourhood usually has more significance to lower income people (see figure 8).

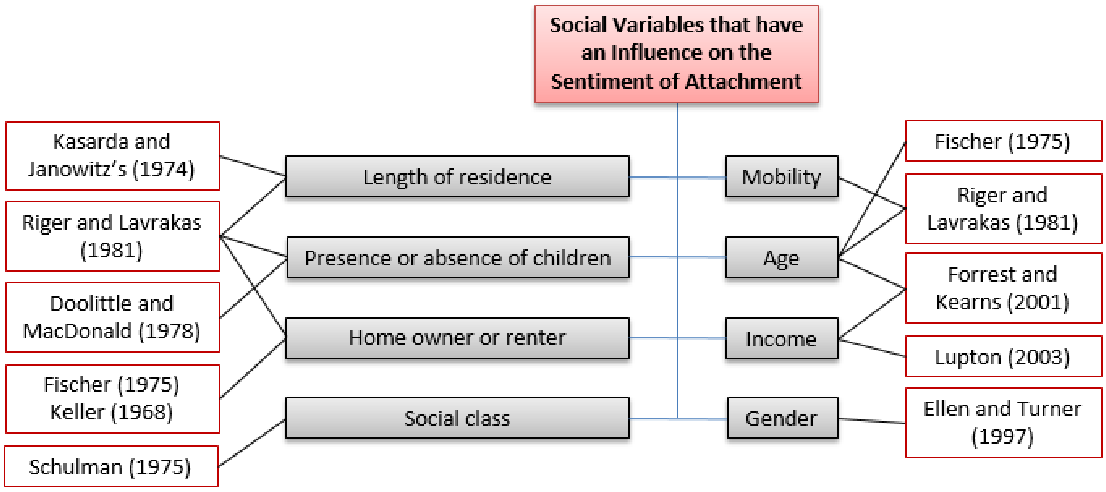

Figure 8 – Diagram of views of sociologists who relate community to variables that influence sentiment of attachment.

4. Artificially Created Communities

The sentiment of attachment or sense of community usually happens naturally. This is often due to factors such as the level of social interaction. As the scale of interaction can be influenced by social variables, it could be suggested that an intentional intervention in these variables could lead to a greater level of interaction between community members. Therefore, it is claimed by some scholars that the sentiment of community can be artificially created. Suttles (1972) contends that planners and developers are able to induce the development of a local social system, through the creation of mechanisms that develop the idea of belonging to a community. However, the idea of a natural community may seem more attractive to people, as it gives the impression of being created automatically by its own members (Bauman, 1990). Nevertheless, there is a belief that this is a romantic idea and the expectation of leaving it to happen naturally has a very uncertain outcome. Suttles (1972) defends the idea that the planners and developers should take a role of intervening in the process of creating a community. Moreover, the artificial mechanisms that started to create a community might, over time, feel more natural. As König (1968) points out an artificially created community, e.g. a new settlement in a development area, will in time adopt its own cultural features and appear more as a naturally created community.

In the case of territorially based communities, physical mechanisms can stimulate social interaction and thus result in the development of sentiment of attachment (Lewicka, 2010). One of the features suggested by Suttles (1972) to induce the sentiment of community is the use of patterns to create segregation between the residents and the outside world. Cohen (1985) agrees that it is more likely that people will feel part of a community where it is well defined as to who are the insiders and who are the outsiders of the group. Edges can play a fundamental role in defining who are the members of a community and who are not. In order to form a community, it is necessary to determine not only the people who have similarities, but also people who have differences. The idea of being included in a group can be clearer when it is perceived that there are people who are excluded (Cohen, 1985). However, boundaries are often not physical. They can be, for example, language, clothing style or a type of ritual, as a means that will be recognised by the members of the community (McMillan and Chavis, 1986). Even when they are physical, they can be subtle, such as paintings on walls of the neighbourhood, which represent a certain ethos or shared images (Bernard, 1973) (see figure 9). Therefore, in this case, boundaries can be interpreted as symbols of the community. Although the residential segregation is a contentious issue, it is fundamental to acknowledge the importance of symbols in a community to develop a sentiment of identity. The importance of attempting to intentionally create mechanisms in a neighbourhood to provide the residents with the sentiment of community is in the impact it can make on their lives.

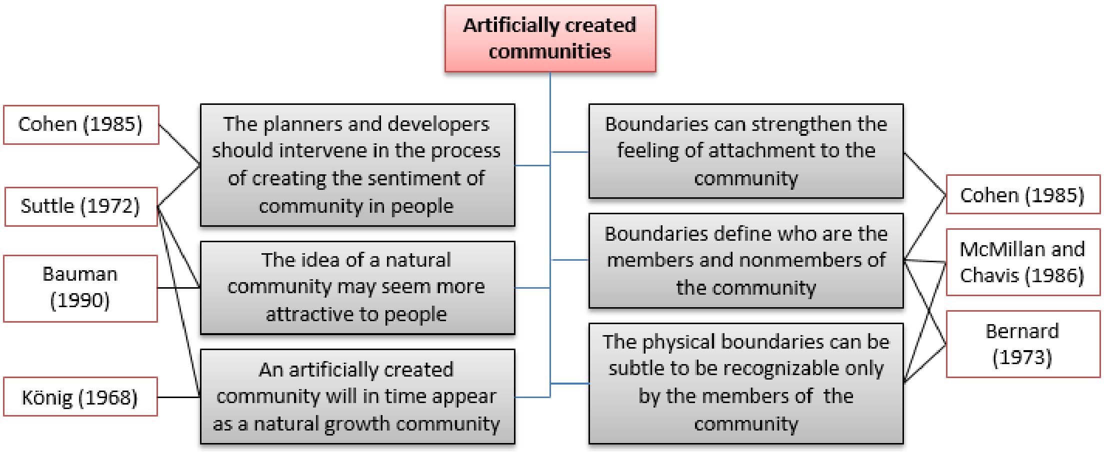

Figure 9 – Diagram of statements about artificially created communities

5. Findings

In the cases of urban residential areas, the literature suggests that the quality of life of residents may be largely determined by the environment surrounding their homes. Therefore, the conditions of the neighbourhood where they live can cause significant effects on the quality of life of those residents. The conditions of a neighbourhood are not determined only by the housing stock, but also by the social interactions between neighbours, mobility, shopping, cultural and leisure places and other facilities available to the residents. The satisfaction of residents with their neighbourhood is highly impacted by combinations of these issues. The sentiment of attachment of people to the place where they reside can be strongly influenced by the level of satisfaction they have in relation to their neighbourhood. Therefore, housing programmes that do not take the comprehensive characteristics of a community into consideration and have as the only concern, the production of housing units, may not be able to deliver places which people can identify as their home and which the dwellers can recognise as their community.

6. Conclusion

This study has highlighted the relevance of community development to social housing through demonstration of the different elements that comprise a community. Social housing developments should be able to create communities, which does not happen where space-based strategies are adopted. Programmes that adopt space-based approaches present a perspective that considers social housing development as a collection of physical structures, without contemplating the entire complexity of a community. This type of strategy has proven to be inefficient in the creation of community by not considering the human aspects of the development.

Where place-based strategies are adopted, it is important to acknowledge the main principles and characteristics of a community. It has been shown that a community can be based either in locality or in common bonds, and also that social interaction and sentiment of attachment can enhance a community. Moreover, it has been shown that different variables stimulate social interaction and sentiment of community in people. As presented in this paper, people from different backgrounds, i.e. age, gender and income have different perspectives of the relevance of community, which can be related to their mobility. It has been demonstrated that a community has a greater significance for people with limited mobility. Therefore, community has a considerable relevance for poor people, due to their limited mobility. Therefore, these strategies are applicable to the context of the social housing developments in Campo Grande, where low income people live in the periphery of the city.

As the sentiment of attachment has been identified as an important element in the development of community, mechanisms that intentionally develop this sentiment in people have been investigated. Elements that can be considered as symbols of the community can strengthen their feelings of belonging and identity. The relevance of this work has been to identify the main components of a community and the importance of placemaking in its development, especially in relation to social housing. Therefore, it has contributed to the PhD research by providing knowledge about the essence of community and its principles and characteristics. It has also pointed to the avenues that the research should take to achieve its aims. As shown in this paper, it is not only possible but also necessary to intervene in the process by creating communities. Thus, the research will carry out investigations into methods of intervention and models of social housing, which reflect on the study of community development presented in this paper.

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Assessing the Social Impact of Sports Facilities On Surrounding Communities: A Study of the Orlando Stadium In Soweto, Johannesburg

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Abstract

South Africa has experienced a boom in the construction of sporting facilities in the past decade and this is mainly as a result of South Africa winning the rights to host the 2010 FIFA World Cup. Successfully hosting of the FIFA world cup in South Africa did raise expectations of benefits in terms of developments (economic and otherwise) and the international exposure the country will receive as a result of hosting such an event.

So much has also been documented about the financial and economic impact of the $3Billion spent on the 2010 event. This paper takes an a view on the social impact the (re) development of the sports venues used have on the host community especially in terms of social legacies. The paper focuses on the Orlando stadium in Soweto. 19 interviews were conducted with stakeholders within the Johannesburg Development Agency as well as various community leaders. 153 of the 500 questionnaires distributed were returned and analysed. Analysis of the surveys shows that 'ownership status', 'duration of stay in the area' and the 'distance of respondent's house from the stadium' were key factors responsible for their perception of the social impact of the stadium. The paper concludes that as a way of further enhancing the perception of social impact, government should encourage actions that help promote increased home ownership in the surrounding areas of the stadium.

Keywords:

Economic development, social impact, South Africa, sporting facilities and urban regeneration.

1. Introduction and Background

Several studies have assessed the impact of sports facilities on communities where they are located (see Kasimati 2003; Davies 2005; Lee and Taylor 2005; Kim and Morrison 2005; Ahfeldt and Maening 2010; Lorde et al., 2011 and Billings and Holladay 2012). Many of these studies did find a positive impact of sporting events and facilities on social outlook of the host community. According to Kasimati (2003), the expectations of Sports facilities/franchises and major sporting events such as the Olympic Games and the FIFA World Cup is that they have an impact on the national and regional economies of host nations and cities. Kasimati (2003) goes further and argues that sports facilities/franchises and mega sporting events can regenerate host regions, increase civic pride, increase economic growth and create new job opportunities.

Davies (2005) further noted that construction of sports stadia is not only intended for their immediate sporting purposes but also to stimulate economic and physical regeneration on the long run. Lee and Taylor (2005) added that sports tourism receives a boost during mega gaming events and subsequently contributes to both the economic growth of not just the host cities or regions, but the countries in general; these were corroborated by Kim and Morrsion (2005);

they assessed the change in the image of South Korea among foreign tourists after the 2002 FIFA World Cup and they found that the assessment suggest that international sporting events can change the image of a tourist destination. Their study found that visitors had positive images of South Korea after the World Cup than before the World Cup. Conversely, in economic terms, Madden (2006) reported that the 2000 Sydney Olympics had a negative effect on the Australian economy when assessing the economic and fiscal impacts of mega sporting events.

From a community's point of view, local communities sometimes initially fear that locating a stadium in their communities and urban areas might have a negative effect on their communities. The study by Davies (2005) hypothesised that local communities fear that locating stadia in their urban areas would cause a decline in general property outlook; the study however found that in both the Millennium Stadium in Cardiff and the City of Manchester Stadium which were used as case studies, these stadia improved both internal and external images of the areas they are located and instilled civic pride in local communities.

Having identified some studies assessing the impact of sports facilities on communities on the international front, it is realised that studies assessing the impact of sports facilities on communities within the South African context is very limited. The few available seems to focus on sports and economic regeneration of the host communities. Although more recently, studies are focusing on the intangible effects mega sporting events and sports facilities have on communities. Walton et al., (2008) highlighted this as they found through extant literature quantification that there seems to be an improved emphasis on the possible intangible effects such as civic pride and legacy of sports facilities on communities.

Earlier, Feng and Hamphreys (2008) had highlighted that most promotional and academic studies on economic impact of sports facilities focus on the impact sports facilities have on income, jobs and tax revenues and not on the impact sports facilities have on a community's quality of life, the intangible utility and satisfaction based on how residents enjoy a community's attributes and amenities. They argue that the characteristics of a house and intangible characteristics associated with that house determine the value of that house; the intangible characteristics include public amenities located near that house. This is the basis for the hedonic pricing model of property pricing. The urban regeneration potentials of a community will surely impact on individual property prices in the area.

For example, Thornley (2002) highlights that the development of sports stadia has an effect on neighbourhoods and can be important for the image and economy of a city. Lee and Taylor (2005) added that sports tourism receives attention as contributor to economic benefits of host cities, regions and countries. According to Kim and Morrsion (2005) a variety of social and cultural events supporting mega-sporting events create opportunities to promote a host country's culture and traditions when publicised using sources such as television or other media. It is important to investigate the long-term effects of hosting of mega events by communities and effect sports facilities have on communities and the benefits these facilities bring to communities.

Kim et al., (2006) investigated the impact of the 2002 FIFA World Cup on South Korea and compared the impact pre- and post-games. The study found significant differences in dimensions that include cultural exchange, social problems, economic benefits, natural resources and cultural development, traffic congestion and pollution, price increase and construction cost. The study found that local residents expected the world cup to bring benefits that include economic benefits, cultural exchange, natural resource and cultural development to communities however these benefits were not realised. Kasimati and Dawson (2009) examined the impact of the 2004 Olympic games on the economy of Greece and found that there were positive impacts during the preparation phase and the year the Olympics were hosted however the long-term economic legacy effects were modest. Cornelissen et al., (2011) states that governments from both developing and developed worlds view hosting of mega sporting events as a way of stimulating development and highlights that there is debate on what the benefits of hosting such mega events are.

This paper as a way of contributing to extant knowledge especially within the South African context assesses the social impact of sports stadia on communities where the stadia are located. It does not just focus on the economic impact; it explores the often-elusive social and community impact of these sporting facilities on the host communities. Using the Orlando Stadium example, this paper investigates the residents perception on whether or not the Orlando Stadium has any social impact; if it does, what factors contributes to this and how can this social impact be optimised?

Cornelissen et al., (2011) stresses that after mega-sporting events legacies should be sustained, have long-lasting effects and be evaluated for at least 20 years after the event. They listed 5 important legacies as follows:

i) Sporting legacy: the actual stadium or sporting facilities itself
ii) Urban legacy: a form of urban regeneration
iii) Infrastructural legacies: e.g. transport and telecommunication networks
iv) Economic legacy: this includes economic unemployment rate, tourism etc.
v) Social legacy: this includes change in local residents' perceptions of the host city or region, skills and experience gained by local residents through their direct or indirect involvement.

Hosting of mega sporting events can have an impact on the host country and cities, and hosting of the FIFA world cup in South Africa did raise expectations that there would be possible benefits as a result of infrastructure developments in preparation for hosting the event and the international exposure the country would receive as a result of hosting the event (Pillay et al., 2009; Kasimati 2003, Kim et al., 2006; Walton et al., 2008; Cornelissen et al., 2011). The South African Government has invested funds to upgrade old stadia and construct new stadia to prepare for the hosting of the 2010 FIFA World Cup that was hosted by South Africa in 2010 (Haferburg, 2011). Below is a table indicating the monetary value of stadium investment.

Table 1: World cup 2010 city stadium investment figures Source: Haferburg (2011).

CITY	INVESTMENT (R)
JOHANNESBURG	R 3.64 B
TSHWANE (PRETORIA)	R 131 M
RUSTENBURG	R 460 M
CAPE TOWN	R 4.5 B
NELSON MANDELA BAY (PORT ELIZABETH)	R 2.1 B
DURBAN (ETHEKWINI)	R 3.1 B
MANGAUNG (BLOEMFONTEIN)	R 314 M
POLOKWANE	R 1.3 B
MBOMBELA (NELSPRUIT)	R 1.2 B

Maenning and du Plessis (2009) investigated under what conditions hosting the 2010 FIFA World Cup will have positive effects on urban development by considering the stadium construction and infrastructure projects carried out in preparation of the 2010 FIFA World Cup in South Africa. The study found that host communities were hoping for considerable positive economic benefits from the World Cup.

2. Sports Facilities and Urban Generation

Various studies have investigated the role of sports facilities on urban regeneration and the importance of these facilities to their communities. Davies and Thornley (2010) state that in the past cities have used games to obtain lasting physical benefits for their cities beyond sporting events. Barghchi et al (2009) opines that there has been a sports facilities construction boom in the past two decades and argue that recent sports facilities construction has been focused more on urban development and changing the image and economic redevelopment of local communities and not necessarily on getting the local community involved in sports.

Gratton et al (2005) highlighted that getting local communities to be involved in sports is not the primary aim of investing in sports infrastructure but that the aim was to attract tourists, encourage inward investment and change the image of the city. In 2005, Gratton et al analysed the justification of investing in sport in cities and assess the success of such investments. The study indicated that there is immediate economic impact during and immediately after a sporting event is held, the authors also indicated that there is a need to investigate the long-term urban regeneration benefits that sport can deliver.

Sports facilities can and have been used as catalysts for urban regeneration. Literature has shown that stadium developments assist and plays an important role in rejuvenating communities. Orlando football stadium in the heart of Soweto in Johannesburg is one of such mega event stadiums. Arguably, the stadium has added economically as suggested by literature earlier, but little research has been done on the social impact of this mega sporting center on the residents of the community. This paper explores the perception of the residents of this area on the stadium

3. Orlando Stadium and Upgrades to Surrounding Areas

This study assesses the social and economic impact the renovated Orlando football stadium has had on the neighbourhood where it is located, although the focus is on the social impact as perceived by the residents and other stakeholders. According to the Stadium Management South Africa SMSA (2013), Orlando stadium was originally constructed in 1959 and was later demolished in 2006, later to be rebuilt at a cost of R280 Million in 2008. Orlando Stadium has a capacity of hosting 40 000 spectators. The stadium is located in Soweto, a township in the south of Johannesburg South Africa. Orlando stadium is the home of Orlando football club, a football team that participates in the South Africa's Premier Soccer League. Other than being the home of Orlando Pirates Football Club, Orlando Stadium has gained popularity for hosting major sports and entertainment events. Over 3000 construction jobs were created during its construction, training was being provided by certified local Skills Education and Training Authorities, more than 150 workers received certificates in various construction competencies and most importantly, over 50% of the artisans who worked on the site hailed from the townships of Orlando, Mzimhlophe, Diepkloof and surrounding areas. According to SouthAfrica.info (2014) over half of the workers were women and youth.

Johannesburg Development Agency JDA (2013) announced that they have undertaken public upgrades in Orlando East on the strip of land near Orlando Stadium; this strip of land is between the police station, train station, post office and the clinic. Upgrades have also taken place on the public parking along Mooki street include installation of kerbs, asphalt surfacing, paving and street lighting. The JDA opines that these upgrade serves as a social, friendly environment for the community to relax. However a big public debate in South Africa and indeed the Soweto area is if or not the money spent on the construction and subsequent regeneration of these areas makes any difference to the lives of the local residents. This is the focus of this report and the next section details the findings thereof.

4. Material and Methods

In attempting to proffer answers to the question of if or not the Orlando Stadium in Soweto has any social impact on the lives of the residents, both interviews and questionnaire surveys were used in addition to the findings from the literature review. Descriptive data shows the basic indications of the responses from the respondents while the impact of the stadium was regressed on the non dependent variables.

For this study, measuring 'social impact' used the guide by the London Business School LBS and the New Economics Foundation NEF (2004) guide to reduced 'Social Impact' into constructs such as 'support of local sporting clubs', 'feeling of civic pride', 'frequency of attendance of community meetings', 'awareness of community regeneration and improvement plans', 'feeling of community cohesion' and 'knowledge of street names and awareness of local businesses.

From the 19 interviews conducted, it emerged that the top 5 reasons for the perception of a lack of social impact on the part of the residents of the Orlando stadium area are 'short durations of stay', education or training levels, income, distance from the stadium and ownership status. These assertions were further tested by questionnaires administered on 500 residents within 500 meters of the stadium. 153 responses were received making a response rate of 30%. 22.64% of the respondents were over 40 years old, 24.53% owned their building outright and just over half 50.65% of the respondents lived with 200 meters of the stadium. It was observed that just over a third (35.85%) of the respondents were employed and 64.15% of the respondents were unemployed. 24.53% of the respondents were still studying towards a matric qualification (lower education), 43.40% of respondents had matric (GCSE equivalents) as their highest qualification, 26.42% had a college qualification and 5.66% of respondents were university graduates.

The first inferential statistical step conducted was an internal consistency test using the Chronbach's alpha function on SPSS 22. The results are shown on Table 2. It is seen that the responses have a high level of internal consistency at 0.763.

Table 2: Chronbach's alpha

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.763	.781	5

A more detailed test showed that the consistency could be improved if the 'employment status' and 'qualification status' variables were removed. This means that the response to this variable was not as consistent. Hence these two variables were not included in the regression analysis conducted thereafter.

The Pearson product-moment correlation coefficient, a measure of the strength and direction of association that exists between two variables measured on at least an interval scale analysis was conducted, the results as shown on Table 3. The data shows that there were strong positive correlations between perception of social impact and the three independent variables i.e. ‘ownership status’, travel duration from residence to Orlando’ and ‘the duration of residence at Orlando’. The strongest correlation was found between the perception of the social impact on ownership status at 0.621 (r=. 621, n=153. P<. 0005) as shown below.

Table 3: Correlation analysis

		SOCIAL IMPACT ON COMMUNITY	OWNERSHIP STATUS	TRAVEL DURATION FROM RESIDENCE	DURATION OF RESIDENCE AT ORLANDO
SOCIAL IMPACT ON COMMUNITY	Pearson Correlation	1	**.621**	-.220	.532
	Sig. (2-tailed)		.000	.003	.000
	N	153	153	153	153
OWNERSHIP STATUS	Pearson Correlation	.621	1	.410	.764
	Sig. (2-tailed)	.000		.003	.005
	N	153	153	153	153
TRAVEL DURATION FROM RESIDENCE	Pearson Correlation	-.220	.410	1	.135
	Sig. (2-tailed)	.003	.003		.005
	N	153	153	153	153
DURATION OF RESIDENCE AT ORLANDO	Pearson Correlation	.532	.764	.135	1
	Sig. (2-tailed)	.000	.005	.005	
	N	153	153	153	153

It is widely accepted that although correlations indicate relationships, it doesn’t show the direction or nature of the relationship between variables. Hence the next analyses were simple linear regressions on the three significant independent variables identified above. Simple linear regressions were used because the dependent variables are few (only three) and this will make the analysis easier to handle and interpret. The results are shown on Tables’ 4 to 6.

Table 4a provides the R and R^2 value. The R-value is 0.526, which represents the simple correlation. It indicates a good degree of correlation. The R^2 value indicates how much of the dependent variable, "Social Impact", can be explained by the independent variable, "Duration of stay around the stadium". In this case, 26.9% can be explained, which is considerably large.

Table 4a: correlation between 'duration of stay' and respondents perception of social impact

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.526[a]	.277	.269	.32283

a. Predictors: (Constant), **DURATION OF RESIDENCE AT ORLANDO**

The coefficient part of Table 4a shows the values used for the regression equation. The equation takes the form of independent variable = slope * independent variable + intercept. In the case of this paper, the dependent variable is 'social impact'. The independent variable is 'duration of stay within the Orlando stadium area', the slope equals 5.015 and the intercept (found at the intersection of the of the line labelled 'constant' and the column labelled B) equals 11.040. Putting all together, the 1st regression equation is:

Predicted value of 'perception of social impact' = 5.015 X value of 'duration of stay around Orlando + 11.040. **(Equation 1)**

That means if a person has a duration score of 2 (i.e. 2 years), we would estimate that their perception of the social impact of the stadium score could be given as

5.015 X 2 + 11.040 = 21.07.

Table 4b: Simple linear regression between the 'perception of social impact' and duration of stay

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.040	4.322		3.225	.002
	DURATION OF RESIDENCE AT ORLANDO	5.015	.467	.432	2.230	.000

a. Dependent Variable: **SOCIAL IMPACT ON COMMUNITY**

Same analysis was replicated for the distance and ownership status variables and the results showed that they both significant relationships. As designed in the questionnaire, the distance variable analysis showed also that the nearer a respondent lived to the lower their perception of social impact. The results of the analysis of this variable were however treated with caution because of the slight significance it returns. It is opined that the reason for this is due to the seeming confusion between distance from the stadium and the duration of travel to the stadium. Further analysis is proposed to ascertain this potential anomaly.

Table 5a: correlation between 'distance from Orlando' and respondents perception of social impact

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.-171[a]	.-029	-.0218	4.3718

a. Predictors: (Constant), **DISTANCE FROM ORLANDO**

Table 5b: linear regression between the 'perception of social impact' and Distance from Orlando

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	17.130	6.097		11.662	.000
	DISTANCE FROM ORLANDO	7.010	.350	.828	7.198	.001

a. Dependent Variable: **SOCIAL IMPACT ON COMMUNITY**

The respondents were asked about their ownership status with 5 options which were: 'owning outright', 'owning through a mortgage', 'renting privately', 'renting publicly' and lastly 'living with relative.' Tables' 6a and b shows the regression results for the ownership status variable. It is seen that the outright homeowners are more inclined to see the presence of Orlando stadium and a socially impactful development. From Table 6a it is seen that 39% of the response can be explained by if or not they own their house in Orlando and according to Table 6b, every unit of increase in the perception of social impact of the stadium is caused by an increase in 'ownership status'.

Table 6a: correlation between 'ownership status' and respondents perception of social impact

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.627[a]	.393	.390	4.3229

a. Predictors: (Constant), **OWNERSHIP STATUS**

Table 6b: Simple linear regression between the 'perception of social impact' and Ownership status

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.135	7.149		7.633	.000
	OWNERSHIP STATUS	7.011	.676	.621	4.151	.003

a. Dependent Variable: **SOCIAL IMPACT ON COMMUNITY**

5. Conclusion

Mega event sporting centers have been seen to have the potential to contribute positively to the host community in a number of ways. Some of mega event centers can have a negative effect as suggested by Madden (2006). It has also been seen that there is a seeming lack of attention given to the study of the impact of such events on the communities hosting them. This work has focused on the Orlando Stadium in Soweto, Johannesburg. The paper has ascertained that the stadium has a social impact on the residents of the community. The 'measuring social impact' model of the LBS was adapted to the research and the factors that contribute to social impacts were investigated.

The study found that there are three main factors affecting the perception of the respondents on the social impact of the stadium on them. These factors are 'how long they have lived in the area', their house ownership status and the distance of their houses from the stadium.

It is further implied by this paper that one of the best ways of improving the residents perception of social impact of the stadium would be to assist residents towards home ownership in the area as it emerged that home ownership is a major contributing factor to social impact. It can also be similarly argued that once a person owns a home in the area, they will tend to reside there for longer. This is however in line with one of the other findings, which show that, the length of stay of the residents affected their perception of the social impact.

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An Overview of Municipal Solid Waste Management in Developing and Developed Economies: Analysis of Practices and Contributions to Urban Flooding in Sub-Saharan Africa.

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Abstract

Different natural and anthropogenic factors have contributed to increased flood events in recent times. Studies have noted the impact of municipal solid waste management (MSWM) practices on increased flooding. Increases in population, economic growth and rapid urbanisation, especially in developing countries, have led to increased waste production. Despite economic growth, countries in the Southern hemisphere are struggling to cope with the levels of waste generated in their cities. This paper presents global differences in waste generation, composition, legislation and general practices based on existing literature. An understanding of the relationship between MSWM practices and urban flood risk is significant in order to save lives, properties and reduce the direct and indirect effects of environmental degradation. This paper reviews the various MSWM practices and critically studies the constraints and challenges in Nigeria. Nigeria, the most populous African country, the largest economy in Africa and the 26th-biggest economy in the world has a history of flooding and unsustainable waste management practices. This research reveals a gap in knowledge about the contribution of MSWM practices to urban flood risk, and will act as the basis for future research around their relationship.

Keywords:

cities, developing countries, municipal waste, Nigeria, urban floods

1. Introduction

Across all continents, flood events have increased in recent years from a variety of causes including changes in weather events but equally from activities relating to urbanisation (Jha *et al*., 2011). Rapid urbanisation, climate change, increased variation in precipitation and poor town planning (construction of informal settlements near floodplains, rivers and drainage channels) are some other reasons given by researchers for increased cases of flooding.

Among the identified anthropogenic factors, researchers (Boadi and Kuitunene, 2003; Bras *et al*., 2009; Muñoz-Cadena *et al*., 2009; Dodman *et al*., 2011; and Lamond *et al*., 2012) have observed waste frequently leads to blockages in drainage and watercourses. This causes practicable negative effects on the environment, in particular urban pluvial flooding, pollution by emissions into surface water and groundwater, and the resulting risks to human health and property. Blockages of urban drainage systems by wastes increases frequency and severity of flood events, and are a particular difficulty in developing countries (Lamond *et al*., 2012).

World Bank (2012) estimates municipal solid waste (MSW) generation levels to double by 2025. It is necessary to investigate how sub-Saharan African (SSA) cities would cope with population growth, rapid urbanisation and industrialization which are the causative factors for increased levels of waste production. Hence, this paper considered municipal solid waste management (MSWM) in Nigeria, a developing country in SSA by studying existing literatures, policies and data. Rapid urbanization especially in low-income countries includes the rapid growth of cities and metropolitan areas (Zurbrügg, 2002).

Article 3 (1) of the 2008 Waste Framework Directive (Directive 2008/98/EC) defines "waste" as: "…any substance or object which the holder discards or intends or is required to discard…" (DEFRA, 2012). Solid waste is any unwanted or discarded material that is not liquid or gas (Miller, 1997). MSWM is the collective process of sorting, storage, collection, transportation, processing, resources recovery, recycling and disposal of waste in urban areas (Abila and Kantola, 2013; Ogwueleka, 2009).

Municipal solid waste in this research includes residential, industrial, commercial, institutional, municipal, and construction and demolition waste in conformity with United Nations (1992). Waste disposed by individuals, community and non-governmental groups instead of local authorities are included as MSW in this study.

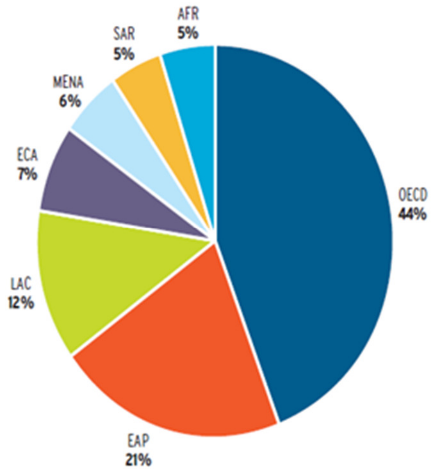
MSWM is a major problem in most developing countries (Parrot *et al*., 2009). This paper investigates waste management legislation and practice in Nigerian cities because studies (Lamond *et al*., 2012; Babayemi and Dauda, 2009; and Onwughara *et al*., 2010) have indicated that inadequate infrastructure for MSWM presents a challenge to flood risk management. In the context of this research, the relationship between MSWM practices and flood risk management (FRM) was investigated in order to understand the contributions of MSWM practices to increased flood events.

2. Global Waste Generation

0.49 billion tons of MSW was generated in 1997 with an estimated annual growth rate of 3.2–4.5% in developed nations and 2–3% in developing nations (Suocheng *et al*., 2001). World Bank (2012) estimated that 1.3 billion tonnes of waste are produced each year which is expected to increase to approximately 2.2 billion tonnes per year by 2025. MSW generation is influenced by the level of economic development, population demographics, industrialization, public habits and local climate. Petts and Edulijee (1994) agreed that the state of the economy influences waste generation.

UN-HABITAT (2010a) agreed that urban population now exceeds those residing in rural areas across the globe. Urban residents produce about twice as much waste as their rural counterparts (World Bank, 2012). OECD countries produce almost half of the world's waste, while Africa and South Asia produce the least waste (Figure 1) (World Bank, 2012). This contrast in waste volumes could be attributed to differences in socio-economic status and socio-cultural attitude towards solid waste management.

China is responsible for 70% of 270 million tonnes of waste generated each year in East Asia and the Pacific Region, and overtook the United States of America in 2004 as the world's largest waste generator (World Bank, 2012). World Bank (2012) estimates that in 2030, China will likely produce twice as much MSW as the United States of America (Table 1). These estimates of increased waste generation in China could be connected to higher income level, high rate of urbanization and population.



AFR: Africa region here refers to sub-Saharan African
EAP: East Asia and Pacific region
ECA: Europe and Central Asia region
LAC: Latin America and the Caribbean region
MENA: Middle East and North Africa region
OECD: Organisation for Economic Co-operation and Development
SAR: South Asia region

Fig 1: Current Waste Generation by Regions (World Bank, 2012)

Table 1: Waste Generation Projections for 2025 by Regions (World Bank, 2012)

Region	Current Available Data			Projections for 2025			
	Total Urban Population (millions)	Urban Waste Generation		Projected Population		Projected Urban Waste	
		Per capita (kg/capita/day)	Total (tons/day)	Total Population (millions)	Urban Population (millions)	Per capita (kg/capita/day)	Total (tons/day)
AFR	260	0.65	169,119	1,152	518	0.85	441,840
EAP	777	0.95	738,958	2,124	1,229	1.5	1,865,379
ECA	227	1.1	254,389	339	239	1.5	354,810
LCR	399	1.1	437,545	681	466	1.6	728,392
MENA	162	1.1	173,545	379	257	1.43	369,320
OECD	729	2.2	1,566,286	1,031	842	2.1	1,742,417
SAR	426	0.45	192,410	1,938	734	0.77	567,545
Total	2,980	1.2	3,532,252	7,644	4,285	1.4	6,069,703

Cities in India generate high proportion of wastes due to greater economic prosperity and increased urban population. Mumbai generates 8,000 tonnes per day, Delhi 6,000 tonnes per day; Chennai 4,000 tonnes per day and Hyderabad produce 2,200 tonnes per day (Chattopadhya et al., 2009). World Bank (2012) attributed the highest per capita rates of wastes produced in Latin America and the Caribbean to the tourism industry and a complete accounting of all wastes generated. Manaf et al. (2009) highlighted the relationship between population growth and solid waste generated in Peninsular Malaysia.

The proportion of Africa's population living in urban areas increased from 24% in 1970 to 40% in 2010, and is expected to reach 50% by 2030 (UN-HABITAT 2010a and 2010b). SSA generates an estimated 62 million tonnes of waste per year (World Bank, 2012). Urbanization is jump-starting industrialization and the 40 % of Africa's population that now live in cities, produces 80 % of its GDP (UN-HABITAT, 2010b). UN-HABITAT (2010b) cited 61.7% of the urban population of SSA live in slums where there is an absence of social amenities. Smit and

Parnell (2012) agreed that the growth of 'slums' is the most tangible manifestation of Africa's urban malaise.

The above listed statistics indicate that growth in urban areas is in tandem with increase in population and waste generation. It is evident that there is unsustainable population growth in urban areas in most developing countries which has led to increased levels of waste production. Waste generated in cities vary in composition and volume from location to location and within a location.

3. Global Waste Composition

Composition of waste affects the collection, storage, and transportation of wastes. Knowledge of waste composition is important in order to implement the most appropriate treatment and disposal process (McDougal *et al*., 2001). Wastes generated in developing cities are heavier, wetter and more corrosive than those from developed cities (Ogwueleka, 2009). This could inhibit the effectiveness of compaction vehicles used for collection and transfer of waste. The developed cities of the world are able to balance the negative impacts of urbanisation, industrialization and population growth using environmental legislation and appropriate mitigation.

Waste generation rates ranged from 0.66kg/cap/d in urban areas to 0.44kg/cap/d in rural areas of developing countries as opposed to 0.7-1.8kg/cap/day in developed countries (Cointreau, 1982). Wastes generated in developing countries have high organic content (more than 50%) and a low energy value (3,350–4,200 kJ per kg) (CPHEEO, 2000). The USA (65%) and Western Europe (48%) generate higher quantities of paper and plastics compared to those from developing countries (IGES, 2001). The largest generator of waste in the United Kingdom in 2004 was from the construction and demolition industry (32%) (Fischer *et al*., 2011).

3.1. Waste Generation and Composition in Nigeria

Population is distributed at 48.3% urban and 57.7% rural and population density at 139 people per square km in Nigeria (Ogwueleka, 2009). Lagos grew from 252,000 in 1952 to 10.5 million people in 2010, and is projected to be 15 million by 2020 (UN-HABITAT, 2010b). 25 million tonnes of MSW are generated annually in Nigeria (Ogwueleka, 2009). The evidence above suggests that due to increased urbanisation and population, waste generation is likely to accelerate more in SSA countries such as Nigeria than other parts of the world.

Table 2 below highlights the volumes and densities of waste generated in 9 major cities in Nigeria. The density of solid waste in Nigeria ranged from 250 kg/m3 to 370 kg/m3 higher than those in developed countries (Ogwueleka, 2009). Waste management challenges in Abuja Municipal Area are linked to population growth and the high number of construction projects (Oyeniyi, 2011). 2,000 Council workers in Abuja are faced with considerable challenges on MSW collection and disposal especially in sub-urban districts and clusters of satellite settlements (Oyeniyi, 2011).

Nsukka (waste density 370 Kg/m^3), a city surrounded by agrarian areas is significantly different to the more cosmopolitan city of Lagos (waste density 294 Kg/m^3) (Table 2). Lagos State Waste Management Authority (LAWMA) classified majority of the waste types generated and collected in Lagos into: vegetable matter, putrescibles, paper, textiles, metal, plastics, glass, grits, miscellaneous, inert, tyres and others (Adewole, 2009). However, experiential knowledge indicates water packaged in plastic sachets (*pure water*) for human consumption, polyethylene shopping bags and plastic drink bottles constitute a compelling source of waste in Nigerian cities.

Table 2: Urban Solid Waste Generation in Nigeria (Ogwueleka, 2009).

City	Population	Agencies	Tonnage (monthly)	Density (Kg/m^3)	Kg/capita/ day
Lagos	8,029,200	Lagos Waste Management Authority	255,556	294	0.63
Kano	3,248,700	Kano State Environmental Protection Agency	156, 676	290	0.56
Ibadan	307, 840	Oyo State Environmental Protection Commission	135,391	330	0.51
Kaduna	1,458, 900	Kaduna State Environmental Protection Agency	114, 433	320	0.58
Port Harcourt	1, 053, 900	Rivers State Environmental Protection Agency	117, 825	300	0.60
Makurdi	249,000	Urban Development Board	24, 242	340	0.48
Onitsha	509, 500	Anambra State Environmental Protection Agency	84, 137	310	0.53
Nsukka	100, 700	Enugu State Environmental Protection Agency	12,000	370	0.44
Abuja	159, 900	Abuja Environmental Protection Agency	14, 785	280	0.66

3.2. **Waste Legislation**

Effective waste legislation is not only beneficial to citizens and governments but contributes to economic advancement while protecting the environment. Differences in MSW legislation between developed and developing countries were analysed using the United Kingdom and Nigeria as case studies. Nigeria is Africa's largest economy, fastest urbanizing and most populated country (Bloomberg, 2014 and United Nations, 2014), with chronic MSWM problems. On the contrary, the UK has significantly reduced landfilled MSW from 80 % in 2001 to 49 % in 2010 (Watson, 2013).

In 2001, before the EU Landfill Directive came into effect in England and Wales, around 84 million tonnes of waste was sent to landfill, which means a 23% reduction when compared to 65 million in 2007 (DEFRA, 2008). Municipal waste sent to landfill has decreased from 25 million tonnes in 2010 to 20 million tonnes in 2012 (DEFRA, 2013). These reductions in waste volume are connected to the enforcement of the European Union Waste Framework Directive.

EU Waste Framework Directive, revised in 2008, streamlines waste management in the Member States in order to limit the generation of waste and to optimise the organisation of waste treatment and disposal (EC, 2010). EU policies aim to reduce the environmental and health impacts of waste and improve Europe's resource efficiency (EC, 2010). Prevention of wastes; preparation for re-use; recycling of wastes; other recovery methods such as energy recovery; and waste disposal in descending order is the preferred hierarchy of options in the EU policy.

Developing countries including Nigeria viewed global environmental concerns in the 1970's with suspicion (Nwufo, 2010). Nigeria and Italy were engaged in a diplomatic dispute due to the dumping of 8,000 drums of hazardous waste in Koko, (a small Nigerian port) by an Italian ship. Aftermath of this incident changed the way wastes were viewed in Nigeria, prompting the development of the national policy on the environment and enactment of legislations to back it up (Ogbodo, 2009).

Federal Environmental Protection Agency (FEPA) Act enacted by Decree 55 of December 30th 1988 and Decree 59 (amended) of 1992 was created and charged with the administration and enforcement of environmental law in Nigeria (NESREA, 2014). Prior to this incident, environmental legislation was covered under unrelated laws on distinct topics, such as, "wild animals," "sanitation," "National Parks," and "domestic personal hygiene (Ogbodo, 2009).

The National Environmental Standards and Regulations Enforcement Agency (NESREA) established by section 20 of the 1999 Nigerian Constitution in 2007 is responsible for enforcing environmental laws, guidelines, policies, regulations and standards (Federal Ministry of Environment, 2015). There are 11 laws and regulations used by NESREA to enforce compliance with provisions of the Nigerian Constitution, international agreements, protocols, conventions and treaties on the environment (NESREA, 2014).

3.3. **Municipal Solid Waste Collection and Disposal**

Certain deficiencies inhibit efficient waste collection, segregation storage and transportation in developing countries. Factors such as nature of local activities, food habits, cultural traditions, socio-economic factors, climatic conditions, and seasons determine the waste components (Chattopadhya *et al*., 2009). Abila & Kantola (2013) cited the connection between ineffective governance, low quality living standards, limited level of environmental awareness and poor domestic waste practices.

Municipal waste management systems in Indian cities are often unscientific and chaotic (Chattopadhya *et al*., 2009). There is ineffective MSWM in most of the developing countries notably the absence or limited level of resource recovery such as formal recycling schemes. Anecdotal evidence suggests that *pure water* sachets contribute to urban pollution in Nigeria due to the absence of formal recycling facilities. Only 8% of the wastes generated in Nigeria are recovered for reuse (Ogwueleka, 2009). Waste scavengers are responsible for collection of recyclable prior to the disposal of the waste in developing countries.

The type, condition and location of collection and disposal facilities influence MSWM practices. Yunus and Kadir (2003) agreed that most of the landfill sites used for MSW in Malaysia are open dumping areas pose serious environmental and social threats. Lack of sanitary landfills means that majority of waste collection and disposal in Kenya do not meet environmentally safe MSW disposal levels (Henry *et al*., 2006). Residents of Ikoyi and Victoria Islands in Lagos cited inadequate waste facilities as their reason for dumping waste in drainage canals (Folorunsho & Awosika, 2000).

Socio-economic, socio-cultural and socio-political factors influence urban waste collection, disposal and treatment. It is common to see outsiders deposit waste in poorer locations considered marginal (Davis, 2006). Friends of the Earth (2004) argue that poorer communities tend to be hit hardest by environmental pollution, by highlighting that 50% of operating municipal waste incinerators in England are located in the most deprived 10% of wards. Despite the relocation of environmental problems away from wealthy locations, citywide and regional environmental degradation, due to a poor MSWM, remains or increases (Zurbrügg, 2002).

Chattopadhya *et al*. (2009) found the collection points in Kolkata, India, are in poor conditions due to a lack of awareness and maintenance. The waste transport system is inefficient due to unreliable vehicles and residents dispose waste haphazardly at the collection points soon after removal of waste (Chattopadhya *et al*., 2009). Unskilled personnel, political interference and economic constraints are obstacles to efficient MSWM in developing countries.

Henry *et al*. (2006) cited that Kenyan politicans pursue the interests of their parties when voting or making decisions. Zurbrügg (2002) listed bureaucratic confusion and delays due to a multitude of agencies and political interference as main challenges to MSWM in Asia. Despite the overlap in MSWM responsibilities between the different levels of governments in Nigeria, LAWMA has improved MSWM within Lagos State but it still falls below the required standard in developed countries.

Zurbrügg (2002) cited public private partnerships (PPP) due to inefficient municipal systems or by pressure from national governments and international agencies as an alternative. Outsourcing of MSWM duties to profit making organisations requires urban authorities to supervise and penalize the companies if required. The successful use of PPP recorded in Chennai, India as noted by Zurbrügg (2002) may not be applicable in other countries. PPP have been introduced by different levels of government in Nigeria with mixed levels of success.

3.4. **Urban waste and flood risk**

Halley (2001) cited inadequate drainage facilities as the major cause of floods in Africa. Climate change is directly and or indirectly increasing the amount of rain and ice melting that is increasing the amount of runoff (Adetunji and Oyeleye, 2013). Rise in flood risk is connected to the proportional increase of a catchment's impermeable surface area due to urbanisation (Swan, 2010).

Continuous construction of properties on floodplains and low lying coastal areas is a direct consequence of rapid urban growth especially in developing countries. There are questions about the management of wastes generated from these properties in SSA. Due to rapid urbanisation in recent years, many existing waste disposal sites have been encircled by settlements and housing estates (Zurbrügg, 2002).

Certain MSWM practices increases the risk level thereby exposing people to different hazards which promote environmental vulnerability. Uncontrolled dumping of waste in watercourses is a common problem that leads to flooding in Malaysia (Manaf *et al*., 2009). Chattopadhya *et al.* (2009) found that in certain locations in Kolkata (boroughs 11–15), which still have some open space, a large quantity of waste is disposed of in open canals and drains, or dumped into low–lying areas instead being collected.

Understanding the relationship between MSWM practices and flood risk is vital in order to evaluate the contributions of the practices to increased flood events. Accumulation of debris and waste on the streets that is then washed into the drainage system can lead to surface and property flooding. Indiscriminate dumping of uncollected waste in the streets and in drains which mixes human and animal excreta contributes to flooding (Zurbrügg, 2002).

Two-thirds of Lagos residents live in slum communities of different sizes, spanning from clusters to large districts (Morka, 2007). MSW are highly desirable resource in Badia, a large slum. Ajibade and McBean (2014) highlighted the use of waste for flood control in Badia during heavy rains and storm surges. This practice called waste-filling is a cheaper option to sand filling when constructing a foundation for a house and it generates income for garbagecollectors and unauthorized developers who waste-fill parts of the canal for sale (Ajibade and McBean, 2014).

Waste filling in Badia pollutes the local environment and exposes residents to flood risk because Lagos is a coastal city with a history of flooding due to a low-lying terrain. Environmental vulnerability in Badia is on the increase due to the destruction of natural buffers against flooding, blocked available drainage systems, and increased housing subsidence. Henry *et al.* (2006) cited cases in Kenya whereby Nairobi River and Nairobi Dam were polluted by MSW generated from the nearby slums.

Wastes are usually dumped on roadsides, available open pits, flowing gully water and drainage channels in Nigeria (Babayemi and Dauda, 2009; and Onwughara *et al.*, 2010). Residues from waste incineration and wastes deposited in uncontrolled and unregulated landfills/dumpsites are often carried away by urban water runoff thus increasing flood risk. The absence of waste transfer stations makes it difficult to compact wastes thereby exposing them to high winds. Wastes on transit that are dispersed during moderate and high winds, and tropical rain often end up in waterways and canals thereby compromising the natural drainage system.

Developing countries are susceptible to illegal dumping of hazardous wastes which in certain cases end up in watercourses. This could damage water pumping stations meant for flood control thereby clogging storm drains and inland waterways leading to flash floods after heavy precipitation. Olurominiyi (2008) cited the construction of the hazardous waste landfill in Dakar close to the water network. This is a direct hazard to drinking water supply of the estimated 2.5 million residents.

MSW inhibit the natural flow of water, contaminate surface and groundwater. The unreliable nature of the waste fills as a structural base could lead to land and housing subsidence in Badia. Waste sites become a sanctuary for vectors that transmits communicable diseases. An outbreak of diarrhoea in Kenya was traced to a vegetable farm due to MSW dumped upstream which contaminated surface water used for irrigation (Henry *et al.*, 2006). Accelerated growth of water hyacinth (*Eichhornia crassipes*) in Lake Victoria was partly connected to MSW disposal (Ecoforum, 2001).

Certain studies have proposed solutions for improving MSWM but have failed to adequately address the source-pathway-receptor link in relation to MSW and flood risk. For instance, Folorunsho & Awosika (2000) recommended a comprehensive drainage rehabilitation plan in order to solve the clogging of the drainage channels in Lagos by MSW. This solution is inadequate and not inclusive because in most informal settlements there is remarkable absence of drainage facilities.

4. Discussion

Evidence from the above literature reveals the contrasting state of MSWM in developing and developed countries. The review identifies that enforcement of MSW legislation is weak and operational policies are outdated and ineffective in many developing countries. Systemic management of waste is challenging in the absence of effective waste legislation (Gertsakis and Lewis, 2003). Appropriate waste legislation could improve MSWM practices in the Southern hemisphere.

State and local governments in Nigeria use legal frameworks to establish environmental agencies such as Lagos State Waste Management Authority (LAWMA) and Abuja Environmental Protection Board (AEPB), for the protection and improvement of the environment within their jurisdictions. These agencies have not solved the problems of

MSWM. Major components of MSW in Nigeria are unclear and the trajectory of MSW composition is likely to change with urbanisation.

The provision of basic services in waste management is an uphill task for many municipalities (Zurbrügg, 2002). The provision of facilities alone would not solve the problems of indiscriminate dumping of waste. A comprehensive understanding of the relationship between MSW and urban flooding is required. Research findings indicate a more complicated relationship than previous works suggests. Neglecting social components and priorities in waste management practices would lead to failure (Dijkema *et al.*, 2000; Morrissey and Browne, 2004; and Petts 2000).

Researchers have different opinions on how the awareness, attitude and behaviour of residents towards environmental issues are influenced by demographics. Fortman and Kusel (1990) found that women were more ecologically active than men. Herrera (1992) concluded that both groups did not differ in their environmental values. Young people have been found to litter more than older ones and males more than females and people who are alone litter more than those in groups (Bell *et al.*, 2001).

Environmental awareness through education is a non-structural measure that could prepare people to manage urban floods. Preparedness education that emphasizes on keeping drains free of wastes is part of the flood risk mitigation efforts in Mozambique (Jha *et al.*, 2011). There is need to investigate if contributions of MSWM to increased flood risk could be minimized by increasing the awareness, improving the attitude and behaviour of residents towards waste. Conclusions were drawn using available literature assessed in this research.

5. Conclusion

The purpose of this study was to examine MSWM practices and investigate their contributions to increased flood events. After a critical review of available literature, an understanding of the poor state of MSWM in developing countries was gained and knowledge gap on relationship between MSW and flooding identified. The research agrees with previous studies that neglecting social components and priorities in MSWM practices would lead to failure. There is need for more research to understand why individuals and organisations have failed in adhering to, and enforcing the various waste regulations.

MSWM is at unsatisfactory levels in developing countries despite generating lower quantities of waste. Significant contrast exists in the composition of wastes generated in developed and developing countries. Developed countries are witnessing a reduction in landfilled waste due to effective MSW legislation, provision of necessary facilities and others. Further research would need to investigate if this could be connected to the higher density of wastes generated in developing cities.

Available literature indicates that impacts of increased flood events due to progressive urbanisation are not limited to developing countries but the effects are felt more in these countries in part to poor MSWM. Open dumping of wastes, deposition of wastes in uncontrolled and unregulated landfills, open burning of wastes in unauthorised locations and in landfills increases flood hazards hence promoting vulnerability.

Nigeria has high levels of precipitation especially during the wet season thereby exposing cities such as Lagos that are low lying and highly prone to flooding. The absence of a National Waste Management Plan in Nigeria advances the risk of surface water flooding due to unsustainable MSWM practices in Nigerian cities.

Flooding has a direct impact on the local, regional and national economies. Available research has not provided a clear pathway on how the wastes generated increase the impact of urban floods on individuals, organisations and the environment. Further studies are required to interrogate the knowledge gap particularly on the sources, pathways and receptors of urban floods due to municipal solid waste.

The next stage in this research is to develop a conceptual framework of urban flood risk and municipal solid waste to provide a linkage between them. This would identify critical pathways that can be used to reduce flood impact with emphasis on informal settlements which are particularly a problematic aspect.

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The Influence of Modern Architecture in Transforming Iraqi City Identity

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Abstract

Many Iraqi cities are losing their character and becoming more ambiguous. Basra is the second main city in Iraq after the capital Baghdad; it is the most important economic, cultural, touristic city in Iraq. A city distinguished by its architectural style and identity. However, this identity was threatened many times by external and internal factors leading to distortion or obliteration of the city such as a colonial influence in the early 20th century, modernity movement, policies of old governments, and the three recent wars in 1980, 1991, 2003, have led to a significant effect on society and demography of the city.

After 2003, many of the investment companies in different sectors entered Basra city to carry out different projects. These companies adopted foreign, alien designs, which reflect their ideological culture. However, it was far from a city spirit, didn't respect the city's history and identity, and didn't care for the culture and traditions of the city.

The aim of the paper is to justify the need for an urban design strategy framework that should guide authorities and professionals for maintaining architectural identity in Iraqi cities while enabling modernization. It adopts the case study research with comparative analysis to measure the influence of modernity on the Basra city identity. The findings achieved in the research so far illustrate that the global modern architecture has played an important role in the transformation of the Basra city identity. Therefore, there is a need for the development of an urban design strategy framework to produce urban design solutions that should consider maintaining identity while enabling modernization.

Keywords:

Identity, architecture, modernity, Basra, Iraqi cities.

1. Introduction

Architectural identity issue has become a real global concern, especially in the last three decades. Many cities have started losing their character and becoming more and more ambiguous. The identity is the mixture of similarities and differences, which generates a sense of distinctiveness for the identity of individuals, groups, and societies by distinguishing themselves from others. Identity is the basis for sense of belonging; it is the way that people could associate themselves as member of communities and groups (Adam, 2012).

Architecture is part of the identity phenomenon so the impacts of changes in buildings and places on communities are critical to maintain the identity. Architectural identity is a cultural phenomenon that could help integrate the social life progression and dialogue from past to the future (Humeyra, 2012). Architectural identity formation could be achieved through interaction between many historical collective factors.

Change in modernity is very common. Hence, change is the human intervention to shift the mores of cultural structure (Heynen, 2000) and architecture is also cultural structure. Subsequently, architectural identity is influenced by this change. There are two types of architectural changes; the first is preservation changes which could be leading to the stability of phenomena generation and, the second type destructive changes which are trying to generate new types of phenomena (Jorge and Nuno, 2012). As Amos Rapoport (1999) says that it is not logical after modern developments if we revive the traditional systems because the originality will be lost or if we full change toward contemporary systems so the result will be a huge waste for communities. Therefore, the hybrid case of communities will continue, as a mixture of traditional and contemporary systems, it will be close to a traditional image sometimes while other times will be closer to a modern image. Frampton (1987) mentioned that critical self-consciousness which involves individuals and groups who borrows from other cultures, so they try dismantling, understanding and adapting with the new, according to their conceptualization and the values systematic. It is a natural issue for communities that seek to conserve their identity. Thus, when searching for architectural identity, one should expect to find several overlapping identities.

1.1. What is Architectural Identity?

Architecture is phenomena of mixing of art and emotions; it is a harmonies issue and creating the "pure spirit" (Vogler, 2006). It is a one of the cultural productions but the problem that it is a tangible product while others are not, in addition it's more stable and remains than the others, especially when the culture changes, which give architecture the ability to express history. Because of that there is a profound interconnection between identity and cultural meaning of the places, so it not easy to measure it. According to Thompson, (1996) architecture is the best way to give identity for people and cities because it describes and reflects the lifestyle for local communities. Determination of architectural identity is not only done by architect, but rather, many others local factors shared by the community in the formation and design process such as the socio-cultural interpretation of the built form by the local people in addition to the built environment contextual conditions. The formation of identity process always builds on previous symbolic images or source of inspiration and never starting from scratch, these are considered as the bedrock of identity formation.

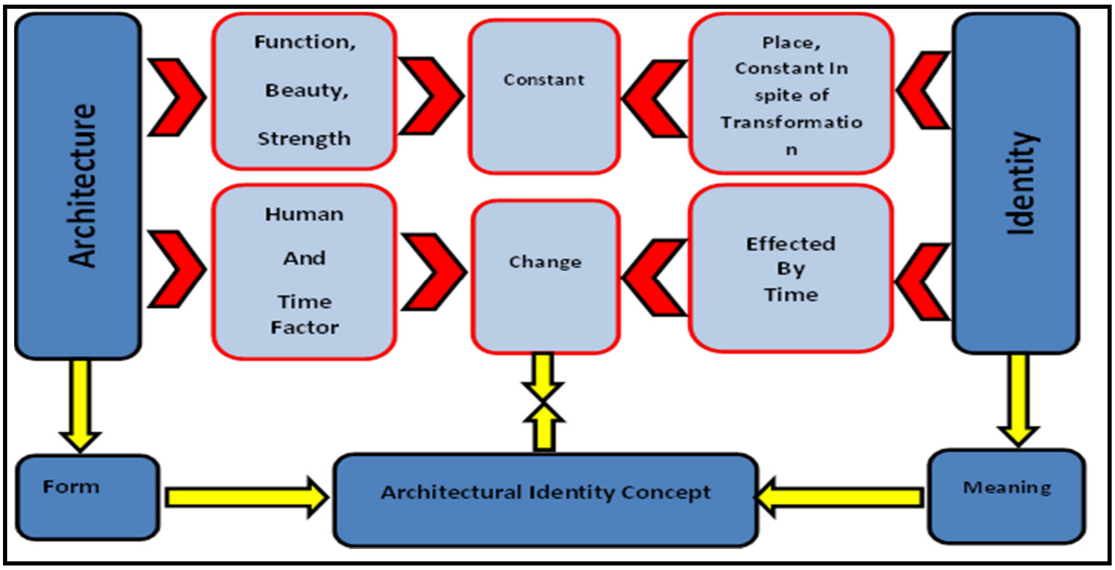

Figure 6: Relation between identity and architecture (Time and Place)

Currently there are two techniques to maintain the local identity in modern architecture, which are the spirit of place and symbolic identity. Spirit of place is related to site- specific design while the symbolic identity is about the architects' personal discovery of local symbolism. Both of them can be used either independent or in mixture (Robert Adam, 2012).

Sometimes, special skills of new architectural design process could introduce a new identity, while at another time an ancient identity which was lost but still strong in the place memory may be recovered through the design process; memory of place may be used by new architecture as a starting point to develop a new identity by introducing new functions. Develop and transform the symbols of the built environment by architects contribute to the formation of the identity for people and communities. So, they have a unique responsibility to do that (Robert Adam, 2012).

The two main references that could be used in architecture to form identity: These are time and space. Time is connected to history while space connected to geography. Time is associated with the concept of tradition and appears as rooted from the past while space provides the physical construction assets that reflect the contextual background of identity. However, the claim today is to make design from a global perspective with no or little consideration of local values and identity figure (1).

1.2. **What is Modernity in Architecture?**

Modernity is the period that expresses historical transformation by linking the historical events, people and ideas through a number of disciplines, periods and locations to build the present meaning (Simon, 2005). It is the movement that gives a particular quality for the present to distinguish it from the past which point the way to the future (Berman 1994). Modernity is a break with traditions and rejects all the heritage of the past. It may also mean the process of selecting elements of other civilizations or cultures, which are different from them. For Habermas modernity is a civilized phenomenon has a numerous forms and logical context with several meanings (Afaya, 1998).

Figure 7: Modern Architecture in Basra City (Mnawi Basha Hotel)

According to Habermas, the Modernization theory is modern forms analysis and assessment in social life. He described that modernity is more than a period. It indicates to the set of different conditions such as social, political, cultural and psychological, which are shaped through historical events (Finlayson, 2005). In architecture, modernism is a term, which describes any new work trying to distort the previous relations and rules of traditions (Stern, 2009), while (Berman, 1994) explains modernity as a non-continuation or alteration of past. It's a new style of power, which could achieve as a new form of human self-conscience. Ibelings (1998) clarifies that the aim of the new modernity is to use separate buildings programs, out of time and place by using technology of globalization in order to change, transform and built an appropriate environment, which reject a cultural background.

2. The Case Study: Basra City

Basra chosen as an appropriate target for this study because of the following points:

- Historically, Basra is the first city established by Muslims outside the Arabian Peninsula, thus it owns an important historical character making it more significant with a distinct civilization and heritage.
- Basra is currently classified as the second Iraqi city after the capital Baghdad, in terms of population and the importance.

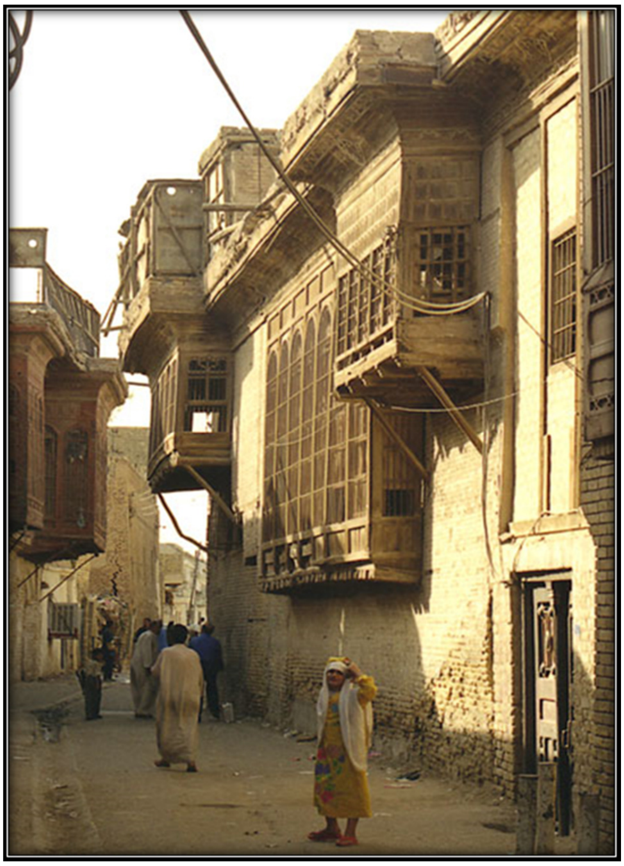

Figure 8: Traditional neighbourhood in the Iraqi cities

- Economically, Basra is the economic capital of Iraq because it contains a multiple fortune; it is a richest oil city in Iraq and one of the richest cities worldwide for oil production too, and this led to:
    - The presence of oil and spread of oil fields around the town influenced on land use plan of the city, where there is a many forbidden areas and other reserved, this led

to restricting the expansion of the city, at the same time, the large population growth that happened during this period has created an enormous momentum in the old city center. This influences on city planning and its capacity, thus impact on the traditional city identity.

  - The oil presence is considered an important attraction factor for workers, therefore the city suffered intense immigration from other regions, especially neighboring regions, to obtain job opportunities, and this in turn has led to a change in the habits and traditions of society, as well as social relations, this led to a social transformation and then to the transformation the architectural identity of the City.

- Basra is the only Iraqi port of the Arabian Gulf. Thus, as with other coastal cities, it's always in the case of direct contact and on-going interaction with other civilizations through friction with the foreign community it affects and is affected by others.
- The strategic site of the city, where it is a border town with three countries that has led to cross-pollination between Basra society and the society of other neighboring communities of habits, traditions and conventions, which in turn has been reflected in social, cultural and architectural city identity.
- Basra city is considered as a magnet for tourists, because it contains historical monuments, in addition to the attractive tourist areas with varied topographical regions, which have attracted visitors and tourists to city. Therefore the identity of the city has a great role to play in enriching this aspect.
- Frequent wars have plagued the city, starting from the First World War to the Second World War and concomitant of foreign occupation, in addition to the three last wars which are clearly reflected in architecture, culture, demographic and social life of the city, all of which have had a dangerous impact on the social, cultural and architectural identity of Basra.
- Multiple and large numbers of investment companies and projects, which entered the city after 2003, especially foreign companies. They often do not respect and don't care for the privacy and identity of the city. Projects with alienated kind and design styles, which are far beyond the spirit of the city and do not reflect cultural identity. Based on all of the above, Basra is considered as a commercial, national, economical, artistic and historical center. In addition, the pluralism of the city makes it a gathering place for multiple cultural, social and architectural identities, which makes the identity of the city threatened and unclear. Furthermore it requires further research and study.

3. City Identity in Urban Design Practice in Iraq

Since the early of past century, most Middle East countries started use modern architecture while ignoring the local architectural identity. Architectural identity could be as a clear tool for political system of any country. The western colonization power had forced the Middle East countries during the colonization period to adopt their cultures and traditions (Al-Sultany, 1982). During the past century, many factors such as colonial, technology development, new materials of building and construction, oil discovery and westernized lifestyle had a major impact on Iraqi cities identity. The discovery of oil in Iraq in 1927 was one of these major transitions, which led to huge transformation in all life aspects such as economic, social, cultural, and architectural. These factors resulted in creation of a modern architectural identity, not related to the traditional, cultural and local built environment and allowed intrusion of foreign traditions without any filtration.

Modernity in Iraq has been a very significant issue of urban development. The contrast between modernity and local traditions and values in the second half of the 20th century became a clear truth in the social life of most Middle East cities. Loss of local identity and spiritless modern development became the main characteristics of the cities.

Wilson, the first British colonial architect named in Iraq as the head of the Public Works Department, He spoke of "the tremendous influence that architecture can have on public life generally but especially on education. Iraq has been the home of a certain style of architecture, which has influenced the rest of the civilized world. However, present circumstances need a new style of building. It is hoped that it will integrate the best of the traditional decorative features. It is also intended to use natural building materials available in the country, so that what is built may truly become an Arab Renaissance" (Caecilia, 2006).

The lack of public awareness was the main reason led to transformation, which were unconsciously moving inside society and changing the local built environment, and consideration of transformation as a kind of liberation form rather than as a problematic one. The rush towards modernization without filtering process was a problem more dangerous than modernization itself. The full idea of architecture with identity will be achieved when the modernity viewpoint towards traditions and past is changing because it is considered all of the historical and traditional set of values should be retired. Therefore, since 1970 most architects around the world have found that it was crucial blunder since their bases of architecture were formed for half of the century and then they began to compensate it by taking inverse steps (Manzoor, 1989).

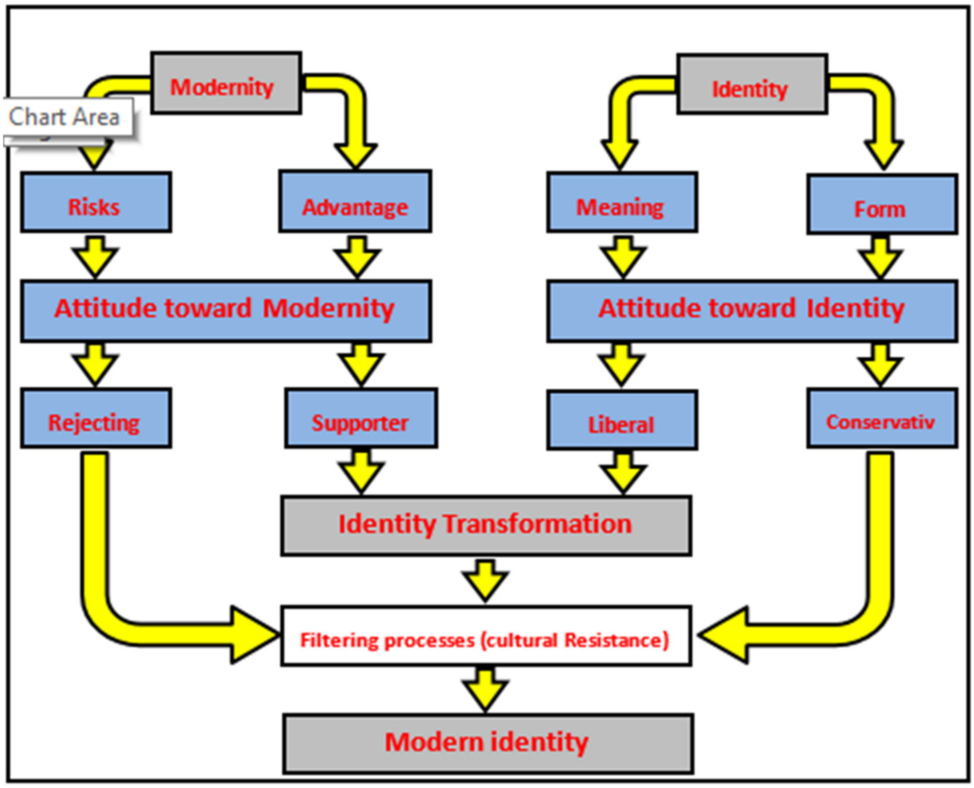

Figure 9: Identity Transformation in the Iraqi Environment

Generally, all Iraqi cities, and especially Basra, there hasn't been enough studies on identity and architecture. However, Basra and other cities have been suffering considerable social, economic, and cultural change and dramatic transformation in the architecture and urban built environment (Ali, 1988). Modernization of the city has not given enough attention of local environmental factors such as social, traditions, habits, values, climate and characteristics of the place. In addition to ignoring the history of the city, the three wars in Iraq that were in 1980, 1991 and 2003 should be seen as the dramatic historical incidents, which influenced on Basra city culturally, socially and architecturally. All these led to loss of the local identity of the city. Due to the lack of studies that deals with the architectural identity of Basra (Bazi, 1989), many attempts of architects have been failed to acquire positive impact on the local identity.

4. Challenge of Basra City Architectural Identity

Basra is a city distinguished by its architectural style and identity, which has made and developed over the time (Bazi, 1989). However, this identity is now prone to deterioration and its unique style prone to extinction. This is Because of the lack of studies to clarify the characteristics of architectural identity in the traditional architecture of the city and benefit for the future design to maintain city architectural identity.

Figure 10: Neglect of Architectural Identity in Iraqi Built Environment

Basra's identity was formed by history, tradition, habits, topography and the climate of the city. In addition to features of Arabic Islamic cities, the cross-pollination with other civilizations through trade or colonial, which has given the city a particular feature that has distinguished it from other cities (Ali, 1988), this identity was threatened many times by external and internal factors at certain times with certain circumstances to transform, distort or obliterate or blunt it, firstly by Ottoman period, British colonization, modernity, and finally globalization. In addition, there are many internal factors such as the policies of previous governments, and the three recent main wars in 1980, 1991, 2003, which led to a significant effect on society and demography of the city. As well as this disappearance, most of the architectural city landmarks were lost due to the dereliction and destruction that occurred during war periods, figure (5).

After 2003 many investment companies entered Basra city with a variety of disciplines to carry out different projects in various aspects. These companies adopted foreign, alien designs, which reflect their ideological culture. However, it was far from the city’s spirit and did not respect the city's history and identity. Moreover it did not care for the culture and traditions of the city, which represents a real dangerous threat for the architectural city identity in particular, and culture identity in general. Because of that, modernity and globalization are necessary in present times. Hence, all people and cities worldwide cannot dispense it. Because Basra city is in significant need of rebuilding and urban regeneration projects especially after the destruction that happened in the city during the wars periods, it is often a necessity after major war when rebuilding a city to focus on new development. Therefore, there is a need to have a framework of guideline that can be utilized in current and future design considering local identity while enabling modernization.

5. Transformation of Architectural Identity in Iraq

The Arab community was suffering from civilizational isolation, then opened up for the world after the First World War, and connected with different civilizations. This impacted on the overall existing civilization and architecture in particular, as a huge number of imported civilization elements had affected the overall architectural character (Makiya, 1982). Connection, and the large number of the newly acquired elements, led to dominate a clear impact on this civilization, especially in architecture, which was the main reason for transformation to modernity that broadly and clearly used in Arabic culture. This was gradually changed to focus on traditional building of the past and was mixed with modern design, which was strange for the local identity, architectural characteristics, cultural heritage, and historical roots. The rationality of modernity failed to protect the old, so mingled with it (Al-Naem, 2001). There were three trends for Western culture’s influence on the Arab architectural region styles, these are explained below:

- Many of the Arabic people have been affected by Western thought, since the artistic imagination succeeded to persuading Arab community, that the modern classic Western style is an integral part of the Arabic culture.
- The second trend had a significant impact for the first architects, who were aware of the negative impact of modernity on the Arab city urban fabric, which focused on the traditional fabric. With the influence of this belief, the traditional build was the essential reason for the spread of identity when they refused public architecture.
- Another group of Arab architects started to refuse this mechanism, which involved mixing between their communities and Western ideas. It was necessary to introduce traditional Architecture in a modern movement, which tried to distinguish parts of the city such as the old places, museums, and public squares, in order to associate the people with originality (Jadraji, 1995).

Iraqi urban environment was also affected by this foreign intellect during the British occupation, the output of architectural identity had been influenced at an urban level according to civilization trends, which imported and used new technologies in construction. Civilizations overlap creates opportunities for the emergence of thought trends on an architectural output level as a reaction to this overlap (Al-Sultany, 1982).

6. Intellectual Trends of Modern Architecture in Iraq and Challenges

Global trends and Western architectural ideas were more common in the fifth decade of last century in third world countries, but it did not continue. Revolutions that happened in the world and a search for privacy and the tendency toward national, political and economic independence, led eventually to a rejection of the modern style for architecture, to meet people's ambitions and aspirations to achieve a better future, and emphases the civilization and cultural bases at the same time (AL-Mullah, 1988). According to the new considerations, the concern of some architects became not to imitate and convey prevailing values in a particular country, or re-copy famous and common architectural compositions. Nor was it to transform it for variety climate, nature, and demographic sites, or different historical values and characteristics. Instead it was to associate with local architectural heritage in order to derive positive elements and recreate it with a contemporary form to keep up with the present and go on for the future (Al-Sultany, 2000). So, some ideas emerged in Iraq, which supported cultures and global arts and what a new in the field of environment. According to that, the architectural intellectual trends that emerged in Iraq as a reaction to external influences were as the following:

- Intellectual trend that supported the foreign currents, especially those who supported the tide of modernity, since philosophy of the current time depends on function. Symbolic and aesthetic aspects achieved in this approach were as a result of the relationship between form and function in modernity, while the need for the symbolic and aesthetic was increasing for postmodernism supporters.
- Intellectual trend that adopted linking, the new with the old, through copying heritage elements. The symbolic aspect is more important, due to deriving the traditional elements from urban environment.
- Intellectual trends that mimic the old elements, and transfer them to a new frame with a clear climate need for this trend, while symbolic aspects were abstract, so it was achieved within a semantic level, As well as this, there was a full achievement of the aesthetic aspect within a semantic level, due to the use of abstract thought (Al-Sultany, 1984).

Iraqi architectural identity passed through transformation processes, due to the change of form and content of architectural products, which were caused by many attempts by architects and urban designers, as well as this, the effect of foreign thought when many foreign architects arrived in Iraq, which supported the change processes, in addition to the political instability of the country (Shirzad, 1987). The existence of the Architectural currents (modernism and postmodernism) led to emergence of architectural cultural resistance, as a reaction to this existence and the transformations that happened. The architectural trends were as a result of internal transformations, which have taken place within the urban environment at structural and semantic level (Al-Sultany, 1984).

creating and formation of new built environment with all of its elements and its relationships, led to internal transformation, when interaction happened between the new built environment and the natural cultural factors of Iraqi urban environment, so trends appeared depend on the degree of distance from the traditional environment (Shirzad, 1987). As a result, supporter trend was further away from locality and closer to modernity, while the imitation trend was taken from traditional environment elements. There was a third approach, which was taken from mixing traditional elements with modern through new style, this approach was very close to postmodernism's current in the Iraqi environment(Al-Sultany, 1985).

7. Comparison between traditional and modern identity:

The paper uses comparative analysis method to discover the differences between old and new architectural identity in Basra city. This method gives possibility for analyzing most design components such as form, space, relations and materials used. It is can be possible to analyze the influence of modernity, globalization and others new movements on the local identity.

Moreover this method gives also more understanding for problems and solutions in urban design.

There are a number of factors used to compare traditional and modern architectural identity in the Iraqi built environment. These are elaborated below.

7.1. **Privacy:**

The issue of privacy was always an important component in Arabic Islamic city design. Privacy is fundamental factor in developing the identity of the built environment. The need for privacy is one of the important desires for human beings. The meaning of privacy in the global society is completely different from the meaning of privacy in the Iraqi society. Therefore, the concepts and principles applied in modern designs were not based on local conditions. The modern designs have ignored local people's needs, habits, customs, religion and social structure, where the privacy remains very important for Iraqi society, especially designing of houses (Losing the courtyard, large windows, and high-rise buildings nearby), which failed to meet the households' need for privacy, figure (6).

Figure 11: Privacy in Iraqi Traditional House

7.2. **Social relationships:**

Current changes in architecture are not only affecting the appearance of buildings but also the social and cultural life of people. Concept of neighborhood, as it was known in the traditional city, missed in the modern districts because of big plots, high fences, wide streets, and busy lifestyle. The traditional neighborhood, where people enjoy social life with others, working, studying, shopping, and socializing with others is not found in modern districts. Social relations between people became weaker and people enjoy spending times in malls and hotels even meeting their friends there instead of their own houses. Dependence on the car as the main unit for city planning lead large scale environment does encourage human interaction figure (7).

Figure 7: The Social Relationships in Iraqi Neighborhood

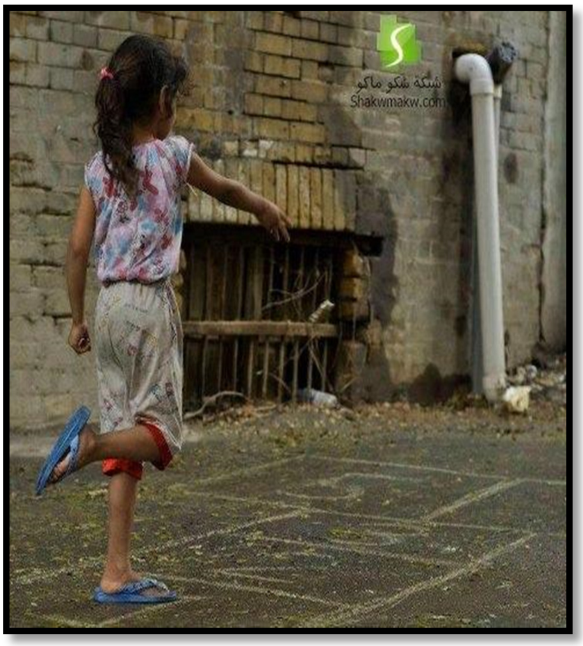

Figure 8: The safety of Traditional Environment

7.3. **Safety of environment:**

The good architecture would satisfy the necessary needs of its users such as safety and reasonable degree of freedom of living and movement. The lack in safety resulting from bad planning of streets and heavy traffic discourage residents, especially children, from contacting each other. Living in traditional areas and communities is very safe. Streets in their neighborhoods were empty of cars and also courtyards in their houses provided safety for their family, especially children, while planning of streets in modern areas giving priority to cars without enough care to pedestrian safety. Safety in the traditional city was as a result of design concepts and principles used in the neighborhoods, which restricted car access and provide safe courtyards and the social, cultural and economic harmony between residents, figure (8).

7.4. **Belonging:**

Sense of belonging depends on many factors such as, length of residence in the place, social relations, and availability of place facilities.in general, the traditional environment provide to people strongest level of belonging to the place.

7.5. **Place Memory:**

the ability of residents, who live in the traditional districts to notice, understand, and remember their built environment better than in modern districts, as well as they have ability to link their physical architectural production to their cultural norms.

The courtyard in houses in traditional areas was using for multi functions. Firstly, it is private interior meeting space for family members, secondly the courtyard provide a suitable climate especially in summer in Iraq, thirdly provides a safe place for children to play, as shown in fig(9).

Figure 9: Courtyard in Iraqi Traditional House

At the contrary, in modern areas the interior courtyard transfers to outdoor space where privacy is missing, especially in regard to visual aspect since many high neighboring buildings. In addition, the courtyard provides relationship between family members, which are lost in contemporary houses. Using new buildings materials and disappearing of courtyard in houses in contemporary areas made people looking for new solutions for climate problems.

Figure10: Traditional house in the Iraqi city

Figure 11: Modern house in the Iraqi city

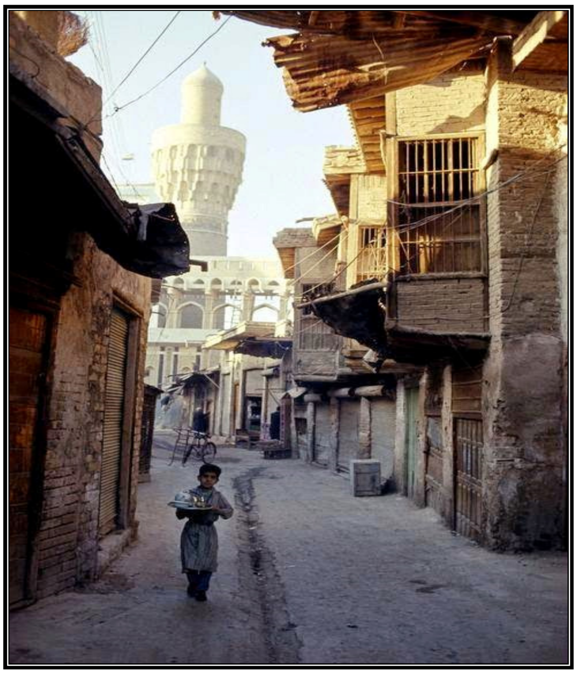

Figure 12: Landmark in traditional

Privacy reflected also in external elevation of houses in the traditional areas by using solidity in the ground floor while the first floor has a window with wood screen ((Shanshoul)) figure

(10). While in contemporary areas, the house elevation is transparent and has large windows, which does not provide enough privacy for family. Figure (11)

Regarding to social relationships, the traditional neighborhood have strongest relations more than contemporary. Because of streets in traditional areas are narrow, which is not suitable for cars. Therefore, local people can have many opportunities to contact with each other. However, in contemporary areas the wide streets and the high buildings did not encourage people to build strong ties with their neighbors, and don't encourage them to meet each other.

One of the main weaknesses in contemporary areas is the loss of landmarks of the city, which led to the loss of the place memory, while the traditional areas are rich with the multi landmarks. Therefore, the place memory enriches the local people's identity. The landmarks available in traditional areas support the people who live in these areas to build a strong memory while in contemporary areas disappearing of landmarks has led to weak a memory for people who they live in these areas. Figure (12)

8. Conclusion:

The previous available studies about Basra city could be classified as historical, descriptive, and exploratory studies, which were not analytically useful studies to clarify characteristics of architectural city identity so that they cannot be used in urban design applications on the field. It is, therefore, essential that any future development should be informed by an understanding of these problems and shortcomings. The motivation of conducting the studies on the traditional architectural identity and assessment of its characteristics is to find the way to transfer or recreate the useful logical principles in order to maintain local identity. This is not done by the blind imitation and copy of its appearance, but through the conscious and deep understanding of esoteric principles of identity. Therefore, there is a vital need to develop a framework to guide professionals in producing urban design solutions, which will consider maintaining identity while enabling modernization. This framework should be based on i) understanding the concept of identity in architecture, ii) aspects of environmental and social, cultural identity, such as privacy, safety, belonging, and place memory and iii) analyzing traditional and contemporary identity.

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ICT, Technology and Engineering

ID 003

BIM Client Maturity: Literature Review

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Abstract

The term BIM represents different things to different people, which starts with tools and technology, and ends with a process. Therefore, there have been quite a number of models used to evaluate the BIM implementation maturity in recent years. Each model has its own targets, but mainly these various maturity models and scoring systems tend to fall into two basic categories. The first category focuses on how to evaluate a particular project against BIM. The second category would take the entire organisation as its target to assess. Through a literature review, this paper investigated all the existing BIM maturity models that could be used to evaluate client organisation inside the UK. This paper concludes that the available BIM maturity models can be used to assess UK clients against BIM maturity but essentially it needs to be connected to the UK standards as a first step.

Keyword:

BIM, Client, Maturity, Organisation, UK

1. Introduction

Generally, maturity is defined as the state of being fully developed (Collins dictionary, 2015). Therefore, to become fully developed in something is not easy to achieve; you must pass a set of evolutionary stages until reaching the desired level of sophistication. In particular, recent developments in the construction industry explain its interest in the maturity models as it increasingly seeks to manage organisational change (Nesensohn et al, 2013). It has been widely recognised that maturity models support organisations with benefits when implementing a change or improvement strategy (Amaratunga & Baldry, 2002).

One type of change that the organisations in the UK construction industry are seeking to manage is the implementation of Building Information Modelling (BIM). The Government Construction Strategy published by the Cabinet Office in 2011 announced the Government's intention to require collaborative 3D BIM on its projects by 2016. Since then it has received a significant amount of attention from both practitioners and academics, which is evident through the amount of publications available on the topic. BIM is a very broad term that describes the process of creating digital information about a building or asset (such as a bridge, highway, tunnel and so on).

The range of levels that this form of modelling can take is described as maturity levels (WIKI, 08 Oct 2014). Therefore, BIM maturity represents the quality, repeatability and degrees of excellence in delivering a BIM model (Succar, 2010). There are a growing number of BIM maturity evaluation models (Chen, Dib, & Cox, 2012; B Giel & Issa, 2012; Mom & Hsieh, 2012; Succar, 2010). All these evaluation models are intended to measure BIM maturity for organisation, projects, or individuals. Client organisation has magnificent importance in the

BIM implementation process by stimulating the innovation to achieve crucial BIM benefits (Gann & Salter, 2000; Harty, 2005; Kulatunga, Kulatunga, Amaratunga, & Haigh, 2011; Manley, 2006; Miller, 2009).This research will aim to compare the available models in order to find out which is suitable for measuring BIM maturity of client organisation.

2. Research methodology

The literature review method was adopted to identify journal articles, books, reports, and websites that describe and investigate the use of BIM maturity in the construction industry, published in referenced journals, conference proceedings and other scholarly publications. Initially, a comprehensive literature search based on the keywords search method was conducted using the Scopus, SCI and Google Scholar. The search keywords included BIM maturity, BIM performance measurements in construction, etc. Papers with these specific terms included in the title, abstract or keywords were selected as possible publications. Then, a more intensive and complete search was then conducted with the support of the search engines. Articles (journal and conference) and review papers were included. Finally, only nine BIM maturity methods were found in literature and included in this article.

3. Maturity Models

Building Information Modelling Maturity (BIMM) represents a ranking system including all the important areas of an effective modelling process to deliver the expected BIM product/service (Succar, 2010). Industry practitioners and academics developed several models for evaluating BIM implementation and performance in the architecture, engineering and construction (AEC) industry (Brittany Giel & Issa, 2013; Succar, 2010). These models could be classified into two main categories according to their target in the evaluation process (Brittany Giel & Issa, 2013). The first one, project assessment models (PAM) which rates the maturity of asset projects based on use of different competences. The second category, organisation assessment model (OAM) measures the maturity of organisations who are implementing BIM in their process as shown in the fig (1).

While this research aims to find the maturity method most suitable to assess client organisation, only OAMs will be covered in the comparison process. Table (1) represents each model's characteristics. From table (1) it could be concluded that from 8-maturity assessment methods available in the literature, only four models could be used to assess client organisation against BIM maturity. These models are Succar's BIMMI, IU,s BIM proficiency matrix, CIC research programs owner matrix, and Owner BIMCAT model. All these models will be investigated in order to find out the suitability of these models to measure client BIM maturity inside the UK.

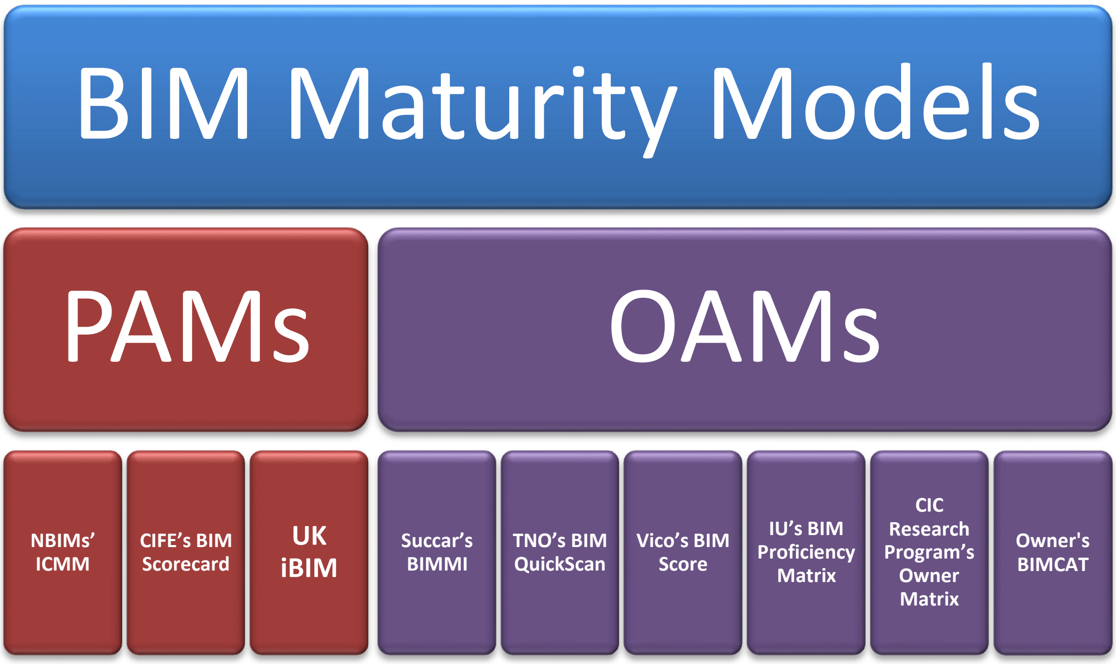

Figure 1. Existing BIM maturity assessment Methods

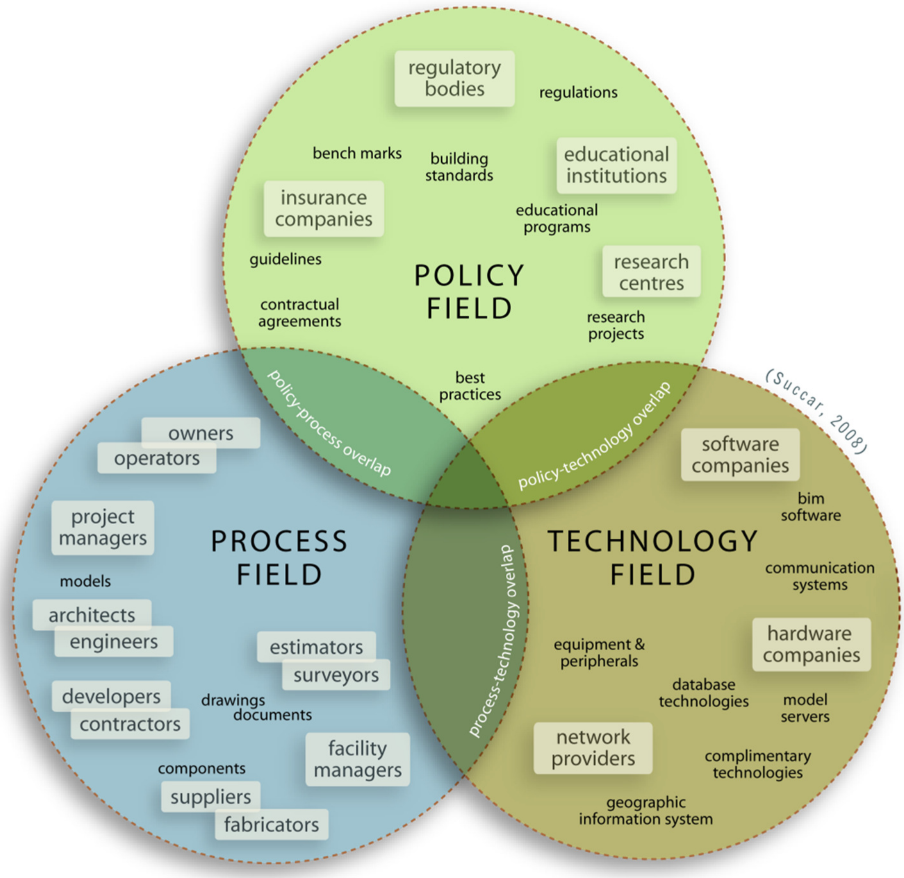

Fig .2.BIM maturity matrix components (Succar, 2010)

Table 1: The summary of BIM maturity evaluation model.

Model Characteristics	*Succar's BIMMI*	*TNO's BIM QuickScan*	*Vico's BIM Score*	*IU's BIM Proficiency Matrix*	*CIC Research Program's Owner Matrix*	*Owner's BIMCAT*
The beneficiary	*Designers, Contractors, and Clients*	*Designers, Contractors*	*Designers, Contractors, and Clients*	*Designers, Contractors*	*Clients*	*Clients*
Number of maturity levels	*5*	*Percentage of 100*	*5*	*4*	*6*	*6 (Competence levels)*
Key elements and category	• *Technology* • *Process* • *Policy*	• *Strategic* • *Organization* • *Resources Partners* • *Mentality* • *Culture* • *Education* • *Information flow* • *Open standards Tools*	• *Planning* • *Adoptions* • *Technology* • *Performance*	• *Physical accuracy of the model* • *IPD methodology* • *Calculation mentality* • *Location awareness* • *Content creation* • *Construction data* • *As-Built modelling* • *FM data richness*	• *Strategy* • *Uses* • *Process* • *Information* • *Infrastructure* • *Personal*	• *Operational* • *Strategic* • *Administrative*
Evaluation Method	*Multi-method*	*Self-online evaluation*	*Multi-method*	*Evaluate stakeholder's competence.*	*Self-evaluation*	*Self-evaluation*

From the table (1), it could be seen that only four of the six models are suitable to be used to assess client organisation against BIM maturity. In the following sections, these models will be investigated in detail to find out their suitability to UK client organisation.

4. Succar's BIM Maturity Matrix (BMMI)

Succar developed a BIM Maturity Matrix that offers a comprehensive evaluation framework based on technology, process, and policy (Chen et al., 2012). His model is suitable for different organisation types and size using five maturity levels based on 12 Key Maturity Areas (KMAs). As shown in figures (2&3). One of the main concepts proposed by Succar is the difference between BIM capability and BIM maturity across organisations and the different capability stages that organisations work through on their BIM implementation roadmap. In addition to that, he defines BIM capability as "the ability to perform a task or deliver a BIM service/product" whereas, BIM maturity might refer to "the quality, repeatability, and degree of excellence with which BIM services are executed (Brittany Giel & Issa, 2013; Succar, 2010)

Unfortunately, some areas of information management are not covered in the competency sets, though data usage, storage, and exchanges are included (Chen et al., 2012). In addition to that, if this model is used to evaluate the client organisation in particular, the evaluation system needs to be modified according to the privacy of the client organisations from the rest of the organisations through the benefits and requirements of the BIM implementation process.

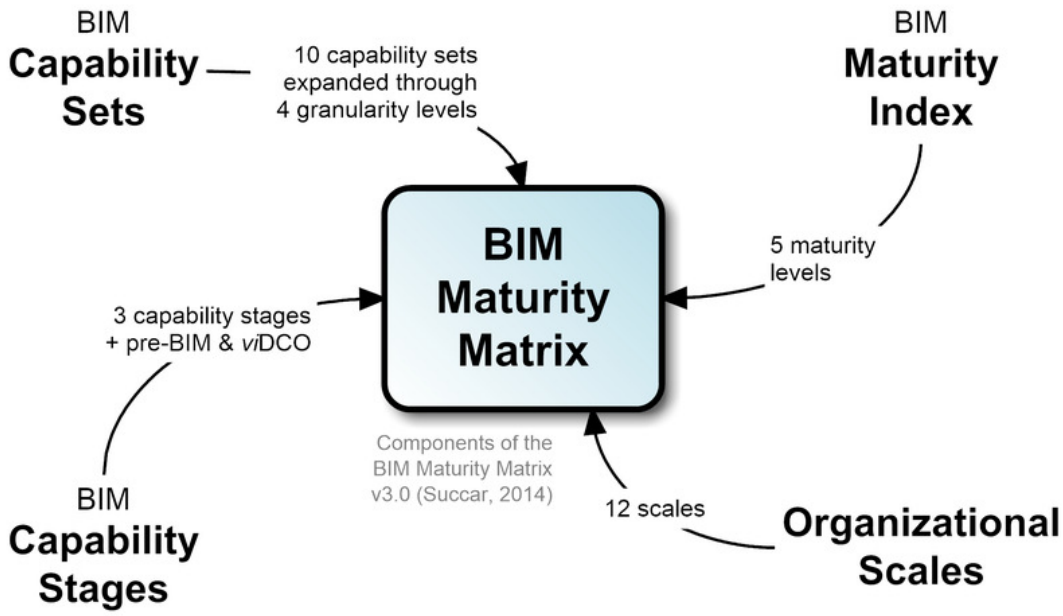

Fig .3.BIM maturity matrix components (Succar, 2010)

5. Vico's BIM Score

In recent years, many software vendors within the construction industry have been developing new services that are helping their clients to evaluate their organisation's BIM maturity that may help them to compare themselves against their competitors. One of the leading venders in that field is

VICO, Inc(Brittany Giel & Issa, 2013; Kam, Senaratna, Xiao, & McKinney, 2013). Vico offers a special BIM Scorecard that allows any organisation to evaluate their current solutions for clash detection, scheduling, and estimating in terms of three aspects: functionality/capability, best practices, and enterprise integration as shown in figure (4).

The limitation of this model to the clash detection, scheduling, and estimating is the only main weakness of it, where BIM can be used in many areas throughout the project life cycle. In addition, the differences between the organisations (Designer, Contractors, and Client) in terms of the goal of using BIM as well as the requirements for implementing BIM in their process, is not clearly defined in the evaluation system. All these weaknesses will lead to this model being considered suitable for general evaluation only, without any suggestions for improvement.

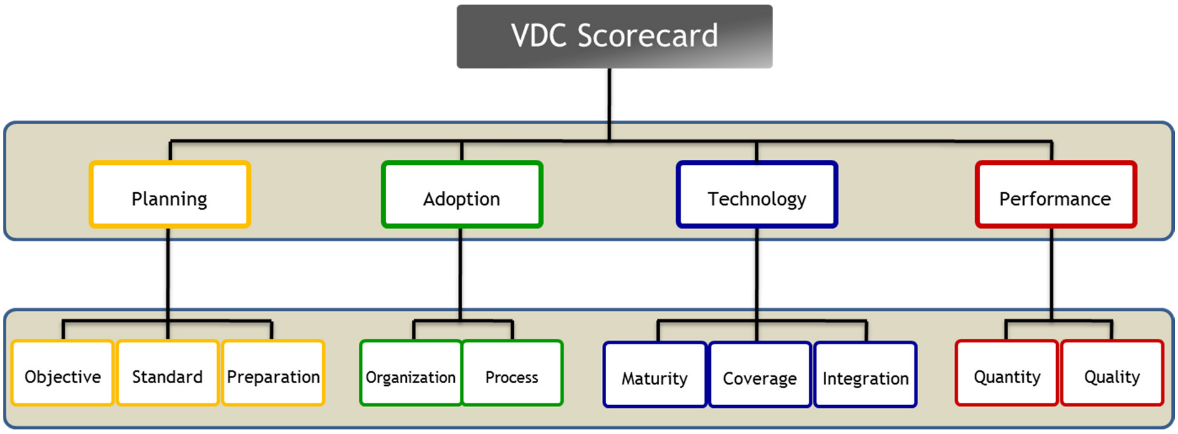

Fig .4.BIM maturity VDC scorecard components (Kam et al., 2013)

6. CIC Research Program's Owner Matrix

The Building Information Modelling (BIM) Planning Guide for Facility Owners V2.0 was released in 2013 to support project teams by directing them through a planning process for BIM implementation. A fundamental principle of the planning procedure was to highlight the need for facility owners to understand and communicate their goals for implementing BIM throughout the lifecycle of the asset. This guide contains 6 key BIM planning elements. In addition, it provides a simple description for each of the maturity levels identified within the planning elements. The level of maturity starts with zero (0), which represents non-existence or non-use of that element within the organization, and continues to level five (5) in which the planning element is optimized (State, 2012) as shown in figure (5).

This model is considered as one of the most effective evaluation models for evaluating client organisation BIM maturity. The only thing that needs to be done is to adjust UK standards with this model.

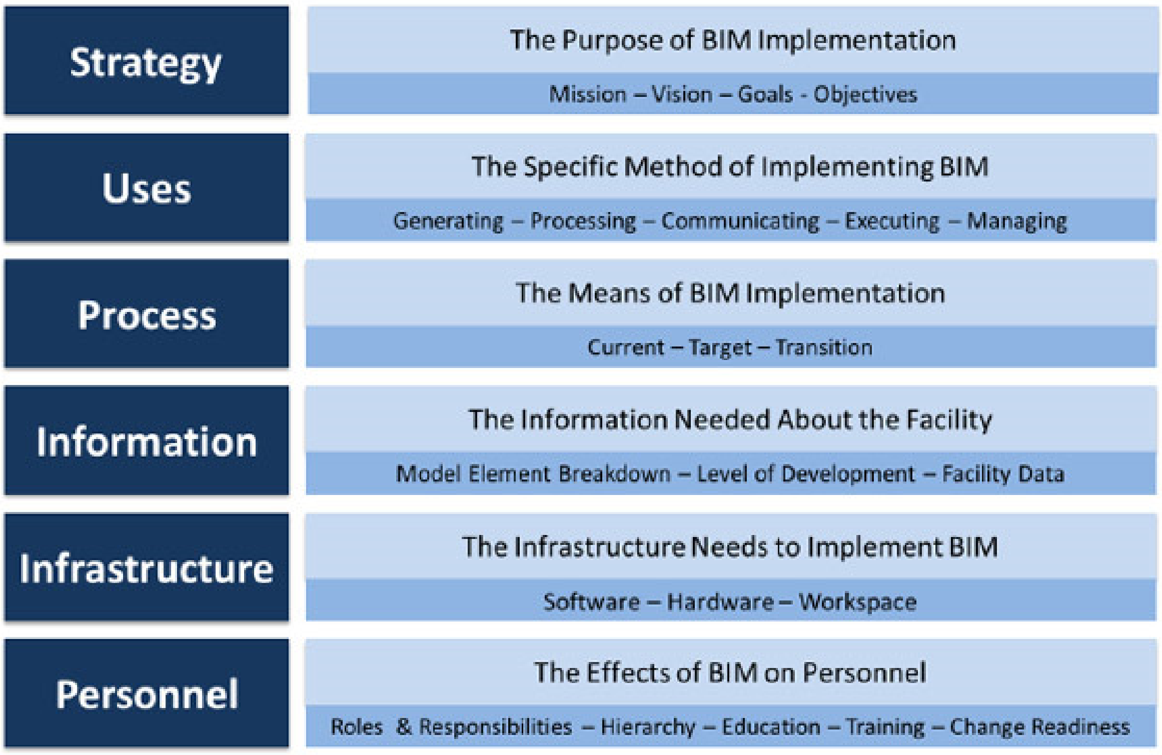

Fig .5. BIM Planning Guide for Facility Owners (State, 2012)

7. Owner's BIMCAT

The owner's BIMCAT has been divided into three main competence categories: operational, strategic, and administrative. Each of these categories is also split into sub-branches as shown in the figure (6). This model mainly covers most of the key evaluation criteria, even including the geometric requirements that have not been mentioned in the other models. This model which was developed by Giel and Isaa in 2013 has 6 competency levels.

The huge number of details that need to be evaluated, where most of this information may be incomprehensible to the infant BIM client, has affected the high quality of the model. The simplicity of the other models is absent here which prevents clients assessing their organisation in most comprehensive way.

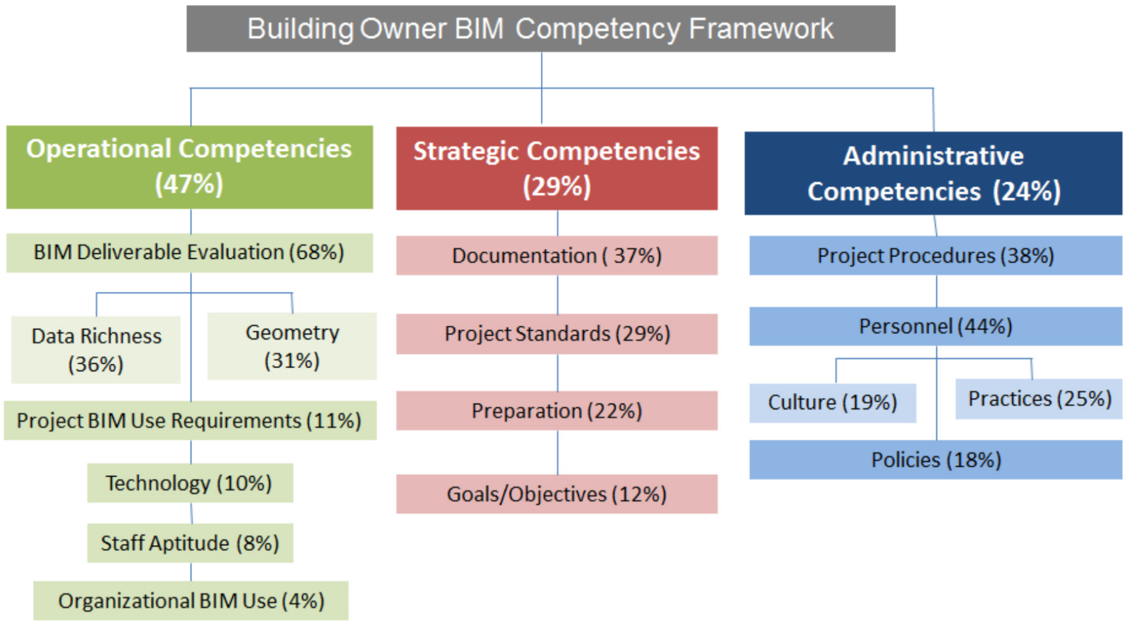

Fig .6. BIMCAT maturity model components (Brittany Giel & Issa, 2013)

8. UK BIM Maturity Model

Bew and Richards (2008)developed the UK BIM maturity model. Since it was first developed, the BIM Maturity Model has established itself as the main component of a UK BIM implementation strategy (Succar, 2015). Recently, it is impossible to talk about other UK-centric construction industry strategies (e.g. Soft Landings), workflows (e.g. RIBA Plan of Work), roles (e.g. Information Manager), and protocols (e.g. UK's version of COBie) without including this model (Succar, 2015). It has four main levels as defined below:

- **Level 0**: is the use of unmanaged CAD,
- **Level 1**: is managed CAD in 2D or 3D format where the company engaged industry standards within the process such as BS1192 with commercial data and is managed by stand-alone finance and a cost management package,
- **Level 2**: is managed 3D environment held in separate discipline tools with parametric data and commercial data and managed by Enterprise Resource Planning. During this stage, integration occurs on the basis of proprietary interface or bespoke middleware,
- **Level 3**: is a fully open interoperable process and data integration enabled by IFC. Named as integrated BIM, the data and information are managed by a collaborative model server.

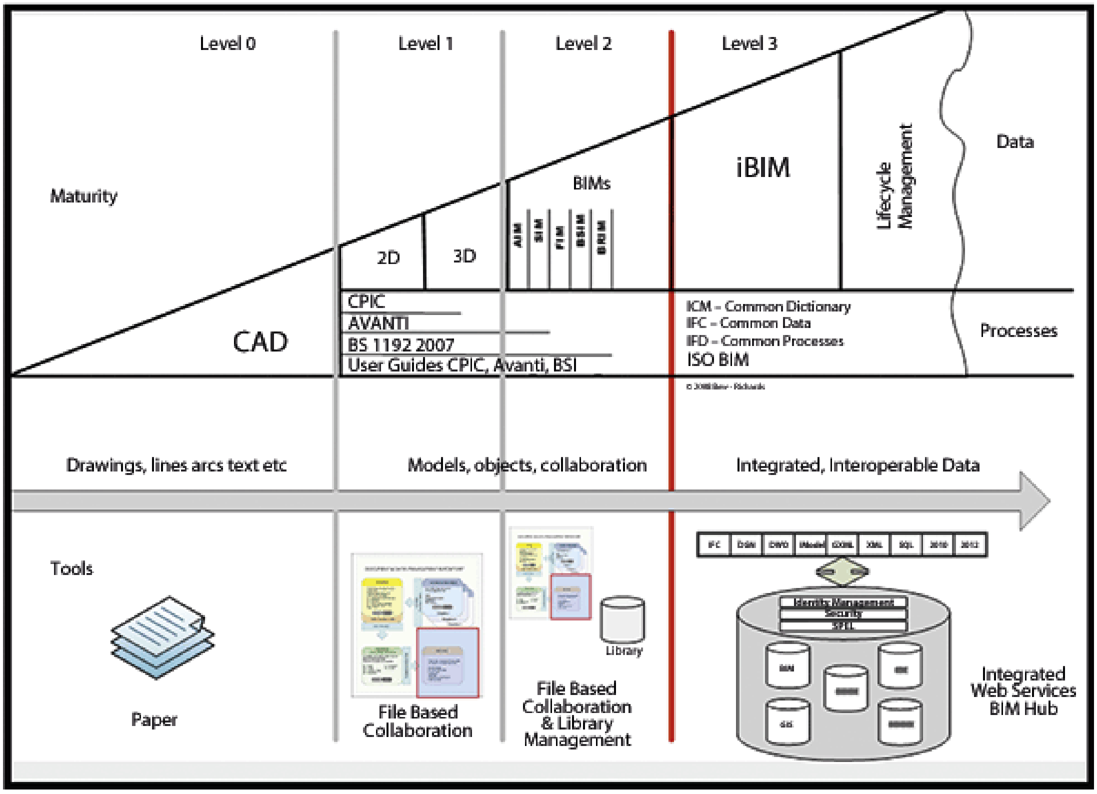

Fig .7. The UK maturity Model (Bew & Richards, 2008)

This model is very simple and can be easily understood by most of the stakeholders. Organisations' compliance with the specifications listed within the model represents the measuring system of the maturity. This philosophy in maturity measurement cannot measure organisational performance or market maturity (Succar, 2015). This model can only be used in the UK due to the correlation between the maturity level and UK (Local) standards only.

9. Conclusion

From what has been explained in previous sections, it can be concluded that the existing BIM maturity models available in literature can be used in the UK. However, there are a set of amendments that must be performed on these models to make them easy to use for the client organisation inside the UK. One of the main important amendments is establishing a strong link between the client BIM maturity model and the BIM UK standards, for example PAS1192-2&3&4. This link will increase the extent to which the client will accept the use of the model, as well as aiding the understanding of the model.

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ID 011

Digital Engineering: A Case Study of the Implementation of Building Information Modelling (BIM) in Construction Projects

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Abstract

The worldwide thrust for improving construction project delivery process has led to the adoption of Building Information Modelling (BIM), which is now drawing attention of the AEC practitioners to discover the most appropriate method of implementation and value proposition of BIM. However, a number of issues are increasingly becoming apparent with the progression of BIM adoption. One of the issues with implementing BIM is that the parties in a construction project have different organisational cultures, each with their own methods of behaviour and working practice. A separate issue is with the meaning of BIM, which varies between individuals and organisations, ranging between tools, technology and process. Combined with this, there is no proven protocol yet available that will fit to a particular project to extract optimum return of the investment in the cutting edge technology. The aim of this paper is to examine the mechanisms for effective implementation of BIM within the project delivery process. The paper will report on an investigation conducted by case studies of two large hospital projects in the UK. It was found that in the absence of any proven protocol, BIM is being implemented in the projects through the company's own process named 'Digital Engineering (DE)'. The case studies show that DE has been used as an effective way of implementing BIM within the project delivery process with breaking the boundaries. Through the process of DE, the essential elements of BIM such as application protocol, implementation plan, value proposition, and collaboration framework are featured in a more clear and acceptable way to each of the levels of participants working on the project. Additionally, it is shown to drive a fundamental change in the way of working in the project delivery process. Implementation of BIM through DE can remove the uncertainty within the process, enhance the level of understanding of the contract parties, and motivate them to work in a more collaborative way; where people, process and technology will be unified to promote an improved project delivery process.

Keywords:

BIM, Construction, Digital Engineering, Implementation, Project.

1. Introduction

It has been identified in many reports that the construction industry has underperformed and clients are not getting optimum value (Latham, 1994; Egan, 1998, 2002; Cain, 2003; Fernie *et al.*, 2006; CO, 2011). This issue stimulated the mounting pressure for improving efficiency in the construction project delivery process (Jackson, 2000; Elmualim, 2008). As such, the construction industry has spent continuous effort to achieve a fully collaborative process throughout the whole lifecycle of the project; the latest example of which is the implementation of Building Information Modelling (BIM) (Cain, 2003; Arayici *et al.*, 2011; CO, 2011). The core proposition of BIM is to attain a fully collaborative practice in the project supply chain and achieve optimum project value (Philp, 2012; BSI, 2013). The multi-skilled team is required to integrate by developing and sharing new ideas, tools, and innovations (Egan, 2002; Khalfan and McDermott, 2007; NBS, 2011). However, such a cultural shift necessitates the design community to learn and adopt a new generation of tools in design and collaboration (Jeong *et al.*, 2009; Succar, 2009; Philp, 2012). Besides, it is often argued that with the progression of the intelligent model, an increasingly close and interdependent relationship between the parties is developed but the border of responsibilities becomes blurred and the results in the emergence of critical issues which hinder inter-organisational collaboration (Rosenberg, 2007; Clough *et al.*, 2008; Gu and London, 2010; Andre, 2011; Udom, 2012).

Numerous authors believe that in a changing environment, individuals select their actions according to the available things and meanings in front of them to choose their destiny (Blumer, 1980; Corbin and Strauss, 1990; MacKinnon, 2005; Charmaz, 2006; Nooy, 2009). The authors further mention that the individuals perceive meanings gradually through the interactions and interpretations in the changing environment. In the transition period of adopting BIM, which involves producing and managing digital information in a certain standard people from various disciplines endeavour to implement the modelling process according to their own positions, understandings, and capabilities (Gu and London, 2010; Azhar et al., 2011; Philp, 2012), the pattern and effectiveness of which is yet to be investigated.

Several authors highlight the necessity of addressing diverse issues to derive the appropriate method to implement BIM for particular projects (Rosenberg, 2007; Dossick and Neff, 2010; Andre, 2011; Redmond *et al.*, 2012; Udom, 2012; Hossain *et al.*, 2013). Hence, diverse methods of implementation of BIM in individual projects are undertaken on a trial-and-error basis. Much has been written on this but the optimum procedures are yet to be determined. This paper aims to represent a particular method of implementing BIM which has been captured from two large hospital projects in the UK. This study has been conducted to investigate how BIM can be implemented successfully by addressing the potential issues and encouraging the people to promote a collaborative environment through adopting new technology and process in the construction projects. The investigation has been conducted through a detail examination by observing the ongoing work practice in the BIM enabled projects.

2. Literature Review

2.1. BIM in the UK Construction Industry and Necessity of Integration

Over recent years the industry has made several attempts to improve efficiency in construction project delivery process (Latham, 1994; Egan, 1998, 2002). Eventually, implementation of BIM became a mandate, with the aim in the UK to attain Level-2 BIM in 2016 (CO, 2011). Survey results show that from 2011 until early 2014, the use of BIM increased from 31% to 54%, i.e. a raise of 23% in three years after the mandate was been circulated (NBS, 2014a). According to the survey, a major proportion of the participants (41%) were just aware of BIM but not using it, and 5% are neither aware of it nor using it. The survey result evidently indicates that implementation of BIM is not taking place as widely as intended. As such, it has become the central concern of the practitioners to attain the desired level of adoption in the construction industry.

Many authors mention that achieving optimum project value and realising investment in BIM necessitates a fully collaborative delivery process which integrates people, process, and technology (Eastman *et al.*, 2011; Ahmad *et al.*, 2012; Philp, 2012; Hossain *et al.*, 2013). Though the necessity of collaboration and integration in a BIM project has been prescribed by numerous academics and industry professionals, the industry is yet to deliver the desired contribution into the process (Khalfan and McDermott, 2007; Rosenberg, 2007; Yan and Demian, 2008; Dossick and Neff, 2010; Andre, 2011; Azhar *et al.*, 2011; Philp, 2012; Udom, 2012). Consequently, practitioners in the industry are still looking for viable ways to implement BIM to functionalise collaboration and extract optimum benefits through the technology.

2.2. **Barriers of BIM**

Many authors have highlighted factors which hinder collaboration and integration in a BIM project; commonly, habitual resistance, fragmented information flow, legal and contractual issues, and interoperability of software, distribution of risk, reward and responsibilities (Rosenberg, 2007; Dossick and Neff, 2010; Sebastian, 2010; Andre, 2011). It is asserted by Ashcraft (2008), Andre (2011), and Udom (2012) that the model related issues are often an impediment to an open collaborative process; which include: data copyright, ownership of intellectual properties, mode security, access and confidentiality of data in a blended state, and signing the documents. Gu and London (2010) further state that in a BIM project, technical issues in the project include factors such as diverse perceptions and capabilities of the participants from each of the disciplines. This kind of situation causes the difference in the desired levels of implementation of BIM on individual projects.

Extant literature states that a construction project team is typically attributed by complexity, and the participants are often seen as competing with each other due to their distinctive organisational and cultural backgrounds (Latham, 1994; Harvey *et al.*, 1998; Steele and Murray, 2001; Macmillan, 2011). Ogunlana and Roma (2009) and Macmillan (2001) add that it is typical phenomenon in a construction project to have the tendency of the participants to contribute less into the teamwork, especially in a period of management inconsistency. As BIM is a contributory process and it requires higher level of collaboration and integration within the team (Eastman *et al.*, 2011; Philp, 2012), this kind of barrier causes frontline obstruction to the implementation of BIM.

The specification for production and management of data in certain formats has been suggested (BSI, 2013, 2014). However, several reports show that organisations face the challenge of emerging phenomena created by a huge volume of data which is generated during the project delivery process (Lock, 2012; Russom, 2013). The reports further state that organisations face challenges to manage information, not just the volume but also the complexity. According to Lock (2012) and Russom (2013), this non-traditionally structured data, termed "*big data*", requires specialised infrastructure and relevant skills. They argue that sources of data are expanding which challenges the analytical process to transformation and use through the available system. Such an unfamiliar complex situation stimulates stress, and calls for particular attention to overcome growing concerns in the rapidly developing technology.

The factors of diverse culture, non-cooperative attitude, opposing nature, technical readiness, economic stance, and inconsistency in management not only impede the implementation of BIM but also affect in the value of the project. Therefore, the industry is seeking effective ways to overcome the barriers and extract optimum value, and improve the project delivery process.

3. Aims of the Case Study

During a broader study on the implementation of BIM, a number of projects were found to be implementing BIM using an adaption with is referred to as Digital Engineering (DE). Within this research it was decided to focus on the characteristics of these projects to understand the particular characteristics of these projects, and what distinguished them. The key aims of this paper are to:

- identify how BIM can be implemented through DE in the project delivery process by considering the whole lifecycle of the project.
- investigate the components of DE and their scopes within the project delivery process to promote implementation of BIM.

4. Research Methodology

As the construction industry is in a period of cultural shift, i.e. the changing path of the way of working on projects (Eastman *et al.*, 2011; Malleson, 2012; Philp, 2012; Udom, 2012), people in the industry are now in a position to decide how to cope with the latest technology in this changing environment. At the same time practitioners hold diverse views, beliefs, and aims about the technology. Such a condition suggests rigorous and in-depth investigation to understand the critical behaviour of participants in a transition period. Many researchers suggest to conduct this kind of investigation through the Grounded Theory (GT) approach (Charmaz, 1983; Corbin and Strauss, 1990; Strauss and Corbin, 1993, 1998; Bowen, 2006; Charmaz, 2006, 2008; Jones and Alony, 2011). The paradigmatic position of this study has been justified accordingly and this study has been carried out using GT.

DE, an alternative term of BIM is a relevant part of the current phenomena during the transition period of the implementation of BIM within the construction industry. However, it was not possible to compare the behaviour of the participants in similar conditions such a variety of DE projects to understand variations and their effects. Furthermore, the boundaries between the implementation of BIM and DE was not clear. According to these certain conditions, as suggested by (Stake, 1995; and Yin, 2014), a case study had been undertaken on two large scale hospital projects to investigate the process of the implementation of BIM through DE.

5. Data Collection and Analysis

A constructivist grounded theory approach has been employed in this research. Interviewees were selected from individuals on the case studies involved throughout the supply chain. Respondents were selected to cover diverse disciplines and organisational positions such as project leader, functional director, BIM coordinator, M&E manager, design manager, project planner, architect, engineer, and procurement manager. An open interview schedule was developed which included general information about the project, data management, project management, and the process of implementing BIM. All the interviews were taken in the form of verbal conversations ranging from 35 to 65 minutes in length, which were recorded and transcribed and analysed through coding and classification following the GT methodology. The data analysis was focused on the two particular aspects, i.e. the process of implementation of DE and the factors promoting the implementation of BIM through DE.

As a widely accepted process and suggested by many authors (Corbin and Strauss, 1990; Bowen, 2006; Charmaz, 2006), findings from preceding interviews were observed to identify emerging concepts. Similar concepts were grouped into categories and incorporated with the further interview schedule to develop the attributes and parameters of the concepts. Through memo writing and the coding process of the GT approach, theoretical sampling and theoretical coding was performed to identifying the properties and dimensions of each entity. For example, the entity "Digital Engineering" was identified to explore the phenomena underpinned by this entity along with the relevant properties and dimensions to uncover the process of implementing BIM through DE.

6. Results and Discussion

The interviews and their analysis through theoretical sampling to examine the aspects of DE are shown in Table 1.

Table 4: Aspects of investigation (theoretical sampling)

Theoretical sampling of DE	
Properties Method of implementing DE; Implementation plan; Application protocol; Value proposition; Distinct feature; Collaboration framework: communication, interaction, integration.	**Dimensions** Level of implementation of BIM; Number of DE activities performed in the project delivery process; Level of understanding on using digital information; Level of value optimizations.

6.1. Reason for Using Different Terminology

Both the projects were found to be nearly identical for participants' perception of a common ideology, i.e. implementing BIM through DE. From observations, the following points were identified as reasons behind using a different terminology:

Promotes the organisational position in business sector: As the lead company has the considerable capability beyond main contracting such as self-delivering manufacture, heavy engineering, and own design capabilities, it is meaningful to them to stand as an engineering enterprise rather than a contractor within the industry.

Enables clear and extensive value plan but captures government BIM feature: It is easier to articulate the scopes, roles, and responsibilities of the diverse disciplines as per the target value of the organisation without being questioned on the boundary of BIM by the associate organisations. Participants clearly understand that they are implementing BIM at the desired level at the same time.

Promises extensive use of digital information: Implementation of DE encourages the participants to use digital information at an extensive level such as offsite manufacturing and coordination, real time data transfer, and integration of time, cost or other parameters.

Sharper ideology: By bringing DE on board, various such as implementation plan, application protocol, and value proposition can be articulated more clearly.

6.2. **Method of Implementation of DE**

From the analysis, it has been found that the overall method of implementation of DE is driven by following four major activities:

6.2.1. DE Implementation Plan

The leading organisation draws a plan by considering their own vision, current work practice, government feature, implementation target of modern technology, and value aspects. The implementation plan was mentioned as one of the key to successful implementation of DE and resided as a part of the agreed contract. For instance, one of the project leaders mentioned, "We spend a lot of time agreeing process, protocols, deliverables, we have right of think, we have absolute clarity on over those. So, there is no debate and everybody understands what they need to do, and you keep that nice and clean no overlap line, then everything is a lot easier". Both the projects have meticulous implementation plan that they set up by considering the lead organisation's strategy and vision. Table 2 shows the Elements of the DE implementation plan in the projects things have been found in the projects in terms of implementation plan:

Table 5: The elements of DE implementation plan

No	Elements of the DE Implementation Plan
1	Covers government feature of BIM.
2	Defining scope and responsibilities with ensuring deliverables.
3	Integration of work packages and programmes.
4	Examination and selection of suitable tools.
5	Setting up the meetings, participants' behaviour and tone.

The organisational vision of DE is to use digital information at an optimum level within the project is identified and rigorously articulated. The scope of work for individual parties are clearly defined, and the each piece of work is carefully examined against the capability of individual parties. Skill deficiencies are minimised by undertaking capacity building programmes to enhance the level of capability of the parties for delivering the specific assigned works. In some special occasions, a shadow programme is prepared to carry out deliverables. Also, the current work practice and available facilities in the project are verified against the deliverables to assess the skills and IT infrastructure to purchase necessary software and arrange learning programmes.

Meetings, timetable, and attendees are set up in the implementation plan to functionalise collaboration and integration. For example, there is a supply chain coordination meeting every week with representatives of all disciplines. Parties are expected to follow set communication methods for raising and resolving issues through the BIM station. For instance, particular managers will be contacted through the federated model or any other means depending on the importance of the problem. These are established in the planning stage, so that individual parties know what to do in any particular situation.

6.2.2. DE Implementation Protocol

In both projects, protocols have been established as one participant mentioned, "…we have got quite chunky document, a protocol, it goes through software, it goes through the level, the type of information you are looking for it is on there". These document the project and set individual target for each party, and is organised by:

Design and information management: specific formats and targets are articulated and agreed, together with checklists and processes to upload, download or work on files, the name and version of software, the document management system that will suit for the planned work, and the procedure for accessing models and reporting issues.

Specific commitments: these are clearly stated and agreed by all the participants. For instance, there is a checklist on items and volume of producing information as well as actual production of the items in terms of offsite manufacturing. The project management sets a target of 60% of concrete manufacturing offsite, which involves production of information in certain format and volume.

Inspection checklist*:* for individual subcontractors, work must be checked by the manager of the respective subcontractor prior to be inspected by the manager of the main contractor.

6.2.3. Value Proposition

Value proposition is a vital activity in DE through which parties understand their responsibilities and the scope of potential benefits. The projects not only focused on the production of 3D object based information, but also using the information at every level of business within the supply chain to add value. Value proposition covered:

- Identifying the scope of using BIM by scrutinising the work packages according to their level of complexity.
- Individual work packages established to create precise tender documents.
- Subcontractors are given access to use the model so they can plan their work effectively.
- The detail and quantity of information is determined to ensure accounting every item in the estimate to reduce unexpected cost at the end of the project. For example, in projects without DE, fire stops incurred much higher cost than the estimated contingency, which reduced the overall profit.
- The value plan during design includes using a common data environment, clash detection, real time data transfer, programme integration, and cost estimates. Time and effort of coordination between the disciplines are saved through the configuration of design planning.
- Project management examine the latest tools for their scope of application and additional value added. For example, younger team members were the frontline drivers to this activity under the direction of the project leaders.
- The activities of the BIM station are precisely defined to facilitate coordination between the parties. If any party is intended to work in a particular zone, this defines coordination between disciplines prior to and during the work.

- The production, organisation, use and management of information is done to derive value for the client, who not only see the project after completion but also during the delivery process. The instant feedback from the clients not only minimise rework but also build trust with the client.

6.2.4. Communication, coordination, and integration

Prior to uploading information, the level of detail and volume are double checked. For instance, after the information is checked and uploaded by a discipline, staff at the BIM station check this before uploading in the master folder in the common data repository. It is then made open to the parties to download or use.

All the entities are integrated as a single 'frozen' model which is also open to participants, which is strictly maintained by the BIM station and updated every two weeks. All the disciplines and client can see the progress of the work from the model with an integrated timeline, which records both progress and expenditure. Figure 1 shows the integrated data management in the DE projects.

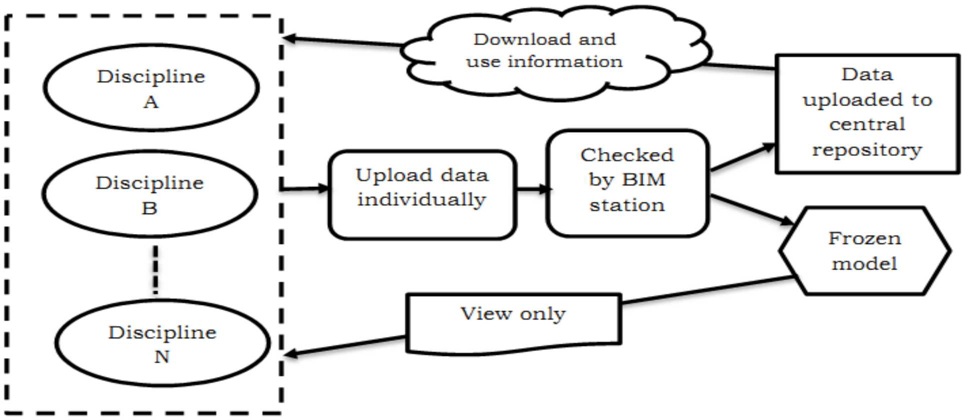

Figure 1. Data exchange and integration

An open information environment is encouraged, with discussions held to diagnose issues in the models. For any regular or particular issue, the model is opened up and the reason is identified and discussed face to face. As a result the decision making process is transparent and quicker which helps to improve the trust between the parties. Thus, integration happens between the parties gradually along with the development of model and the progress of physical construction, which passes through a learning curve.

6.3. **Implication of DE Goes Beyond BIM**

A comparison has been made based on the mandatory feature of BIM (NBS, 2014) and the DE implemented in the projects. The activities required for BIM level 2 and the activities committed in DE are plotted in Figure 2 to illustrate how BIM Level 2 is accommodated within the process of DE. It has been observed that the parties are motivated to implement DE as it ensures implementation of BIM with the necessary support of the lead contractor. From the results of the study, it can be summarised that if a project implements DE as its core ideology, it ensures the implementation of BIM at the same time. Moreover, the value planning is extended to an optimum level to create extra value for all the parties within the project team as well as the client. The key idea of the implementation of BIM through DE in a transition period of has been mentioned by a project leader as, “Run before you walk”.

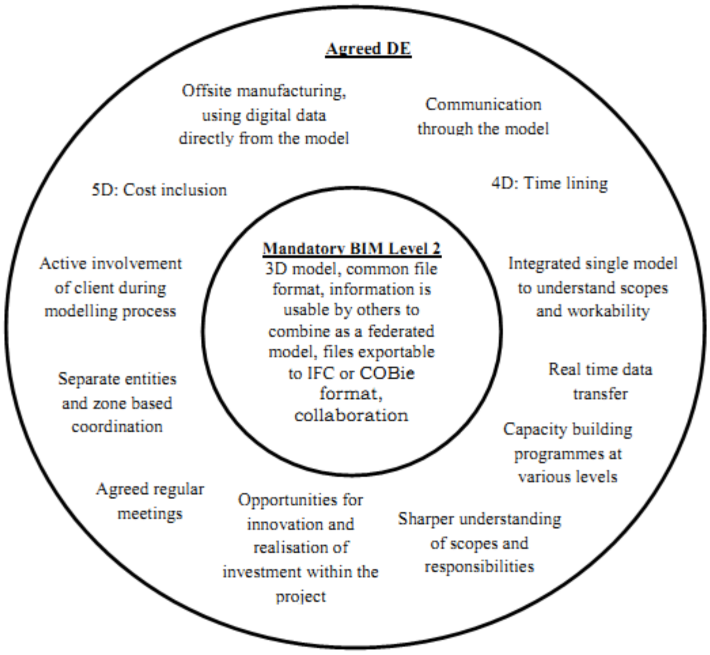

Figure 2. DE and BIM in the Case Studies

The shape of the working pattern though DE in both the projects has been found as collaborative. People work as a single team which is facilitated by the implementation of DE. People in the project feel that DE removes the fear of adopting BIM in terms of investment, education, competition, and survival. Participants push the boundaries of BIM through an extensive design coordination process in the project while they are committed to carry out the activities. As a precise and extensive form of BIM on implementation within the project delivery process, DE goes beyond BIM. DE allows a variety in the extent of support provided to the individual parties according to their needs, which are represented to them against the expected deliverables.

7. Conclusion

DE provides one potential way to implement BIM. DE in the projects is carried out through articulating particulate components such as the implementation plan, protocol, communication and behaviour of the participants in a common data environment, and the value proposition for all the stakeholders. The overall process not only removes the barriers of BIM but also assures and motivates the participants, as they can see the mutual benefits. The process clarifies responsibilities, minimising cultural differences, enabling collaboration, and clarifying individual actions. Therefore, implementation of DE can be an effective way of adopting BIM. Such an opportunity is open to every organisation within the industry.

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Towards Successful Implementation of ICT in Saudi Schools A Literature Review

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Abstract

In the last few decades, the massive advances in information and communication technology (ICT) encouraged many countries all over the world to integrate technology tools into classrooms. Computers, the internet, interactive whiteboards, mobile devices, and an assortment of other technological tools have now turned out to be valuable teaching and learning resources. Therefore, several research studies indicated that the use of technological tools creates an environment where students are more actively engaged in the learning process as opposed to the traditional education where they are passive observers and listeners. Saudi Arabia government is not in isolation from this, they have invested heavily in the ICT field. Nonetheless, the progression has often been disappointing; there is still a clear gap between the availability of ICT technology and methods of implementation. Simply, there is no meaning to instructional practices or investing huge amounts of money to equip schools with ICT tools unless they are used effectively with clear strategies, the intended benefits may not be realized. Therefore, this paper focuses on identifying the critical success factors for the implementation of ICT in Saudi Arabian schools, by reviewing the relevant literature, highlighting the barriers that may hinder the utilization of ICT. The literature revealed that a successful implementation of ICT in education requires paying attention to some factors. For example, providing adequate infrastructure, adequate management support, adequate teacher training on ICT and pedagogy, a clear educational policy and evaluation on an ongoing basis.

Keywords:

ICT in education, educational technology, Saudi schools, Factors for successful implementation

1. Introduction & background

The success of any nation is connected to the standard of education it delivers to its people (Ojiambo, 2009; Umezinwa and Chigbata, 2013; Al-harbi, 2014). "Today, real borders do not lie between nations but lie between those who can access ICT and those who cannot" (Shaffer, 2001). Therefore, ICT (Information Communication and Technology) has become a strategic resource in the teaching and learning environment. These resources such as computers, the internet, interactive white boards, and mobile devices are now widely used in the classroom. Evidence reveals that with technology in the classroom, students are more actively involved in learning process as opposed to the conventional classroom where they are passive observers and listeners (Asenso-Okyere and Mekonnen, 2012). Other benefits associated with the use of ICTs in education include encouraging collaborative learning, equipping students with problem solving skills, and offering flexible learning opportunities (Almalki and Williams, 2012). These benefits explain why ICT has turned out to be a crucial element of educational reform in several countries across the world. The US, for instance, spends more than $10 billion annually in educational technology in public schools (Brunk, 2008), while Australia spends approximately AUD$8 billion (Lane, 2012).

The Saudi Arabia has not been left behind, as there has been commitment of considerable investments to the objective of advancing public education. For instance, during 2007 the government of Saudi Arabia spent about £2 billion towards reforming and enhancing education by means of contemporary technologies. Additionally, public learning was enhanced by revising the curriculum and bringing in electronic tools to assist teaching. This scheme additionally commenced training and development schemes for educators to ascertain adequate employment of ICT in learning (Tatweer, 2015). Thus, over a quarter of the entire Saudi 2015 budget is committed towards the educational division (£ 36 billion), which augments the already immense finances put into the educational sector for the integration of technology within the school curriculum and enhancing ICT amenities (Ministry of Finance, 2015).

However, In spite of this huge investment and governmental support, Saudi Arabia still lags behind those countries that lead the world in education, particularly concerning ICT (Ageel, 2011). There is still a clear gap in Saudi schools between the availability of ICT tools and the methods of implementation. Several contemporary researches associated with ICT within Saudi schools (Oyaid, 2009; Almadhour, 2010; Almalki & Williams, 2012; Al-harbi, 2014), stated that the Saudi government has to develop an effective strategy for ICT in education and to apply it practically.

Almadhour (2010) in his research reached this conclusion, "Unfortunately although the Saudi Arabian government has lots of funding, there is no clear strategic framework towards equipping ICT in schools". This has largely been attributed to poor implementation. In addition, studies conducted in North America have actually shown that greater availability of technological resources in the classroom does not necessarily translate to improved academic achievement (Wozney et al, 2006; Ungerleider & Burns, 2002; Balanskat et al., 2006). This has largely been attributed to poor implementation. The literature revealed that a successful implementation of ICT in education entails first, identifying educational problems, what students, educators, and learning institutions desire to accomplish, and then utilizing ICT as knowledge construction tools as opposed to instructional tools and viewing ICT integration as a process.

Consequently, this paper aims to explore the success factors for the effective incorporation of ICT into instructional practices by answering the research question, 'what factors affect the successful implementation of ICT in Saudi schools' through reviewing the relevant ICT literature in education, In addition, to identifying the main barriers that hinder ICT in education. The paper concluded that the successful implementation of ICT entails paying attention and investigation of some factors, which will be discussed in the next section.

1.1. **Success factors for ICT implementation**

ICT comprises a “varied set of technological devices and resources utilized to interact, as well as create, distribute, gather and control information” (Blurton, 1999. p46). This includes desktops, portable computers, storage devices, the internet, projectors, and interactive whiteboards. Based on this definition, it is clear that ICTs are now common elements in the teaching and learning environment (Bhattacharya and Sharma, 2007).

In Saudi Arabia, the introduction of ICT as a subject of study dates back to 1985, when the subject was taught only in private schools (Al-Aqeely, 2001). Compulsory learning of ICT subjects in all secondary schools was however introduced later in 1991. For several years, computers in the Saudi education environment were used for administrative purposes (CITC, 2015). The government has nonetheless since 2005 committed to integrating ICT into instructional practices. To achieve this, the government has established some projects such as, Learning Resource Centers, computer labs, and digital technical centers in various regions across the country (Ildeniz, 2012). However, the successful implementation of these technologies remains a real challenge for the decision-makers in education.

1.2. **Clear justification of ICT integration**

According to Vallance et al. (2009), one of the major factors that account for ineffective implementation of ICT in education is the lack of a clear justification for the incorporation of ICT in the classroom. In a similar vein, Al-harbi (2014) argues that in spite of adopting ICT in their instructional practices, educators have limited knowledge of how to effectively integrate ICT into classroom practices. In other words, the adoption of ICT is often conducted without a solid understanding of what the technologies should enhance and in the absence of clear guiding values. This view was supported by Twining (2007), who argued that lack of a common vision about the value of technological tools in education explains why, despite substantial investments in educational technology, the desired benefits are yet to be realized. Twining's (2007) research, which involved respondents from 94 countries, highlights three broad justifications for the adoption of ICT resources in the classroom: enhancing technological literacy, supporting learning, and boosting productivity. Therefore, it is imperative to have a clear rationale before making the decision to invest in educational technology.

1.3. **Singling out an educational problem and objectives of the curriculum**

According to Al-harbi (2014), successful implementation of ICT in teaching and learning starts with singling out an educational problem. In other words, the need to adopt ICT in the classroom should be grounded in dissatisfaction with the status quo and the desire to improve the educational opportunities provided to students. This view is supported by Hakami et al. (2013), who posit that it is important, at first to identify the objectives of the curriculum and the outcomes desired. Having a clear understanding of the educational problem enables educators to choose the most appropriate ICT tools to address the identified need, paying attention to their merits and demerits. As Al-harbi (2014) puts it, educators cannot effectively utilize ICT in the classroom without a clear understanding of the most appropriate ICT tools.

In the same concept, Singapore, for instance, has recognized ICT as a driver of its educational sector in 1997 with the launch of the ICT Master Plan. Its primary goal was to ensure proper integration of ICT tools into the school curriculum along with the development of a culture of lifelong learning, thinking, and social responsibility (Lim, 2007). To sum up, the goals pursued by the Master plan were to design curriculum and assessment techniques, to provide learning resources, to conduct teacher development, and to build a technological and psychical infrastructure. The implementation plan prescribed three stages to take part in 1997, 1998, and 1999. Schools with previous history of the use of ICT tools were chosen as demonstration units. The process of the ICT integration addressed all subject areas in primary, secondary, and junior college institutions (Lim, 2007).

It is also important for educators to note that greater availability of ICTs in the classroom does not necessarily translate to productive learning. Al-harbi (2014), calls this techno-centric thinking, which should be avoided if educational technology is to produce the desired benefits. Simply stated, productive learning does not occur merely because technological tools are available in the classroom. This is because ICT on its own does not lead to improved academic achievement. Some studies have actually demonstrated that no direct relationship exists between ICT utilization and positive learning outcomes (Wozney et al., 2006; Balanskat et al., 2006). Effective utilization of the technologies is what matters; otherwise, the whole idea may be a waste of resources.

1.4. **Promote a constructivist learning environment**

Another aspect of successful ICT implementation is that it should promote a constructivist learning environment (Pedersen and Liu, 2003). A growing body of literature is urging educators to shift from the conventional teacher-centered classroom to more student-centered learning, which is referred to as constructivist learning (Roblyer and Doering, 2010). Constructivist learning pays attention to the manner in which students construct knowledge. In such an environment, students become active participants in the learning process as opposed to passive listeners, as they learn via purposeful activities. In this regard, technological tools should be used as tools for constructing knowledge rather than for instructional purposes. This way, as argued by Kirschner and Erkens (2006), students' critical, analytical, and cognitive abilities are aroused.

1.5. **ICT should be a process, not a product**

The implementation of ICT should be viewed as a process, not a product (Yalin et al., 2007). According to Afshari et al. (2009), ICT implementation is a sophisticated process that is dependent upon myriad factors. This sentiment is well amplified by (Bingimlas, 2009), who argued that the integration of ICT into the classroom needs addressing of the barriers that may hinder the success of the various processes involved. Roblyer and Doering (2010), emphasize that the implementation of ICT is most successful when there are supportive processes in place. Therefore, it should be investigated in some of the obstacles that might hinder the use of ICT tools at schools. This could then help to make the implementation of ICT tools more successful.

Some of the obstacles that hinder effective ICT implementation include inadequate organizational support, infrastructure, resources, planning, training, as well as teacher beliefs and attitudes towards educational technology (Bingimal,2009; Ertmer et al., 2007; Hew & Brush, 2007). These obstacles are experienced in both developed and developing countries.

2. Factors hindering ICT implementation

The previous section showed some factors that could help to make the application of ICT in education more successful. However, the absence of these factors could be considered to comprise barriers, which hinder ICT implementation. Accordingly, the following section discusses main barriers that hinder the effective implementation of ICT in general and in Saudi schools in particular. Overcoming of these obstacles could turn them from barriers to be success factors and vice versa.

2.1. **Lack of ICT resources**

Lack of adequate supportive resources is one of the main factors that hinder ICT implementation in education (Alhawiti, 2013). According to Bingimlas (2009), inaccessibility of resources remains a major obstacle to the incorporation of technology in education in both developed and developing countries. Bingimlas's analysis shows that computers may not always be accessible to educators. One reason for this is that such resources are mostly shared in most learning institutions. This is further aggravated by inadequate copies of software, lack of simultaneous internet access, slowness of ICT systems, and limited availability of educational software. Essentially, it is difficult to successfully implement ICT in education without sufficient hardware and software (Bingimlas, 2009).

In Saudi Arabia, lack of adequate resources is a major hindering factor in as far as the adoption of educational technology is concerned (Almaghlouth, 2008). In fact, most teachers in the country avoid using audio-visual aids in class, due to lack of supportive equipment and resources such as internet access, laptop computers, and computer labs (Al-harbi, 2014). ICT resource scarcity also affects students. A study carried out by Hakami et al. (2013) in order to investigate critical success factors for ICT integration into the Saudi school curriculum shows that one computer serves about 10 students in each secondary school. This is despite using computers in virtually all lessons. It is therefore important to provide both students and educators with sufficient supportive equipment.

2.2. **Lack of ICT policy**

Another major factor that hinders the effective implementation of educational technology into schools is the lack of educational policy and strategy relating to ICT adoption (Oyaid, 2009). In this concept, Wozney et al. (2006), argue that a clear policy framework helps in the creation of a school culture that supports ICT adoption. Balanskat et al. (2006), stressed that it is important for policy makers in the education sector to focus on policies that encourage educators to incorporate educational technologies in their instructional practices. This, for instance, includes rewarding teachers who use educational technology.

In Saudi Arabia, educators have called for clear policy planning in terms of ICT implementation in schools(Al-Oteawi, 2002). Accordingly, without such a plan, it would be difficult to effectively implement ICT tools into schools. Some scholars emphasize the role played by the perceptions of educational policy makers in the successful implementation of ICT in schools. Tondeur et al. (2008), for instance, argue that ICT implementation is successful when educators have a common vision, clearly articulated in the school's policy.

2.3. **Lack of management and technical support**

ICT implementation in schools is also hindered by lack of management and technical support (Kozma, 2008). Research done by Ismail (2010) argued that one of the key obligations for the school administration comprises being conscious of areas that necessitate attentions for the fruitful application of ICT within institutions. Wong et al. (2008) established that if the school administration offers support and motivation for the teachers, a suitable working atmosphere would be formed to encourage teachers to test the use of ICT within their lessons. Technical issues such as poor internet connectivity, for instance, discourage teachers from using educational technology. This is particularly true for school teachers (Bingimlas, 2009).

In Saudi Arabia, teachers would be reluctant to use technological resources if they believed that they would experience technical or hardware problems (Almaghlouth, 2008). To avoid this, learning institutions should provide adequate ICT support services (such as making technicians available and securing ICT maintenance contracts) and ongoing technical training for teachers (Mumtaz, 2000). Studies done in 17 different European countries demonstrate the importance of technical support in encouraging teachers to use ICT tools in their teaching methods (Korte and Hüsing, 2007).Therefore, educational managers have an instrumental role to play in achieving this.

2.4. **Time limitations**

Teachers are also hampered by over-loaded curriculums, which leave them little time to integrate technology into their instructional practices (Bingimlas, 2009). Time limitations and difficulties of scheduling adequate time for technology-oriented classes is actually a significant barrier to the use of technological resources in teaching (Jones, 2004; Tearle, 2003). A survey conducted on twenty-six different countries showed that 54% of teachers agreed that they do not have sufficient time to use ICT tools in the classroom (Pelgrum, 2001).

In Saudi Arabia, the average teacher's schedule comprises 18 lessons per week, with each lesson lasting 45 minutes; this could hinder the implementation of ICT tools due to the lack of adequate time (Al Asmari, 2011; Al-Alwani,2005). This leaves a very limited amount of time to work on integrating technology into their instructional practices. This is worsened by the lack of motivation and encouragement from the administration. It is therefore important for educational managers to provide the necessary support, such as reducing teacher workload and creating flexible teachers' timetables (Hakami et al., 2013).

2.5. **Lack of teachers training and confidence**

It is also important for learning institutions to provide teachers with more training on educational technology (Hennessy, 2005). Lack of training is actually the most commonly cited barrier in the successful implementation of ICT in teaching and learning (Bingimlas, 2009; Balanskat et al., 2006; Hakami, et al., 2013;Buabeng-Andoh, 2012). Teachers have limited knowledge on the use technological resources in the classroom. Therefore, training equips teachers with the skills and knowledge necessary for utilizing ICT in the classroom (Hew & Brush, 2007). This also equips teachers with greater confidence in as far as using educational technology is concerned. Bingimlas (2009), actually argues that lack of teacher confidence, which is occasioned by anxiety, teachers' fear of failure, and limited ICT training, should be viewed as a major hindrance factor to the successful implementation of ICT in teaching and learning.

In Saudi Arabia, lack of training and education on educational technology is a major factor that hinders the successful implementation of ICT (Al Asmari, 2011; Bingimlas, 2009), as most educators have limited computer and/or internet literacy(Al-harbi, 2014). This is particularly true for science subjects in which the integration of ICT has been more challenging as compared to other subjects (Bingimlas, 2009). Inadequate teacher training warrants the establishment of teacher development programs to assist teachers in their efforts to incorporate ICT in the classroom. Adequate ICT training has promising implications for the successful implementation of ICT in Saudi classrooms as it focuses on enhancing technical efficiency, increasing awareness of educational technology, and changing negative attitudes towards educational technology.

2.6. **Lack of pedagogical training**

Though technical competence is necessary, it is important for educators to be competent in other areas such as technology, pedagogy, and content (Koehler and Mishra, 2009). This view is also supported by Bingimlas (2009), who argues; that rather than just ICT training, pedagogical training should as well be provided to teachers. He adds that even after receiving ICT training, educators still face the challenge of incorporating the knowledge acquired. For effective utilization of ICT in the teaching and learning process, teachers must have comprehensive knowledge in technology, pedagogy, and content. According to (Koehler and Mishra, 2009), these elements interact to provide an understanding of delivering content using the most appropriate pedagogy and technology. Knowledge in these aspects places teachers in a better position to use subjects in specific activities to improve student learning. In essence, teachers knowledgeable in these aspects are better placed to use ICT effectively as opposed to those with ICT training only. The implication is that teachers should receive not only ICT training, but also pedagogical training.

2.7. **Teacher attitudes and beliefs**

Teacher attitudes and beliefs about educational technology have also been shown to affect the implementation of ICT tools (Alshumaimeri, 2008; Saleh, 2008). It is generally assumed that as long as there are adequate technological resources, enough technical training, a supportive policy, and a favorable environment, the implementation of ICT will occur automatically (Lim and Khine, 2006). Research studies nonetheless reveal that without the right teacher attitudes towards educational technology, ICT implementation may be a big failure (Hew & Brush, 2007; Tezci, 2009). The ultimate decision to use technological tools in instructional practices largely lies with the teacher. Teachers with negative attitudes towards ICT are less likely to use or support the use of ICT in their schools as opposed to teachers with positive attitudes (Al-harbi, 2014). Negative attitudes may be occasioned by factors such as lack of understanding about how the technology will be beneficial to the teacher and uncertainty about management support and guidance (Bingimlas, 2009). It is therefore important for learning institutions to understand how educators view the use of technology in the context of education.

2.8. **Resistance to change**

Bingimlas (2009) further argues that resistance to change significantly hampers the successful implementation of ICT in classrooms. Integrating technology into teaching and learning certainly implies changes in the educational setting. It is therefore obvious that the change will elicit different reactions from different teachers. As explained by Bingimlas (2009), resistance to change may not be a barrier in itself; it may be a sign that something is not right. Teachers could be worried about inadequate technical support, their limited technical expertise, as well as the time needed for planning. A study conducted by Almaghlouth (2008) to investigate the perceptions of Saudi science teachers towards the use of ICTs in instructional practices found that even though some respondents perceived educational technology to be of immense value, they would be reluctant to use the resources if there was no adequate support. This raises the importance of considering the opinions of teachers towards the change; otherwise, teachers may continue holding on to their conventional instructional practices.

To change negative attitudes towards educational technology, and to reduce resistance to change, professional development programs for teachers can be of great value (Al-harbi, 2014). As shown by Alshumaimeri (2008), who carried out a study to investigate the link between ICT training and attitudes towards technological tools in language teaching, more ICT training increases teacher confidence and the probability of using technological resources in instructional practices.

Regarding teachers' beliefs, Almalki and Williams (2012) identified culture as another factor that hinders the integration of educational technology into Saudi Arabian classrooms. In most cases, developing countries copy and paste educational technology frameworks from developed countries. Most of these initiatives end up failing due to differences in culture. Cultural differences directly or indirectly affect the degree of ICT integration into the learning environment (Almalki and Williams, 2012) As mentioned before, it is important for technological tools to promote constructivist learning, which entails collaborative learning, student-centered learning, and independent learning. However, in most non-Western countries, especially Arab countries, educators express some reservations with the constructivist learning advocated by Western discourse(Almalki and Williams, 2012). This to some extent explains the unsuccessful implementation of ICT in Saudi classrooms. In fact, as explained by Alenezi (2014), balancing technology with Islamic values has been a challenging endeavor for the country's education sector. Therefore, he sees that there is a necessity to consider the underlying cultural framework when implementing ICT initiatives in the teaching and learning environment in order for Islamic beliefs not to be in conflict with digital technologies.

2.9. **Lack of progressive evaluation**

Finally, the lack of progressive evaluation explains the ineffectiveness of ICT integration into Saudi classrooms (Hakami et al., 2013). Ongoing evaluation is important for establishing the effectiveness of any reform initiative. This enables the identification of faults and correcting them early enough before they escalate. In Saudi Arabia, there is no evidence of the evaluation of the impact of ICT-based instructional practices on learning; eight years after the government introduced the initiative. According to Hakami et al. (2013) this has cost the country a lot in terms of resources.

To sum up, the study concluded with 16 main factors, which should be taken into consideration in order to make ICT application more effective in schools. These factors are illustrated in the subsequent diagram.

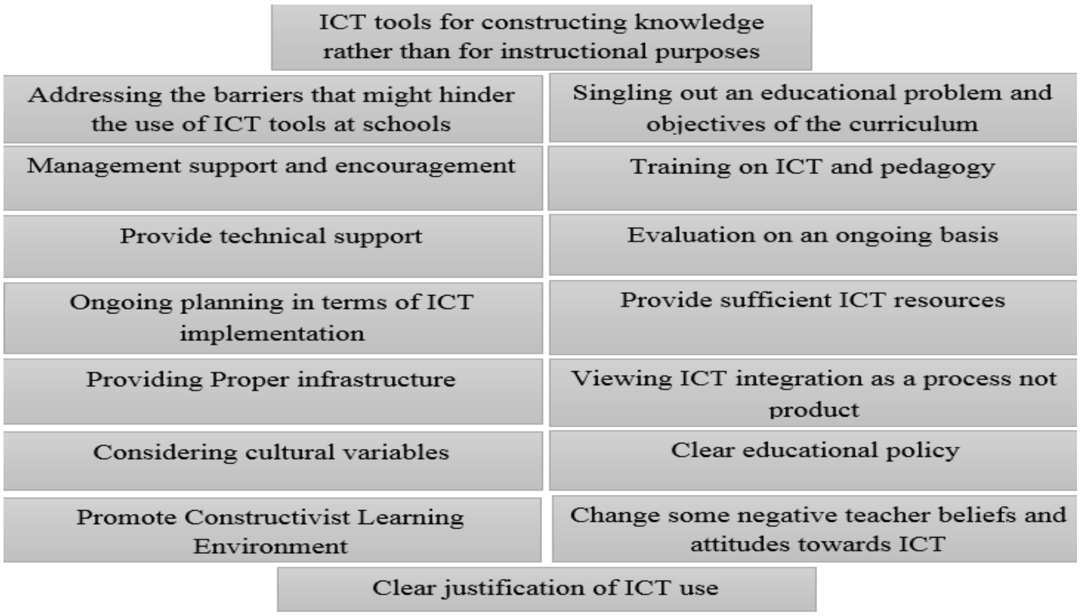

Figure1: Success factors for ICT implementation in education

3. Conclusion

In conclusion, the use of ICT in the teaching and learning environment has promising implications for Saudi schools in. This implementation, however, is hindered by several factors, including inadequate management and organizational support, inadequate training, negative teachers' attitudes towards educational technology, cultural factors, and insufficient infrastructure. Other hindrances include lack of ICT policy, lack of a justification for the need of ICT in education, and lack of progressive evaluation. Without first addressing these barriers, ICT implementation in Saudi Arabian schools will not be successful in the classroom. No single element is sufficient to guarantee quality teaching, but the presence of all the elements increases the possibility of successful implementation of ICT in schools. Consequently, this paper could help to answer some questions such as; how to support the implementation of ICT in education, what barriers hinder its successful implementation, what are the best methods to make the application of ICT more effective, and establish the kind of support that ICT stakeholders need. Hence, the importance of this research is to suggest some effective solutions, which may help to make ICT implementation in Saudi schools more successful and which could lead to suggesting some solutions for decision-makers.

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Factors affecting Trust in Virtual Project Teams in Construction Sector in Middle East

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Abstract

The continuing market pressure throughout the project life cycle to achieve reduction in costs, improvement in quality, and reduced time to market, is becoming a threat to many Architectural/Engineering/ Construction companies. With the latest technologies, global alliances and changing customer needs, these companies have adopted virtual teams for their business activities. It has been observed that distributed work of virtual teams introduces huge coordination overheads. Cross-Functional cooperation and effective teamwork have emerged as some of the crucial ingredients for making these virtual teams work.

The Middle East is a multicultural region with people coming from various backgrounds and different countries to work on various kinds of projects, and hence, it's very important to understand the phenomenon of these groups who relate across multiple cultures. Trust among virtual team members is considered to be one of the primary concerns that affect the performance of virtual teams in Construction Sector. A great deal of literature has pointed to the importance of trust as a facilitator of positive relationships among project stakeholders. Much of the research has been done in understanding the parameters of trust involving owners, suppliers and contractors in any construction company. There has been lack of research involving trust among virtual team members working in the construction sector in Middle East. This is particularly important as trust among virtual team members is responsible for their increased performance. This will help them to have information sharing that will result in faster execution of the projects and leads to greater performance of the virtual teams. This aim of the paper is to identify key factors affecting trust in virtual project teams. This paper provides with the review of the literature regarding virtual teams, key challenges faced by them and research methodology adopted. Further to this, this paper reviews existing international literature to identify the variables affecting trust among virtual teams. The variables are then grouped together to form factors after understanding their definitions and commonalities among them. This research would be beneficial to Project Managers of Architectural/ Engineering / Construction Companies by facilitating them to know the actions required for better team collaboration in virtual teams. This will lead to greater team performance and individual learning.

Keywords:

Construction Sector, Collaborative Tools, Performance, Trust, Virtual Teams

1. Introduction

The increased demand of faster development time of projects advocates the use of a multi-disciplinary project team, whereby participants are brought together during the design stage to determine how downstream issues may be affected by design decisions(Nathaniel & Anthony, 2012). Certain reports identified, amongst other factors, the fragmented nature of the construction process and industry, the distinct separation of the professions, poor communication, a lack of concurrency, institutional barriers, ad hoc problem solving approaches, lack of trust and collaborative spirit within the client/design/construction team as responsible for the consistently low levels of performance(Nathaniel & Anthony, 2012). It has been found that 90% of the research on trust in virtual teams is being done on trust between suppliers, contractors and owners of the construction company (Kadefors, 2004a) (E Lau & Rowlinson, 2011) (Pinto et al., 2009) (Ellen Lau & Rowlinson, 2009b). Virtual teams from High Tech IT companies, Online Communities, Telecommunication Company, Health care Industry, Private Enterprises from various parts of world are being studied (Ho & Richardson, 2013) (H. Lee et al., 2014). Trust among team members of virtual project team members has not been analysed in industry /field settings especially in Construction sector in Middle East which is considered as one of the main reasons of delays in projects.

There would be construction boom by 2020 in Middle East because of Qatar World Cup 2022 and a Dubai Expo in 2020. Government–led construction projects will drive an estimated AED 3.3 trillion (USD 0.9 tn) spending boom in the building sector by 2020. Report by building material company Danube, real estate projects account for an estimated AED 1.89tn ($514billion) of the current developments across the GCC. There would be great demand of hotels in 2020 as around 25 million tourists are going to visit Dubai (Deutsche Bank forecast) and it shows the requirement of extra hotel rooms of around 47000 by 2016. The analysis shows a total of USD $43bn to be spent on Airport Expansion (USD $7.8bn), Construction of hotel rooms and hotel apartments (USD$24bn), Creation of additional retail space (USD $9bn), Metro expansion plan (USD$1.38bn) and Jebel Ali Port – T3 Terminal (USD $1bn).The analysis also showed that there is a need of extra construction of 30, 69,000 sq. m by 2020. Therefore, there is desire for faster completion of projects which demands multitasking and better coordination among project teams and hence trust among team members is required for better performance.

The Gulf construction projects suffers from delays and cost over runs. There are many reasons for that, few of them are listed here:

- There is an increasingly significant gap between what is expected of virtual team members; and what they are actually able to deliver (Anderson, S., Navratil, P. & Hanson, J., 2013).
- There is dissatisfaction among employees because of lack of career growth opportunities and challenging projects within a particular industry. So it becomes very difficult to attract and retain expatriate to work on a particular project making further delay in the execution of the project.
- Communication problems between project managers and team mmbers, lack of recognition, delay in responding to requests for information leads to communication issues among team members (Jarkas, A.M. et al., 2013).

These issues gave us the required motivation to work on multi-disciplinary virtual project teams, to understand their performance factors and to propose a conceptual framework to analyze the impact of these factors on trust of virtual project teams in construction sector in the context of Middle East.

Following this introduction, the remainder of this paper will be organized as follows: In section 2, we present with the Research Methodology. Section 3 discusses about Virtual teams with its definition, challenges faced by the virtual project teams and trust in Virtual teams. Understanding the need from the literature, we have concentrated our efforts on one of the primary concern of Virtual project teams that is **Trust**. Section 4 of the paper deals with variables affecting the trust in virtual teams which has been shortlisted after comprehensive literature review and grouping of these variables into various factors after understanding their definitions and finding the commonalities among them.

2. Research Methodology

This study is a part of an on-going PhD programme which is conducted in three phases:

Phase I: The Research Planning phase that includes problem description and literature review. The aim of this paper is to provide factors affecting trust in virtual teams in construction sector of Middle East. This was achieved by extensive review of literature. In the Literature review process, the systematic analysis of various research papers and articles are done to achieve list of variables affecting trust in virtual teams in construction sector of Middle East. After getting list of variables through this comprehensive literature review, these are grouped into various factors after understanding their definitions and finding the commonalities among them.

Phase II: The Research Development phase would include Pilot Study and Analysis, Design of Data collection methods, Sampling, Data Analysis using SEM technique. This phase would finally lea to the development of a model for assessing trust in virtual project teams.

Phase III: The model would be proposed after validating it with required methodology in the Research Validation phase. The findings would be critically examined to draw conclusions and future research recommendations.

This paper reveals the results of phase I of the research. To provide a timely and sufficiently in-depth analysis of the current state of the literature, key papers were identified by looking at the archives from the top databases such as ACM Digital Library, Construction Information Science, Emerald Insight, EBSCO, Science Direct, Google Scholar, IEEE Explore, JSTOR, ProQuest and SAGE. The terms such as trust, computer mediated teams, virtual teams, dispersed collaboration, virtual groups were used to search in abstracts.

3. Literature Review

The construction industry generally has been faced with continuously increasing and sophisticated demands, which call for most efficient use of resources (Nathaniel & Anthony, 2012). Project life cycles are shrinking virtually in all areas. The overall goal is to increase productivity and product quality and to bring new products and projects to market faster. In response, the construction industry has evolved, with the fragmentation of the production responsibilities into many sub-processes split amongst many participants, who belong to different organizations with different policies, objectives and practices (Aniekwu, 2002). For this to happen, the construction industry has to rely on foreign skills and technologies leading to the evolution of virtual teams. Such teams are expected to comprise of capable individuals representing the relevant departments in the organization. From the literature, we have understood that there are social, technical and structural issues involving the operation of the virtual teams which are discussed in further sections of the literature review.

3.1. **Virtual Teams**

A global virtual team is an example of organizational form, where a temporary team is formed on an as-needed basis, for the duration of a task and staffed by members from far corners of the world (Jarvenpaa, Knoll, & Leidner, 1998). Another definition suggests that virtual teams, are distributed work teams whose members are geographically dispersed and coordinate their work predominantly with electronic information and communication technologies (e-mail, video-conferencing, telephone, etc.)(Hertel, Geister, & Konradt, 2005). From the perspective of Leenders et al. (2003), virtual teams are groups of individuals collaborating in the execution of a specific project while geographically and often temporally distributed, possibly anywhere within (and beyond) their parent organization. Lurey and Raisinghani (2001) defined virtual teams - groups of people who work together although they are often dispersed across space, time, and/or organizational boundaries. Amongst the different definitions of the concept of a virtual team, the following from one of the most widely accepted: (Powell, Piccoli, & Ives, 2004), ‘‘we define virtual teams as groups of geographically, organizationally and/or time dispersed workers brought together by information technologies to accomplish one or more organization tasks’’.

Such virtual teams rarely meet face to face and are primarily linked through computer and telecommunication technologies often across national boundaries.

With globalization partially spurred by improved telecommunications infrastructures, virtual teams are becoming the norm in most corporate environments such as consulting firms, technology products, and e-commerce (Lurey & Raisinghani, 2001) and are being increasingly examined in academic literature (Powell et al., 2004), in open source software development (Ho & Richardson, 2013) and in online communities (H. Lee, Ahn, Kim, & Lee, 2014).

3.2. **Challenges of Virtual Teams**

While there are great advantages that come with the adoption of the virtual teams, it has been understood from literature that new challenges rise with them. In this section, the challenges of virtual teams are listed with their respective references.

Being equipped with even the most advanced technologies is not adequate to make a virtual team effective, since the internal group dynamics and external support mechanisms must also be present for a team to succeed in the virtual world. The first and foremost challenge involved in virtual project team is Trust (Dirks, 1999), (Furst, Blackburn, & Rosen, 1999), (Bal & Teo, 2001), (Chi, Jen, Yang, & Fu, 2004),(Sridhar & Paul, 2006), (Peters & Karren, 2009), (Mansor, Mirahsani, & Saidi, 2012), (Pangil & Chan, 2014) which is a key element to build successful interactions and to overcome selfish interests. Trust increases the motivation of the team members which help them to share information among them which is needed for greater performance of the virtual team. The absence of trust leads to greater dissatisfaction among the team members which greatly effects the performance of the team. The second one is effective communication (Lurey & Raisinghani, 2001),(Sridhar & Paul, 2006),(Munkvold & Zigurs, 2007),(Chang, Chuang, & Chao, 2011),(Gustavo, Ferreira, Pinheiro, Lima, & Gouvea, 2012), (Amah, Nwuche, & Chukuigwe, 2013) which if not there, creates communication and language barriers and this gets increased with the discrepancies in technological proficiency among team participants. Then team cohesiveness is needed for information sharing (Warkentin, Sayeed, & Hightower, 1997),(Sridhar & Paul, 2006),(Garrison, Wakefield, Xu, & Kim, 2010),(Brahm & Kunze, 2012),(Daspit, Tillman, & Mckee, 2013). The primary factor leading to team cohesion is degree of trust among team members. Related to conflict (Paul, Seetharaman, Samarah, & Mykytyn, 2004), it has been found that the virtual context lends itself to more uninhibited behavior by team members compared to interactions within face-to-face contexts. Also diversity is a challenge which includes functional and cultural diversity (Furst et al., 1999), (Munkvold & Zigurs, 2007),(Chang et al., 2011),(Gustavo et al., 2012),(Naha, Mansor, & Mirahsani, 2012),(Amah et al., 2013). Cultural and functional diversity have been found to negatively impact virtual coordination and reduces the probability of group think. Additionally leadership of the project manager affects the performance (Lurey & Raisinghani, 2001),(Chi, Jen, Yang, & Fu, 2004),(Amah et al., 2013), (Daspit et al., 2013). The attitude of team manager should be assertive yet not bossy, caring, relates to members at their own levels and should be consistent throughout the life of the project. In building a virtual team, all of these issues must be at least implicitly addressed in order to have an effective virtual team (Hunsaker and Hunsaker, 2008).

3.3. **Trust in Virtual Teams**

One key component in a successful virtual team is the ability of the team members to deliver the promised work. It is generally assumed that a critical factor in the successful completion of a project is trust in fellow team members to deliver their share of the work on time and with sufficient quality (Jarvenpaa et al., 1998). The issue of trust is very important particularly in the context of virtual teams because virtual team members are "geographically dispersed" and lack "shared social-context" and "face-to-face encounter" that are considered by many researchers as irreplaceable for building trust and repairing shattered trust (Jarvenpaa & Leidner,1999).Although there is great amount of international literature on trust involving owners, suppliers and contractors, but there has been very less work done on the trust involving team members of virtual teams in Construction Sector of Middle East. From the comprehensive literature study, it can be concluded that most of what we know about trust in virtual teams is based on student participants, primarily in educational field studies and in experiments (Powell et al., 2004).

Trust has been defined as the "willingness of a party to be vulnerable to the actions of another party, based on the expectation that the other will perform a particular action important to the person in whom trust is placed, irrespective of the ability to monitor or control that other party" (Mayerson, et al. 1996).

Virtual team failure is directly related to the difficulties of building trust, positive relationships across the three boundaries of geographical distance, time zones, and cultural differences (Kimble, 2011a). Some of the problems that multi-cultural virtual teams experience include the following: time delays in replies, lack of synergy among cross-cultural team members, communications breakdowns due to cultural variances, unresolved conflicts among culturally different members, limited hours allowed to be worked and different holidays (Vinaja, 2003). The key findings reported by (Vakola & Wilson, 2004) were the challenge of leadership, managing virtual aspects of communication and developing trust. Further to this, it is understood by the literature that virtual teams face particular challenges involving trust, communication, deadlines, and team cohesiveness (Hosseini & Chileshe, 2013).

Based on the extensive review of 150 research papers, it has been found that 90% of the research on trust in virtual teams is being done in industry environment where the major consideration was on trust between suppliers, contractors and owners of the construction company (Kadefors, 2004a) (E Lau & Rowlinson, 2011) (Pinto et al., 2009)(Ellen Lau & Rowlinson, 2009b).It has been figured out that trust among team members of virtual project team has not been analyzed in industry / field settings especially in Construction sector of Middle East whereas much work has already been published on open source software development teams (Ho & Richardson, 2013) and in online communities (H. Lee et al., 2014). Considering this fact, our focus is on identifying the factors that affect trust in virtual project teams in construction sector in Middle East.

4. Variables affecting Trust in Virtual Teams

After reviewing about 150 papers from various reputed journals and conferences, the researcher has identified 40 variables affecting the trust of virtual teams. This investigation was divided into two parts- the first part is identifying the variables affecting the trust in virtual teams and second part is dealing with grouping of variables affecting trust in virtual teams into factors by understanding their definitions and commonalities among them.

The definitions of variables along with their references are listed below. Through the references, the researcher could understand their importance in the field of virtual team and definitions helped in finding the commonalities among them.

1. Team Size: Number of primary team members and it is related to amount of communication that transpires among team members. (Mansor et al., 2012), (Peters & Karren, 2009), (Amah et al., 2013),(Daspit et al., 2013), (Muethel, Siebdrat, & Hoegl, 2012), (Von der Ohe & Martins, 2010a).
2. Respect: Refers to respect towards team members which helps in understanding the colleagues and helps in developing trust among them. (Mansor et al., 2012), (Ashleigh & Nandhakumar, 2007a)
3. Recruitment Strategy: Refers to the recruitment of people who possess interpersonal skills in addition to technical skills that will enable them to be better team players. (Mansor et al., 2012), (Lurey & Raisinghani, 2001), (Amah et al., 2013), (Nader Ale Ebrahim, Ahmed, & Taha, 2009),(Diallo & Thuillier, 2005)
4. Reward Plan: Refers to incentive in terms of recognition in company newsletters or monetary benefits based on individual and team performance. This greatly motivates the team member and which leads to better performance. (Mansor et al., 2012), (Amah et al., 2013), (Lurey & Raisinghani, 2001), (Nader Ale Ebrahim et al., 2009), (Furst et al., 1999), (Bryant, Albring, & Murthy, 2009), (Tran, 2012) (P. T. Nguyen, Babar, & Verner, 2006)(Kadefors, 2004)
5. Communication: Refers to Synchronous (Chat, Net meeting) or Asynchronous (email, electronic bulletin boards) communication. The highly natural communication among team members, include a high degree of synchronicity, the ability to observe and convey facial

expressions, the ability to observe and listen to speech will enhance virtual team performance. It also refers to communication quality which is defined as degree to which the content of the communication is received and understood by the other party in the relationship. (Mansor et al., 2012),(Chi, Jen, Yang, & Fu, 2004),(Sridhar & Paul, 2006), (Hsin Hsin, Shuang-Shii, & Shu Han, 2011), (Gustavo et al., 2012), (Lurey & Raisinghani, 2001), (Amah et al., 2013), (Shachaf, 2008), (Lin, Standing, & Liu, 2008), (Bryant, Albring, & Murthy, 2009), (Mansor et al., 2012), (Dorairaj, Noble, & Malik, 2012a), (Xiao & Wei, 2008a), (Bergiel, Bergiel, & Balsmeirer, 2008), (Horwitz, Desmond, & Ulrik, 2006), (Kasper-Fuehrera & Ashkanasy, 2001), (Kimble, 2011b), (Muethel et al., 2012), (P. Nguyen, Babar, & Verner, 2006), (Olson & Olson, 2012), (Saxena & Burmann, 2014), (Verburg, Bosch-sijtsema, & Vartiainen, 2013), (Webster & Wong, 2008), (Zimmermann, 2011), (Tran, 2012), (Ashleigh & Nandhakumar, 2007b), (Bao, Yang, Xie, & Zhou, 2004), (Berry, 2011), (Bodensteiner & Stecklein, 2010), (Chutnik & Grzesik, 2009), (Dakrory & Abdou, 2009), (Germain, 2011; Hosøy, 2011),(Iacono & Weisband, 1997), (Kramer & Lewicki, 2010),(Lau & Rowlinson, 2009), (Maley & Moeller, 2014),(Mancini, 2010),(Nakayama, Binotto, & Pilla, 2006), (Pierce & Hansen, 2013), (Thomas & Bostrom, 2008),(Zhan & Xiong, 2008)

6. Employee Satisfaction: Refers to the attitudes of the group members towards one another. As group members develop more positive attitudes towards one another, their satisfaction with the group's work increases and leads to greater trust among themselves. (Mansor et al., 2012), (Beranek, 2000), (Yang, 2014), (Chi et al., 2004), (Bryant et al., 2009), (Joe, Tsai, Lin, & Liu, 2014), (Vakola & Wilson, 2004), (Warkentin et al., 1997)
7. Network Security: Virtual teams involve exchange and manipulation of sensitive information and data through the internet, therefore security is always an important issue of concern. The higher amount of security of their data leads to more trust in the organization. (Mansor et al., 2012)
8. Training: The training includes self-managing skills, communication and meeting training, project management skills and technology training and is important for the overall development of the team member which facilitates better understanding of other individuals in the team.(Mansor et al., 2012), (Beranek, 2000),(Furst et al., 1999),(Germain, 2011), (Lee-Kelley & Sankey, 2008), (Chi et al., 2004), (N Ale Ebrahim, Ahmed, & Taha, 2009), (Mansor et al., 2012), (Vakola & Wilson, 2004)
9. Clear objectives and goals: The team's goals refers to the appropriate setting of goals which incorporates the organization's strategy, the objectives of the various team members and the needs of team members. The clear understanding of goals leads to better understanding of what is expected of the team members. (Amah et al., 2013; Bergiel et al., 2008; Brahm & Kunze, 2012; Christoph Clases, Renhard Bachmann and Wehner, 2004; N Ale Ebrahim et al., 2009; Germain, 2011; Gustavo et al., 2012; Hung, Dennis, & Robert, 2004; Information, 2014; Lee-Kelley & Sankey, 2008; Mancini, 2010; Munkvold & Zigurs, 2007; Naha et al., 2012; Prasad & Akhilesh, 2002; Sumita Raghuram, Raghu Garud, Batia Wiesenfeld, 2001; R. M. Verburg et al., 2013)

10. Task Complexity: Refers to the nature of tasks. It says that more complex tasks call for more cooperation and coordination between team members because teams must search and evaluate alternatives. (Amah et al., 2013; Munkvold & Zigurs, 2007; Naha et al., 2012;Bell & Kozlowski, 2002; Xu, Le, Deitermann, & Montague, 2014)
11. Task-technology fit: It is important in virtual teams' life cycle to evaluate the possible fit between various technologies available to virtual teams and the tasks which are called upon to be completed. The choice of technology depends on individual preferences, experience with the technology and its ease of use. (Bergiel et al., 2008; T. Daim, Ha, & Reutiman, 2012; Furst et al., 1999; Lurey & Raisinghani, 2001; Naha et al., 2012; Pinjani & Palvia, 2013; Qi, Wang, & Ma, 2010a; Xu et al., 2014)
12. Diversity: It involves Functional diversity and Demographic Diversity. Functional Diversity involves a range of functional assignments and demographic diversity includes a range of categories such as race, gender, ethnicity, and nationality. Diversity greatly effects the trust among the team members. (Amah et al., 2013; Bao et al., 2004; Garrison et al., 2010; Krebs, Hobman, & Bordia, 2006; Muethel et al., 2012; Naha et al., 2012; Peters & Karren, 2009; Pinjani & Palvia, 2013; Saxena & Burmann, 2014; Von der Ohe & Martins, 2010b)
13. Cultural Barriers: Refers to people from different countries with different backgrounds. It may be reflected in differences in communications, work ethics, and approaches to problem solving among virtual teams. Cultural differences leads to negative performance of the project as it leads to distrust among them. (Amah et al., 2013; Bao et al., 2004; Berry, 2011; Bodensteiner & Stecklein, 2010; Chutnik & Grzesik, 2009; T. Daim et al., 2012; Dorairaj et al., 2012a; Gustavo et al., 2012; Horwitz et al., 2006; Hsin Hsin et al., 2011; Lee-Kelley & Sankey, 2008; Maley & Moeller, 2014; Munkvold & Zigurs, 2007; P. Nguyen et al., 2006; Paul & He, 2012; Paul & Ray, 2009; Shachaf, 2008; Vinaja, 2003; Zhan & Xiong, 2008)
14. Language Barriers: Refers to the obstacle that exists when not all participants of communication have the same and/or required proficiency of the language used for the communication. It is the difference in languages that are spoken. When the team members speak different languages they have trouble communicating. (Gustavo et al., 2012; Maley & Moeller, 2014)
15. Ability: Refers to the degree to which the trustee is believed to possess the necessary skills, competencies, and abilities within a specific domain. It is directly proportional to degree of trust. (Aubert & Kelsey, 2003; Bryant et al., 2009; Hung et al., 2004; Jarvenpaa et al., 1998; Kramer & Lewicki, 2010b; Kuo & Thompson, 2014; Lau & Rowlinson, 2009a; Mansor et al., 2012; Mukherjee, Renn, Kedia, & Mukherjee, 2012; Naha et al., 2012; Riedl, Gallenkamp, & Picot, 2013; Rusman, Bruggen, Sloep, & Koper, 2010; Schiller, Mennecke, Nah, & Luse, 2014; Staples & Ratnasingham, 1998)
16. Integrity: Refers to the degree to which the trustee is believed to follow principles and guidelines that are accepted by the trustor. This allows trustor to trust more on trustee. (Aubert & Kelsey, 2003; Hung et al., 2004; Jarvenpaa et al., 1998; Kramer & Lewicki,

2010a; Kuo & Thompson, 2014; Lau & Rowlinson, 2009a; Mansor et al., 2012; Mukherjee et al., 2012; Naha et al., 2012; Riedl et al., 2013; Schiller et al., 2014)

17. Benevolence: Refers to the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive. It suggests that the trustee has some specific attachment to the trustor.(Aubert & Kelsey, 2003; Hung et al., 2004; Jarvenpaa et al., 1998; Kramer & Lewicki, 2010a; Kuo & Thompson, 2014; Lau & Rowlinson, 2009a; Mukherjee et al., 2012; Riedl et al., 2013; Rusman et al., 2010; Schiller et al., 2014)
18. Propensity of Trust: Refers to 'general willingness to trust others''. It will influence how much trust one has for a trustee prior to data on that particular party being available. (Aubert & Kelsey, 2003; Jarvenpaa et al., 1998; Kuo & Thompson, 2014; H. Lee et al., 2014)
19. Risk: Refers to an assessment of the likelihood of significant and/ or disappointing outcomes. The nature of outcomes decides the nature of trust.(Christoph Clases, Renhard Bachmann and Wehner, 2004; Hung et al., 2004; Mansor et al., 2012; Naha et al., 2012; Robertson, Gockel, & Brauner, 2013)
20. Knowledge Sharing: Refers to sharing of knowledge between team members. It gets affected by individual characteristics and the context or internal environment of project teams. Knowledge sharing presumes a relation between at least two parties, one that possesses knowledge and the other that acquires knowledge. It gets affected greatly by the trust between the team members. (Bodensteiner & Stecklein, 2010; Christoph Clases, Renhard Bachmann and Wehner, 2004; Dirks, 1999; Dorairaj et al., 2012a; Pangil & Chan, 2014; Pinjani & Palvia, 2013; Vakola & Wilson, 2004; Yang, 2014)
21. Cognitive Elements: Refers to the calculative and rational characteristics of trustees such as reliability, integrity, and competence. These elements lead to increase in trust among team members. (Ashleigh & Nandhakumar, 2007b; Kanawattanachai & Yoo, 2002; Melisa Beach, Sue Coates, Carol Hinton, 2014; Pangil & Chan, 2014; Pierce & Hansen, 2013; Staples & Ratnasingham, 1998; Webster & Wong, 2008; Xiao & Wei, 2008a; Zimmermann, 2011)
22. Affective Elements: Refers to the emotional aspects and social skill of trustees. Care and concern for the welfare of partners form the basis for affect-based trust. (Dirks, 1999; Joe et al., 2014; Kanawattanachai & Yoo, 2002; Kuo & Thompson, 2014; Lurey & Raisinghani, 2001; Melisa Beach, Sue Coates, Carol Hinton, 2014; Pangil & Chan, 2014; Sridhar & Paul, 2006; Staples & Ratnasingham, 1998; Webster & Wong, 2008; Xiao & Wei, 2008a; Yang, 2014; Zimmermann, 2011)
23. Group Cohesiveness: Refers to degree to which team members are attracted to each other and are motivated to remain in the team. Lack of cohesiveness leads to greater distrust among team members. (Amah et al., 2013; Ashleigh & Nandhakumar, 2007b; Bao et al., 2004; Beranek, 2000; Berry, 2011; Brahm & Kunze, 2012; Bryant et al., 2009; Christoph Clases, Renhard Bachmann and Wehner, 2004; Dakrory & Abdou, 2009; Daspit et al., 2013; Diallo & Thuillier, 2005; Dirks, 1999; Dorairaj et al., 2012a; Garrison et al., 2010; Horwitz et al., 2006; Lankton, McKnight, & Thatcher, 2014; Lin et al., 2008; Paul et al.,

2004; Sridhar & Paul, 2006; Sumita Raghuram, Raghu Garud, Batia Wiesenfeld, 2001; Warkentin et al., 1997; Williams & Brown, 2010)

24. Perception of the process: Refers to include aspects such as trust, openness, and equality in participation. It also have also been associated with process gains and losses. (Beranek, 2000; Lurey & Raisinghani, 2001; Warkentin et al., 1997)
25. Decision Quality: It is an outcome related measure and accounts for perceived freedom of participation. It relates to efficiency of team. (Chi et al., 2004; Lurey & Raisinghani, 2001; Paul et al., 2004)
26. Decision Quantity: It refers to effectiveness of team. (Chi et al., 2004; Paul et al., 2004).
27. Conflict Management Style: Conflict is defined as ‘‘an expressed struggle between at least two inter–dependent parties who perceive incompatible goals, scarce rewards, and interference from the other party in achieving their goals’’. Its source can vary from power differentials, competition over scarce resources, tendencies to differentiate, negative inter-dependence between work units, ambiguity over responsibility or jurisdiction, to denial of one’s self-image or characteristic identifications including values and sensitivities(Brown, 2000; Hosøy, 2011; Panteli & Sockalingam, 2005; Paul et al., 2004; Vinaja, 2003; Zimmermann, 2011)
28. Group Heterogeneity: Heterogeneity refers not only to differing demographic characteristics and cultural norms of team members, but also to their diversity of functional roles and the tenure of virtual team members. (Furst et al., 1999; Paul et al., 2004; Vinaja, 2003)
29. Project Length, Percentage of work done, age, gender, work experience, comfort with computers: Number of years in decimal terms; Age and Gender (impact on intragroup communication and the comfort level); Ease of use of computers. All of them effects the degree of trust among virtual team members. (Bryant et al., 2009; Daspit et al., 2013; Muethel et al., 2012; Munkvold & Zigurs, 2007; Peters & Karren, 2009; Sumita Raghuram, Raghu Garud, Batia Wiesenfeld, 2001; Von der Ohe & Martins, 2010a)
30. Leadership: It refers to the leadership skills of Project manager. Firstly the leader provides continuous feedback, engages in regular and prompt communication, and clarifies tasks. Secondly, the leader is sensitive to schedules of members, appreciates their opinions and suggestions, cares about member’s problems, gets to know them, and expresses a personal interest in them. Thirdly, the leader clearly defines responsibilities of all members, exercises authority, and mentors virtual team members. Fourthly, the leader is assertive yet not too “bossy,” caring, relates to members at their own levels, and maintains a consistent attitude over the life of the project. (Amah et al., 2013; Bao et al., 2004; Bell & Kozlowski, 2002; Bergiel et al., 2008; Chi et al., 2004; Chutnik & Grzesik, 2009; T. U. Daim et al., 2012; Dakrory & Abdou, 2009; Daspit et al., 2013; Horwitz et al., 2006; Information, 2014; Lankton et al., 2014; Lurey & Raisinghani, 2001; Pierce & Hansen, 2013; Xiao & Wei, 2008b)

31. Organizational Resources: Refers to monetary status, raw materials and equipment of the company. The availability of these resources leads to trust with the organization and leads to better performance. (Amah et al., 2013)
32. Team Reflexivity: Defined as the extent to which team members overtly reflect upon the team's objectives, strategies and processes, and adapt them to current or anticipated circumstances. This leads to better understanding of the strategies and hence communication improves. (De Jong & Elfring, 2010; Delgado-Márquez, Hurtado- Torres, & Aragon- Correa, 2012; Jo, Lee, Lee, & Hahn, 2014; Kadefors, 2004; Vinaja, 2003)
33. Team Effort: Defined as the extent to which team members devote their resources (i.e., energy, attention, time) to executing team tasks. (De Jong & Elfring, 2010)
34. Team Monitoring: Defined as the process of observing actions of teammates and watching for errors or performance discrepancies so that suggestions or corrective feedback can be provided to assist team members. More team monitoring sometimes leads to negativity among the team members and distrust arises.(De Jong & Elfring, 2010)
35. Time difference and holidays: Refers to the differences in time zones and holidays between virtual project team members working in different countries. This effects the execution of the projects as sometimes the team members are working 24 X 7 because of time difference. (Lee-Kelley & Sankey, 2008; Munkvold & Zigurs, 2007; Vinaja, 2003)
36. Team Evaluation: Refers to mechanism for evaluating the team with respect to their performance. It can be broken down into four empirically separate dimensions: distributive justice (fairness of outcomes), procedural justice (fairness of decision-making procedures), interpersonal justice (fairness of interpersonal treatment), and informational justice (adequacy of information about decision-making procedures and outcome distribution). (Fang & Chiu, 2010; Furst et al., 1999)
37. Corporate Culture: Organizational culture includes norms regarding the free flow of information, shared leadership, and cross-boundary collaboration leads to better trust if all of them are positive. (Brown, 2000; Diallo & Thuillier, 2005; Dorairaj, Noble, & Malik, 2012b; Furst et al., 1999; Kadefors, 2004; Kasper-Fuehrera & Ashkanasy, 2001; Kimble, 2011b; Lau & Rowlinson, 2009b; Lin et al., 2008; Rusman et al., 2010; Tran, 2012; R. Verburg & Vartiainen, 2013; Wong, Cheung, Yiu, & Pang, 2008)
38. Motivation: The word motivation implies movement towards fulfilling the needs of the self or the organization, and is thus a primary concern of organizational leaders. It can be extrinsic or intrinsic. Motivation greatly enhances the trust with the organization and hence better performance.(Brown, 2000; Qi, Wang, & Ma, 2010b)
39. Task Interdependence: Refers to the extent to which unit personnel are dependent upon one another to perform their individual jobs. It needs dependence of team members on each other and therefore trust between them is very important (Olson & Olson, 2012; Saxena & Burmann, 2014)

40. Satisfaction of Outcomes: Refers to the affective and positive emotional reaction, team members have with the ways (e.g., procedure, deliberation, etc.) they arrive at an outcome. (Beranek, 2000; Staples & Ratnasingham, 1998)

4.1. Grouping of variables to factors affecting Trust in Virtual Teams

As mentioned earlier, secondary data analysis of 150 research papers was instrumental in identifying 40 variables. The understanding of definition of these variables and after finding the commonalities among them grouped these variables into 15 factors as depicted in Table I.

Table I Grouping of variables to factors affecting trust in Virtual Teams

S. No.	Factor Name	Grouped Variables
1	Team Cohesiveness	• Respect • Employee Satisfaction • Group Cohesion • Affective elements (e.g., caring, emotional connection to each other) • Team Effort
2	Team's reflection on processes	• Satisfaction of Outcomes • Perceptions of the Process • Team Reflexivity • Risk
3	Incentives	• Reward Plan • Team Evaluation
4	Training	• Training on self-managing skills, technology training, Project Management skills
5	Corporate Culture	• Clear Objectives(Goal Setting) • Recruitment Strategy • Corporate Culture • Organization Resources
6	Task-Technology Fit	• Communication (Type ,Tool, comfort with computers) • Network Security • Task Complexity • Task-Technology Fit • Task Interdependence
7	Team Heterogeneity	• Diversity • Group Heterogeneity • Cultural Barriers • Language Barriers

S. No.	Factor Name	Grouped Variables
8	Team member Characteristics	• Ability • Integrity • Benevolence • Cognitive elements(e.g., competence, reliability, professionalism)
9	Team Manager Characteristics	• Propensity to trust
10	Knowledge Sharing	• Knowledge Sharing among Team Members
11	Decision Effectiveness	• Decision Effectiveness (Quality, Quantity)
12	Conflict	• Conflict among team members
13	Control Variables	• Team Size • Project length • Percentage of work done • Age • Gender • Work Experience
14	Leadership skills of Team Manager	• Leadership • Motivation • Team Monitoring
15	Time Zone	• Time difference and holidays

5. Conclusion

Strong business and social pressures are driving the adoption of virtual team working in Construction sector. Though virtual teams offer many benefits to organizations striving to handle a more demanding work environment, they also present many challenges and potential pitfalls. Cross-functional cooperation and effective teamwork are some of the crucial ingredients for making these virtual teams work. Reviewing the literature showed that trust among virtual team members is considered to be one of the primary concerns that affect the performance of virtual teams. Even though lot of research has focused on trust among contractor, supplier and owner of the construction company, there is a gap in the studies of trust among the team members of virtual teams in this sector

The paper revealed the results of literature review and aims to provide a list of factors affecting trust in the virtual teams in Construction sector. Through the comprehensive literature review, the researcher was able to extract 40 key variables that affect trust in virtual teams. These variables were grouped to 15 factors after understanding their definitions and commonalities among them. It is proposed that future research will be further carried out to develop instruments for data collection: Pilot Study. The pilot study will give directions on how to collect relevant data from construction companies which is the Research Development phase.

This research would be beneficial to Project Managers of Construction/ Architectural/ Engineering Companies by helping them know the actions required for better team collaboration in virtual teams. This will lead to greater team performance and individual learning. It is researcher's belief that these findings will provide an important step in studying how trust in virtual team members in construction sector in Middle East can be enhanced which will lead to increase in the performance of virtual project teams.

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Innovation as A Response Strategy to Compressed Time Demands for Pre-Contract Documentation In Quantity Surveying Firms In Nigeria

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Abstract:

The constant pressures on consultants, in the Nigerian construction industry, to deliver pre-contract documentation within very short timelines and the paucity of studies on how these consultants respond to these pressures provide the motivation for this study. Using a case study methodology, this investigation was carried out employing interviews and personal observation as instruments of data collection. Data were analysed using template analysis. The findings reveal that these pressures are potent and that firms are using innovative strategies in responding to them. The study further underscores the need for firms to embrace innovation, not on an ad-hoc basis as is presently done but, as a deliberate strategic action plan in order to be able to address the challenges of unstructured problems that crop up during pre-contract practice.

Keywords:

Case study, Innovation, Practice-based research, Pre-contract documentation, Professional service firms, Quantity surveying,

1. Introduction:

It is mostly heard in hushed tones but it is there nevertheless that consultants in the Nigerian construction industry, more often than not, complain of inadequate timelines allowed for the preparation of pre-contract documentation. Inadequate timeline for pre-contract practice has the capacity to negatively affect the quality of documentation and make the entire procurement process inefficient (Kelly and Duerk, 2002; Akinsiku et al, 2014). It is already established that there are significant cost implications and in some cases outright abandonment of projects due to problems in the pre-contract process (Bowen et al, 1997; Kelly and Duerk, 2002, Akinsiku et al, 2014). The construction industry is globally seen as being inefficient (Egan, 1998; Barrett et al., 2008) but with the capacity for improvement if it could commit to some deliberate plan (Latham, 1994; Egan, 1998). Innovation has been suggested as a way of improving performance (Barrett et al., 2008) and nowhere is this more important than in addressing the problems of compressed time demands during pre-contract documentation.

The pre-contract process is a very important sub-process of the procurement process and Kelly et al (1992) opine that its importance has been rising over the years probably due to the complexity of construction projects. Inadequate pre-contract timeline for documentation, due to the increasing client demands for shorter pre-contract time is therefore a critical issue that must be considered due to its negative consequences on project delivery. Barrett et al (2008) have suggested that problems of this category could be resolved through innovation even as Egbetokun et al (2008) submit that the major reason why firms innovate in Nigeria is to satisfy customer demands.

Egbetokun et al (2010) opine that innovation evidences in Nigeria concentrate on manufacturing at the expense of professional service firms while Jegede et al (2012) claims that there are no in-depth study in Nigerian firms on factors that influence innovation and how firms respond to the pressures of market-led innovation. If the claim of McAdams (2004) and Abiola-Falemu et al (2010), that the future survival of firms will depend on the ability to innovate, is correct; then it is necessary to take the advice of Aouad et al (2010) that the presumption of innovation in the minds of the practitioners is not enough but must be investigated empirically at different levels of the firm.

This paper, which describes an initial investigation of a professional doctoral thesis into compressed time demands in the delivery of pre-contract documentation, explains and discusses the following:

- The key factors that create the pressures of inadequate timelines within the Nigerian construction industry.
- An exploration on how consultants, particularly practicing quantity surveyors, respond to these pressures in the delivery of their services.
- How the services rendered are affected due to those pressures and, a consideration of whether such deliverables are fit for purpose.

2. The problem:

The seriousness and practicality of the problem was brought home on a recent project, the reflection on which triggered this study. After a preliminary meeting, the firm was selected as the quantity surveyor for a 500-seater capacity lecture theatre and was asked to provide initial cost information based on cost per seat. After the submission of the initial cost advice, there were no further communications from the client for a long period.

Several months later, the consultants were informed that they have now been appointed for the 500-seater capacity lecture theatre and were given a one-week timeline to produce and submit all tender documents! A minimum of four weeks would naturally have been required to design and produce the tender documents so, in every practicality; the given timeframe looks very unreasonable. This experience brought to focus the need to reflect on similar experiences on other projects where consultants have always been put under intense pressure to perform under very short pre-contract procurement timelines. Reflection should however be considered if learning had occurred. Eraut (1994) opines that learning in professional context only happens informally through working processes.

It is possible that consultants have been responding to the challenges of compressed time demands in some specific ways even though there are no evidence to support this both in research and practice. Otherwise, they will not remain in business. Perhaps consultants' responses are in the application of tacit knowing (Polanyi, 1966) in tandem with *reflection-in-action* (Schön, 1991) or *research through practice* (Frayling, 1993; Archer, 1995; Chynoweth, 2013). If this is correct then, Barrett et al's (2007) position that official statistics have been unable to capture innovation activities in firms because these innovations are hidden may provide the leading lights towards innovative activities of consultants in addressing compressed time pressures.

3. Related Literature:

3.1. **Definition of Innovation**

Barrett et al. (2008) opine that "innovation" is an overused word as it is very common for people to employ it in defining a plethora of activities and actions like invention, modernisation, alteration, novelty, etc. Etymologically, innovation originated from the Latin word *innovat*, which means *renewed, altered* (The New Oxford Dictionary, 3rd Edition). Sexton and Barrett (2003a) analyse the definitional debates of innovation and conclude that there is consistency between the general literature and the construction literature on the definition of innovation even though innovation literature mostly concentrate on large firms at the expense of small firms and on manufacturing firms rather than professional service firms. Both literatures agree that innovation is concerned with the generation of a new idea that is implemented by the firm (see Thompson, 1965; Amabile et al., 1996; Slaughter, 1998; Woodcock et al., 2000).

These definitions however appear not to consider the value inherent in the innovation process and perhaps assume that innovation is always positive (Kimberly, 1981). However, an activity must add value in one way or the other to qualify as innovation (Barrett et al., 2008). The key ingredients of innovation from the above views appear to be novelty, implementation, value addition and process/product improvement. Sexton and Barrett (2003b, p. 628) therefore summarised these key issues and proffer a definition for innovation as, " the effective generation and implementation of a new idea, which enhances overall organisational performance". This definition is adopted for this investigation.

3.2. **Innovation Classifications**

Innovation literature is very broad but can be classified into two basic categories: resource-push innovations and market-led innovations (Sexton and Barrett, 2003a; Sexton and Barrett 2003b; Barrett et al, 2008). Resource-push innovation is of the initial school of thought, which seeks to find more profitable areas to deploy existing resources for maximum benefits. It is based on the theory of creative destruction (Schumpeter, 1934/1983) whereby the size of the firm, available resources and the ability to profitably deploy those resources become imperative. Though "resource-push" contextualises innovation within the concept of economic gain, recent works however recognise the impacts of market (customer demands) and how it is defining a larger proportion of innovation in recent times (Zawdie, 2012). In the market-led innovation, the customer is king and her changing requirements need to be met as fast as possible in order to remain relevant in the market place. Meeting a client's demand for compressed timeline of pre-contract documentation therefore appears to fall into the category of market-led innovation.

The process of innovation may equally be incremental or radical. Incremental innovation process ensures stability by enhancing competence in a systematic fashion while radical innovation seeks to implement large-scale innovation all at once. The concept of destructive innovation (Christensen, 2003) provides an example of a radical innovation process.

3.3. **Innovation in Construction**

Due to the nature of the construction industry, innovation in construction has been described as very slow (Slaughter, 1998). An appraisal by Wolstenholme (2009) seems to indicate that not much has been achieved through several initiatives in how innovation could be beneficial in the construction industry with particular reference to effectiveness and efficiency in the sourcing and deployment of resource inputs. However, Barrett et al (2007) reject the thesis that construction firm do not innovate. They opine that due to the hidden nature of innovation in most construction professional firms, the existing instruments and methodology of identifying and collating such innovations are inadequate. This brings innovation in construction professional service firms into the framework of tacit knowing (Polanyi, 1966). Subsequently, Aouad et al., (2010) opine that the journey seems to be far and therefore requires purposeful research at different levels and points of innovation in firm's operation. This research engagement is therefore more in line with the recommendations of Aouad et al., (2010).

Project-based organisations are characterised by temporary and short-term relationships, which do not encourage any innovative initiative to be properly "learned, codified and applied to future projects" (Winch, 1998, p. 273). With the bulk of the industry consisting of a high number of small firms with each employing mostly less than eight people (DETR, 2000), large scale innovation may be impossible due to the inability of the small firms to leverage on size, resources and long term relationships. Adversarial environment, which is a feature of construction undertaking, may not provide an appropriate atmosphere for innovation, as people are busy protecting individual turf through highly skewed argumentation (Latham, 1994; Egan, 1998).

Gann and Salter (2000), Sexton and Barrett (2003b), Lu and Sexton (2006) and Sexton and Lu (2012) all agree that within the construction industry, innovation literature, research and practice are heavily skewed against the knowledge-intensive professional organisations. Egbu, (2012a) stresses this further by opining that since innovation is anchored on the workforce who provides the knowledge capital for each organisation, the ability of an organisation to innovate is heavily dependent on how it is able to exploit its knowledge capital.

Although Jegede et al, (2012) opine that there are no in-depth studies on innovation in Nigerian firms; Oluwatayo and Amole (2012) offer that ICT innovation in professional service firms in Nigeria enable the firms to compete favourably in the market place. This position is also echoed by Oladapo (2006), Abiola-Falemu et al (2010) and Ibironke et al (2011). Specifically in quantity surveying firms in Nigeria, Oyediran et al (2005), Musa et al (2007), and Ibironke et al (2011) see significant improvements in the service delivery of quantity surveying firms that embrace technological innovation.

In summary, literature shows that innovation is any new idea that is systematically applied and which enhances organisational performance. Although professional service firms in the Nigerian construction industry are seemingly slow in adopting innovation, there are some evidences to show that adoption of innovation has the capacity to improve service delivery in knowledge-intensive professional service firms.

4. Research Methodology

The research problem is from practice, hence the research methodology should be amenable to the processes of practice. It should be a methodology that could acquire and process data from practitioner's experience and derive meaning using instruments that could make tacit knowledge (Polanyi, 1966) become explicit. The support for this approach is found in Mills (1959, p. 196) who opines that:

> *you must learn to use your life experience in your intellectual work: continually to examine and interpret it. In this sense craftsmanship is the centre of yourself and you are personally involved in every intellectual product upon which you may work. Life and intellectual work should not be separate.*

Learning from experience is anchored on reflection (Jarvis, 1999) and when the experience is unique and contextualized, a case study approach is ideal (Yin, 2009). Moon (1999) opines that reflection provides better resolution when dealing with unstructured and tacit problems. Within Schön's (1991) categories of knowledge based on reflection, *reflection-in-action* appears in sync with the tacit knowledge under investigation. This is also synonymous with the art of *research through practice* as proposed generally by Frayling (1993) and Archer (1995) and specifically for chartered surveying professions by Chynoweth (2013).

Through reflection, practice-based researchers have built repositories of knowledge, although hardly acknowledged by academia (Drake & Heath, 2011), by reflecting on experience in ways that Moon (1999) sees as information processing through engaging a problem, collecting data, reinforcing concepts and enforcing change. This perhaps builds on Dewey (1933) on the psychology of thought. More appropriately however, Schön (1991) refers to knowledge based on reflection by identifying two broad categories: *reflection-in-action* and *reflection-on-action*. Within the context of the taxonomy of practice-based research in the chartered surveying profession by Chynoweth (2013), which also builds on Frayling (1993) and Archer (1995), it could be inferred that *reflection-in-action* is equated to *research through practice*.

Since the essence of this study is to answer the "why" and "how" question, a qualitative strategy and case study method is therefore applied. Data is collected through interviews and personal observations analysed using template analytical method, a variation of thematic data analysis. Coding template (King, 2012) is developed from the key themes that have emerged in theory (literature) and practice and these themes are obtained within the context of the aim of the study.

The study describes how a registered quantity surveying firm in Nigeria uses innovative methods in responding to the challenge of compressed time demands during pre-contract documentation. With staff strength of 4 and about 75% of the firm's commission coming from the public sector clients, the firm operates mainly in the building construction sector with few incursions into civil engineering projects. As this study is a pilot study or preliminary investigation, the case is selected to firm up the subsequent large-scale doctoral study hence; evidence of previous involvement in innovation through desktop research was used as a criterion for selection. This meets with the conditions for selection of cases, particularly for pilot study, according to Yin (2009).

5. Results:

The first interview was conducted with the Principal Partner while the second interview was conducted with the Partner. During the interview however, the operations in the firm were observed and the following noted:

1. There was no project being undertaken which was still at the pre-contact documentation stage during the visits to the office. So, observation of activities on any live project was not possible.
2. Although a spare copy was not allowed for confidentiality and commercial reasons, two different letters of commission were presented for sighting. The letters show timelines less that a week from the date the letters were received by the office and the date for the submission of the pre-contract documents.
3. Copies of letters from the firm submitting the deliverables to the client on the final submission date as indicated on the letters of commission were also made available to confirm that the pre-contract documents were successfully delivered.

Table 1: Interview Result 1

HIGH LEVEL THEMES	MIDDLE LEVEL THEMES	LOW LEVEL THEMES	1ST RESPONDENT
COMPRESSED TIME DEMANDS INFORMATION (A)	Do firms experience it?	Private projects Public projects	✗ ✓
	When do they experience it?	Pre-contract stage Post-contract stage Commissioning stage	✓ ✗ ✗
CAUSES OF COMPRESSED TIME DEMANDS (B)	Market pull	Client demand Competition Technology vendor demand	✓ ✓ ✗
	Resource push	Financial availability Tacit knowledge demand Explicit knowledge demand Technology inadequacy	✓ ✗ ✗ ✗
RESPONSE TO COMPRESSED TIME DEMANDS ©	Innovative methods	Meets innovation definition Technological innovation Organisational capacity	✓ ✓ ✗
	Action forces	Partner's drive Staff ownership of process Supportive resources Fear of competition Client demand Survival strategy	✓ ✓ ✓ ✓ ✓ ✓
	Reaction forces	Partner's lack of interest Lack of staff commitment Inadequate firm capability Lack of financial resources	✗ ✗ ✗ ✓

OUTCOMES OF RESPONSE TO COMPRESSED TIME DEMANDS (D)	Successful	Improved service to clients Efficient delivery of service Effective delivery of service Operational improvement Growth of the firm Satisfied staff	✓ ✓ ✓ ✓ ✗ ✓
	Unsuccessful	Gained new insights Lost jobs from the client	✓ ✓
ADVICE TO INDUSTRY (E)	Government policies	Start budgeting on time Use in-house professionals Be wary of in-house professionals	✓ ✓ ✗
	Practice	Need to innovate to survive Use simple technology in-house Train staff to use technology Innovation can ensure growth	✓ ✓ ✓ ✓

5.1. **Summary of Interview 1**

This firm do experience compressed time demands from clients on public sector projects regularly at the pre-contract stage. Compressed time demands are usually caused by the inability of the clients to plan well ahead of time. Due to the interest of both partners and staff in new ideas, this firm has been responding to the challenges of compressed time demands using some in-house innovative methods, which are less expensive but very effective. It is recommended that public sector projects should be planned on time but SQSFs should also be ready with innovative ideas on how to respond to the challenges of any compressed time demand should it occur.

Table 2: Interview Result 2

HIGH LEVEL THEMES	MIDDLE LEVEL THEMES	LOW LEVEL THEMES	2ND RESPONDENT
COMPRESSED TIME DEMANDS INFORMATION (A)	Do firms experience it?	Private projects Public projects	✗ ✓
	When do they experience it?	Pre-contract stage Post-contract stage Commissioning stage	✓ ✓ ✗
CAUSES OF COMPRESSED TIME DEMANDS (B)	Market pull	Client demand Competition Technology vendor demand	✓ ✓ ✗
	Resource push	Financial availability Tacit knowledge demand	✓ ✗

		Explicit knowledge demand	✗
		Technology inadequacy	✓
RESPONSE TO COMPRESSED TIME DEMANDS ©	Innovative methods	Meets innovation definition	✓
		Technological innovation	✓
		Organisational capacity	✗
	Action forces	Partner's drive	✓
		Staff ownership of process	✓
		Supportive resources	✓
		Fear of competition	✓
		Client demand	✓
		Survival strategy	✓
	Reaction forces	Partner's lack of interest	✗
		Lack of staff commitment	✗
		Inadequate firm capability	✓
		Lack of financial resources	✓
OUTCOMES OF RESPONSE TO COMPRESSED TIME DEMANDS (D)	Successful	Improved service to clients	✓
		Efficient delivery of service	✓
		Effective delivery of service	✓
		Operational improvement	✓
		Growth of the firm	✗
		Satisfied staff	✓
	Unsuccessful	Gained new insights	✓
		Lost jobs from the client	✗
ADVICE TO INDUSTRY (E)	Government policies	Start budgeting on time	✗
		Use in-house professionals	✗
		Be wary of in-house professionals	✓
	Practice	Need to innovate to survive	✓
		Use simple technology in-house	✓
		Train staff to use technology	✓
		Innovation can ensure growth	✓

5.2. **Summary of Interview 2**

This firm do experience compressed time demands from clients on public sector projects regularly at the pre-contract stage. Compressed time demands are usually caused by the inability of the clients to plan well ahead of time and the intentional delays caused by in-house professionals. Due to the interest of both partners and staff in new ideas, this firm has been responding to the challenges of compressed time demands using some in-house innovative methods, which are less expensive but very effective. It is recommended that public sector projects should be planned on time and that CEOs of MDAs should be wary of

the advice of in-house professionals. However SQSFs should also be ready with innovative ideas on how to respond to the challenges of any compressed time demand should it occur.

Table 3: Cross-Interview Analysis Result

HIGH LEVEL THEMES	MIDDLE LEVEL THEMES	LOW LEVEL THEMES	RESPONDENTS		
			1ST	2ND	Agree (A) / Disagree (D)
COMPRESSED TIME DEMANDS INFORMATION (A)	Do firms experience it?	Private projects Public projects	✗ ✓	✗ ✓	A A
	When do they experience it?	Pre-contract stage Post-contract stage Commissioning stage	✓ ✗ ✗	✓ ✓ ✗	A D A
CAUSES OF COMPRESSED TIME DEMANDS (B)	Market pull	Client demand Competition Technology vendor demand	✓ ✓ ✗	✓ ✓ ✗	A A A
	Resource push	Financial availability Tacit knowledge demand Explicit knowledge demand Technology inadequacy	✓ ✗ ✗ ✗	✓ ✗ ✗ ✓	A A A D
RESPONSE TO COMPRESSED TIME DEMANDS ©	Innovative methods	Meets innovation definition Technological innovation Organisational capacity	✓ ✓ ✗	✓ ✓ ✗	A A A
	Action forces	Partner's drive Staff ownership of process Supportive resources Fear of competition Client demand Survival strategy	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	A A A A A A
	Reaction forces	Partner's lack of interest Lack of staff commitment Inadequate firm capability Lack of financial resources	✗ ✗ ✗ ✓	✗ ✗ ✓ ✓	A A D A
OUTCOMES OF RESPONSE TO COMPRESSED TIME DEMANDS (D)	Successful	Improved service to clients Efficient delivery of service Effective delivery of service Operational improvement Growth of the firm Satisfied staff	✓ ✓ ✓ ✓ ✗ ✓	✓ ✓ ✓ ✓ ✗ ✓	A A A A A A
	Unsuccessful	Gained new insights	✓	✓	A

		Lost jobs from the client	✓	✗	D
ADVICE TO INDUSTRY (E)	Government policies	Start budgeting on time Use in-house professionals Be wary of in-house professionals	✓ ✓ ✗	✗ ✗ ✓	D D D
	Practice	Need to innovate to survive Use simple technology in-house Train staff to use technology Innovation can ensure growth	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	A A A A

5.3. Summary of Cross-Interview Analysis

Both respondents agree that their firm experiences compressed time demands only on public projects and during the pre-contract stage. However, the second respondent confirms that the firm equally experiences compressed time demand during the post-contract stage. Also, both respondents agree that the causes of compressed time demands are client demands, the fear of competition and financial capacity. However, the second respondent believes that the inadequacy of existing technology is also a cause of compressed time demand. The responses of the firm to compressed time demands are by embracing technological innovation, which they see as a new idea, applied to improve the firm's operations. Partner's drive, staff ownership of process, supportive resources, and survival strategies are the action forces or the agents of innovation that help in responding to compressed time demand. Also, they contend that the lack of financial resources is a potent reaction force that suppresses the capacity to innovate. However, the second partner believes that inadequate capability of the firm is an additional reaction force.

The experiences of the firm in responding to compressed time demands through innovation bring about the benefits of improved services to clients, efficient delivery of services, effective delivery of services, operational improvements and a satisfied and motivated staff. Both respondents do agree that innovation does not necessarily bring about firm's growth. The few unsuccessful innovations were also useful as they provided a learning curve for the next set of innovations. Finally, while both respondents agree that a firm's survival is highly related to its innovation capability, they advise using simple in-house technology and training staff in the use of the technology. Consequently, they agree that innovation can enhance growth if that is the goal of the firm. They however differ in advising on government policies due to the different positions they hold on the impact of in-house professionals in compressed time demands. While the first respondent believes that government need to rely more on in-house professionals to fill the gap created before external consultants are commissioned, the second respondent advices MDAs to be wary of advice from in-house professionals, which in most cases, are geared towards frustrating the procurement process.

6. Discussion:

The discussions of results from interviews are structured according to the identified themes.

6.1. **Understanding of the meaning of innovation**

The understanding of the meaning of innovation is very central to this study. With little variation in individual perception, both respondents gave definitions of innovation as understood in the case study firm in ways that resonate with that of general literature. For instance, Respondent 1 defines innovation in the professional quantity surveying firm as:

> *a new idea that you can apply in an office that will ease your work…. innovation is a fresh idea that you use in the office to get a good result.*

Respondent 2 who defines innovation within the context of the firm's organisational structure reinforces this position:

> *coming with something new as a result of a present challenge that will help to overcome that challenge. It is a new idea, and when I say new, it does not mean that it has not existed somewhere but, it has to be new at that particular time to that organisation.*

The definition of innovation as understood in the firm enables the firm to confirm that it innovates mostly when faced with a challenge.

6.2. **Innovation triggers/causes**

Literature classifies the causes of innovation basically into market pull and resource push (Barrett et al. 2008; Sexton and Barrett 2003a; Sexton and Barrett 2003b). This study shows however that the major cause of innovation in the firm is when the firm is faced with a challenge to deliver to some very tight timescale of the clients particularly during the pre-contract documentation. The challenge or demand from the client is therefore the trigger. This gives an indication that market pull forces cause a significant part of innovation experienced in this quantity surveying firm. The letters of commission and the letters submitting the pre-contract documents demonstrate strong evidence of pressure from clients and successful delivery by the quantity surveying firm. In responding to how challenge causes innovation, Respondent 1 says:

> *Yes it does greatly. It is one of the drivers of innovation. By the time you have a challenge, you sit down and think about how you can approach it. Then you innovate*

The experience of the firm therefore agrees with literature wherein it is established that innovation journey starts when there is a shock or stimulus in the external or internal environment in which the firm operates.

6.3. **Innovation Response**

The case study firm states that it responds to compressed time demand during pre-contract documentation by using innovative methods. For instance, Respondent 1 says:

> *When the client called, he wanted the job to be submitted in 6 weeks but we asked for 6 months. The client said either we take it or leave it. When the client insisted and we realised how important the job was to us we had to dig in. And of course we delivered*

On how this feat was performed, Respondent 1 says:

A staff of my firm had developed a spreadsheet model that helped to do this job in little or no time. By the time you are still working manually on the first bid, that spreadsheet would have completed the analysis of about three different bids. I take that as an innovation.

The development and use of in-house software appears to be the major way that this firm responds to any challenge of compressed time demands from their clients. However, the firm also engages in the extensive use of templates to support the use of in-house software applications.

The other issue is that we already have a template for writing a tender's report in our firm. As data is coming in, they are entered and processed automatically. Of course I have to give credit to my partner who is somebody with an eagle's eyes for innovation.

It appears that whenever the firm is faced with a challenge in practice due to the tight requirements of clients, the first port of call is technological innovation. Evidence of this is copiously demonstrated in the interviews for instance, Respondent 2 submits that:

There was a time that we had to prepare a programme of work and schedule for a client. I used the Microsoft Project software for the project. That was a new idea that hastened the work.

This system of doing things resonates with literature on incremental innovation (Slaughter, 1998) as against radical innovation. It also agrees with Salge and Vera (2011, p. 157) where they refer to it as incremental learning which, "gradually refines and expands organisations knowledge base" and "steadily improves upon existing knowledge.

6.4. **Innovation Outcome or Deliverables**

The letters submitting the deliverables within the compressed timeline given by the client are strong evidences of a successful outcome. The outcome of the responses to compressed time demand in the firm is first and foremost the urge to engage in technological innovation in addressing the challenge. Such innovation, according to the responding firm, brings about efficiency and effectiveness in service delivery to clients as pointed out by Respondent 1 who confirms the result of a particular assignment from the client.

We delivered and it was incidentally the best tender report that our firm ever written.

Respondent 2 explicitly expresses this in discussing the reactions of the firm's clients after presentation of deliverables:

We have made presentations in about four places where clients commend us for the deliverables for having done good jobs. We come out of these presentations feeling happy because we have done well. Our clients do feel satisfied. During a recent presentation, the CEO of a client organisation said," you people have really helped me a great deal in getting this project to come to this level of seeing the light of the day".

The above comments agree with literature that for any action to be innovative, it must add value or bring about some improvements (Barrett et al. 2008; Sexton and Barrett 2003a; Sexton and Barrett 2003b).

6.5. **Advice for policy and practice**

Respondent 1 sees compressed time demand as occasioned by a lack of appropriate planning in the client organisations and therefore recommends that:

Clients should start on time and put in their thought on time and not at the dying minute. Client should also work with their in-house professionals. I notice that most times they do not consult or involve their in-house professionals

Conversely though, Respondent 2 advises the chief executive officers of client organisations to be wary of the advice given by in-house professionals because some may have intention of frustrating the project. Respondent 2 argues that in-house professionals are part of the problem in most cases.

Those of us in practice have come to realise that the in-house professionals of the client organisations don't really help matters because of certain personal interests that they may have. On one part it may happen that the consultant quantity surveyor appointed is not the one that the in-house professionals would have loved to do the job.

Some of the in-house professionals see these jobs as what they could have done in-house but for which consultants are now being appointed. In a particular case, a highly placed officer and head of in-house professionals lamented that the agency has given all the jobs to consultants leaving all the in-house professionals with none of the jobs to handle.

He however gave reasons to support the appointments of external consultants, which he anchored on the level of experience that may be required for these projects, particularly the complicated ones.

But the appointment of external consultants do happen because the in-house professionals lack capacity to perform judging by the comments of some chief executives

Reconciling the advice of both respondents appears to be that while external consultants are desirable particularly on complex projects because of their experience, there are times when the in-house professionals should be used particularly at the budgeting stage when the project has not been approved by Government because the agency would be unwilling to commit itself to paying external consultants for abortive works. This could be inferred from the statement of Respondent 2 when he suggests that:

Yes the delayed budget affects the pre-contract procurement timelines but I have a different thinking. Probably if you want to do a job of N500,000,000.00, a solution could be the planning and preparation of documentation on time, keeping it and waiting for the "certificate of no-objection" and budget approval, which comes later in the year. MDAs can use in-house professional staff. Of course they also need external consultants even though they are always constrained of appointing consultants until BPP's approval

An advice for practice is that small professional firms should put in a lot of sacrifice and embrace innovation because innovative capacity of a firm affects its ability to win further jobs, survive and also grow. This is very explicit in the statement of Respondent 2:

Any quantity surveying firm that is faced with the challenge of time should not just let it go. They should sacrifice the time. We once did a work, which was to take us 6 weeks in 24 hours. We let go of every other thing and concentrated on the job at hand. This office thrives best when we are put under pressure. Not that we like to be put under pressure but when we are constrained is when all our systems are focused for better result.

7. Research Validity:

Validity is the measure through which an empirical research is assessed (Miles and Hubermann, 1994). Yin (2009) offers four critical areas through which the validity of a case study research is assessed: construct validity, external validity, internal validity and reliability. On construct validity, the multiple sources of evidence used in this study include interviews and personal observation. Although the empirical data is from a single case, external validity could be better improved in a multiple-case study.

For internal validity, patterns were noticed through literature and practice and themes were subsequently developed from those patterns. These themes culminated in the design of the case study template, which represents the previously predicted pattern. Empirical data from interviews were then compared with the previously predicted pattern and it shows significant literal replication. Finally the case study database and case study protocol are available and this will enable the case study to be replicated by another investigator thereby making the study highly reliable.

8. Conclusions:

Although this is the preliminary study of a larger multiple-case study, it has discovered substantial evidence for it to draw some inferences as it relates to the aim of the study. Both in literature and practice, it has been confirmed that enormous timeline pressure is put on consultants on public projects towards pre-contract documentation. Consultants, particularly quantity surveyors, use innovative techniques in meeting those challenges. And through those innovative activities or processes, they are able to present deliverables that are fit for purpose. Innovation in quantity surveying firms may not be made explicit but every firm is in a way or another embracing innovation due to the value added by innovative activities. Firms are therefore enjoined to embrace innovation not as a once-off event but as a deliberate strategy that ensures continuous improvement.

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The Extent to Which Human Relations in the Construction Industry Contributes To Productivity

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Abstract

The construction industry has an essential feature of been classified as a labour intensive sector. The workforce plays a vital role in the Construction process. As a result, the performance and improvement in construction productivity are achieved through prudent resource allocation, human efficiency and human relations. Human relations within an organization cease only on employee relationship, but it goes beyond and also promotes extrinsic factors that enhance productivity. The purpose of this study is to explore the extent to which human relations within the construction industry contributes to productivity. The research was exploratory in nature and made use of structured interviews with professionals from the construction sector selected via purposive sampling technique. The study established that successful human relations within the organization creates harmony, encourage employee satisfaction and enhances employee's operational efficiency. The study recommends Managers of construction firms to institute good human relations in their corporate objectives due to its associated benefits that emanate from such practice.

Keywords:

Construction Industry, Human Relations, Impact, Productivity

1. Introduction

Human relations refers to the daily interactions between human and their fellow humans and dealing with their needs in their immediate environment be it an organization, firm, association or groups and amongst others (Highland 2007). Human relation is an integral part of Human resource management and in the context of the Construction industry; the human management is considered the backbone of the industry. The Construction sector has an essential feature of been classified as a labour intensive sector. This due to the enormous and vital roles labour plays in the Construction process as confirmed by Moselhi and Khan (2010) that labour productivity plays a significant role in the successful delivery of engineering procurement and construction projects. Missbauuer and Haube (2006) pointed that contractors within the sector perceive proper planning, attractive labour rate, adequate and experience skill labour among others. As this attributes to the success and failures of construction projects without paying much attention to the human relations aspect of employed labour within the organization or on a project. The Construction industry has been characterized as a fragmented sector where the worker (skilled and unskilled) are grouped to work in teams under an activity. These workers in group/ team develop a standard unit and their behaviour and conducts impacts on the firm's productivity. As a result, attitudes, emotions and prejudices exhibited by workers (labour) are hugely influenced by the human relations that co-exist between employer and employees. The nomadic nature of the construction industry makes the industry prone to recruiting people from the various ethnic background, groups and cultural environ to work cooperatively and productively in a work situation. This integration of human relations performs a very vital role in every organization as well as all levels of human endeavour. Human relations have an effect on performance (Rivera 2002). Employees have many needs beyond those satisfied by money. Teams/ groups have a powerful influence within a firm. The behavioural science of groups/teams in a works situation is not a new science but depends on psychology and sociology theory and practice as captured by Hawthrone in as early as 1927. However, huge research on this human resource management is silent on human relations aspect and how productivity is achieved through this relationship. Blyton (2008) revealed that employees do not put up their best performances at workplaces when they are unhappy with management, government, or even their fellow colleagues. If an organization is to succeed, the relationships among the people in that organization must be monitored and maintained. This study, therefore, seeks to spark a debate on the extent to which human relations affect productivity in the construction industry.

2. Significance of Human Relations

Maintaining healthy employee relations in an organization is a pre-requisite for organizational success. Strong employee relations is required for high productivity and human satisfaction (Pilbeam and Corbridge, 2002). Highland (2007) stressed that Human relations deal with avoiding and resolving issues concerning individual that might arise out or influence the work. A strong human relation depends upon healthy and safe work environment. Highland (2007) further established that perhaps the single most important aspect of designing any work environment is the plan that links all workers and supervisor with multiple channels of communication. Good communication may be referred to as the critical component of sound human relations. A good human relationship is fitting people into work situations so as to motivate them to work together harmoniously. The process of fitting together should achieve higher levels of productivity for the organization while also bringing employees economic, psychological, and social satisfaction. Human relations covers all types of interactions among people their conflicts, cooperative efforts, and group relationships (Highland 2007). It is the study of why our beliefs, attitudes and behaviours sometimes cause interpersonal conflict in our personal lives and work-related situations. Human relations in a firm also installs integration. This is referred to as the bringing together of people from the various ethnic background and varying groups and association to work cooperatively and productively, with economic and psychological means including social satisfaction with the ideology of motivation in a work situation.

2.1. Human Relations in Organization

Organizations recruit labour to accomplish various tasks for clients on behalf of the organizations. The relationship becomes the focus as labour renders services to clients. Relationships are becoming more vital than physical products (Highland 2007). In any service firm, there are thousands of critical incidents in which customers come into contact with the organization and form their impressions of its quality and services. Employees must endeavour to project good human relations in terms of a favourable image of the organization they represent. Internally within the firm, teams must have good relations to encourage harmony. Management must also endeavour to have human relations as part of the company's policy to foster good working environment.

2.1.1. Types of relationships

Human relations occur at all levels settings such as supervisors, subordinates, mates and friends. At whatever level relationship is built. Relationships exist in various forms within firms including the following:

a. Inter-personal

An interpersonal relationship is an affiliation, connections or associations between two or more people. This relationship also exists in firms and among project managers and has become more prominent (Project Management Institute 2008). Dinsmore (1990) argued that charts and schedules are useless if the human factor of projects is not taken into consideration. The project takes place in a complex environment where the vast background of the workforce will be managed by a project manager (Ida 2012). As a result, a project manager in an organization must be aware of an excellent interpersonal skill with everyone to be able to communicate with everyone to fine-tune diversity in his team. Further, interpersonal relations also enable team leaders first to know their needs in order to understand how to reacts to the workforce under their control.

b. Inter-group relations

Inter- group relations as defined by Sherif (1966) ensue wherever individual belonging to one group interact collectively or individual with another or its members in terms of their group identification. Further, whenever individuals belonging to one group interact, together, or individually, to another group or its members in terms of their group identification it means that inter-group relation has taken place (Sherif, 1966). Sociological theory and relations have focused on the structural determinants of inter-group behaviour. These theories emphasize the importance of cognitive factors such as stereotyping, as well as motivational underpinning of intergroup behaviour including the presumed desire on the part of the group members positive social groups.

3. Labour Productivity

Considerable effort has been demonstrated to understand productivity concept (Gundecha 2012). This resulted in different definitions (Oglesby *et al.* 2002). Productivity has a great significant in construction. Productivity of Labour constitutes an essential part of production input for Construction projects. Productivity expresses the relationship between outputs and inputs (Gundecha 2012). Productivity is one of the major components of every company's success and competitiveness in the construction market. A Construction firm stands to gain or lose, depending on how well the company's productivity responds to competition. Construction firms may gain advantage over their competitors by improving productivity to build projects at lower costs; yet, most contractors do not systematically and adequately address this strategic issue or evaluate its impact on the project's profit (Mojahed and Aghazadeh 2007) cited in (Enshassi 2012). Construction productivity improvement is a crucial issue for businesses and nations to increase profitability, reduce costs, create and sustain competitive advantage. In order to remain as unique players in a highly competitive global market, construction decision-makers must promote individual productivity strategies that match business needs (Flanagan et al., 2005). Construction tasks are complex and hard to quantify when assessing and measuring productivity (Janssen, 2008). In many countries, the construction industry attracted criticism for low productivity and poor quality (Eriksson and Westerberg 2011). Improving productivity is a management issue, and the introduction of new techniques or technologies may be a necessary but not a sufficient condition.

Enshassi (2012) affirmed that in order to improve productivity at the construction site, there should be the need to develop methods, improve training programs, enhance worker motivation, improve strategic management and improve procurement management. Table 1 depicts the factors that affect Labour productivity on a construction site.

Table 1

1	Lack of Providing Labour with Transportation
2	Working Overtime
3	Crew Size and Composition
4	Unrealistic Scheduling and Expectation of Labour Performance
5	Incentive scheme
6	Early Quite and Frequent Unscheduled Breaks
7	Delay in Inspection by Site Management
8	Material Shortage
9	Unavailability of Suitable tools
10	Proportion of work subcontracted
11	Lack of Human Relations
12	Material Shortage
13	Lack of Adequate motivations
14	Lack of suitable Rest Area Offered to Labour on Site
15	Lack of Training offered to Operatives
16	Sequence of Work
17	Communications between Site Management and Labour
18	Late Arrival
19	Lack of Construction Manager Leadership
20	Delay in Payment
21	Construction Methods
22	Labour Supervision

Source: Adapted from Gupta and Kansal (2014),

4. Research Method

A number of studies on human resource management have focused on productivity and performance with a limited view the human relations aspect. In light of that, exploratory research technique was adapted to determine the extent to which human relations affect productivity. Interview section was conducted among construction professionals and clients via purposive sampling. The targeted population for the study were adequately prepared as a result of the prior notification of the semi-structure interviews. In all, twelve interviews section were conducted with the aid of scheduled guide and recorders and was subsequently transcribed. Each Interviewee had a total of eight minutes duration to answer all the scheduled questions. Table two (2) shows the summarized data of the firms interviewed which was transcribed.

Table 2

Firm Name	Designation	No Interviewed	Construction Industry Sector	Category of Employees	Structure and size of firm
I	Project Mangers	2	Diverse projects such as Roads, Bridges, and Steel Works.	Expatriates and Locals	25 Employees
J	Site Foremen	2	Specialist Steel Wks.	Locals	8 Employees
K	Construction Managers	3	Public Sector projects, School &Health	Expatriates and Locals	10 Employees with 17 casual workers
L	General Managers	1	Both Public and Private projects.	Locals	10 Employees
M	Quantity Surveyors	2	Private Sector projects	Locals	15 Employees

5. Findings and discussions

These exploratory findings from the study are consistent with the literature regarding the fundamental features of human relations within firms. Results from the study revealed that human relationship is imperative in an organization if high productivity is to be accomplished. Moselhi and Khan (2010) affirmed that labour productivity plays a significant role in the success delivery of engineering procurement and construction projects. Targets and core goals of the firm are disrupted by the absence of human relations. Highland (2007) supported that establishing human relations within an organization deals with avoiding and resolving issues concerning individual that might arise out or influence the work. Further, Highland (2007) stressed that right human relations will be enhanced when there is good communication among teams that will motivate employees to work together. Similarly, labour productivity is increased when healthy human relationships ensue among employees at all levels within the firm. Findings indicate that issues concerning Labour are vital in achieving productivity. Dinsmore (1990) stressed that charts and schedules are useless in achieving goals of companies if the human factor is not taken into consideration. As a result, labour productivity is significant as its impact on project or firms profit (Mojahed and Aghazadeh 2007). The study also revealed that labour productivity on a construction site is affected by several factors captured on Table (1). Interviewees indicated that maintaining healthy employee relations in an organization is a pre-requisite for firm success. As a result, strong employee relations are required for high productivity and human satisfaction as supported by (Pilbeam and Corbridge 2002). Interviews with the construction professionals also confirmed as established in literature that good human relations is in a firm installs integration which brings together of people from various ethnic background and different groups and association to work cooperatively and productively with economic and psychological means including social satisfaction with the ideology of motivation in a work situation. Management must also endeavour to have human relations as part of the firm's policy to foster good working environment the will drive employees to work in harmony. Some clients of the sampled population remarked that in principle human relations concepts is essential, but its implementation becomes challenging within a firm.

6. Conclusions

The goal of this study was to explore the extent to which human relations contribute to productivity on the construction site using the exploratory technique. Construction professionals and clients were the populations sampled. Interviews were conducted and transcribed with the aid of interview guides. The study concludes that human relations perform a very vital role in every organization as well as all levels of human endeavour. As a result, in the construction industry as a labour intensive sector, management must strive to establish such relationship in order to foster harmony.

The study further concludes that good human relations at the workplace installs integration that brings together of people from the various ethnic background and different groups and association to work cooperatively and productively. This would drive social satisfaction with the ideology of motivation in a work situation. Management must also endeavour to have human relations as part of the firm's policy to foster good working environment the will drive employees to work in harmony.

The study also proved that successful human relationships within the organization creates a union and encourage employee satisfaction that further enhances employee's operational efficiency. The study recommends Managers of construction firms to institute good human relations in their corporate objectives due to the associated benefits that emanate from such good practice.

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Development of Sustainable Cold Asphalt Concrete Binder Course Mixtures Using Waste Fly Ash and Metakaolin

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Abstract:

Cold bituminous emulsion mixtures (CBEM) can be considered to be a promising alternative for traditional hot mix asphalt or warm mix because of its four main drivers: low environmental impact, cost-effectiveness, energy efficiency, and greater safety. However, these mixtures have been considered inferior to hot mix asphalt over the last decades due to the long time required to reach its full strength, high air-void content of the compacted mixtures, and long curing times required to achieve an optimal performance. Cold emulsion bituminous mixtures are normally manufactured by mixing cold aggregates with an asphalt emulsion and water; consequently, they can be described as bituminous materials prepared at ambient temperature.

So far, researchers have made intensive efforts to improve CBEM properties to obtain their full benefits. A traditional active filler material such as Ordinary Portland Cement (OPC) was used widely to develop these features. Thus, waste fly ash (WFA) with Metakaolin were considered for developing a new cold asphalt concrete binder course bituminous emulsion mixture (CBC) with the same gradation as the traditional hot dense bitumen macadam mixture, which is the most common mixture in use as binder course in road pavement in the UK, by the addition of (WFA) as a replacement to mineral filler. Metakaolin was used as an additive in four percentages (0.25%, 0.5%, 0.75% and 1%) by the weight of aggregate. With this purpose, all the mixtures were prepared with granite aggregate and slow setting cationic emulsions. The mechanical properties were assessed by the indirect tensile stiffness modulus test (ITSM), while water sensitivity was inspected by assessing the stiffness modulus ratio before and after samples' conditioning. In addition, two types of hot binder course mix, namely AC 20 dense binder course 100/150 and AC 20 dense binder course 40/60, have been used throughout the research with the same aggregate type and gradation for comparison.

The experimental results have shown a substantial enhancement in the indirect tensile stiffness modulus and a significant improvement of water sensitivity resistance by using WFA. In the other hand, the addition of Metakaolin to the cold asphalt concrete binder course improves the initial strength as well as long-term strength and durability. The new CBC mixture has comparable indirect tensile stiffness modulus and durability to that of conventional hot binder course, which indicates the possibility of the use of CBC in heavy road construction.

Keywords:

binder course, cold bituminous emulsion mixtures, indirect tensile stiffness modulus, Metakaolin and water sensitivity

1. Introduction

Cold bituminous emulsion mixtures are usually obtained by mixing cold aggregates with an asphalt emulsion and water; accordingly, it can be defined as bituminous materials prepared at ambient temperature. There are continuously changing properties shown by emulsion bound mixtures (stiffness modulus, permanent deformation resistance, water sensitivity, fatigue resistance, etc.) until reaching a steady state, at a fully cured condition, though it may still contain a low amount of residual water (Ibrahim and Thom, 1997). Cold bituminous asphalt mixture has a comparatively low initial strength, long curing time and high voidage so that full curing of these mixtures on site may occur between 2 and 24 months (Leech, 1994).

On the other hand, there are certain restrictions linked with the use of hot mix such as greenhouse emission gases and problems in keeping the temperature when transporting long distance. Consequently, it is important to develop a cost-effective cold mix asphalt using industrial by-products to decrease the shortcomings recorded during the production of those mixtures. As a result, energy conservation and reduction of carbon emissions will be ensured during highway construction.

In order to improve the early performance of cold emulsion bitumen mixture, numerous studies have been implemented in terms of Ordinary Portland cement (Schimdt et al., 1973; Head, 1974; Al-Hdabi et al., 2014), Rapid setting cement (Thanaya et al., 2009; Fang et al., 2015), fibres (Bueno et al., 2003; Ferrotti et al., 2014) and polymers (Khalid and Eta, 1997; Forbes et al., 2001) which have been used as additives. Alternatively, use of waste by-products that possess hydraulic and pozzolanic properties will reduce the environmental problems by absorbing these materials in the construction sector. Accordingly, these materials bring both economic and technical advantages. Metakaolin is obtained by the calcination of kaolinite. It is used very generally as pozzolanic material in mortar and concrete, and has showed significant effect in improving both mechanical and durability properties of mortar and concrete (Siddique and Klaus, 2009; Antoni et al., 2012; Nežerka et al., 2014).

In spite of wide research on fabricating different types of CBEM, there is no singular study presence dealing with manufacturing cold asphalt concrete bituminous emulsion mixture appropriate for heavily trafficked binder course using bitumen emulsion and including waste materials activated by Metakaolin.

This research aims at understanding the role of WFA activated by Metakaolin in CBEM. In particular, the objective of this work is to study the influence of WFA together with Metakaolin in strength development of the CBC. The development of the mechanical properties of the mixture with time was characterized by the indirect tensile stiffness modulus test. Water sensitivity has been examined by means of stiffness modulus ratio.

2. Materials and Experimental Methods

2.1. Materials

Materials utilized in this research work are briefly presented as follows:

a. Aggregate

A continuous dense aggregate gradation for asphalt concrete AC-20 dense binder course was used in this research which is outstanding type of asphalt binder layer material, as shown in Figure (1) of mixtures (cold and hot) which are in accordance with BS EN 13108-1 (European Committee for Standardization, 2006). The reasons for using dense bitumen macadam mixtures is because they are, by far, the most general mixtures in use as binder course and base in road pavement in the UK having a continuous grade providing a good aggregate interlock which results in this material having very good load-spreading properties as well as a high resistance to permanent deformation (Read and Whiteoak, 2003).

A crashed granite coarse and fine aggregate was used throughout this research, which is usually used to produce asphalt concrete hot mix. The physical specifications of the crushed coarse and fine aggregate are listed in Table (1).

Table (1): Aggregate physical properties

Material	Property	Value
Coarse aggregate	Apparent particle density, Mg/m^3	2.67
	Particle density(OD), Mg/m^3	2.62
	Particle density(SSD), Mg/m^3	2.64
	Water absorption, %	0.8
Fine aggregate	Apparent particle density, Mg/m^3	2.65
	Particle density(OD), Mg/m^3	2.54
	Particle density(SSD), Mg/m^3	2.58
	Water absorption, %	1.7
Mineral filler	Particle density, Mg/m^3	2.57

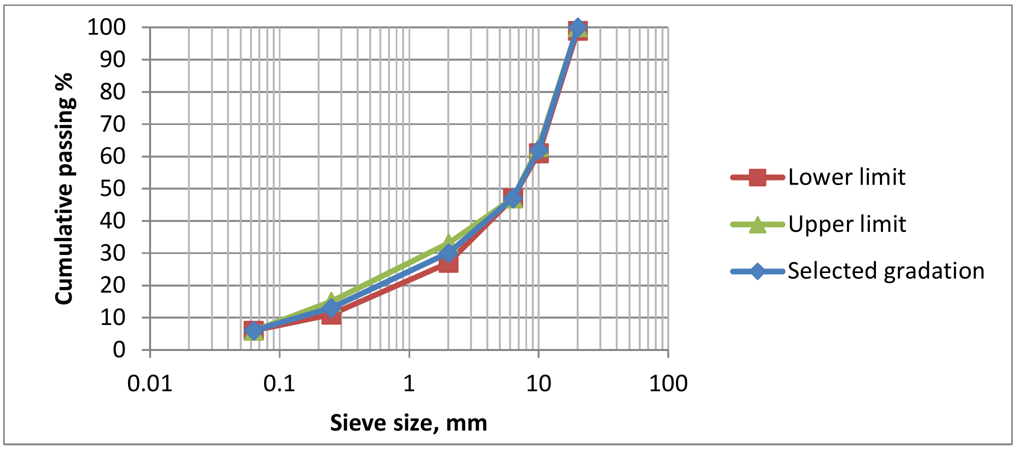

Figure 1: AC 20 mm dense binder course aggregate gradation

b. Bitumen emulsion and bitumen

Cationic slow setting bitumen emulsion (C 60 B 5) was used throughout the research. Nikolaides (1994) showed that cationic emulsion is appropriate due to its ability to coat the given aggregate as well as to confirm high adhesion between aggregate particles. Table (2) illustrates the properties of the chosen bitumen emulsion. Furthermore, two grades of bitumen (100/150 and 40/60) have been used to fabricate hot binder course mixtures and Table (3) shows the properties of these binders.

Table 2: Properties of (C 60 B 5) bitumen emulsion

Description	(C 60 B 5) bitumen emulsion
Type	Cationic
Appearance	Black to dark brown liquid
Base bitumen	100/150 pen
Bitumen content	60 %
Boiling point, °C	100 °C
Relative density at 15 °C, g/ml	1.05

Table 3: Properties of 100/150 and 40/60 bitumen binders

Bituminous binder 40/60		Bituminous binder 100/150	
Property	Value	Property	Value
Appearance	Black	Appearance	Black
Penetration at 25 °C	49	Penetration at 25 °C	131
Softening point, °C	51.5	Softening point, °C	43.5
Density at 25 °C	1.02	Density at 25 °C	1.05

c. **Filler:**

Traditional mineral filler (limestone dust) and waste fly ash (WFA) were used in this study.

d. **Activator:**

a commercially available Metakaolin was used with various percentages starting from 0.25%, 0.5%, 0.75% and 1% of total dry aggregate weight in the mix.

2.2. **Preparation of specimens**

The method adopted by the Asphalt Institute (Marshall Method for Emulsified Asphalt Aggregate Cold Mixture Design (MS-14)) (Asphalt Institute, 1989) was used to for designing the cold asphalt concrete binder course bituminous emulsion mixtures.

Various pre-wetting water contents were examined to find the lowest ratio and as a result adequate coating will be confirmed. Moreover, indirect tensile stiffness modulus tests were used to decide the optimum emulsion content, where the mix density test was used to determine the optimum total liquid content at compaction. According to this procedure, pre-wetting water content, optimum total liquid content at compaction and optimum residual bitumen content were 3.5%, 14% and 6.3%, respectively.

Incorporation of the waste fly ash (WFA) was carried out over partial replacement of the conventional mineral filler with different percentages (0%, 1.5%, 3%, 4.5% and 6%) by total mass of aggregate. While, Metakaolin was used as activator in four percentages (0.25%, 0.5%, 0.75% and 1%) by dry aggregate weight.

The materials were mixed in a Hobart mixer. Aggregate together with the filler and the pre-wetting water content were added and mixed for 1 min at low speed. After that, bitumen emulsion was added progressively throughout the next 30 second of mixing, and the mixing was continued for the next 2 min at the same speed. In addition, the samples were mixed and placed in the mould, and after that they were directly compacted with 100 blows of the Marshall hammer, 50 on each side of the specimens by using standard Marshall Hammer (impact compactor).

The specimens were left in room temperature (20±1°C) while they are still in their moulds for one day which represents the first stage for specimen's condition according to the procedure adopted by the Asphalt Institute. After this, they were extruded and cured for 1 day in a ventilated oven at 40 °C where the second stage was achieved. Jerkins (2000)confirmed that this curing regime, i.e. 24 h@ 20 ºC plus 24 h@ 40 ºC represents 7-14 days in the field. After that, all the specimens were left in the room for the required curing time of 2, 7, 14, 21 and 28 days.

The indirect tensile stiffness modulus test has been conducted to examine the effect of replacement of conventional mineral filler with WFA and the effect of Metakaolin addition. Furthermore, the results have been compared with a standard AC 20 hot dense binder course. Consequently, two types of hot binder course mix namely, AC 20 dense binder course 100/150 and AC 20 dense binder course 40/60, have been used throughout the research with the same aggregate type and gradation. 4.6% optimum binder content by weight of aggregate was used according to the PD 6691:2010 (European Committee for Standardization, 2010) for the AC 20 dense binder course. Specimens were fabricated and compacted at lab temperature (20◦C), whereas 100/150 and 40/60 hot mixtures were mixed at (150–160 ºC) and (160–170 ºC), respectively.

In addition, a cold asphalt concrete binder course containing limestone was used for comparison. Every indirect stiffness modulus test value is the average of 3 specimens to ensure the reliability of the results.

2.3. **Testing**

The indirect tensile stiffness modulus (ITSM) test was used to evaluate the mechanical properties, whereas the stiffness modulus ratio (SMR) was utilized to examine the water sensitivity of the new cold asphalt concrete binder course bituminous emulsion mixture (CBC) mixtures as well as traditional hot dense binder course mixtures.

2.3.1. Indirect tensile stiffness modulus test (ITSM)

The ITSM test is designed to test the ability of the individual layers of pavement to distribute traffic loads to the layer underneath. It is a non-destructive test and is used generally to assess the stiffness modulus of hot mix. Currently, the stiffness modulus is generally recognized as a very significant performance property of bituminous paving materials and it can be utilized as an indication of the load-spreading ability of bituminous paving layers. Stiffness modulus is one of the most significant properties which strongly affects the critical strains generated in both base and subgrade (Read and Whiteoak, 2003). The test was conducted in accordance with BS EN 12697-26 (European Committee for Standardization, 2012), using Cooper Research Technology HYD 25 testing apparatus. The test conditions are shown in Table (5).

Table 5: ITSM Test Conditions

Item	Range
Specimen diameter mm	100 ± 3
Rise time	124 ± 4 ms
Transient peak horizontal deformation	5 μm
Loading time	3–300 s
Poisson's ratio	0.35
No. of conditioning plus	5
No. of test plus	5
Test temperature °C	20 ± 0.5
Specimen thickness mm	63 ± 3
Compaction Marshall	50 × 2
Specimen temperature conditioning	4 h before testing

2.3.2. Water sensitivity test

The presence of water in pavement layers will cause early failure of asphalt pavement represented in two types of failure, stripping distress as a result from debonding of the bitumen film from the aggregate surface and/or premature rutting/fatigue distress resulting from mix strength reduction(Al-Busaltan, 2012). Specimens are divided into two groups, with three parallel specimens in every group. Two sets of three samples were prepared and separated using Marshall hammer. The first set was considered for the unconditional test (dry) and they were left at 20 ºC for 10 days after preparing the samples. Whereas, the second set was considered for the conditional test (wet) and these were left at 20 ºC for 7 days. Following this a vacuum (6.7 kPa pressure) was applied to the samples for 30 min, after which they were left submerged for the next 30 min and then they were immersed in a water bath for 3 days at 40 ºC. All samples were tested for indirect stiffness modulus test where the water sensitivity was assessed by determining the SMR as the ratio of the wet to dry, in accordance to with BS EN 12697-12: 2008 (European Committee for Standardization, 2008).

3. Results and Discussion

3.1. Indirect Tensile Stiffness Modulus Test Results

The first step in the manufacture of new cold asphalt concrete binder course mixtures was the incorporation of supplementary cementitious material that has a cementitious activity as a substitute for conventional mineral filler.

The following points can be drawn according to the ITSM results shown in Figure 2: (i) cold asphalt concrete binder course mixtures with 6% WFA can offer a stiffness modulus around 10 times that of control mixtures at a curing time of 2 days; (ii) the ITSM results increased significantly for WFA mixtures with curing time especially for 4.5 and 6% replacement of WFA. Nevertheless both hot mixtures do not show noticeable differences in ITSM with time.

A point of interest is that the development in ITSM is due to the generation of new binder resulting from the hydration process of WFA which dominates the strength gain that works together with the bitumen residue binder. In addition, this hydration process absorbs the trapped water which is responsible for the mixtures' weakness.

The second stage is the addition of Metakaolin as a pozzolinic material that could increase the hydration process. The results here were very remarkable where the sample has shown a substantial enhancement in the stiffness modulus with the increasing quantity of Metakaolin added to the mixtures containing WFA. It is obviously shown by the data presented in Figure (4) that the addition of 0.25% of Metakaolin to the CBC containing 6% WFA improved the stiffness modulus by approximately 43%. The addition of 0.5%, 0.75% and 1% of Metakaolin enhanced the stiffness modulus by about 76%, 91% and 99% respectively. Furthermore, all of these results are more than the target value for the 131-pen AC 20 mm, after just 2 days of curing.

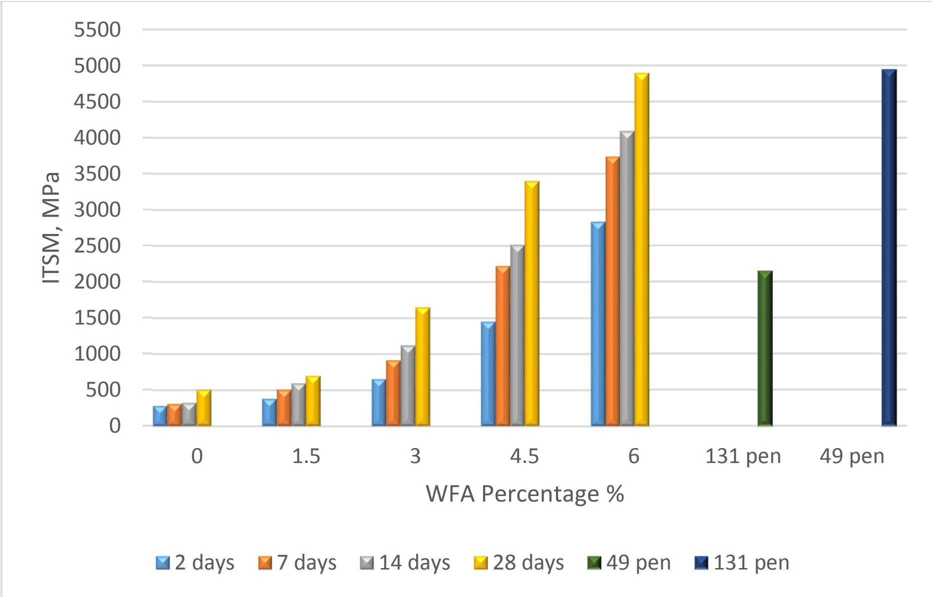

Figure 2: Effect of (WFA) percentage on ITSM results

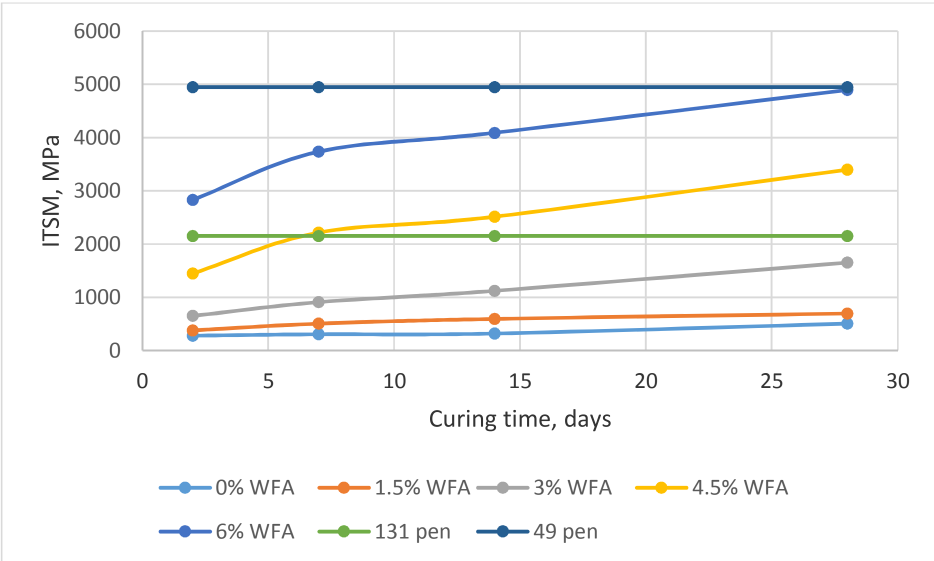

Figure 3: Effect of curing time and (WFA) percentage on ITSM results

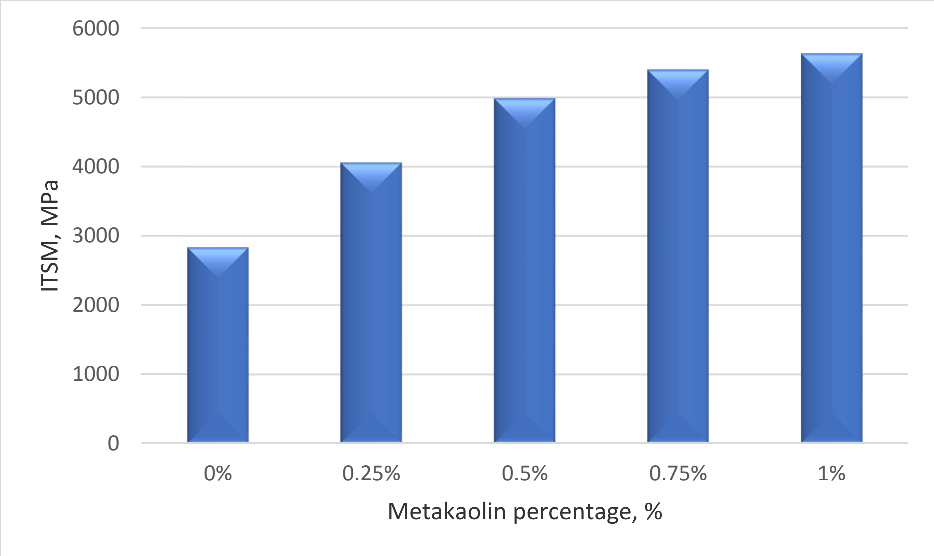

Figure 4: Effect of Metakaolin addition on ITSM results after 2 days

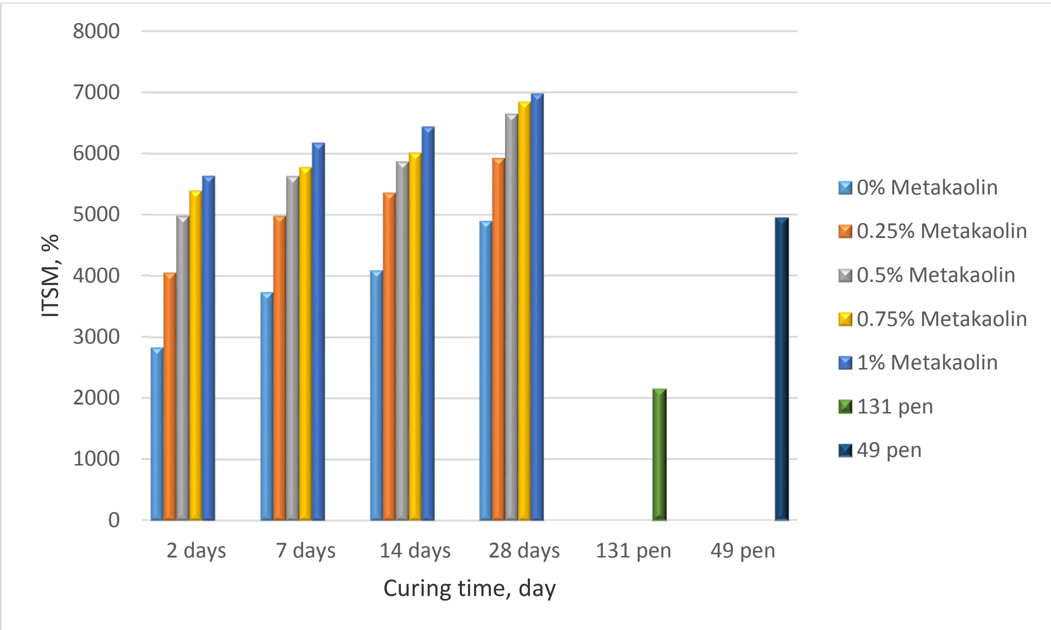

Figure 5: Effect of curing time for 6% WFA and Metakaolin addition on ITSM results

3.2. Water Sensitivity Test Results

Water sensitivity performance of the new cold asphalt concrete binder course mixtures was conducted as per BS EN 12697-12: 2008 (European Committee for Standardization, 2008) in terms of SMR to assess the performance of these mixtures and the results are illustrated in Figure 6.

From these results the following can be stated: (i) CBC with 6% WFA filler showed promising effect, i.e. the SMR was more than 100%; (ii) CBC comprising WFA and Metakaolin (MK) offered an outstanding effect under water sensitivity tests; better than both types of traditional hot asphalt concrete binder course, i.e. 131 pen and 49 pen.

It is obviously shown that the mixtures with WFA and WFA-MK have an excellent performance in terms of water sensitivity compared with untreated cold binder course as well as conventional hot asphalt concrete mixtures.

A point to note is that samples with 6% WFA as well as all the samples with MK have more than 100% stiffness modulus ratio i.e. the wet stiffness is more than dry values. The hydration process is behind this promising performance of the conditioning WFA and WFA-MK samples for the water sensitivity test as shown diagrammatically in Figure 6. The two reasons behind this enhancement are: (i) soaking the samples in water has a positive action on hydration process. Additionally, ii) conditioning of the samples at high temperatures under water (40 ºC), further activates this process.

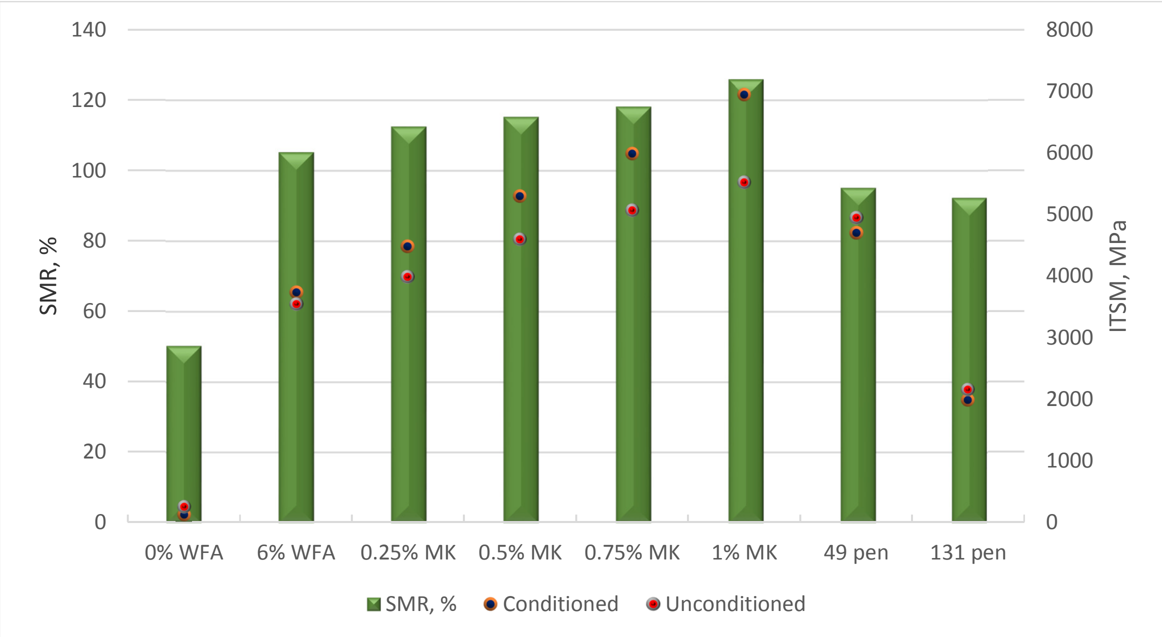

Figure 6: Water sensitivity results

4. Conclusions

Based on the experimental results of this research, the following can be concluded:

1. New CBC with a comparative indirect tensile stiffness modulus to hot asphalt concrete binder course can be introduced using WFA especially with higher percentages of filler i.e. 4.5% and 6%.
2. MK has been used for the first time to activate WFA, which showed excellent improvement. After 2 days of curing, the addition of 1% MK increased the stiffness modulus by 99%. Those mixtures make new paving mixtures appropriate for heavily trafficked roads as well as low and medium trafficked roads.
3. In accordance to water sensitivity results, the enhancement in durability of CBC containing 6% WFA is more than twice that of the control mixture. In addition, there is a considerable

achievement obtain from the use of MK as activator where those mixtures perform better under wet conditions.

4. Sustainable and fast curing CBC mixtures can reach the desired stiffness modulus (for the hot asphalt concrete binder course with soft binder) after a very short time. Therefore, this would be an outstanding improvement in comparison with the 2–24 months curing time necessary for conventional cold bitumen emulsion mixtures as stated by Leech (1994).

5. Recommendations

While this paper has studied ITSM and the water sensitivity of waste fly ash treated with Metakaolin in CBEM, permanent deformation and fatigue resistance of CBEM also need to be considered.

6. Acknowledgements

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Collaboration challenges for detailed design and optimisation via building performance simulation

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Abstract

At the present time, Building Information Modelling (BIM) has become a standard practice in the AEC industry. However, with this wide embrace from the industry, new problems and challenges are appearing. The largest of these issues is the interoperability, which hinders the BIM adoption through the whole lifecycle of building projects. The interoperability had been more developed in areas such design coordination, in detriment of other areas such as Building Performance Simulation (BPS). This lack of interoperability in BPS had discouraged the early collaboration in design, and then simulations are carried out as late as possible to minimize the number of information exchanged.

Considering the existing conditions, this research aims to solve the collaboration issue at early design by providing information exchange guidance between various BIM tools used by designers. The methods to achieve the aim include: literature review focused on describing the project communication; challenges to achieve an integrated approach (interoperability issues and the state of the art for BIM servers); development of a business process model for early design by Information Delivery Manual (IDM).

These research findings will encourage early collaboration for performance analysis by enabling information exchange between stakeholders. Besides, the development of a guideline can be used by the BIM vendors to improve their BIM tools for successful interoperability. The outputs will reflect on the design process, with increased flexibility such as development and review different design alternatives and addressing the building performance challenges at early design successfully.

Keywords

Building Information Modelling, interoperability, collaboration, Information Delivery Manual

1. Introduction

Building Performance Simulation (BPS) allows simulating the thermal performance for a design, making possible to determine how a change in it affects the energy consumption through the project life cycle. However BPS is a newest discipline into the AEC industry and needs facing some challenges in order to facilitate a wide adoption in the design. The largest of these problems is the absence of collaborative work as a result of a lack of interoperability or ability to share data created by different software. This lack in sharing data push to designers to spend time re-entry manually missed data. As a consequence, the collaboration is reduced or carried out as late as possible to minimize the time used in the re-entry data process.

Even though the BPS tools are not widely used in the industry, there some hints to think that the current outlook will improve in the coming years. The reasons to expect a higher demand than the current engagement are based on: the disruptive emergence of Building Information Modelling (BIM) in the AEC industry is boosting the interest for simulation tools; government policies to reduce the carbon footprint; awareness about the environment and better use for resources.

This research seeks go on ahead for an increasing demand of energy tools that facilitate the collaboration through a better interoperability. Once this issue is solved, will be possible an early collaboration between different actors to optimize the designs ensuring a low energy consumption through the project lifecycle.

2. Literature review

The interoperability is the ability of a BIM tool to exchange data with other applications (Eastman et al, 2011), stimulating collaborative relationships among team members and enabling an integrated project execution (McGraw Hill 2007; Smith & Tardiff, 2009).

Despite the importance of the interoperability, many authors (Attia, 2010; Krygiel & Nies, 2008; Hemsath, 2014; Levy, 2012) have reported an underdevelopment in the interoperability into BPS. As a consequence of a lack of interoperability, running a performance analysis will be slow because some data will need to be re-entry manually then collaboration will be affected (Sanguinetti et al, 2014). Even though most of the tools are able to translate from their native formats into a common format readable for other tools (Kymmell, 2008), the data created by these software is not completely mature and then fundamental data for the analysis is missed (Eastman et al, 2011).

2.1. Data management and project communication

It is possible to manage the data developed in a project through two approaches such as standard practice and integrated workflow, each of these approaches have a different way to set the communication between actors. Depending how the communication is carried out it could require interoperability between tools.

In the standard practice (fig 1, on the left side) every consultant is responsible to manage their own data, when an update is required, it is passed through different consultants to ask for their check and approval. This approach uses the same platform to create the data, and then does not exist any interoperability issue, however it is unlikely that all consultants will use the same platform in a project. Besides there is no tool able to create the entire data for the life cycle project (CRC, 2009a), then creating the data for the whole life cycle will require using different tools through each stage and as a result interoperability issues will appear between the different project stages.

On the other hand, in the integrated workflow (fig 1, on the right side) each actor will make their own information available to others specialists uploading it in a server. This approach is more realistic than standard practice because of different tools are used by each consultant. Nonetheless the success of this approach will require a good information exchange between the different tools and project members (CRC, 2009a; Kymmell, 2008), otherwise the each actor could share their own information but other contractor should not able to read it or some data could be missed.

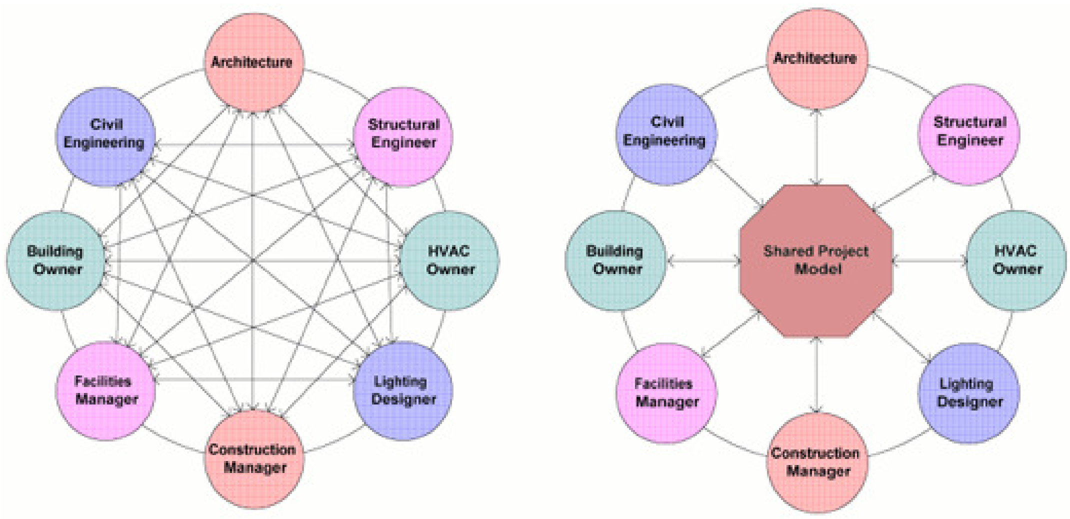

Figure 1. Data management view (Lister, 2012)

2.2. Challenges for integration

As previously have been explained, the most likely data management approach to be used in a project is the integrated workflow, but it needs to face the interoperability issue in order to achieve a successful implementation. The information exchange problem may be divided in two parts (CRC, 2009a; Kymmell, 2008): interoperability between tools; information exchange between actors.

a. Interoperability issues

Currently the interoperability issues are addressed via two formats: Industry Foundation Class (IFC) and Green Building XML (gbXML). The IFC schema has been widely accepted by the AEC industry (Smith & Tardiff, 2009), nevertheless many researches have remarked different problems with this schema. The IFC format is able to provide geometric information, non-geometric properties (material properties) and relationship between the components, nonetheless the IFC data exchanged by commercial tools is general and it includes generic data and then most of the specific information will be missed in the exchange process (Juan & Zheng, 2014). The gbXML schema allows exchanging some HVAC information that is missed in the IFC schema, but nevertheless this format is not mature enough and it is limited to simple designs given that the exportation process is not able to read complex geometries (Bahar et al, 2013).

The interoperability issue between authoring and BPS tools is shown in the figure 2, here are introduced the results for a comparative study between ten simulation tools (Attia, 2010). From the figure 2 is possible to state that most of these software have a low interoperability what is focused mainly in CAD files. IES and Vasari have a better information exchange via gbXML and RVT files respectively. However the workflow in both software is unidirectional (authoring-simulation tool way), then there is no way to send back the changes from the simulation to the authoring tool.

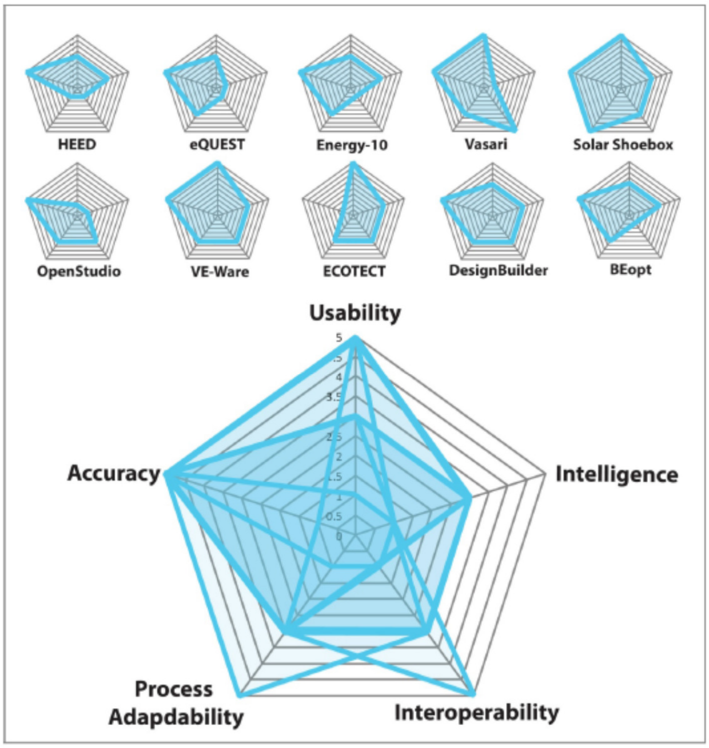

Figure 2. Benchmarking for energy tools (Attia, 2010)

b. BIM servers

The second challenge to obtain an integrated workflow is creating a server. This is a database system used to facilitate the collaboration allowing query, transfer, updating and data management created by different applications (Eastman et al, 2011; Jørgensen et al., 2008).

The early servers in the AEC industry have been focused on document management, however the interest of the industry for using digital models have pushed to adopt this technology from other well-established industries such as manufacturing, electronics and aerospace (Beetz et al., 2010; Eastman et al, 2011). Nonetheless, the technology is not mature enough and needs to be adapted to BIM requirements yet (Shafiq, Matthews & Lockley, 2013). Currently the BIM servers available in the market are centred on the building planning, design and construction stages (Wong et al, 2014).

To create a server will be necessary to define some requirements to ensure a proper management of data (CRC, 2009b; Eastman et al, 2011; Jørgensen et al, 2008; Smith & Tardiff, 2009). Shafiq, Matthews & Lockley (2013) identified some key features to considerate in a BIM server, these elements may be grouped in four categories:

Model content management: requirements related with storage, operation and maintenance of the data into the BIM model.

Model content creation: requirements related with creation of data into the building model.

Design review: requirements related with design review activities, including visualization, mark-up and consultation of information, navigation functions, team communication and interaction.

Data security: requirements related with system, users and data management, to define activities as access control, data backup, security etc.

The above requirements will be useful to compare the different servers available in the market and understand how those servers could be suitable to the interoperability requirements.

Choosing the right software to be analysed is hard because of the changing scenario where there is not a clear dominant tool (Beetz et al., 2010). Based on the literature it is possible to identify some tools that are constantly mentioned (Eastman et al, 2011; Shafiq, Matthews & Lockley, 2013; CRC, 2009a; Singh, Gu and Wang, 2011): Express Data Manager, ArchiCAD BIM Cloud, ProjectWise Navigator, BIMserver, Onuma Planning System and Autodesk BIM 360 Field.

Table 1: Model content management (Shafiq, Matthews & Lockley, 2013)

	EDM	*Archicad BIMcloud*	*Bentley projectWise*	*BIMserver*	*Onuma Planning System*	*Autodesk A360*
Model upload/download	*x*	*x*	*x*	*x*	*x*	*x*
Multiple data model format	*x*			*x*	*x*	*x*
Partial model exchange	*x*	*x*		*x*	*x*	
Versioning	*x*	*x*	*x*	*x*	*x*	*x*
Model merging	*x*	*x*	*x*	*x*	*x*	*x*
Data locking	*x*	*x*	*x*	*x*		
Clash detection	*x*	*x*	*x*	*x*	*x*	*x*
Conflict resolution	*x*	*x*	*x*	*x*	*x*	*x*
Audit trail	*x*	*x*	*x*	*x*	*x*	*x*
Data publishing	*x*	*x*	*x*	*x*	*x*	*x*
Workflow management	*x*	*x*	*x*			*x*

The table 1 shows interoperability issues for Archicad BIMcloud and Bentley projectwise, these software are not able to manage IFC files, then these software will not able to read BIM models created for other authoring tools.

Besides is worrying that Onuma and Autodesk A360 cannot locking their files, it means that these servers are not able to set access privileges then any user has access to the information to modify it.

Table 2: Model content creation (Shafiq, Matthews & Lockley, 2013)

	EDM	*Archicad BIMcloud*	*Bentley projectWise*	*BIMserver*	*Onuma Planning System*	*Autodesk A360*
Model modifications	x	x	x	x	x	x
2D data modelling	x	x	x		x	x
Data querying	x	x	x	x	x	x
Reference data linking	x	x	x	x	x	x
Product libraries support	x	x	x	x		
Model checking	x	x		x		
Rule-based modelling	x			x		
Model comparison	x	x	x	x	x	
Change management	x	x	x	x	x	x

The table 2 shows some problems in model checking, then it will not possible to validate and verify data using pre-defined rules. Neither it is possible to compare two models to identify changes in those models, this fail could be worrying during the design stage where is need to identify the frequent changes made to the project.

Table 3: Design review (Shafiq, Matthews & Lockley, 2013)

	EDM	*Archicad BIMcloud*	*Bentley projectWise*	*BIMserver*	*Onuma Planning System*	*Autodesk A360*
Remote model viewing			x		x	x
3D navigation	x	x	x	x	x	x
Mark-up	x	x	x		x	x
Collaborative communication	x	x	x	x	x	x
Report generation	x	x	x	x	x	
FM data support	x	x	x	x	x	x
Colour customization	x	x	x	x	x	x
Workflow reporting	x	x	x	x	x	x
Mobile computing support		x	x		x	x

The problems identified in the table 3 are of little relevance, being the most important the inability of BIMserver to communicate design problems to other team members via mark ups.

Table 4: Data security (Shafiq, Matthews & Lockley, 2013)

	EDM	**Archicad BIMcloud**	**Bentley projectWise**	**BIMserver**	**Onuma Planning System**	**Autodesk A360**
User profiling	x	x	x	x	x	x
Access control	x	x	x	x		x
Data handling	x	x	x		x	x
Interface customization				x	x	x
Security	x	x	x		x	x
Disaster protection	x	x	x		x	x
Data archiving	x	x			x	

The table 4 shows that BIMserver has serious security problems to manage their files, these problems are related with the impossibility to create data backups and to check the system security, then for BIMserver exist a likely to miss data easily.

3. Methodology

Bazjanac (2008) says that an automatic exportation from authoring software to simulation tool will not possible without improving the interoperability for IFC files created by HVAC software. In this sense, Juan and Zheng (2014) point out that Information Delivery Manual (IDM) will become the foundation for improving the interoperability breaking down a complex workflow to make explicit the functional parts to be exchanged. This methodology is very simple to use then any user can develop an IDM following a series of basic steps such as process modelling, use case, information exchange and functional part (buildingSMART, 2010) to break down the IFC schema and adding the data required in the information exchange.

3.1. **Process modelling**

The first activity to carry out is identifying the needs of information; this data can be made visible mapping the business process through methods such as Business Process Modelling Notation (BPMN), it describes the flow of activities for a particular topic, roles played by each actor involved and the information used or created by each of them (Eastman et al, 2011; BS ISO, 2010).

The figure 3 shows the main components of a process model developed with BPMN, this method uses rows and columns called swim lanes to categorize activities with different functional capabilities. The rows identified the actors involved in the exchange while the columns show project phases. Into the cells created by the swim lanes, it is possible to represent activities as white rectangles and data to be exchanged shown as corner folded blocks (Eastman et al, 2011).

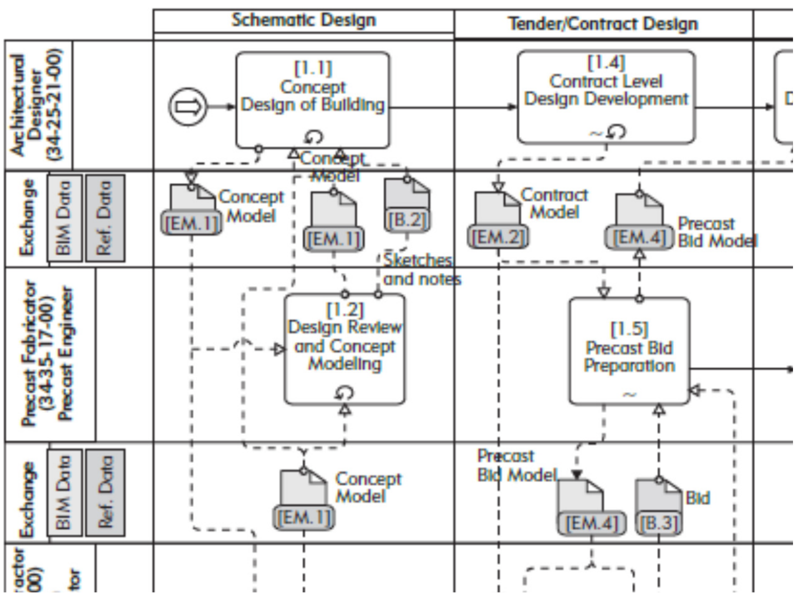

Figure 3. Process map (Smith & Tardiff, 2009)

3.2. **Use case modelling**

Use case describes the information exchange between any two actors within a particular stage of project lifecycle. The use case diagram deals with functional requirements for a system, it means that just describe how the information exchange must works. Other requirements such as order in which the activities are performed and high detail about the information exchanged, must be described separately (Microsoft, 2013).

The data shown by the use case is lower than process modelling, however it describes a requirement on the system so a correct system design allows each use case to be carried out (Aouad & Arayici, 2010), and then the use case will be useful as a checking tool to avoid missing exchange information data.

The use case model in the figure 4 shows the information exchange requirements between energy expert and client to carry out a feasibility study. The use case starts with the energy expert running feasibility studies and generating results for it, then this data is shared with the client who will analyse the information to set the design performance values.

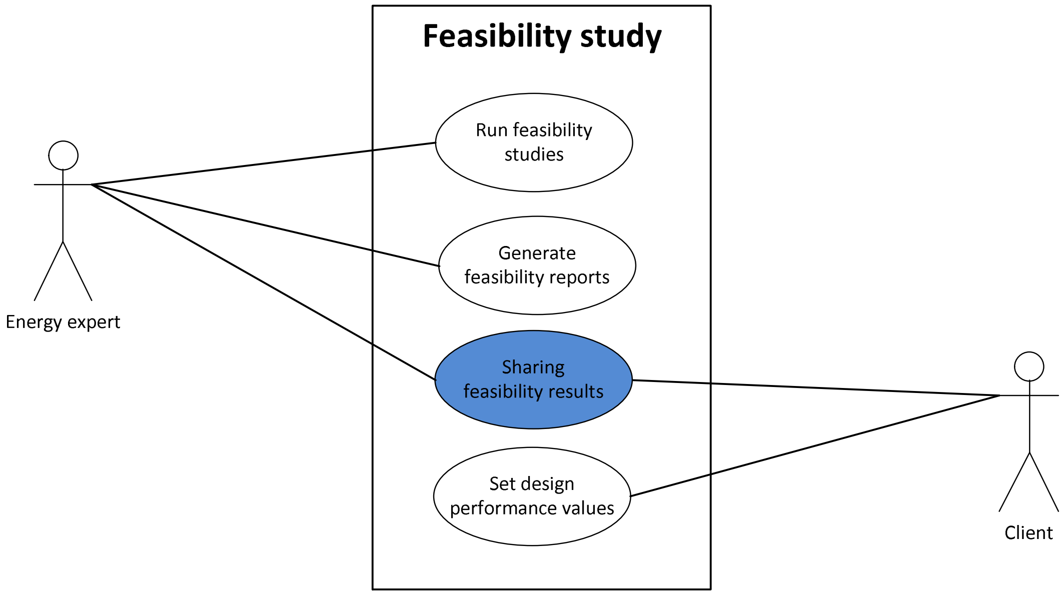

Figure 4. Use case model

3.3. Information exchange requirements

Based on the outcomes from the modelling process, a set of information exchange requirements are defined. Next step, will be to specify the information exchange and its content.

An exchange requirement represents the link between process and data. It contains the relevant data to ensure the correct exchange of data between two business processes at any stage of the project (buildingSMART, 2010).

Below in the figure 5 is shown an example for an exchange template:

- Header section: it contains name of the exchange requirement; project stage during the exchange will be carry out; disciplines involved in the exchange.
- Overview section: it states the aims and content of the exchange requirement explained in terms that are familiar to the user.

- Information section: it provides the breakdown of technical information required by the exchange requirement. It is the exchanged data, but explained in technical terms.
- Footer section: it describes the exchange models between which are located the information exchange described.

Table 1 Information exchange example

Project Stage	31-10 41 44: Feasibility stage
Exchange Disciplines	34-20 11 21 – 34-10 11 00 : Energy expert - Client
Description	Purpose: to share the feasibility results with the client who will use them to determine the best option according their requirements Content of the exchange: feasibility results Detailed exchange data:: LCC (Euro/m2) ROI (years) Low energy demand Renewable Energy Source (%) Self Sufficiency rate (%) Primary energy need for electricity, heat, cooling (kWh/m2) Energy Supply Reliability, including the reliability of local grid (%) Environmental Impact Possible tools: GIS Simulation tool Possible format for data exchange: GML, cityGML, XML One way exchange
Related Exchange Models	

3.4. **Functional parts**

Each functional part provides a detailed technical specification of the information that should be exchanged. Since that action may occur within many exchange requirements, a functional part can be linked to one or many exchange requirements. Therefore, maintaining the balance in the level of granularity for exchange is critical to ensure that they are not context specific, otherwise it would be difficult to use them in multiple applications in various exchange models related to different context (buildingSMART, 2010).

Below in the figure 6 is shown a detail for a functional part, it contains the technical information specified in the information exchange template. To carry out with the feasibility results data is required to exchange lifecycle cost, return of investment, low energy demand, renewable energy sources, self-efficiency rate, primary energy needs, energy supply reliability and environmental impact.

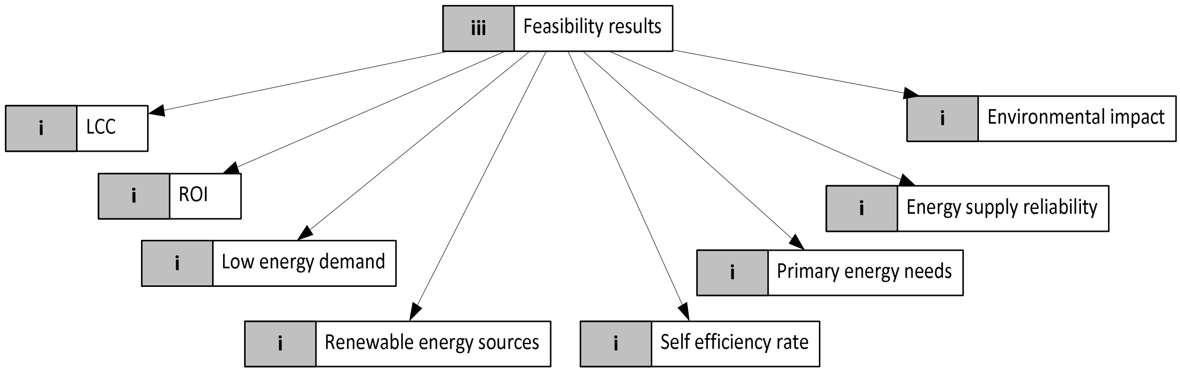

Figure 5. Functional Parts example

4. Conclusions

This research has pointed out the collaboration problems in BPS field as consequence of a low interoperability, having a clear urgency to improve it in order to obtain the early collaboration benefits claimed by BIM.

The standard information exchange approach does not work in a real situation given that in most of projects each consultant uses their own tools. Additionally, no tool is able to create the entire data required for a project through the life cycle. Then to generate the whole data in a project will be need to use an integrated information exchange approach that will allow using any tools. Nonetheless the formats used to manage the interoperability are not good enough and some data is missed in the process.

Overcome the interoperability issue requires using Information Delivery Manual methodology to improve the information exchange within an IFC file. IDM is a procedure simple enough to allow the communication between technical and non-technical users via plain language. However for further stages it will be need to validate the IDM with the IFC structure, in doing so, the programmer will understand which data is required by the user.

While the servers analysed are able to read the IFC format, the analyse shown that most of these servers are not reliable enough to manage data, being likely to miss data or that external actors could access to the information, then creating a server with security standards will be a must in order to keep safe the data.

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Affordances of BIM during the Architectural Design Process

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Abstract

Building Information Modelling (BIM) represents a move away from traditional practices and the formation of digital models to enable optimized decision making throughout planning, design, construction and operation stages of a facility's life. Usage of BIM is increasing, and seemingly has the capacity to transform every aspect of the construction industry, therefore making it essential for architectural practices to adapt and embrace this new way of working. Delivering projects through BIM within the UK construction industry is reaching a state of necessity. With the UK Government's mandate for BIM implementation coupled with developments in the BIM area, industry practitioners are becoming increasingly under pressure to adopt BIM. BIM technology can potentially change the process and product of architecture. According to Gaver (1991), new technologies primarily concentrate on the current articulated needs and tasks of the users and have the tendency to overlook the innovation potential of the new technologies at the same time. Understanding affordances that BIM can bring to the process of architectural design is a significant factor in the verdict of successful BIM implementation. This preliminary research aims to identify functional affordances of BIM and explore how they influence the architectural design process. Data collection was carried out through semi-structured interviews with BIM coordinators, architectural technologists and designers working on BIM projects to understand their perception of affordances that BIM can bring to the process of architectural design. We found that most actors/designers realize the potential of functional affordances of many BIM applications, however only a few utilize this capacity to enhance the design process. The literature and the results obtained through the interviews both revealed a potential additional affordance category which relates to the design stages and the use of BIM.

Keywords:

Affordances, Architectural Practices, BIM, Design Process, UK Construction Industry

1. Introduction

Currently in the UK construction industry architectural practices are adopting Building Information Modelling (BIM) at an increased rate. In this paper we have analysed the way in which design professionals have adapted their BIM-based design activities. Attempts to link the design tools and the functional affordances of BIM technology have been made by applying the affordance categories which were introduced by Gaskin (2010). However the main focus of this paper is to link the affordances at a much higher level of the design processes. By understanding some of the fundamental ways in which designers think we have attempted to link the affordances associated with BIM technology for the following stages of the design process: analysis, synthesis, evaluation and communication.

The main aim of the research is to identify different functional affordances of BIM in the architectural design process and to explore the perception of their significance to the designer during the design process. Further, the work is expected to contribute towards the ongoing research, which is focused on the broader aim of integrating BIM into the UK construction industry based on Government mandate. This study of affordances and BIM can be placed within the current research stream on BIM's impact on social and organizational practices in construction projects.

2. Literature Review

2.1. **Design Process**

Architecture is one of the fields which is most centrally placed with in the spectrum of design (Lawson, 2007). In the context of architecture 'design' can be defined both as a product and a process (Lawson, 2007; Ostman, 2005). "Architectural design" refers to both the piece of architecture as an end product and the process which the architectural piece is created. This particular study places emphasis on the process of architectural design with the tools that designers are now able to use with BIM technology. According to The Royal Institute of British Architects (RIBA) the design process contains three sub stages; concept design, developed design and technical design which falls between preparation brief and the construction stages (RIBA, 2013). However in reality, the practice challenges the existence of pure sequential building process due to limitation on time, budget, resources and contractual models. Thus there is a certain amount of interplay between unpredictable, highly interactive and non-sequential activities on one side and sequential and regulated activities on the other (Moum, 2008; Sariyildiz and Schwenck, 1996). Similarly affordances may be perceived as sequential. This is when acting on a perceptible affordance leads to information indicating new affordances (Gaver, 1991).

According to Kalay (2004) and Lawson (2007) the creative design process can be described as complex realm of predictable and un-predictable interactions and dependencies among actors and their actions. Lawson (2007) talks about a three stage design process with analysis, synthesis and evaluation which were linked with an iterative cycle. However in Kalay's view this formalized process of architectural design consists of intertwined phases of analysis, synthesis, evaluation and additional element of communication which acts as the glue that connects the rest of the phases together. Thus this paper will focus on the categorization of the following key stages of the design process against the affordances of various BIM tools. BIM technology used by designers has challenged conventional thinking and begun to create a new standard for the entire industry (Di.net, 2009).

2.2. **Building Information Modeling**

The UK HM Government defines Building Information Modeling (BIM) as a collaborative way of working, underpinned by the digital technologies which unlock more efficient methods of designing, creating and maintaining assets. BIM embeds key product and asset data and a three dimensional computer model that can be used for effective management of information throughout a project lifecycle – from earliest concept through to operation (HM Gov, 2012). What is important to highlight from this definition is the efficiency of the design process. Penttilä (2006) also supports the influence of design process and defines BIM as "a set of interacting policies, processes and technologies producing a methodology to manage the essential building design and project data in digital format throughout the building's life-cycle". Building Information Modelling has shaped the way that designers operate at different working stages of a development. The most prominent market-scale, and academic BIM implementation surveys and ratings have been developed globally by France & Germany (McGraw-Hill, 2010), U.S. (McGraw-Hill, 2012), UK (F. Khosrowshahi, 2012), Finland (T.Lehtinen, 2010), Iceland (I.B. Kjartansdóttir, 2011), Sweden (O. Samuelson, 2013), and Australia (N. Gu, 2010).

BIM creates a 'resonance' between analysis and synthesis within this process of discovery. Kalay (2004) viewed design as a process of discovery. BIM can be seen as an informant with this process of discovery. BIM "put forth unexpected elements of synthesis as key ingredients for discovery". Therefore "discovery is a double relation of analysis and synthesis together" (Blake, 2011: 01). According to Blake (2011) analysis "probes for what is there" and synthesis "puts the parts together". This compliments Kalay's view of design as an act of puzzle making and attempting to create a new whole by synthesizing the given parts. Accordingly BIM fuels up the mind of the designer in pulling these elements together in non-intuitive ways within process of design.

2.3. **Affordances**

Affordances are the fundamental elements of perception. Humans perceive the environment around them in terms of its potentials for actions. Thus affordances show independency from the perception and exist whether the perceiver cares about them or not, whether the perceiver perceived it or not, and even whether perceptual information of the affordance is available or not (Gaver, 1991). A study conducted by Gaskin et al. (2010) on digital design routines across several project based industries have found five elements which are important for the analysis of design activities. These elements consist of: activities, actors, tools, affordances and design objects. Activities are incorporated with actors whom are engaged with tools which are capable of affording the actors the opportunity create design objects. Similarly this paper will look at the ways in which BIM technology and its tools afford actors to create design objects and how this influences the design process.

Table 1. Lexical model of Affordances (Gaskin et al. 2010)

Affordance	Definition
Representation	functionality enabling users to define or change a description of a design object
Analysis	functionality enabling users to explore, simulate, or evaluate alternate representations or models of objects
Transformation	functionality to execute a significant planning or design task
Control	functionality enabling the user to plan for or enforce rules, priorities or policies governing or restricting the design process
Cooperative Functionality	enables users to exchange information with others
Support	functionality to inform users in which context production and coordination technology will be applied
Infrastructure	functionality to transport knowledge, skills or methods to other projects or planning situations
Store	functionality allowing information to be housed within a device

3. Methodology

This is an applied research inquiring into architectural practices. Background and preparatory reading was used to identify and formulate the research problem. In addition this was expected to provide assistance in selecting an appropriate research methodology for the study. A mix of both inductive and deductive approaches was used within this research with an overall leaning towards the inductive process. Deductive approach requires a clear theoretical positioning prior to its testing through empirical observations (BUSM, 2007; Tan, 2002). In contrast, the inductive approach involves moving from the observations of the empirical world to the construction of explanations and theories about what has been observed (Gill and Johnson, 2002).The literature review is expected to provide the necessary frame of reference and background with the gradual move towards overall inductive approach by collection of data.

During the literature review the concept of affordances focuses on the actionable properties latent in the environment. Affordance of BIM in the Architectural design process forces on the actionable properties which BIM can bring in to the architectural design process. The research was aimed to identify and evaluate affordances of BIM and evaluate different affordances against the context. Therefore the research was required to adopt a research philosophy which provided a framework for understanding, measurement and evaluation of the behavior related phenomena such as affordances. Semi structured interviews involving six BIM coordinators/architectural technologists/designers were carried out. These interviewees were chosen on the basis of competencies in the use of BIM applications and involvement on projects implemented through BIM. Interviews were conducted face-to-face. The interviews were focused on reconfirming the findings of literature survey with UK construction industry context. Interview questions were structured to follow the RIBA design stages to inquire into the nature that BIM affected the design team member roles at different stages of the development, as well as the tools and procedures used at each stage. The stages discussed were Preparation and brief, concept design, developed design, and technical design. Further findings of the literature survey were also used as appropriate as stimulus materials during discussions. Additions and omissions in the themes and areas were made to in the structure to some extent during the interview depending on the flow of the conversation and the situation. It gave the flexibility to explore in depth on certain aspects and areas sometimes crucial to each organisation in terms of their own work flow, procedures and standards. The interviews were recorded, transcribed and coded in order to identify BIM tools and affordances comprising the design routines under study. (Fig 2.)

4. Results

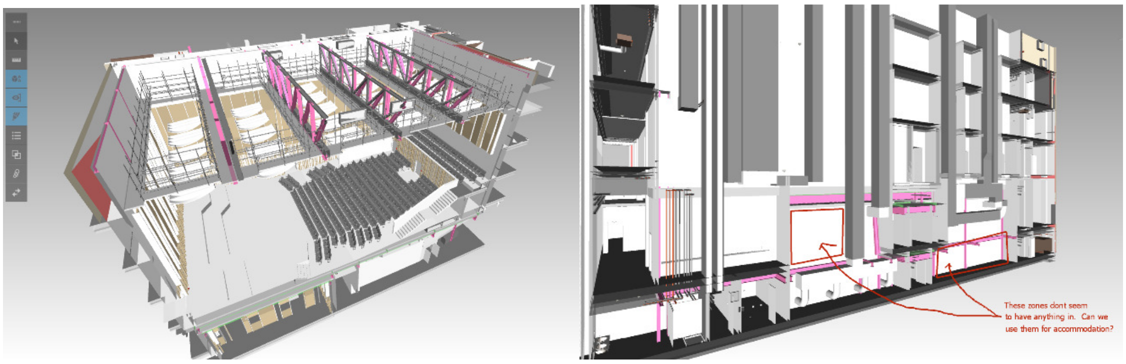
4.1. **Function Task Interaction Matrix**

Based on the interviews, functional affordances were identified linked with the tools that have been outlined by the BIM coordinators and designers. Figure 1. Displays how each tool has been mapped against Gaskins Affordances categories. The Function Task Interaction Matrix (FTIM) proposed by Galvao and Sato (2005) identifies affordances as the intersection between artifact structure and user tasks. A similar approach has been applied with Figure 2. Identifying intersections between BIM affordances outlined by the designers and Gaskin's categories of affordance. This matrix has been used to map out the functional affordances of the BIM tools which were outlined during the interviews. Each BIM tool or function identified during the interviews has been placed in the function matrix against Gaskins categories of affordances. Even though all the tools were familiar to the interviewees the frequency at which they are actually used in practice varies. An emerging functional affordance outlined by all of the interviewee's in relation to BIM implementation and design stages remains validation/checking. This is a category which was not introduced by Gaskin, potentially due to the limitations of CAD tools as a whole.

User BIM Tools (Function) / Tool Affordances (Task)	Associative 3D model	Parametric 3D content or families	Clash Detection	Federated Model	Design team Work sets allocation	Applicable sustainability analysis tool	Applicable site analysis tools	Design Options tools	Design Templates Project standards	Supply Chain BIM compliant content	Cloud based model
Representation	● ●	●	●	●		●	●	●			●
Analysis		●	●			●	●	●			●
Transformation	●	●	●		●	●	●	●		●	●
Control			●								●
Cooperative Functionality	●		●	●	●					●	●
Support					●				●	●	●
Infrastructure	●	●		●					●	●	●
Store	●	●		●	●				●		●

Figure. 1. Function Task Interaction Matrix: Adopted for Gaskin's BIM tools and Affordances

Cloud based modelling tools enabled most affordances from the 8 outlined categories. Figure 2 shows how the 3D model can be integrated and viewed by design team members, as well as used as a communication platform to inform design decisions. Cloud based models as shown in the FTIM enable multiple stages of the design process to be explored: Analysis, Evaluation, Communication and Synthesis. Figure 1.b. displays communication on design elements between the Design team members accessing the cloud based model**.**



(a) (b)

Figure 2: (a) Linked models of the architectural, structural and mechanical models of a BIM coordinated project in Autodesk Glue. (b) Display of Autodesk Glue; a cloud based data sharing platform for the integration of 3D models which enables communication between the different members of the design team.

Figure 1. can be used to view the overall affordance appearances for each BIM tool. This will enable the understanding of how the tools used can fit into a number of the affordance categories. The focus of this matrix is to display the number of affordances applicable for each tool. For certain tools we can see a higher number of functional affordances associated than others. The FTIM matrix when mapped against the affordance categories indicates the way in which cloud based modeling and data sharing fits into all of the affordance categories outlined. It is through cloud based modeling where interviewees have confirmed the correlation between cloud based technology and its impact on the design processes. It has a direct correlation in communication between design team members. Interviewee C: "*We can use BIM 360 Field to impact the way in which designers coordinate and communicate with each other*" As well as communication cloud based BIM management shows impact in decision making. Interviewee C: *"…designers can directly communicate with relevant contractors designers and make design decisions directly within a few hours…*" This supports the argument in direct influence of the design processes such as synthesis and analysis.

5. Discussion

FTIM matrix (Fig 2.) figuratively demonstrates which of the BIM tools commonly referred to by the interviewees fit with Gaskin's Affordance categories. An important factor to note is that Gaskins categories of affordances were outlined in relation to CAD tools. During the interviews it became evident that validation and checking of linked files is a crucial functionality, which has only recently been applied in practice through data integration of common BIM compatible file formats such as IFC files. Transformation which according to Gaskin allows the functionality to execute a significant planning or design task. Transformation as an affordance is being enabled by the following BIM tools; Associative 3D model; parametric 3D content or families; Clash Detection; Applicable sustainability analysis tool; Applicable site analysis tools; Design Options tools; Cloud based modelling. This was also supported by the discussions with the interviewees. Interviewee A; "*It's informing the designer about their design decisions based on a 3D model…*"

If we look at the same table from the context of design processes it becomes evident that representation is an affordance that allows analysis related functions. Another significant affordance is Representation. According to Lyytinen et al. (2009) representation is particularly important to design, as iteration across representations is the fundamental activity of all design activities. Representation is yet another significant affordance associated with a number of the tools outlined by the designers. Synthesis is a reoccurring design process stage which can be linked with the affordance of representation. This can be seen enabled by the use of 3D models and integration of associative 3D models.

Primary benefit of using BIM technology and application in the production of design is the reduction of time. Drawing production and amendment can be a time consuming process, BIM applications enable a significant time reduction. Some of the tools made available through BIM applications were never really explored prior to the shift to 3D information modeling. BIM technology is promising to manage even some of the more vague building and design criteria, such as design richness or even overall building quality can be managed though BIM technology (Penttilä, 2006). While most designers agreed that the tools enabled efficient and quick means to produce drawings and schedules, there is a negative impact on time at the later stages of the design. Interviewee E expressed that more time should be given at Concept Design stages. While the tools enable quick designs models are embedded with more information than required at concept design stages, this can also be a hindrance at later stages of the design process. Whereby the client is shown more detail than required at Concept stages which can further affect the overall process of the design development. According to Coates et al. 2010, BIM concentrates too much on providing a representation of the final form of the design, whereas designers also need a continual stream of abstractions, advice and information to move from information to the distillation of knowledge. Few BIM tools can accommodate the ambiguities of early design. To accommodate concept design stage Pauwels et al. (2009) recommends that the concept of architectural informational modeling should be developed as a precursor to BIM in the design practice. This concurs with what Interviewee E discussed during the interview. Interviewee E: "*The concept stage should be stretched to allow stakeholders to have an input, before you sign off feasibility. Once you have a concept model it's almost too tempting to start populating it with information …The perception is that if that information is embedded in the model it must be right*." Some of the modeling tools through BIM applications actually act as a hindrance at these early design development stages, due to their level of detail attached with the 3D objects. Their tools can be seen as limiting the amount of time spent on developing and valuating designs. On the other hand Interviewee B discussed how "*the more traditional methods of pen and paper design will never fully disappear*, *and the designs are only enhanced to evolve quicker through the use of 3D representation*". This 3D representation helped develop the designs which were initially made by the more senior practitioners, used with the more traditional means of design development.

During the interviews conducted with the Coordinators and designers, it became evident that the practices that were practicing a higher level of BIM maturity had a better understanding of the available tools for the designers and their functionality. The number of tools utilized when implementing projects at a higher BIM maturity level increased for both the designers and other stakeholders. This was in particular demonstrated by Interviewee C when discussing how their projects were linked through cloud based platforms. As demonstrated in the results Cloud based modelling tools is associated with all of Gaskins categories. Following this is 'Clash detection' tools made available through BIM applications. This is also associated with almost all of the affordance categories.

This paper has explored Gaskins work by an in depth discussion of the similarities and differences of the design routines within the UK architectural practices, though new digital design tools such as BIM. This paper is limited in that we did not provide a longitudinal perspective identifying if and how these design routines change over time, when more dimensions are linked with the BIM model. Each year the tools available for designers to extract and analyse new dimensions of a project increase. Deploying a longitudinal perspective explaining how new modelling dimensions i.e. 4D, 5D,6D etc. will influence the cognitive design processes of the actors could be a worthwhile avenue for further research. The design process and its stages are a reoccurring phenomenon during the project development stages. However for projects that are being implemented at a Level 3 or above evaluation and synthesis becomes reoccurring tasks given to the designers with the help of checking and auditing. An example of a new dimension that is currently underway for BIM technology has been introduced by the BIM Task Group. This will enable a checking existing designs and auditing their compliance with regulations. 'BIM4Regs' in the UK is aiming to link building regulations with working models Lewis (2013). Clash detection can be seen as a means of correction in design. Coates et al. (2010) stated that correction is as much about evolutionary design development of the product as it is about error correction. Correcting as part of the design process can enable better design.

6. Conclusion

Evidence from this study suggests using BIM tools and technologies provide more capability for the designers during the architectural design process. The potential affordances of these tools are only realized though the 'actor' or designer. Although these tools as shown in Figure 1. provide affordances and can be used in most of the stages of the design process, the benefits of realizing the affordances require comprehension from the designer's side. Therefore an 'actor' or designer becomes more important than the tool used at hand. These tools can enhance procedures but without understanding of these tools the list of affordances associated with that tool will fall short. The benefits associated with the affordances of the tools are only as good as the users behind the design understanding how those tools work. By fully understanding the functionality of different tools offered through BIM technology the designer opens up their possibilities of affordances. Therefore it could be added that within an architectural organization resources should be allocated to updating the understanding of latest tools and technology and for the exploration into tools that may enhance the efficiency of design stages. Future areas of research are related to the organizational management of practices in terms of allocating a designer whom is both proficient in design and well informed of the tools that are being used to facilitate that design.

Findings also show that the function to audit enhances the merits of using integrated models in BIM. The information of a BIM model affords the use of checking and auditing for various purposes such as costing, regulations, minimum required distances, and structural compliance. Furthermore, BIM applications enable designers to check and detect clashes. Clash detection tools can be seen as a crucial step towards better synthesis and evaluation of designs. These functions are enabled in various software platforms i.e. Revit, Navisworks, and Solibri. One distinctive affordance of implementing BIM technology is the ability to check models produced by various design team members as well as the supply chain. With this affordance, BIM projects are moving towards enabling the users to further check their information within the model.

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A Continual Automated Dynamic Site Layout Planning System (CADSLPS)

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Abstract:

Allocating an optimal space for site facilities in the construction site before the project starts is a problem known as site layout planning. In current practice, site layout objects are often located in the best available space on a first-come first-served basis. This can lead to decreased safety and productivity, or impose unnecessary relocation costs on the project. An efficient site layout can have a significant impact on the productivity, cost, and safety on construction sites. Although a lot of automated site layout systems had been developed, none of these models has been adopted by the construction industry so far. This is due to the shortcomings and limitations of these systems. This paper introduces a Continual Automated Dynamic Site Layout Planning System (CADSLPS) to perform the task of site layout planning and reflect the dynamic nature of real sites over the project's duration. The CADSLPS utilizes Genetic Algorithms (GA) as a multi-objective optimization (MOO) engine in order to enable the simultaneous optimization of the construction cost, time, and safety. The performance of the CADSLPS demonstrated on a real site layout for construction project and the optimum solution obtained is compared with the one developed in the real site.

Keywords:

Automated planning systems, construction site layout, multi-objective genetic algorithms, optimization problems

1. Introduction

The construction site layout planning is considered as a branch of the Layout Planning research area (Issac, Andayesh & Sadeghpour, 2012), as well it is concerned with locating an optimal space for the needed facilities among the project duration into the site before the project starts (Said & El-Rayes, 2013). Choosing this optimal space is a subject to some predefined constraints (such as boundary and overlap constraints) to achieve one or more predefined objectives (such as reduction in project's cost or time, improvement in site safety) (Xu & Li, 2012).

An efficient site layout planning can have a significant impact on performance of construction projects (Andayesh & Sadeghpour, 2013; Ning & Lam, 2013), by minimizing the nonproductive time and cost (i.e. material handling and relocation) and/or maximizing the safety (i.e. decrease or prevent accident, maintaining good employee morale and increase labor productivity) as in the construction industry the risk of a fatality is five times more than that in a manufacturing based industry, and the risk of a major injury is two and a half times higher (Gangolells, Casals, Forcada, Roca, & Fuertes, 2010; Said & El-Rayes, 2013). Furthermore, protecting the surrounding environment (i.e. hazard and harmful materials' storage should not be adjacent to the neighboring hospitals and schools). In addition to the previously mentioned common engineering benefits there are other interesting aspects that can be achieved also such as aesthetics and usability qualities of a layout (Lien & Cheng, 2012).

However, the current practices in most projects that the process of the site layout planning is ignored in the planning phase and is often done in the site by the project manager by adjusting previous layouts based mainly on the project manager's experience, common sense and the famous concepts what come first serve first. In addition, the inadequate staff and time are based on incomplete and ill structured information (Sadeghpour 2004 and Sanad, H. M., Ammar, M. A., & Ibrahim, M. E. 2008). This may lead to generating inefficient layouts which have bad influence on the overall site operation (Sadeghpour, F., Moselhi, O., & Alkass, S. T. 2006).

The construction site layout planning is recognized as a critical step in construction planning (Yahya & Saka, 2014). However, the construction participants consider the site layout planning task as a heavy duty process because it needs a lot of complex information from different sources which vary for each project. Moreover, there is a huge trade-off between its objectives (complex combinatorial multi objectives optimization problem to be done manually) and it is a difficult step to update the layout manually (Sadeghpour, 2004; Wong, Fung, & Tam, 2010). In addition, the needed facilities to support construction activities are quite different (e.g. batch plant, tower crane, material storage areas, working areas). These facilities arrive to the site at different points of time and occupy space on the site for different durations (Andayesh & Sadeghpour, 2013). Therefore, automated systems are essentially required to execute this complex planning task and give the site mangers and planners the capabilities to develop, modify or update an efficient site layout (Elansary & Shalaby. 2014; Said & El-Rayes, 2013).

Although a lot of automated site layout systems had been developed, none of these systems has been adopted by the construction industry until now (Abdel-Fattah, 2013). This is due to the shortcomings and limitations of these systems such as, they are limited to one or two objectives, 2D rectangular facilities shape only, 2D site layouts representation, need experts to use, equal area problem, do not reflect the construction site dynamic nature, or rigid and comprised for limited or fixed elements such as facilities and constraints. Consequently, they cannot be applied for other cases but only the case they are modelled for. In addition, the previous research work on site layout have mainly ignored the user interaction and concentrated on selecting information from their data base.

Accordingly, there is a need to have new automated systems that can overcome the inefficiency of developed systems as well as cover their shortcomings and limitations, this paper present a Continual Automated Dynamic Site Layout Planning System (CADSLPS), to perform the task of construction site layout planning based on Genetic Algorithms (GA) as a multi-objective optimization (MOO) engine in order to enable the simultaneous optimization of the construction cost, time, safety. This CADSLPS generates 4D layouts that reflect the dynamic nature of real sites based on the actual duration of facilities utilized in site. The CADSLPS provides a number of unique and practical capabilities, including: (1) analyzing any regular or irregular sites and facilities' shapes while representing the site space as a continuous space (unequal area optimization); (2) allowing for facilities to be aligned with any angles; (3) facilities closeness relationships that represent the users' desire. Furthermore, this study focuses on developing user friendly interface system to offer huge user interaction in adjusting or adding data and in selecting the desired objectives.

The remainder of the paper is organized as follows. In Section 2, literature reviews on the developed automated system is provided; in Section 3, the CADSLPS is explained in details. Section 4 describes the procedure of the validation process for the CADSLPS and the obtained results. Finally, the proposed work is summarized as well as the achieved target in addition to the future work in section 5.

2. Literature Review

There was a long history of research on automated systems in the construction site layout planning. Amongst the first efforts were those who utilized mathematical optimizations in the automated systems, but few of these systems were successful and even then, these systems were rigid and worked only for the specific cases they were built for (Tommelein 1992 and Sadeghpour, et al. 2006). Later, interests leaned towards heuristic techniques where the knowledge prescribing the order of facility selection and meeting the constraints while locating them on site. As well as, they were capable to reflect the combinatorial and dynamic nature of the construction site (Sadeghpour et al., 2006 and Mawdesley et al., 2002).

Yeh (1995) introduced the SitePlan which is a site layout model that applied a hybrid type of Neural Networks (NN) called Annealed Neural Networks (ANN). Annealed Neural Networks inherited features of both NN and simulated annealing. SitePlan represented site layout as a problem of finding the best location for a set of equal size rectangles in a set of predetermined locations on site. This representation is obviously an extreme simplification of the reality of construction sites where facilities come in all shapes, sizes and can be placed anywhere on the site.

However, Elbeltagi, E., Hegazy, T., and Eldosouky, A. (2004) presented a model for dynamic site layout planning in construction using genetic algorithms optimization that assisted in maintaining safety and productivity on construction sites with important consideration for the cost of reallocation of temporary facilities. However, representation of the temporary facilities have been much simplified and facilitated. The method used in calculating the distance between the facilities (Euclidean: center-to-center distances) did not express the real distance in real life which was governed by actual site paths.

In addition, Sadeghpour, et al. (2006) proposed a static model based on knowledge based system to solve construction site layout planning problems. The developed model performed its task at two levels: Site representation, and site space analysis and allocation. However, the model needed an expert and huge database to enhance its capability.

Besides that, Khalafallah and El-Rayes (2011) introduced a static multi objective automated system based on Genetic Algorithms optimization to provide practical automated support for construction planners and airport operators who need to optimize site layout plans. However, the model had some limitations including: (1) modeling temporary and existing facilities using two-dimensional rectangles, (2) approximating resource travel paths as the center-to-center distance between site facilities, and (3) assuming that site space requirements are predetermined and static, (4) intense specialization in one type of projects (airport project).

Later, Xu and Li (2012) developed a fuzzy random multi-objective decision making model. In this model, two objectives are considered: (1) minimizing the total cost of site layout; and (2) maximizing the safety to avoid accidents. A multi-objective particle swarm optimization algorithm (MOPSO) with permutation-based representation was proposed to solve the optimization problem.

But the model dealt with the site space as equal area problem and utilized only two kinds of constraints which do not happen in real projects.

As well as, Ning and Lam (2013) designed a multi-objective optimization (MOO) model using modified Pareto-based ant colony optimization (ACO) algorithm. The two objectives used in this model were reducing the cost and improving the site safety level simultaneously while solving unequal-area site space problem. It was used to give static layouts with little number of facilities.

Moreover, Said and El-Rayes (2013) presented and compared between two global optimization models of dynamic site layout planning that were developed to overcome the limitations of previous models. The first model utilized Genetic Algorithms (GA) while the second model utilized Approximate Dynamic Programming (ADP). Both developed models had a single objective and dealt with the site space as equal area problem which were considered as huge drawbacks.

Furthermore, Yahya and Saka (2014) proposed a multi objective artificial bee colony (MOABC) via Levy flights algorithm model to determine the optimum construction site layout. The model optimized the dynamic layout of unequal-area under two objective functions. The continuous search scheme was employed in this work therefore; the temporary facilities are not relocated during the different project phases. Accordingly, the arrangement of facilities for the whole construction period can be positioned on a single site layout. However, ignoring the facilities relocation as well as presenting all facilities for different stages in a single layout may produce a non-optimal dynamic layout.

Despite the contributions of the aforementioned site layout planning automated systems, they still have drawbacks and limitations. The following section discusses the Continual Automated Dynamic Site Layout Planning System (CADSLPS) developed by this study with an explanation to its important attributes that cover the developed systems' disadvantages.

3. The Continual Automated Dynamic Site Layout Planning System (CADSLPS)

The purpose of the CADSLPS is to perform the task of construction site layout planning under a multi-objective optimization (MOO) problem to generate 4D layouts that reflect the dynamic nature of real sites. The CADSLPS developed by using MATLAB program based on genetic algorithms toolbox for solving site layout planning problems. This CADSLPS requires data to be ready so the user could use it. This data can be grouped into five major categories as shown in table (1).

Table 1: Data required in the CADSLPS.

Data	Description
Project data	Main project information (name, company, location, start date, duration….). Main project stages and their duration grouped based on facility requirements or user preference.
Geometrical data	Site boundary (regular or irregular shape), fixed facilities, obstacles and protection zone name, locations, start date, duration, size, orientation, shape….
Facilities data	Dynamic and static facility name, locations, start date, duration, size, orientation, shape, relocation cost….
Facilities interactions relationship	Closeness weight relationship between facilities that represent the required objective function
Required objective function	The required objective (cost/time, safety, environmental or multiple objectives with the weight percentage of each).

The following sections describe different aspects of the developed automated system (CADSLPS) in details.

3.1. Dynamic search

The construction sites have dynamic nature progresses, the required facilities, and accordingly the space required to accommodate them on the site, are subject to change (yahya & saka, 2014). These changes must incorporate in site layout to be realistic as real sites. This study uses the approach presented by Andayesh & Sadeghpour (2013) that is considered the actual duration of facilities on the site to reflect the dynamic changes on the site. This approach engages all facilities required in the search simultaneously, to compete for space only for the durations they exist on the site. Engaging all the facilities in the search process simultaneously provides the facilities that are required later in the project an equal chance to compete over desired locations with facilities that are required earlier on, and when they have a time-overlap. Facilities with higher influence on the overall fitness of the layout get the desired locations regardless of their time of arrival to the site.

3.2. Site representation

A common practice used in previous studies for modeling the site space is to reflect the available space as a set of discrete cells using an orthogonal grid, and allowing facilities to be located only in the grid cells, without considering whether their sizes fit with the grid cells or not (equal area problems). The use of grids simplifies the search procedure by decreasing the number of possible choices for the position of objects. In addition, in this approach the shape of the site is restricted to the orthogonal gridlines (Andayesh & Sadeghpour, 2013). In reality, the construction site can take any shape and the facilities can be located in any available space on the site with taking into consideration their sizes (unequal area problems) (Ning & Lam, 2013). The system developed in this study represents the site space as a continuous space and allows the facilities to be located anywhere in the construction site (unequal area problems). This makes the system to be closer to the reality of construction projects. In addition, the developed system is capable of analyzing any irregular site shapes in the search process. An accurate representation of the construction site is important for the site layout modeling, as it enables the development of more realistic and efficient layouts.

3.3. Facilities representation

The developed system is capable of analyzing any regular or irregular facilities shapes in the search process. For the first time the user can input any irregular shape for the required facilities. Furthermore, in order to improve practicality of the system it is allowed for facilities to be aligned with any given angle (Figure 1).

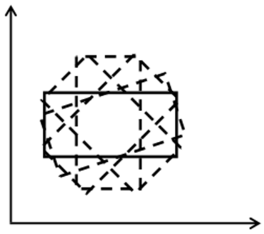

Figure 1. Facility alignment alternatives

In addition, this study presents a classification for the facilities needed for any construction project – based on the way they are engaged in the search process – into four groups as shown in table (2).

Table 2: The site facilities groups.

Category	Description
Fixed facilities	Are those facilities that have a known and fixed location on site and do not require to be positioned in the search process (such as the constructed or existing buildings and any other facilities need to be fixed in one position due to planner opinion).
Static facilities	Are those facilities whose location is determined in the search process just one time then their location remains fixed and are not relocated (such as tower cranes and batch plants). These facilities are not allowed to be relocated on site through any stages due to the significant time, cost, and/or effort required to relocate them.
Dynamic facilities	Are those facilities whose location is determined in the search process and can be relocated through any project stage. Examples of dynamic facilities include site offices, testing laboratories, storage areas and fabrication areas. A dynamic facility can be relocated in case where there is free space available through any project stage that is better than its occupied future location at the end of the stage. However this repositioning must be accounted for additional relocation cost.
Obstacles	Are those facilities that have a known and fixed location on site and do not require to be positioned in the search process as well as do not have any relationship with any other facilities (such as existing buildings and trees).

3.4. Objective function

This study presents multi objective optimization functions (MOO) to mimic the objective of real site layout. Two congruent objective functions are employed in this study to generate optimal dynamic layouts for the whole duration of the project. The first objective function (f_1) is minimizing the total handling cost and time of interaction flows between the facilities in order to reduce cost and time in the construction site. The second objective function (f_2) is minimizing the likelihood of accidents happened in order to improve the safety level. The objective functions (f_1), and (f_2) are mathematically defined as follows:

$f1 = \sum_{i=1}^{n} \sum_{j=1}^{n} C_{ij}\ RD_{ij}$ Equation (1)

$f2 = \sum_{i=1}^{n} \sum_{j=1}^{n} S_{ij}\ e_{ij}$ Equation (2)

Where:

n: number of all type of construction facilities.

i,j: facility i and facility j.

C_{ij}: a relative proximity weight that reflects the cost and time closeness relationship based on interactions between facilities i and j.

RD_{ij}: real distance between facilities i and j as explained later.

S_{ij}: a relative proximity weight that reflects the safety concern closeness relationship based on interactions between facilities i and j.

e_{ij}: Euclidean distance between facilities i and j as explained later.

Since the multiple objective functions defined in this study are congruent, they can be transformed into single objective function using the following equation:

Objective function= min ($w1 \bullet f1 + w2 \bullet f2$) Equation (3)

Where, w_1 and w_2 are the weights of the two congruent objective functions respectively. This method is known as weighted sum method, which is a method combining a set of objectives into a single objective by pre-multiplying each objective with a user-defined weight (Deb, 2001) to solve MOO problems.

3.5. **Facilities closeness relationship**

Effective placement of facilities within the site is significantly influenced by the movement of resources, or basically the interactions among the facilities. Such interactions are termed as the closeness (or proximity weights) relationship among the facilities and represent the desirability of having the facilities close or apart from each other (Hegazy & Elbeltagi, 1999). Traditionally, closeness relationships have represented aspects that are related to the productivity or safety and environmental concerns, also could be set as the actual amount of material moved between facilities or the actual transportation cost. Since it is difficult to determine the exact frequency and cost of work flows between facilities at the planning stages of the project, this study utilizes two proximity weights C_{ij} and S_{ij} to reflect interaction closeness relationship between facilities for the two desired objectives (explained in previous section). The user has to fill the relations between facilities with a 9-point scale. 9 indicate that the user would like to put the facilities as close as possible. On the other hand, 0 indicates that facilities should be assigned far away from each other.

3.6. **Distance calculation**

For determining the first objective function that minimizes the total handling cost and time of interaction flows between facilities this study utilizes and modifies the approach proposed by (yahya & saka, 2014). The real distance represents the actual travel distances between facilities without neglecting the presence of obstruction between them to make the results reliable as shown in figure (2).

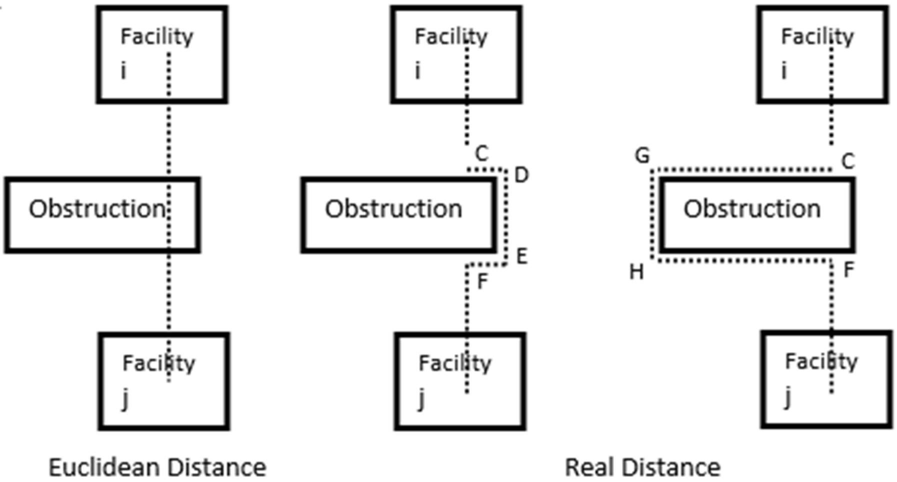

Figure 2. Distance calculation approach.

For example, in figure (2) there are two possible routes for the real distance to avoid passing through the obstruction. The first route i, C, D, E, F, j is the shortest one. The proposed automated system measures the travel distance between Facility A and Facility B by calculating the length of route i, C, D, E, F, j. The real distance RD_{ij} is the result of adding the minimum obstruction distance (C, D, E, F) to the basic two distances (i,C and F,j) and mathematically represented as follows:

$$RD_{ij} = \sqrt{(x_i - x_C)^2 + (y_i - y_C)^2} + \sqrt{(x_f - x_j)^2 + (y_f - y_j)^2} + CDEF \quad \text{Equation (4)}$$

Where, (x_i,y_i) and (x_j,y_j) are the coordinates of the centroids of facility i and j respectively (Figure 2).

For determining the second objective function that maximizes the safety and environmental concerns, the Euclidean distance is considered as the safety and environmental issues depending on the closeness of facilities rather than the travel distance and is mathematically represented as follows:

$$\text{Euclidean distance} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2} \quad \text{Equation (5)}$$

3.7. **Layout constraints**

The layout constraints are a set of rules used to govern the process of positioning the facilities (Sadeghpour, 2004) and (El-Rayes & Said, 2009). However, the layout constraints in this study are classified into two main categories and examined automatically for all facilities as detailed in table (3).

Table 3: The layout constraints. (Easa & Hossain, 2008), and (El-Rayes & Said, 2009).

Constraint	Description
Boundary constraints	Are examined in this system for each solution in order to ensure that the static and dynamic facilities are located within the boundaries of the site. As well as, guarantee that fixed facilities and obstacles location input by user are correctly located within the boundaries of the site.
Overlap constraints	Are examined in this model for each solution in order to ensure that no overlap occurs between any pair of facilities in any layouts.

Furthermore, there are operational constraints imposed in the search process to comply with safety requirements on site and are expressed by a minimum distance added by the user to provide safety buffer distances around facilities shape area.

3.8. **Optimization engine**

The function of this engine is to perform the optimization process in order to allocate an optimal place for all static and dynamic facilities according to the objective function. As such, global search optimization techniques, like genetic algorithms (GAs) are found to be very promising global optimizers (El Ansary & Shalaby, 2014).

Genetic Algorithms are robust and applicable to a wide range of engineering and construction management problems (Elbeltagi et al, 2004). In the current study, genetic algorithms are utilized as an optimization engine for their ability to explore a search space (the space of all possible solutions). This is considered as a powerful feature for site layout planning problems. As well as, genetic algorithms have a huge ability to deal with inexact, missing, or poorly defined problems, and easy to model. Furthermore, it is a very efficient optimization technique to perform multi objective optimization layout planning problems with the huge tradeoffs between the various objectives (Said & El-Rayes 2013).

4. Validation of the CADSLPS

A small-scaled project will be used to validate the CADSLPS. The project is a private villa of area 720 m^2, while the total area of the site which includes the villa is about 4148 m^2 as shown in figure 3. This site is located in Borg El Arab, Alexandria, Egypt and includes six facilities as well as the proposed villa and one obstacle as mentioned in Table (4). The project's start date is the 1st of March 2015 and will end after 153 days. The original site layout – with a layout weight of 2346.8948 – is developed by project manager in order to minimize the overall project's cost and time is shown in figure (3) as well as, the cost and time closeness relationship weights between the required facilities are identified by project manager as shown in Table (5).

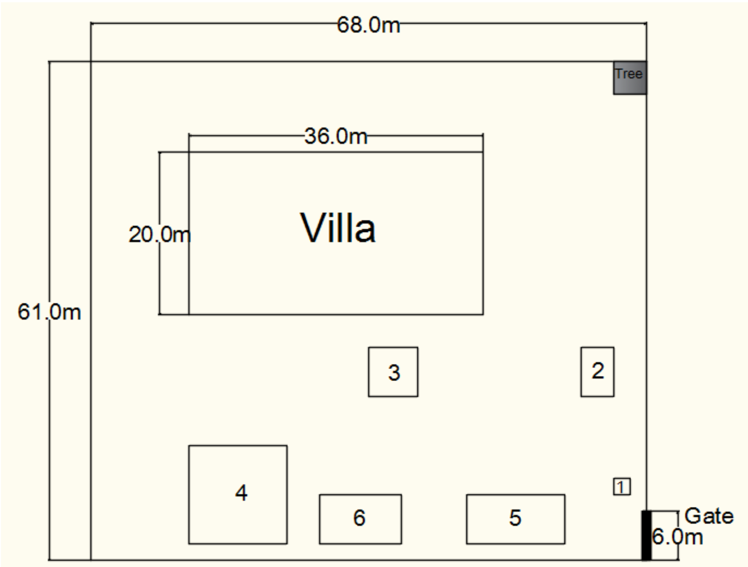

Figure 3. Original site layout prepared by project's manager.

Table 4: Project's facilities.

No.	Facility	Size (width*length) in meters
1	Guard office	2*2
2	Project Office	4*6
3	Mixing area	6*6
4	Steel area	12*12
5	Wood area	12*6
6	Materials store	10*6
7	Proposed villa	36*20
8	Tree	4*4
9	Gate	6

Table 5: The cost and time closeness relationship weights between the project facilities according to project's manager opinion.

Facility number	6	5	4	3	2	1
Proposed villa	9	9	9	9	9	0
1	0	0	0	0	2	
2	5	5	5	5		
3	9	0	0			
4	0	0				
5	0					

The CADSLPS is used to generate an optimal layout by GA search process for previous case that will be compared with the original site layout to validate it (example for entering the evaluation project data in the CADSLPS main window in figure 4, also example for entering the evaluation project facilities data in figures 5 and 6). Two trials are conducted by the CADSLPS, in the first trial the CADSLPS is programed to align facilities engaged in search process with 0^o and 90^o angles only. While in the second trial the CADSLPS is programed to align facilities engaged in search process with any possible angles.

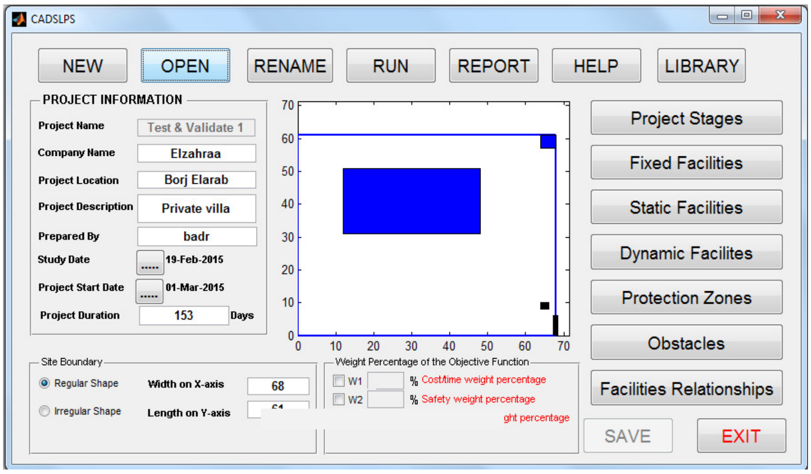

Figure 4. Data entry for the evaluation project.

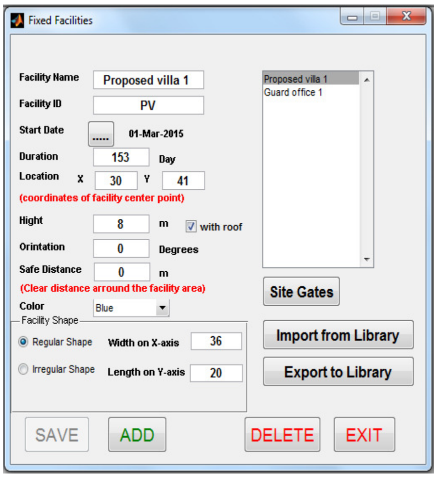

Figure 5. Fixed facilities data entry.

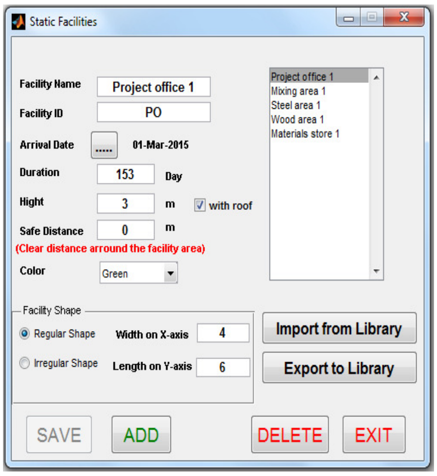

Figure 6. Static facilities data entry.

After the CADSLPS run for the two trials are finished, the generated solution for the first trial (0^o and 90^o angles only) accomplished with total layout weight= 1520.0248 and achieved a reduction in layout weight= 826.87 in 90 minutes, which is 35.23% less in layout weight than the original layout prepared by project's manager (Figures 7 and 8).

In addition to, the generated solution for the second trial (any possible angles) accomplished with total layout weight= 1182.0877 and achieved a reduction in layout weight= 1164.81 in 11 hours and 12 minutes, which is 49.63% less in layout weight than the original layout prepared by project's manager (Figures 9 and 10). The obtained results in both trials shows that the CADSLPS successfully achieved the target it is developed for as well as validating it for generating optimal site layouts in real projects.

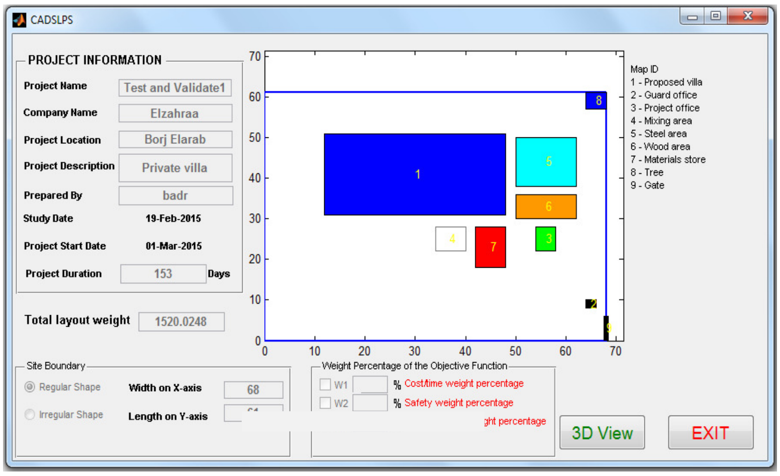

Figure 7. Generated solution by the CADSLPS for the first trial.

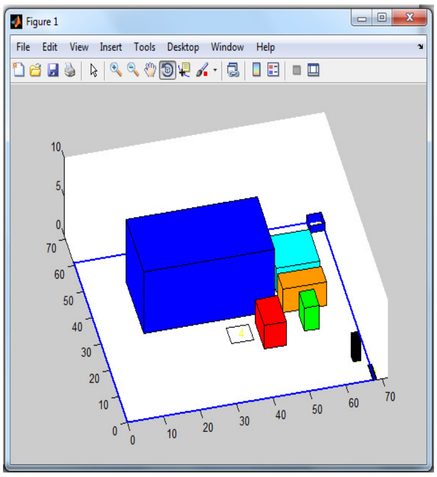

Figure 8. A 3D view for the generated solution by the CADSLPS for the first trial.

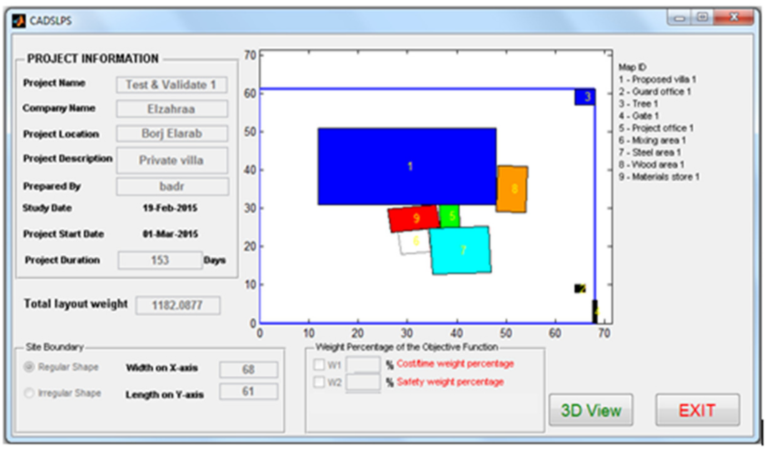

Figure 9. Generated solution by the CADSLPS **for the second trial.**

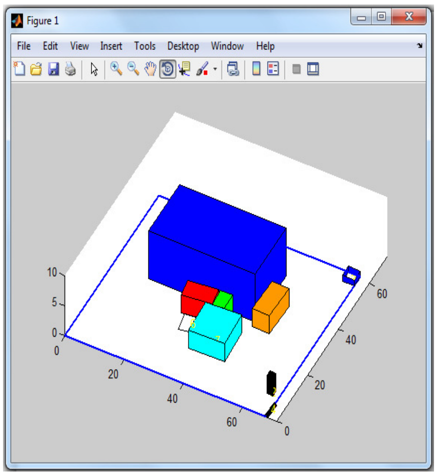

Figure 10. A 3D view for the generated solution by the CADSLPS for the second trial.

5. Conclusion and Future Work

This study developed a Continual Automated Dynamic Site Layout Planning System (CADSLPS) as a solution for the site layout planning problems. The proposed CADSLPS is developed by using MATLAB program based on Genetic Algorithms (GA) toolbox as a multi-objective optimization (MOO) engine, in order to generate 4D layouts that reflect the dynamic nature of real sites according to the actual duration of facilities utilize in site. The developed CADSLPS representing the site space as a continuous space to allow the facilities to be located anywhere in the construction site (unequal area problems) taking into consideration the real distance between site facilities.

The CADSLPS is successfully applied and validated with a real case study to generate a better solution through two trials. The resulting solutions from both trials achieved a reduction in layout weight with 35.23% and 49.65% respectively, than the original layout prepared by project's manager, which means that the CADSLPS successfully and efficiently achieved the target it was developed for. The main contributions of this study achieved by developing the CADSLPS that provided a number of unique and practical capabilities, including: (1) analyzing any regular or irregular sites and facilities' shapes; (2) allowing for facilities to be aligned with any angles; (3) facilities closeness relationships that represent the users' desire. Furthermore the CADSLPS offered a user friendly interface that facilitates a huge user interaction in adjusting or adding data and in selecting the desired objectives.

Although, the case study used to validate the CADSLPS was a small one with few facilities, but the proposed work is a part of a research scheme. Therefore, in the advanced stages the CADSLPS will validate more several – large or congested – projects in order to widely validate it and determine its limitations. Moreover, the CADSLPS will be tested to be integrated with the Computer Aided Drafting (CAD) in order to read data directly from the construction drawings and represent the generated layouts on it.

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People, Skills and Education

ID 017

An alternative approach to doctorate research in the Built Environment

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Abstract

The aim of the paper is to contribute to the debates on bridging the gap between academic theory, knowledge generation and practice. Several researchers have presented evidence that the built environment consists of multiple disciplines and that the built environment is an applied field. Researchers have found it difficult to find a built environment paradigm that embraces this multidisciplinary nature of the field. Researchers have proposed that the built environment should develop its own paradigm that would bridge the gap between academic research and practice. Researchers have promoted the idea of Mode 2 research, being a suitable approach for applied fields and proposed that it should be explored further by researchers in the built environment. Several authors who espoused the Mode 2 or action research were cautious of the challenges pertaining to finding the most suitable epistemological and ontological framework for research in Mode 2. It is acknowledged that combining several methodologies and epistemologies could prove to be a challenge in presenting research output that will be assessed in the academic arena. Researchers who pursue such research should aim for both 'rigour' and 'relevance'.

Keywords:

Built environment, Epistemology, Mode 2, Multidisciplinary, Research

1. Introduction

Every academic research project begins with a clear definition of the problem, the reason for the research, after the researcher has identified a gap in knowledge or theory. In practice, research projects begin with identification of a problem that needs a solution, either to address practice problems or to find ways of carrying out professional work more efficiently. Research in practice is often referred to as Mode 2 research as it is driven by finding practice solutions to practice problems. Research in Mode 2 is rich in relevance but is limited in rigour as the solution derived from the research is often specific to the practice problem. On the other hand, it is often argued that academic research lacks relevance to practice problems. The aim of the paper is to find an approach that will address both the essentials of rigour required in academic research while addressing the problem of relevance required in practice research.

The hypothesis in the paper is based on the envisaged research structure that will be pursued in professional doctorate research. Firstly, it is assumed that for the research to remain relevant to practice, the research problem and questions must be developed from practice. Secondly, the researcher must analyse and classify the nature of the research problem and questions. Thirdly, the research must follow a correct and tested methodology, with the relevant underlying epistemology and framework.

It is a proposition with a 'bottom-up' approach where the solution evolves from the nature and interpretation of the research problem. The research problem remains the focus point, for the research to remain relevant. At this early stage, it is acknowledged that the biggest challenge would be finding the correct epistemological framework to base the research design or finding the correct mix of epistemologies.

The proposition in the paper emulates from the nature of the built environment and the output of professionals in the field. A simple example would be looking at a team of professionals in a home building project. There would be architects, a discipline on its own, together with engineers, quantity surveyors, a contractor to undertake the construction and a project manager to supervise the overall delivery. In addition, there are legal contracts between the disciplines that define the relationship and responsibility of each party. Each of these disciplines has a set epistemology and paradigm that they follow in delivering their services in practice as observed by Schon (1991) and Griffiths (1974).

Research problems or gaps in knowledge could arise in each discipline, for example design failure or non-performance of contractor. Research problems or gaps in knowledge could also arise as a result of failure for interdisciplinary output, where more than one discipline is responsible for delivery of a service in the project. An example of this is cost saving in the home building project which could be a result of poor contractor performance or poor project management or a combination of the two. This complexity clearly indicates that gaps in knowledge which prompts research projects will be varied and cannot follow a single line of enquiry. Dainty (2008) found that most research in the built environment uses the quantitative and positivist framework indicating lack of depth and diversity in the built environment research field.

At doctoral (level) and professional (Mode 2) research, it would be expected that the research questions would be across the multi disciplines hence a proposition that scholars must develop a multi-disciplinary paradigm to address the research problem adequately. Dainty (2008, pg 2) stated that the built environment is an applied field rather than a formal academic discipline. However, researchers who follow such research must be wary of the fact that a "lack of clarity surrounding epistemology can result in application on inappropriate quality criteria and audience misunderstanding", which could be problematic for inexperienced researchers. The built environment being an applied field means practitioner research as described by Kelemen and Bansal (2002, pg 105) is relevant. Kelemen and Bansal (2002, pg 105) stated that "sound management research is located in the nexus between practice and contributing disciplines".

2. Literature review

2.1. The nature of the built environment discipline

Griffiths (2004, pg 711) draws attention to the difference in knowledge production for practice-oriented disciplines from traditional academic disciplines like natural science and social science. Firstly, Griffith observed that the built environment consists of "very heterogeneous collection of fields of study and practice, including architecture, town planning, land and property management, building surveying, construction technology, landscape design, housing policy and management, transport planning and urban regeneration. In some institutions disciplines such as geography and environmental management are also included. As such, they constitute something of a microcosm of the university as a whole, comprising business-oriented fields (e.g. property development), public policy-oriented fields (e.g. housing; planning), design-oriented fields (e.g. architecture; landscape design), technology-oriented fields (e.g. construction), and traditional academic fields (e.g. geography)". This statement clearly states that there is a difference, in nature, between the different disciplines within the built environment. However, in projects where research problems may be identified, the nature of the problem could affect several disciplines hence the need for the research to have a multi-disciplinary approach, to adequately address the problem. The issues arise in defining the correct epistemology and the researcher may be compelled to mix different epistemologies and approaches, for example, having to choose or mix contradicting epistemologies like qualitative and quantitative research methods. Griffith's finding already alludes to the fact that traditional research epistemologies may not be sufficient to address built environment research problems.

Secondly, Griffiths (2004, pg 712) observed that the built environment consists of disciplines that "are mostly applied fields, of a kind that has not featured very strongly in existing studies of the research–teaching nexus. In applied fields, the production and validation of knowledge appears to operate according to somewhat different principles than in more 'pure' disciplines, such as the natural sciences and humanities. There is, for example, a weaker attachment to academic 'discipline' identities, a greater emphasis on multi- or interdisciplinary ways of thinking, and greater emphasis on embedding knowledge in the context of problem solving, policy and professional practice".

From these findings, Griffiths (2004, pg 712) concluded that "conventional or generic ideas about the research–teaching nexus may have limited applicability". He identified the need to develop a "new" epistemology for the built environment, different from traditional academic methods of knowledge production. Griffiths (2004, pg 717) further stated that "applied knowledge production has different epistemological ambitions from those of empirical science, and its 'rigour' takes different forms."

Griffiths' conclusions were supported by Chynoweth (2009, pg 301) who stated that even though the built environment is "now established as a recognised field of study by the international academic community, its identity has traditionally been defined in terms of the traditional construction and property professions from which it has emerged". Chynoweth (2009, pg 308) concluded that the built environment field is interdisciplinary and therefore cannot rely on methodologies suitable for each individual discipline.

Chynoweth went further to describe disciplinary models and to shed light on the positioning of each of the built environment disciplines. He further noted, as observed earlier by Griffiths, the difference between pure knowledge and applied knowledge. He stated that "pure knowledge is based entirely on theory whilst applied knowledge involves the application of theoretical knowledge in a particular practical context". These conclusions are pushing built environment research towards applied knowledge epistemologies closely aligned to Mode 2 research, as it will be defined later on the paper. Chynoweth concluded that the built-environment can be referred to as interdisciplinary as a "realistic aspiration".

Chynoweth developed his disciplinary model (2005) from Biglan's disciplinary model (Biglan, 1973). Biglan (1973, pg 195) observed that in most university organisations, academic departments are organised according to subject matter. This immediately places a dilemma to the built environment which is interdisciplinary, as stated by Chynoweth (2009). It implies that in most universities, the built environment would not fit in the traditional university structure. This presents further difficulties for knowledge development in the built environment as noted by Kuhn (1962). Kuhn argued that "the physical sciences are characterized by the existence of paradigms that specify the appropriate problems for study and appropriate methods to be used while the social sciences and non-science areas do not have a clearly defined paradigm". The built environment could be also classified as non-science, as stated by Chynoweth's disciplinary model (2005).

2.2. **The relevance of the Mode 2 approach to the Built Environment discipline**

Van Aken (2005, pg 19) presented a proposition that management research should focus on "the so-called field-tested and grounded technological rule as a possible product of Mode 2 research with the potential to improve the relevance of academic research in management". His paper emphasises Mode 2 research as an appropriate method for knowledge production in management sciences (and built environment) to increase the relevance of the research to practice. Van Aken refers to Tranfield and Starkey (1998) started the debate on the 'relevance gap' in the British Academy of Management Journal. Nowotny, Scott and Gibbons (2001) stated that Mode 1 knowledge production was purely academic and mono-disciplinary, while Mode 2 was multidisciplinary and aims at solving complex and relevant field problems. From the above statement it supports earlier arguments in the paper that current academic knowledge production and epistemologies were ineffective in addressing practice related problems and could be deemed to be insufficient in knowledge producing in the built environment. In addition, Mode 1 does not address the issue of multidisciplinary, already mentioned in the paper. Hence, there seems to be a natural fit between knowledge production in Mode 2 and the built environment. Van Arken (2005, pg 22) describes design science as a method to develop knowledge that has high relevance that can be used by professionals to design solutions in their practices. Van Arken further proposes means to address the rigour question which often arises in Mode 2 research. He proposes grounding technologies in the generative mechanisms to produce the desired solution and address rigour. Archer (1995, pg 153) stated that "without grounding, the use of technological rules degenerates to mere 'instrumentalism', i.e. to a working with theoretically ungrounded rules of thumb". In his conclusion, Van Arken (2005, pg 31) acknowledges that Mode 2 researchers are reluctant to aim at producing general knowledge which could draw criticism to their research output as lacking in rigour (even though high in relevance).

Kelemen and Bansal (2002, pg 97) proposed that in management research there should be greater emphasis on the use of Mode 2 research whereby academics and practitioners work together to define the research problem and find an appropriate methodology to a particular context. Kelemen and Bansal (2002, pg 105) quoted Tranfield and Starkey (1998) who stated that sound management research in located in the nexus between practice and contributing disciplines. They stated that this positioning requires of researchers to adopt a transdisciplinary approach by attempting to go beyond any single discipline and utilize well established collaborative links with practitioners to ensure validity in the collection and codification of data.

2.3. **The challenge of finding suitable epistemologies**

It is not sufficient to propose integrating disciplines without addressing epistemologies and ontologies challenges for the proposed approach in the paper to be credible. Aram and Salipante Jr (2003, pg 189) proposed that the most suitable "epistemological foundation indicate the potential for a philosophy of science and a process of inquiry that crosses epistemological lines by synthesizing the particular and the general and by utilizing experience and theory, the implicit and the explicit, and induction and deduction. This proposed epistemology point to characteristics of a bridging scholarship that is problem-initiated and rests on expanded standards of validity". This statement consists of several points that need further deliberation. Firstly, it brings about the issue of combining epistemologies from each discipline in the built environment. That on its own is a complex process that could be problematic for most researchers. Secondly, it brings about the concept of combining implicit and explicit, induction and deduction methodologies, a further complication.

Aram and Salipante make reference to Gibbons, Limoges, Nowotny, Schartzman, Scott and Trow (1994) that the Mode 2 research is transdisciplinary and problem focused. This brings about debates on 'reliance and rigour' and whether these key elements of academic research are addressed effectively on Mode 2 methodologies. Aram and Salipante (2003, pg 191) describes the epistemology of knowing and emphasise on general theory arising from traditional realism-positivism inherited from the physical sciences where there is an established research paradigm. Mode 2 research is driven by application, a specific and context driven solution, which may show weakness in epistemological phenomenon as described by earlier researchers. Aram and Salipante states that in Mode 2, "knowledge is problem driven, trial and error, situation-specific, contingent, non-codified and atheoretical". Gibbons et al (1994) made a point that Mode 2 processes are "highly personalised and not codified. It transfers to new situations only through future actions of project participants, as would largely appear to be the known-how generated from action research activity".

3. Discussion

3.1. Possible research approach to the built environment

The greatest challenge for researchers in the built environment who chose to pursue their research along the proposed Mode 2 methods is how to define their epistemological framework for their research design to address both relevance and rigour. Perhaps if researchers were to follow Biglan's disciplinary model that the built environment should fit into a specific discipline, epistemological and ontological issues could easily be addressed in the research. However, the paper presents a counter argument that for research to be relevant, it must pursue a solution that addresses a practice problem. Problems in practice are multi-dimensional in nature and that implies that multi-dimensional (covering different paradigms) methodologies are required to sufficiently address the research problems under scrutiny. Chynoweth's (2009, pg 308) conclusions tacitly imply that multi-dimensional approaches are required in solving built environmental problems effectively. He concluded that there was the lack of a "recognised theoretical disciplinary base for the built environment".

In the paper, it is proposed that research in the built environment must have multi-dimensional approaches to adequately address research problems that are relevant. Contrary to Biglan, where university departments categories subjects into distinct research disciplines, the practice problems in the built environment require enquiry across several disciplines. The paper acknowledges that most university construction management departments try to confirm to the norm by developing a research paradigm and promoting positivism and quantitative methods to address most (and almost all) construction management research problems. There appears to be a lack of a clearly defined paradigm from which research in the built environment can follow (Dainty, 2008).

Griffiths (2004) acknowledged that the built environment is multi-dimensional. In its current form, the built environment has not had conviction and boldness in developing a multi-disciplinary approach and developing its own (strong) epistemological and ontological framework for researchers in the field. Griffiths' statements of multi-disciplinary imply a combination of different subjects hence multi-paradigms should be applied. This should be done to bridge the gap between Mode 1 and Mode 2 research and make academic research in the built environment more relevant to practice, which is required for a practical discipline (Dainty, 2008).

Chynoweth (2009, pg 304) quoted Griffiths (2004) who described the built environment as "a range of practice-oriented subjects concerned with the design, development and management of buildings, spaces and places". Chynoweth (2009, pg 306) then described the steps in developing a suitable epistemology for the built environment. Chynoweth proposed the first step towards integration to involve a state of pluri-disciplinarity. He stated that this "requires the deliberate juxtaposition of different disciplines so as to enhance the relationships between them. Communication between disciplines is encouraged but not coordinated and the nature of any integration is therefore, once again, largely a matter of chance". Chynoweth (2009, pg 306) quoted Jantsh (1972) who suggested that "most claims to interdisciplinarity are at best pluri or cross-disciplinary in nature. True interdisciplinarity only occurs where a number of separate disciplines surrender their own axiomatics and collectively define themselves by reference to a common strategic axiomatic". Chynoweth (2009, pg 306) further stated that "according to Jantsch, this takes place where the traditional disciplines of knowledge are brought together in structures which reflect "basic themes of society or need areas" rather than their own disciplinary identities".

3.2. **Methodological pluralism**

Dainty (2008, pg 2) observed that the built environment is a fairly new field and researchers draw their methodology and paradigm from the natural sciences as well as the social sciences. Dainty et al proposed a methodology referred to as pluralism.

Harty and Leiringer (2007) noted that research in construction management was focused at either objective 'engineering' oriented or subjective approach where the focus was on understanding how different realities are constituted. Dainty (2008) analysed the most dominant methodology in the construction industry by reviewing the methodological positioning of papers published in the Construction Management and Economics journal, Volume 24 of 2006. He found that most of the papers were quantitative in methodological positioning, meaning they adopted quantitative research methods based on the positivist research paradigm. This could present a challenge for a researcher who wishes to deviate from this dominant position in the construction management field. However, the question remains as to whether current researchers are sufficiently addressing the problems in the field with a single methodology. Therefore, Dainty et al builds a case for methodological pluralism in an effort to bring on board a combination of different methods in a single research project. He defines methodological pluralism as the "use of multiple theoretical models and multiple methodological approaches". This concept is embraced by Aram and Salipante (2003, pg 202) in what they refer to as methodology that "transcends epistemological dichotomies". Dainty emphasises that using one methodology and paradigm limits the view and perspective researchers may have on the subject. However, in conclusion, Dainty et al acknowledges that there are many critics of combining methodologies.

3.3. **Overcoming the epistemological challenges**

The built environment research community is fairly new in comparison to the natural sciences and it appears as if it has not developed sufficiently a research paradigm that could guide researchers in the field. In addition, by the nature of 'interdisciplinary" as mentioned in the paper, the research delves into complex research methods in trying to deal with the issue of relevance. The paper suggests that researchers cannot avoid this complexity if they are to undertake credible research in the field, which requires the mixing of epistemologies and ontologies. It is even worth adding that researchers in the built environment must explore opportunity of combining quantitative and qualitative research methods if the need arises to develop a desired, relevant and appropriate solution. However, researchers must be conscious of the consequences of mixing these methodologies. By the nature of the two methodologies, they are different in paradigm and epistemological framework, hence mixing the two in research can lead to confusion in presenting a clear epistemological framework for the knowledge in the research (Dainty, 2008).

According to Plato in classical epistemology, true knowledge is never particular, never simply about this or that, but essential, general and fundamental (Knight and Turnbull, pg 67). This is the case in the epistemology of the natural sciences. In modern epistemology, Deschartes (1996) thought that valid knowledge should rest on secure foundations and that knowledge required a first principle upon which the whole edifice of knowledge could be derived and ultimately rest (Knight, et al, pg 69). This could present a challenge for researchers in the built environment who delves into unknown and untested territory and then try to position and present their research for academic assessment. The epistemological basis upon which the researcher designs and frames his "new" knowledge could be the subject for scepticism and doubt.

Perhaps, the post- modern ideas by Richard Rorty that knowledge is "always relative to the interest at large in culture and so there is no such thing as timeless knowledge" (Knight, et al, pg 71) could help develop epistemology for Mode 2 research. Other post-modern theorists, like Nietzche, support the notion that knowledge is not timeless and must be linked to realities and circumstances, again strengthening the case for the future of Mode 2 research.

Aram and Salipante (2003, pg 196) tried to address some of the epistemological challenges that are often encountered in Mode 2 research. They proposed a method which they referred to as the "externalization-internalization cycle" which involves four processes. First, the individual's personal knowledge is enlarged through increasing the depth and variety of direct experience. Second, a self-organizing, cross-functional team is created in which individuals share experience and tacit knowledge in an environment of increasing trust. Third, shared tacit knowledge is articulated into a concept, largely through metaphorical thinking. And fourth, the concept is crystallized into a concrete form, such as a new product design or prototype, again through interaction within the context of a diverse group". Aram and Salipante (2003, pg 197) quoted Dewey (1891, pg 193) who stated that "explicit reasoning occurs when the mind recognizes the relationship between two experiences and explains the nature of the relationship, such that snow consists of water reduced in temperature and crystalized. Knowledge, either implicit or explicit, then, always involves some reasoned relation between the particular and the universal". This is important in addressing the rigour challenge of Mode 2 research. This point could act as a catalyst in bridging the gap between Mode 2 research and traditional academic research. The key is converting tactic knowledge into explicit knowledge. This process is explained in a process described by Nonaka (1994) as 'trial and error'. The process starts when a group has been able to articulate a new concept through the successive rounds of perspective sharing. Then, through a process of trial and error, this explicit knowledge is translated by group members into tacit knowledge through 'internalization' and learning by doing. Nokata stated that the concepts shed light on the rigour versus relevance debate in management research. They suggest that context (relevance) and empirically grounded theory (rigour) are equally important and mutually supportive factors in knowledge generation. Nokata (1994) stated that "knowledge is incomplete without discovering and working between implicit and explicit reasoning and utilizing processes of induction/deduction". Aram and Salipante (2003, pg 199) stated that interest in knowing or discovery begins with an acknowledged problem. Further stated that knowledge is "neither realistic nor is it idealistic in the sense that ideas have an independent reality". This point further re-emphasises the notion that traditional research epistemologies cannot effectively address practice problems which are removed from the confines of academic departments and epistemologies.

The process outlined by Nonaka (1994) above could evolve into a finite research project where interviews and other data extraction methods (from a sample) could substitute the group engagement.

Aram and Salipante (2003, pg 201) went on to describe a method for addressing the epistemological challenges in 'bridging the gap' between theory (academic) and practice. They first stated that the research problem should be practice driven to address sufficiently the issues of relevance. Secondly, they proposed that for bridging scholarship research the methodology should be epistemologically eclectic, which means that the researcher must mix and borrow from different epistemologies. Lastly they proposed that researchers should produce pragmatic science which is high in both rigour and relevance. The last point of pragmatic science is the biggest challenge and has proven to be slow in its development in the built environment.

On the epistemological challenge, from the literature reviewed and the conclusions made by Aram and Salipante (2003, pg 203), there is a gap in the development of appropriate epistemological and ontological frameworks to sufficiently deal with research problems in the built environment. It appears as though more work needs to be done in this field as proposed by Aram and Salipanthe Jr (2003, pg 203). The challenge lies with the researcher in developing his research sufficiently and having a framework that will result in a thesis that sufficiently addresses rigour. He must follow a methodical and credible process that will clear all doubts from the examiners and readers of his report that his conclusions are a result of a thorough and transparent process.

Another approach is an investigation of the phenomenology of practice (in the built environment) as described by Vagle (2010). Vagle (2010) begins with propositions made by Schon (1987) that reflective practicum is the cornerstone of knowledge. Therefore, if follows that built environment researchers should develop a phenomenology of their practice that captures the essence of how knowledge is developed and emerges in practice. This phenomenology should satisfy the academic standards as well as the reflective nature of practice. Schon (1987) began his work after noticing the emphasis of technical rationality in practice while the reality is that reflecting on reflection-in-action is the dominant feature of practice. Schon favoured a constructive perspective to research in practice.

4. Conclusion

It is clear from the literature reviewed and the presiding discussion that the built environment is multi-disciplinary and that it is an applied discipline. The discussion also suggests that Mode 2 approach would be most appropriate for research in the built environment as it fits better with addressing the issue of relevance between the academic research and the professional practice. The paper however acknowledges the complexity of combining several epistemologies and methodologies and the wilderness researchers may find themselves in when undertaking such an academic research project. The paper acknowledges that there could be questions and doubts raised in the 'rigour' aspects of their research project should they choose to strictly follow the Mode 2 approach in their enquiry unless they follow a pragmatic science approach. The work of Vagle (2010) and van Manen (2007) on the phenomenology of practice has scope for further research to delve deeper into the epistemological issues around developing a new approach for the built environment.

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How to Manage the Support Role to Ensure Successful Learning Using Industrial Simulation

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Abstract

The paper analyses the success of an industrial simulation delivered to final year BSc Building Surveying students. Research is undertaken using an action research approach. The analysis does not focus upon the assessment wording and the methodology employed, but upon the support provided to the learners. The need for this support and the nature of the support is initially established using current literature, whilst its effectiveness is monitored using learner feedback and achievement data. The need for prior risk assessment of potential areas of student disadvantage is proposed, leading to establishment of a robust, flexible and evolving regime of support being imposed throughout the activity. The rationale for a support regime is derived from risk assessment of the proposed activity and its success is tested through feedback obtained from participant learners. It was concluded that evidence gained from feedback and achievement data suggested that, when adequately supported, industrial simulation is an appropriate tool for delivering both academic learning and vocational skills training, as required by all four stakeholders to building surveying education.

Keywords:

Learner Support, Industrial Simulation, Skills Training, Stakeholders

1. Introduction

Whilst this study is applicable to any vocationally focused education, the work analysed in this paper relates exclusively to the delivery of building surveying education to under-graduate students studying a Royal Institution of Chartered Surveyors (RICS) accredited course. The planning and implementation of this research activity is founded upon two principles which relate to accredited building surveying courses. Firstly, on graduation, students mostly intend to seek work as building surveyors and enter into the RICS Assessment of Professional Competency (APC) training programme. In a recent survey of 32 final year BSc Building Surveying students, taken by the author, 85% of participants declared that intent, with only 6% not intending to become surveyors and 9% being undecided. Secondly, students' expectations are that their course will give them knowledge and skills in addition to academic qualification, to help them gain employment in an industry where employers often value applicants who have these skills. This was highlighted recently when all respondents who completed a questionnaire believed practical activity was relevant to becoming a building surveyor. Dempsey reinforces this theme by stating that educators should equip students with a strong sense of confidence and competence (Dempsey et al, 2001).

There are four stakeholders to building surveying education. The first is the student customers. The second is the university, who require that a degree programme in all its parts is delivered at a comparable academic standard to all its other degree programmes, is of a standard comparable with similar degrees offered by other institutions and fully meets the academic and quality regulations it lays down for degree provision. The third would be the accrediting body, the RICS, who lay down regulations governing the content of the courses they accredit for entry on to the APC professional membership process. A fourth and final body are the surveying employers, as without the realistic prospect of graduate employment building surveying courses would face decline.

Module outcomes are generally pre-set and their subject matter often part of agreements made between the university and the RICS. Any assessment must pass both internal and external scrutiny, so that it demonstrates meeting the academic requirements of both module and level of study, and is presented to students in a way which is consistent, fair and unambiguous, in line with quality regulations. One method of teaching allows for the meeting of academic outcomes whilst delivering realistic industrial skills training. This is Enquiry Based Learning (EBL), using a realistic simulation of an industrial activity. This paper uses feedback and achievement from such an activity to assess the suitability of this teaching method and to measure the value of the support, which the author believes is essential if non-traditional learning methods can be delivered in a way that is equitable to all learners. Learner support, often referred to in educational literature as scaffolding, is a technique by which the tutor provides clarity and structure for students as they learn new tasks, without stifling initiative, motivation and resourcefulness (Mckenzie 2000). It is therefore a delicate balance between the tutor, maintaining control and an ability to step in to assist learners, without being seen to totally control the activity, thus losing its student focused learning advantages.

2. Industrial Simulation to Facilitate Enquiry Based Learning

Many education commentators advocate a constructivist approach to vocational education. One such approach, industrial simulation when used as an educational tool in the context proposed, is part of a family of action focused approaches to learning. These include the more commonly used problem based learning (PBL), and enquiry based learning (EBL). There is a strong overlap between the two (Khan & O'Rourke, 2004), and both utilise student focused learning to resolve a given task. EBL is described by the Centre for Excellence in Enquiry Based Learning as an environment where the process of enquiry is owned by the student. They go on to state that the process involves a scenario being set, supported by a facilitator, which allows students to identify their own issues and questions (CEEBL, 2009). Students can then utilise resources provided for them or sourced by themselves to research the topic. One feature of enquiry based learning is that it might involve a small scale investigation involving field work and a case study adapted to meet the disciplinary contexts (CEEBL, 2009). This definition closely mirrors the activities described within the case study analysed later in this paper. Self directed learning as advocated by both EBL and PBL is believed by many educationalists to be a superior form of vocational training in comparison to traditional teaching. The reasoning being a belief that the things a learner has discovered through experience are more likely to be retained (Park et al, 2003). It is however the belief of the author that this experience needs to be realistic. In both PBL and EBL the role of the teacher changes to facilitator (Bradbeer, 1996). Learning in the context of building surveying education, to meet the requirements of all four stakeholders, should ideally include academic outcomes, technical knowledge and practical vocational skills.

In terms of vocational skills training, industrial simulation exercises can contextualise any prior learning into an industrial context, where it is of value to future employers (Khan & O'Rourke, 2004). It reinforces past learning as the learner can test knowledge against a real life scenario. By using the knowledge to resolve problems the learner is afforded access to a whole new canvass for that knowledge, which gives it a greater value. It introduces the concept that learning is not purely restricted to the classroom or within an educational establishment site. It is also cited as preparing a learner for the life long learning required to adapt to the constantly changing nature of professional life (Dempsey et al, 2001). This form of learning would appear suitable when stated outcomes are the embodiment of key vocational skills. The use of a small scale simulated industrial exercise as cited by Khan & O'Rourke appears ideal when seeking to focus learning directly in to a disciplinary context (Khan & O'Rourke, 2004). Conventional education theory would, it seems, suggest that industrial simulation in the given context could deliver a dual outcome of academic and vocational learning, providing it can deliver an equitable means of learning for all participants.

3. The Need To Support Learners During EBL Activity

One danger of such exercises over traditional classroom teaching is that they can take students out of their established comfort zones (CEEBL, 2009). Whilst Nunnington views the challenge of this event as being the catalyst for enhanced learning (Nunnington, 2009), it can if handled poorly, alienate students and detract from that learning. The student taken into a challenge situation must therefore be supported. This support, sometimes referred to in education text as scaffolding, is an essential factor. It must be visible and easily accessible, but also discreet (Nunnington, 2009). If too visible it might overshadow the industrial simulation element. Tosey states the facilitator must "*intervene thoughtfully*" (Tosey, 2006). Being visible allows the facilitator to exert some control and be on hand to render bespoke support if it becomes essential. The facilitator must however not become a focal point which renders the simulation unrealistic. Support levels also need to be bespoke to the type of learner, and often to individual learners, which requires a complete risk assessment of all aspects of the proposed activity before planning a support regime.

One issue is that students traditionally expect to be taught and to have tutorial support. The role of a facilitator is described by Tosey as being one who acts in collaboration with the learner in a cooperative enterprise within which leadership roles, dependant upon time and purpose, may change (Tosey, 2006). As it does not require direct leadership of all learning, the use of industrial simulation could be perceived by students as diminishing the role of the lecturer (Askham, 2009). Khan & O'Rourke speak of the need for the tutor to be seen to establish the parameters of the students' work and remain central to the whole activity (Khan & O'Rourke, 2004). One method of establishing the position of the tutor is by giving them a strong senior role within the simulation. This perception of the tutor as owning superior knowledge may be required to prevent a detachment between learner and teacher. These senior roles also allow the tutor/facilitator to nurture the participant students, (Tosey, 2006).

Successful industrial simulation relies upon the learner owning adequate levels of prior knowledge and having access to relevant information pre-event and during the activity, so that they can fully participate in a realistic manner (Khan & O'Rourke, 2004). The activity designer must therefore ensure that the students actually own the required basic skills and can easily gain access to that additional required information. This is a vital part of the imposed scaffolding. Industrial simulation is about using skills, and the author has found it may be necessary to run demonstration activities to achieve, at least test, basic skill levels, or run classroom activities to embody critical information before exposing the students to the main simulation. This helps prevent detrimental levels of individual challenge, due to a lack of essential skills and knowledge or inability to access essential information.

Whilst students will always be aware that the simulation is not real, and this is indeed another part of the support regime in that potential failure does not carry industrial consequences, there is however a need for as much realism as possible. It is a small step for a final year degree student to adopt the role of a newly graduated surveyor, but a huge leap to adopt the role of an experienced chartered surveyor. Likewise the tasks need to be totally commensurate with the role. It is the belief of the author through experience of construction, design and surveying project work that often students told in an assessment brief that they are now an Architect, Chartered Surveyor, Site Manager or Site Engineer sometimes fail to fully engage, due to an inability to believe in their capacity to fill the role. This loses any industrial simulation aspect the project might have sought. Such role elevation, whilst it may still work for academic learning in a theoretically based PBL context, risks rendering an industrial simulation obsolete as a tool for preparing students for immediate vocational requirements. For a case study to be viable the tasks need to be achievable, if they are not it would send out the wrong signals to the participant students about the industry they propose to enter.

In summary, a successful industrial simulation exercise needs to be well supported, needs for the tutor to adopt a role as facilitator, which does not diminish their effectiveness, requires realism to engage the students, needs to be bespoke to the level of the learner and needs to be fully supported by prior learning, prior skills training, current easily accessible supporting material and a physical tutor presence.

4. The Need for Support

Dempsey states that, for simulations and role plays to be successful, there needs to be a joint ownership of the activity between tutor and learner (Dempsey et al, 2001). This means that the tutor cannot facilitate the activity and then allow learners to participate alone. Claxton describes a process of "disinhibition" by which learners can withdraw and disengage from the teaching activity (Claxton et al, 1996). Lack of support or perceptions of isolation can create that process. Dempsey continues by saying that successfully constructed joint ownership can create a learning community with common goals and challenges (Dempsey et al, 2001). It is the scaffolding implemented and the discreet, but still visible, presence of the tutor which creates this shared learning environment, and differentiates action learning approaches from traditional tutor focused tuition.

Pea compares educational support to the interaction between a mother and her child. A mother will support her child to complete tasks which are beyond it's capabilities. This enables the performance of a more complicated task than would otherwise have been possible, and the consequential enhancement of development, as the child becomes able to autonomously perform the task (Pea, 2004). Pea further states that the mother's support reduces as the child progresses towards independent performance, based upon a maternal assessment of present capabilities (Pea, 2004). By returning to an educational context this would suggest a need to actively and visibly support learners at the start of the activity, with support becoming more discreet as the learning process approaches the meeting of its outcomes, and the learner closes in on autonomous activity, but as with a mother's support, it is never completely withdrawn, even to create greater degrees of challenge, until autonomy is demonstrably reached.

Mckenzie states that "exploration by students progresses most effectively when those students have been well equipped, well prepared and well guided along the path" (Mckenzie 2000). He further cites scaffolding as being required to keep learners on track, clarify expectations and reduce uncertainty, surprise and disappointment (Mckenzie, 2000). Effectively, it is essential to nurture the learner. However a further requirement of scaffolding cited by Mckenzie is that it should bring organisation to the tasks to prevent disengagement brought by excessive timing to complete tasks (Mckenzie, 2000). That factor is vital in delivering a successful realistic simulation and, as Mckenzie states, is dependant upon relevant scaffolding to be in place to "distill the work effort" (Mckenzie, 2000). Given the nature of the building surveying profession, a strong sense of organisation and time management is required. It is these soft skills, as well as the harder skills of professionalism, surveying practice and report writing, that the studied simulation sought to deliver. These cannot be researched as can technical information, but rather purely experienced whilst supported by an appropriate support regime.

Use of an Action Research Approach

Data gathering and progression is undertaken using an action research methodology.

> *"Action research is the name given to a particular way of researching your own learning. It is a practical way of looking at your practice in order to check whether it is as you feel it should be. If you believe your practice is as it should be you will be able to explain how and why you believe this is the case; you will be able to produce evidence to support your claims. If you feel your practice needs attention in some way you will be able to take action to improve it and then produce evidence to show in which way the practice has improved." (Mcniff & Whitehead, 2002)*

This quote from Mcniff and Whitehead describes the philosophy employed by the author. This is reinforced by Carr and Kemmis who state that action research is about improvement of practice, improvement of the understanding of practice and improvement of the mechanics of practice, (Carr and Kemmis, 1984). Action research utilises the action, in this case the supported simulation, to yield improvements and provide data, thus the action becomes the research tool, (Waters-Adam, 2006). A cyclical model described by (Arhar & Kasten, l 2001) and then drawn by (Waters and Adam, 2006), of 4 activities planning, action, monitoring and reflection, mirrors that employed by the author, Unlike the Water-Adams' quite simplistic model the researcher also incorporates external data from additional primary and secondary research in to the reflection and planning stages. This would be endorsed by Stringer who states the importance of the participation of all of the stakeholders, (Stringer, 1996). In this research input from the professional body and employers could only be obtained through separate primary and secondary research. Mcniff noted an important issue with action research is that it can be subject to variables, (Mcniff, 1988). The author endeavoured to keep as many constants as possible from previous simulations, however in research which uses data from learner feedback the unavoidable variable is that the learner cohort changes annually. Any conclusions will therefore require testing against other cohorts, and current research reflects three years of trial and improvement, across a number of similar simulations, based upon eight further years of education practice.

A further purpose of action research in education is elaborated upon by Nixon, who states that the research is a way of informing other teachers within the specialism of practice improvements, (Nixon, 1981), thus encouraging change and improvement to overall practice, (Mills, 2003). As an ex-surveying practitioner teaching specialist surveying modules, this to the author was an important factor, as previous research in to teaching specialist building surveying skills is scarce, and documented pedagogy can inform and improve practice.

In summary the author used an action research approach to understand and improve existing practice. As part of this the author seeks to define and test practice in supporting surveying students during industrial simulations designed to impart academic knowledge, specialist skills and essential work based skills.

Description of the Activity

The activity is an assessment set to meet the learning outcomes of:

1. Carry out a building survey of a traditionally constructed commercial building and critically appraise its condition;
2 Analyse the condition of a building, formulate and communicate an appropriate course of action to a client;
3 Identify and apply to a given context, the legal rights and obligations of property owners, leaseholders and tenants;
4 Apply the design process to a given scenario and critically evaluate design options
5 Demonstrate an understanding of current topical issues within the profession;

In line with the module specification, learners need not show evidence for all outcomes to successfully complete the assessment.

The activity was to undertake a bespoke building survey to a defined client brief. Following student feedback from previous activity, learners were offered the choice of a number of briefs, relating to the same subject building. The building was chosen to reflect the student's likely abilities and knowledge. The briefs required stock building surveys such as condition survey, commercial appraisal, identification of statutory obligations, visual only asbestos survey and access audit. An essential skill was the ability to apply survey findings to the needs of a specific client. The briefs were typical of commercial clients, with logical requirements which could potentially be met by the building. Industrial skills sought were an ability to perform stock building surveys, production of industry accepted reports, interpretation of survey findings, application of a client brief, application of statutory obligations and application of accepted professional conduct. Meeting the client brief required undertaking a number of survey activities. This was additionally communicated to the students by means of a graded list of required outcomes:

Figure 1 The Grading Criteria

Grading Criteria
Organisation, presentation & use of graphic media and illustration (20% of marks)
Appropriate technical recording of the survey notes (20% of marks)

Ability to focus the report towards the client's requirements and circumstances, as given during the client briefing (20% of marks)
Appreciation of your client's potential statutory and other liabilities in respect of the building and site (20% of marks)
Application of professional principles of report writing (20% of marks)

Following lectures to reinforce essential knowledge, a practice tutor driven building survey and a briefing session, the activity took place over a period of 4 hours utilising a local commercial building which was following an extensive health and safety audit and risk assessment deemed safe for learners to work in, and was technically suitable for the level of learner. Submissions took the form of an individually compiled, industry accepted format survey report, which met the expectations of the client brief, and the expectations of a surveyor's professional obligations and requirements. The activity was as realistic to the practice work of a building surveyor as it was possible to get, within the requirements for scaffolding, educational health and safety rules and student numbers.

4.1. **Tutor's Role In the Process**

At the commencement of the activity, the tutor adopted a traditional leading role, as briefs were distributed, information given and students organised in preparation for the activity. A series of technical lectures were delivered to provide the assurance that students owned adequate levels of underpinning knowledge. A more tutor driven practice survey was arranged which started as a tutor led instruction activity, but saw a reduction in tutor involvement as the activity progressed and learners became more confident. During the actual activity the tutor adopted the role, albeit located on site, of the senior experienced colleague who could be contacted from site should an issue beyond the surveyor's knowledge appear. This role allowed the tutor to emerge in to a more visible leading role where observation dictated such was required. Following the activity, in a supporting session, the tutor adopted a more visible leadership role, akin to that of the surveying practice principle, reinforcing exactly how the client report was expected to be prepared.

4.2. **Learning Risk Assessment of the Activity & Measures Imposed**

A learning risk assessment was undertaken, which was additional to health and safety assessments, and focused upon situations which might disadvantage individual learners. The following issues were identified as being possible causes of some student disadvantage. It was believed that students were generally aware of the nature of work they would expect to undertake when joining the building surveying industry, and therefore aware of what is realistic and what would be too high a level to be practical.

Figure 2 Risk Assessment Employed

RISK ASSESSMENT OF SIMULATED BUILDING SURVEY ACTIVITY		
	POTENTIAL PROBLEM	SCAFFOLDING IMPOSED

1	**Learner requires adequate levels of knowledge**	Sessions to contextualise prior learning, all required new material front end loaded to be taught before the activity. Access to an electronic database of legislation, books, manuals, technical briefs, etc.
2	**Learner feels isolated & unsure on site**	Field work performed in groups of up to 4 learners, although reports are to be completed individually
3	**Learner may require technical assistance during fieldwork**	Tutor adopts the role of senior colleague who can be contacted with specific questions.
4	**Learner feels that knowledge levels are insufficient**	Provision of an electronic database of technical material to cover all possible situations arising from the survey work
5	**Learner feels disadvantaged by inexperience of performing surveys**	1. Practice survey arranged 2. Grading expressed to show that results are not heavily dependant upon technical prowess shown on site.
6	**Learner feels unsure how to convert field work in to professional report**	De-brief session after the fieldwork
7	**Learner is unsure how much information is required, and whether they have completed the fieldwork fully.**	As above, and arrange return visits for small numbers of students.
8	**Some areas of the building are deemed unsafe for student access.**	Briefs are written to remove the need for close inspection of the roof and fire escape areas.
9	**Learner feels the role set is too advanced**	Tutor reinforces the nature of work typically undertaken by graduate surveyors and does not set requirements which go beyond what would be expected in early practice.
10	**Learner feels that there is insufficient time and becomes disengaged through feeling that the task is beyond them**	Tutor is available on site to step in with advice if a group appear to be taking irrelevant pathways or under-utilising time resources

5. Analysis of the Results

Analysis of the success of this activity was undertaken by means of a written feedback sheet, a post activity focus group, where participants were encouraged to air thoughts about the activity, tutor observation, on site and analysis of the academic output. Below can be found a copy of the student feedback sheet. This sheet was offered to participating students on a strictly anonymous and voluntary basis. It was completed by all 32 of the participants, which is a return rate of (100%) of the maximum sample. This feedback sheet was not designed to assess success or failure in isolation, but rather to highlight issues of change for future simulations. For a more valid analysis of this activity the feedback sheets have been supported by a tutor led post-activity briefing where, for part of the session, 28 out of the 32 participants (88%) were encouraged to discuss their experience.

Figure 3 Participant Feedback Template and Data

FEEDBACK SHEET					
	STATEMENT	**STRONGLY AGREE**	**AGREE**	**DISAGREE**	**STRONGLY DISAGREE**
1	**I feel this activity is relevant to becoming a Building Surveyor**	26	6	-	-
2	**I felt I was given enough information to undertake this activity**	16	15	1	-
3	**This activity was too advanced for my level of knowledge**	-	4	26	2
4	**I felt I learned/practiced important skills while undertaking this activity**	11	20	1	-
5	**I felt undertaking this exercise was challenging**	14	17	1	-
6	**I fully understood what was expected of me**	6	23	3	-
7	**I felt I could call upon support if I had needed it throughout this activity**	12	19	1	-
8	**The activity and assessment brief was clear and easily understandable**	9	23	-	-
9	**My role in the activity was realistic.**	11	21	-	-
10	**I enjoyed taking part in this activity**	12	19	1	-
11	**This knowledge could have been better achieved through lectures, seminars and a theoretical assessment**	-	6	17	9
12	**I felt tutorial support was available throughout this activity**	10	18	4	-
13	**On graduation I intend to seek employment as a BS**	18	9	3 No 2 undecided	-
14	Please make any observations and comments which you feel might improve the learning experience for future Building Surveying activities of this nature				
This questionnaire will be used exclusively by your tutor to inform future activities for delivering this topic/module. Your genuine opinions will be valuable in ensuring that future simulated activities of this nature are designed to achieve optimum learning outcomes and experience. Thank you for your cooperation					

Feedback from both questionnaire and briefing was similar and overwhelmingly supportive. The author on analysis of the data noted that the key issues relating to scaffolding were amongst those receiving highest participant approval. The validity of using simulation, and the desirability of learning both knowledge and skills also scored highly. The author is aware that there is a variable in the data gained to-date in that the cohort changes annually and this may be a particularly benign cohort. Certainly approval whilst always generally high was higher from this cohort than previous year's learners. An important factor in current fee paying education is that it was almost universally accepted by the learners that this was a realistic and valid exercise, in which they had enjoyed participating. Within the participants additional observations and during focus group activity, no factor outside of the risk assessment was identified as potentially causing disadvantage, although elements outside the tutor's control such as timetabling of other modules did impinge upon the continuity of a four hour activity for some students, meaning some second visits were required.

Given the high approval rating the reflected activity to be carried forwards is to replicate this simulation and compare the response to use of identical pedagogy from a different learner cohort. Research in to use of 3D technology to produce a virtual walkthrough building survey to counter problems with student timetable conflicts, is underway, and the author has commissioned such a virtual simulation, using gaming software for piloting with learners in the next academic year.

Below can be found the assessment statistics which showed comparatively high levels of student achievement. By further investigation the tutor is certain that students who scored lowly did not do so through perceptions of disadvantage during the practical activity, but rather a failure to engage in the preparation required or failure to allocate sufficient effort to the submission document.

Figure 4 Learner Achievement Data

STATISTICS	DATA
No Participants	32
No Submissions	27 (5 non-submission due to authorised special circumstances)
Average Grade	63%
70%+ (10) 60-69% (10) 50-59% (4) 40-49% (2) >40% (1)	

In a situation the researcher has never known previously student hand-in was reduced significantly by special circumstances which led the university allow deferment of the submission due to illness, injury, family bereavement, identification of special needs, motoring accidents, etc. These students although they participated in the practical work completed their assessment based upon a different brief situations, and therefore performance can not be included.

6. Conclusion

Feedback from participants and levels of academic achievement would testify that this was a successful exercise. The author believes that one reason for this was that a risk assessment of issues which might disadvantage individual learners was undertaken and robust scaffolding was imposed to counter this possible disadvantage. One stated advantage of EBL is that the challenge of leaving established learning comfort zones drives the learner to greater achievement. This approach can however lead to some collateral damage in respect of students who fail to cope with this challenge. Such collateral damage was avoided by risk assessment and imposed scaffolding measures, however these were applied in such a way as to be visible but unobtrusive. Consequentially learners were both challenged and supported. Stronger students achieved to a high level, with 10/27 achieving first class grades, whilst weaker students were not allowed to flounder and fail for reasons of lack of available support. On the basis of these achievements, the author proposes further study in the building surveying education domain to establish if this form of teaching can be further developed, so that graduate building surveyors can offer practised industrial skills, applied practical knowledge as well as academic certification to the employment market.

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ID 029

Towards a standards reform in Saudi distance learning: Norms for distance learning in Saudi Arabia

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Abstract

In Saudi Arabia, some improvements have been made in terms of distance-learning objectives, content and methods. However, areas concerning evaluation and feedback have not received much attention in the country. Consequently, there was a call from the Saudi government to revise and reform the standards and best practices of distance learning in the areas of learning/institutional context, learning resources and learning processes to take account of the Saudi educational environment, cultural heritage, religious beliefs, and demands for technological progress. The paper presents a plan for a future project that uses a participatory design approach to contribute to the development of suitable distance-learning standards and best practices for the Saudi context. A model that is based on the third generation of the Activity theory is used to examine processes of distance-learning standards development.

Keywords:

Distance learning, Participatory design, Activity theory, Standards

1. Distance learning in Saudi Arabia and the need for standards reform:

The arrival of new technologies, the rising numbers of students, and the diversity of university programmes have created huge pressure upon universities to develop new approaches to meet these challenges. One predominant approach was the development of a “Distance learning” system where instructions can be delivered while students and teachers are in different locations (Harry et al., 2013).

By utilizing the huge developments in Saudi telecommunications and technology delivered by leading telecommunications providers, many universities in Saudi Arabia have begun to offer distance-learning programmes in an attempt to provide a solution for the growing number of students who have access to higher education.

Beginning in 2009, Saudi universities stopped enrolling students permanently in the so-called "association programmes" (that are partially traditional "blended learning") and announced that distance-learning programmes would be the only alternative (NCEDL, 2011). This was the first step towards establishing a Saudi electronic university that uses only distance-learning programmes to deliver all of its courses. Thus, the development of standards for Saudi distance learning has become a point of interest.

Some improvements have been made in terms of distance-learning objectives, content and methods. However, areas concerning evaluation and feedback have not received much attention in the country. Consequently, there was a call to revise and reform the standards and best practices of distance learning in the areas of learning/institutional context, learning resources and learning processes to take account of the Saudi educational environment, cultural heritage, religious beliefs, and demands for technological progress (NCAAA, 2011).

Standards of distance learning were determined by specialists, with no input from real users (stakeholders). This was not considered satisfactory, so government authorities represented by the Ministry of Higher Education have tried to resolve the issue by arriving at a solution involving both sides. Nonetheless, distance-learning programmes in Saudi Arabia evolved out of their contexts.

Distance-learning standards in Saudi Arabia did not evolve from a national agreement, but in most respects copied Western ideas and standards. This transfer came with the introduction of organized distance learning that was accepted by the more affluent groups. It was no accident that distance-learning standards in the country reflected the aspirations of this class rather than the needs of the majority of people.

With this in mind, distance-learning standards in Saudi Arabia must be reformed to encompass the expectations and the needs of its recipients. This cannot be done by ideas that are brought from overseas to be implemented in a completely different part of the world, with no regard for the real users' concerns. In this study, the real users (stakeholders) will have their say and will play a vital part in redesigning distance-learning features that comply with their expectations and foremost with their environment.

2. The participatory design approach:

The term *participatory design* is broadly applied in technical communication with regard to philosophical and pedagogical work (Simonsen and Robertson, 2012). Participatory design is research but mostly it has been seen as a design approach characterized by user involvement (Simonsen and Robertson, 2012). This approach is more focused on designing systems, work organizations or practical knowledge to be a good match for everyday work. By implementing a participatory design approach, we can ensure that participants' interpretations are taken into account in the research, not only to understand the activity in place but also to reshape it so that workers find it positive. In participatory design, participants' interpretation is an essential part of the process.

Participatory design (PD) originated in Scandinavia in the 1970s through cooperation between academics and trade unions in the production of new technologies to be implemented in the workplace. This was an unprecedented step towards empowering workers democratically and promoting democracy in the workplace. Since then, it has become an important approach for researchers interested in human-computer interaction. It attempts to examine the tacit knowledge of human activity. It also maintains that this kind of knowledge can be elicited through partnerships with participants to cooperatively design a system, workflow, or work environment. This cooperation must be based on an iterative process to provide scope for researchers/designers and participants to develop and refine their understanding of the activity (Spinuzzi, 2004).

Since then, researchers have begun to have different views about how a participatory approach should be used in their research. These views can be characterized broadly into three arenas of participation. First is the *individuals/stakeholders* arena that puts more emphasis on redesigning the system to serve particular stakeholders' workplaces. The second arena is focused in reshaping the system to reach an agreement on the *organizational* level in respect of the whole organization functionality. The third arena has a broader, *national* aspect, where the general legal and political framework is questioned and reshaped. Many PD researchers have attempted to place more emphasis on *national* and *organizational* arenas in favour of the *individuals/stakeholders* arena (Sanoff, (2007). Emphasis that was placed on the *organizational* and *national* arenas turned out to be problematic as it suggests that these arenas are more influential and can steer the system reshape to encompass the expectation of the *stakeholders*. Critiques view these attempts as bias because *stakeholders'* views were merely informative while they should be a central part of the development process. This seems to breach the fundamental aspect of participatory design which is to empower workers and foster democracy in the workplace. On the other hand, PD researchers motivated by a Marxist commitment to democratically empower workers tend to work with *individuals/stakeholders* with the aim of exploring local conditions and expectations of *individuals/stakeholders* as a basis for influencing policies at the *national* level, which will be the case in this study.

In light of this, in this paper the stakeholders - faculty members and students who represent the *individual/stakeholder* arena as their needs and views will be essential to the development process that takes account of the workplace requirements - will work as a steering committee and will be heavily involved in the activities of analyzing the needs and possibilities; selecting the technology components; designing of new technologies; the organizational application. In doing so, the members in the *organizational* arena will have a less important role and will work as consultants throughout the redesign process. By doing so, the redesigned case (standards reform in this study) will gain more credibility as it complies with the organizational functionality which will bring it to the questioning table of the *national* arena.

3. Stages of the study:

Participatory design's methodology is derived from participatory action research; it involves redesigning workplaces and work organization, as well as work tools. It emphasizes that in any participatory methodology, stakeholders' participation is considered central to any development process which covers four core principles: analysis of needs and possibilities; selection of technology components; design of new technologies; organizational application (Sanoff, (2007). Participatory design is still developing and consequently its research design, tools and techniques tend to be flexible; nevertheless, three basic stages are present in almost all participatory design research (Spinuzzi, 2004). These three stages will be implemented in this study.

Firstly, the "Preliminary exploration of work" stage: In this stage, the researcher will observe the workplace and familiarize himself with the ways and conditions in which the users work together. This will include the use of many methods: users' observations, open-ended questionnaires, on-site observation, document analysis and interviews with the technological specialists (i.e. IT specialists, application designers, etc.) and developers. Members who are working as consultants when making decisions regarding distance-learning standards for the materials, workflow and many other design features are mainly experts in the field of Educational Technology and have different levels of authority with regard to their positions in the *Organizational* and *Technological* hierarchy (see the Activity theory, the next section, for more information) will be referred to as the *Developers*. This exploration includes the technologies used, workflow and work procedures, teamwork, and other features of the work.

Secondly, in the "Discovery processes" the researcher and users will employ several techniques to understand and plan for the future workplace. This will allow the researcher and users to clarify the users' goals and values and to agree on the desired outcome of the project. In this stage, the researcher and users will interact most closely, which will typically involve group interactions and individual interviews with the users as a way to not only describe the work but to make meaning out of the work.

Finally, the "Shaping" stage will involve a variety of techniques for iteratively shaping the desired technologies, workflow, work procedures and teamwork. Techniques like scenarios, workshops (with IT designers and developers) and focus groups (with the users) will be iteratively implemented in this stage.

Since most, if not all, studies that use the participatory design approach tend to express the aim of the project/paper as a statement rather than research question, the paper aims to Contribute to the development of suitable distance-learning standards for the Saudi context.

4. The Activity Theory theoretical model to examine the processes of distance-learning standards development:

In a situation that is governed by subjects' interaction in a technological environment, the Activity Theory framework is a valuable tool to understand subjects' activities (Stetsenko and Arievitch, 2010). First generation activity theory (AT) represents activity as a three dimensional process (Figure 1).

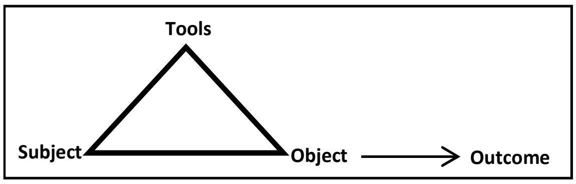

Figure 1: First generation of Activity Theory

It was centred on the theory that tools mediate between the subject and the object. These physical tools and applications are created or changed in the course of an activity. Second generation activity theory (Figure 2) represents activity as an integral process.

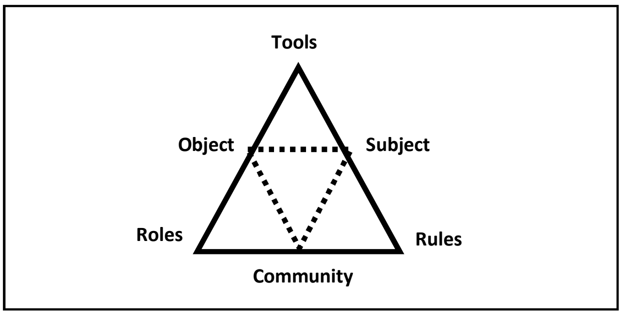

Figure 2: Second generation of Activity

Rules are the condition that governs the activities. Division of labour refers to the organizational roles of the community involved in the activity, based on the elements of the second generation of the AT. Mwanza and Engestrom (2003) suggest eight questions that must be addressed when investigating a system in order to provide an opportunity to identify tensions and contradictions within a single activity system (see Table 1 below).

Table 1

Elements of AT2	Mwanza and Engestrom eight questions
Activity	What sort of activity am I interested in?
Object(ive)	Why is the activity taking place?
Subjects	Who is involved in carrying out the activity?
Tools	By what means are the subjects performing the activity?
Rules	Are there any cultural norms, rules or regulations governing the performance of the activity?
Division of labour	Who are responsible for what, when carrying out activity and how are those roles organized?
Community	What is the environment in which this activity is being carried out?
Outcomes	What is the desired outcome from carrying out this activity?

The third generation 3rd AT represents interrelated activity and integrates the notion of boundary objects that operate at the edge of many contexts or activity systems (Edwards, 2005) (see figure 3).

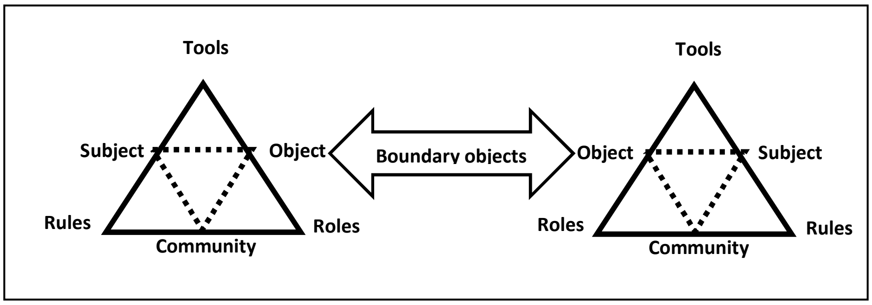

Figure 3: Third generation of Activity Theory

The 3rd AT signifies the contradictions and tensions between activity systems when they come into contact (Engestrom, 2001). Hence, 3rd AT became able to build better understanding of what happens if activity systems come into contact. In this sense, it will provide a broader exploration that helps to understand and develop the activity of many systems that are working together as the case of human-computer interaction in distance learning. The use of the 3rd AT has proved to be a successful model for examining processes that are related to human-computer interaction (Prenkert, 2006). It is therefore the most suitable model for examining processes of distance-learning standards development. This model will provide an incorporated interpretation that encompasses three different activity systems (organizational activity system, technological activity system and pedagogical activity system), as each of these activity contexts/systems will have its own activity's elements that are connected by their boundary objects. In this case, the power relationship between these three systems must be taken into consideration as it plays a key role in interpreting the results data (Jochems et al., 2004).

In order to understand the activity under scrutiny, the shared object - where the three activity systems are connected - and the elements of each activity system must be defined and the position of each activity system in the power relationship must be allocated. In this study, the shared object is distance learning that meets the national demands which will be the denominator between the three activity systems. The organizational activity system will be on the top level of the power structure as it has overall control of the distance-learning organization and resources. It also holds the decision-making power to decide the final outcomes of the other sections. The technological activity system will come next in the power structure as it provides a link between the organizational and pedagogical systems. It works as an implementer that facilitates the implementation of orders from the top level and raises concerns or needs from the lower level (pedagogical activity system). Finally, the pedagogical activity system is the lowest of the aforementioned activity systems in the power structure. In the table below, elements of the activity systems with regards to the three different activities are demonstrated:

Table 2

The elements	Organizational activity system	Technological activity system	Pedagogical activity system
Activity	Distance learning	Distance learning	Distance learning
Object(ive)	Distance learning that meets the national demands	Distance learning that meets the national demands	Distance learning that meets the national demands
Subjects	-Dean -Board members -Departmental managers -Developers	-Developers -Programmers -Designers -Support staff	-Teachers -Students -Consolers -Support staff
Tools	-Control over a variety of resources	-IT software and hardware	-Curriculum -Human intellectual resources -Teaching/Learning resources
Rules	- Government rules, policies and agendas	-Operational standards - Accessibility standards - Content standards	- The organization's desired outcome - Teachers' rules, dispositions - Students' needs
Division of labour	Hierarchical (see subjects' order)	Hierarchical (see subjects 'order)	Hierarchical (see subjects' order)
Community	Executives	Developers	Stakeholders
Outcomes	Future demands of legal, political and social obligations	Future demands of technological needs	The achievement of the desired curriculum outcomes

In light of this, the need to reduce the burden on the pedagogical activity system - people who represent the *Stakeholders* arena with regards to the three participatory arenas (see the previous section for more details) - by empowering its subjects to be actually involved in the decision-making process became a necessity to reflect the needs of the real users who create the national demands (the shared object). Nonetheless, subjects' views from the other two activity systems - people who represent the *Organizational* arena with regards to the three participatory arenas - are required and must be taken into account. This cannot be achieved unless an integrated understanding of the activity is in place by the use of the 3rd AT. The three activity contexts in the paper and their position in the power relation are demonstrated in figure 4 in the next page.

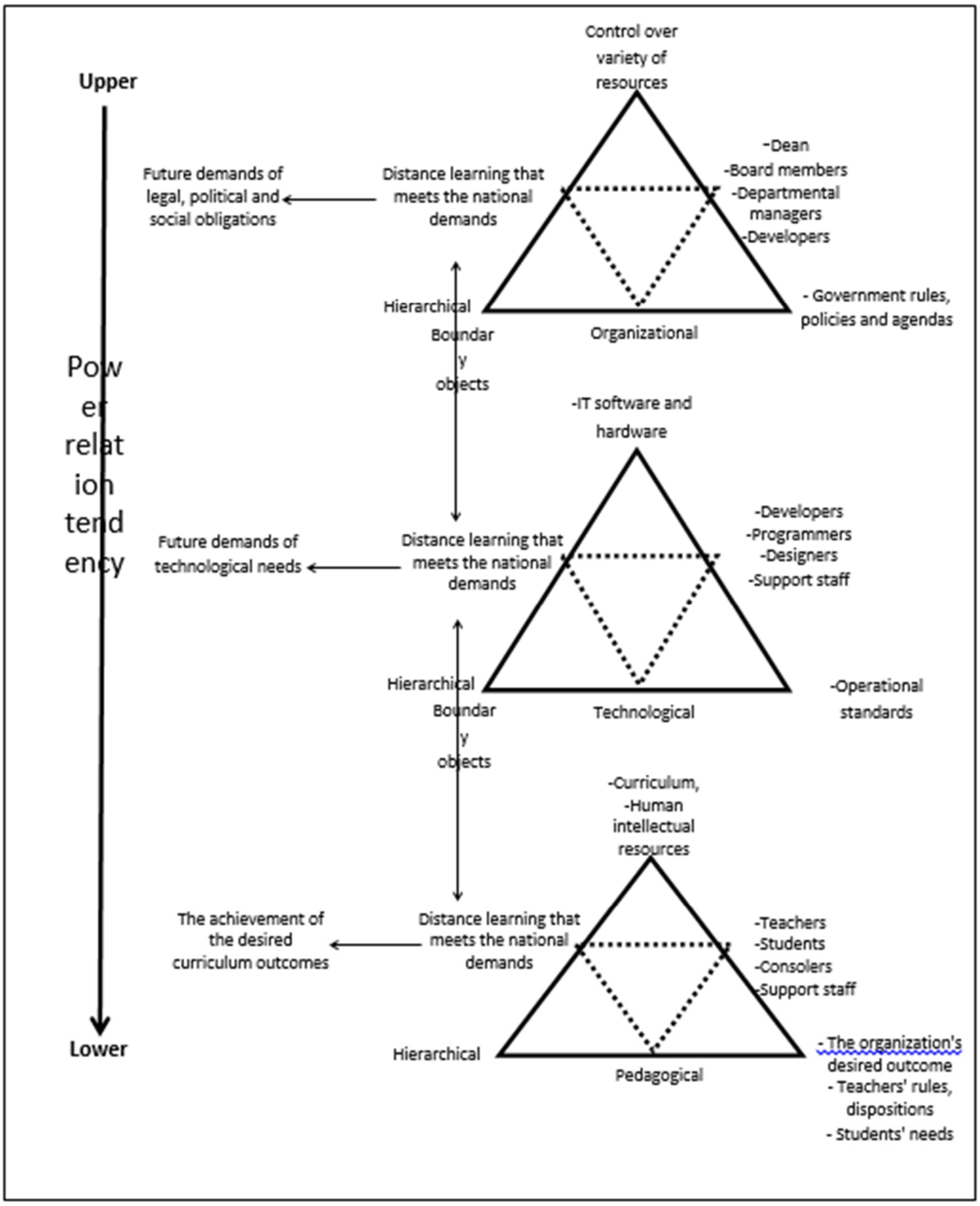

Figure 4: The three activity contexts in the study and their position in the power relation

5. The Sample:

KAU has more than 1200 students enrolled in six different distance-learning programmes with 112 faculty members. Also, 80 members are working as technical staff supporting the ICT components and administrative staff.

This paper puts much emphasis on creating a core team, willing to commit to overseeing the planning process. It is strategic to design this team to include students and faculty members who have the passion to make changes and the commitment to be involved in the participatory process. This is seeking participants who can be a productive source of data. Variables like gender, nationality, cultural heritage and religious beliefs must be represented in the sample (team) as these are key issues in the Saudi community. This can be achieved through the use of Purposive Quota Sampling method (PQS). This team should include at least 10 student participants and 10 faculty member participants to allow the researcher to conduct fruitful group interaction (Stewart et al., 2007).

Those with expertise in both sustainability and organizational content, those familiar with the organizational culture and possible leverage points for change, and IT experts - designers, programmers and developers - are in demand. They will be invited to participate in the paper and recruited by the KAU (the sponsors) as their role will be complementary - in workshops as consultants - to the process and the researcher will have no control in assigning them. Top level managers - with regards to the organization hierarchical structure - will be invited to participate in the paper as external process experts to contribute to the redesigning process to lend it more credibility.

The paper/project will take place at King Abdul-Aziz University (KAU) to represent the Saudi context after several points have been taken into consideration. KAU is the only Saudi distance-learning university that has graduated distance-learning students (University News, 2012). Due to the nature of distance learning, this paper's sample will consist of students, faculty members and developers from KAU who are currently involved in distance-learning activities at the university, which has more than five branches around the country. This offers an actual and integrated experience that reflects the perception of Saudi students, as students enrolled in distance-learning programmes at KAU are from around the country. This will be taken into account when sampling (see sampling for more details). In addition, developers who work in KAU contribute to many other universities around the country, in designing curriculums and courses, as experts and consultants. Accordingly, the participants involved will provide an adequate perception of the whole Saudi experience as it offers an assumed link between the macro level (Saudi distance-learning universities) and the micro level (KAU) (Gomm, Hammersley and Foster, 2000). This link expands to the extent that all universities in Saudi Arabia are working under the umbrella of the MHE and are governed by the same policies and rules.

6. Significance of the paper:

This paper will provide a measurement of Saudi students’ levels of satisfaction with distance-learning quality standards. It will also provide a similar measurement regarding faculty. Moreover, it will give university authorities the opportunity to revise their decisions in light of the users' perceptions (faculty members and students) and, at the same time, it will shed light on new distance-learning standards and best practices to be considered by the policymakers in the country. In addition, this paper will draw an outline for further studies in the field of distance learning that are interested in the development of distance-learning standards. Finally, the paper will offer ways to help to improve methods of investigating standards regionally by adopting a participatory design approach to redesign rules/standards that are created by bureaucratic systems.

7. Ethical issues:

Several measures will be put in place to ensure that the participants will have a safe space to discuss issues related to other stakeholders (including the researcher), especially those who are in a higher position in the power structure amongst stakeholders. While student and faculty members will act as the steering committee in the participatory design, they will be treated as distinct groups; faculty members and student focus group interviews will be conducted separately. There will be no face-to-face interaction between the researcher and the participants; all types of interaction that require immediate response will be conducted through secured a synchronous application program, as emotions and face expressions in these types of topics are not significant. The researcher is an expert in developing educational application programs and holds a Bachelor's degree in computer science in education; his Master's was in the development of educational programs for secondary students. He will therefore act as a facilitator/representative and initiate liaison channels between the three types of participants with regards to authority/power – organizational, technological and student/faculty participants (see the Activity theory section for more details) on the design workshops that require face-to-face interaction with the organizational and technological participants. After obtaining consent from the participants - in the case of student and faculty member participants - they will be anonymous to the researcher and will be identified as codes to indicate only the significant variables that are necessary for analysis purposes but with no information that may enable the researcher to identify the participants (i.e. gender, student/teacher).

8. Conclusion:

The introduction of distance learning as an alternative mode of delivering education in Saudi Arabia has triggered many challenges concerning the implemented distance-learning standards in the country. The implemented standards have, in most respects, copied western standards with no consideration of the Saudi educational environment and the country's cultural heritage and religious beliefs. Such standards have proven unsuitable when it comes to the expectations and needs of the recipients of Saudi distance learning. The use of participatory design offers great potential in reforming such standards by involving distance-learning stakeholders (administrators, IT specialists, faculty members and students) in Saudi Arabia to actively work towards the development of suitable distance-learning standards and best practices for the Saudi context. Although the use of the participatory approach in the development of suitable distance-learning standards for the Saudi context seems to provide a channel for dialogue between authorities and consumers of distance learning in the country, the procedures and complications of opening such a channel must be carefully considered. The third generation of the activity theory offers a flexible analytical tool that facilitates productive dialogue among participants (the stakeholders) based around a shared objective (the development of suitable distance-learning standards for the Saudi context) and takes into account power relationships among participants. A meaningful reformation of the existing distance-learning standards in the country will be possible if distance-learning stakeholders are able to participate collaboratively in a carefully designed environment that facilitates such participation.

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Making ethics count in Construction Organizations: An approach for measuring ethical codes implementation

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Abstract

Setting measurable criteria for implementing ethical codes is a pivotal issue in construction organizations. This study presents an approach for evaluating ethical codes implementation within construction companies based on 30 indicators for effective implementation of codes of ethics, with the objective of advancing ethics in construction organizations. A theoretical model was developed using existing classification in literature including six processes of ethical codes implementation including process of: identification and removal of barriers IRB, coding, internalization, enacting values, monitoring, and accountability. The model was validated with the aid of Partial Least Square-Structural Equation Modeling (PLS-SEM) estimation approach, using data collected from practitioners in construction organizations in Hong Kong, with the aid of questionnaire survey. Fuzzy Synthetic Evaluation (FSE) analysis was adopted to assess the level of six processes of ethical code implementation. The results show that the model has a substantial predictive power and satisfactory model representation, with the process of 'enacting value' having the greatest influence on 'ethical code implementation'. The results of FSE indicate that the overall level of implementation of ethical codes is equally high based on the results but there are rooms for further improvement. Construction practitioners and managers can benefit from the findings of this study by applying the model to assess ethical codes implementation within the organization in order to enhance ethical behaviour. The approach used in this study can be replicated in other countries.

Keywords:

Ethical Codes, Construction organizations, Hong Kong, Implementation, PLS-SEM

1. Introduction

The ever-growing demands for a reputable construction industry require a dynamic approach to creating a formidable professional environment. The expectation of this kind of environment can only be met by strict compliance with corporate codes of ethics (Ohrn, 2002) and by setting a standard for ethical behaviour (Kleiman, 2013). The claim that ethical codes can reshape construction environment is gaining more recognition nowadays. For instance, due to incessant unethical conduct within the construction industry in Hong Kong, codes of ethics soon became a requirement for contractors to tender for government works (Ho et al., 2004). Similarly in the USA, codes of ethics has become a necessary commodity for all registered organizations which is evidenced from the efforts of some construction institutions such as Construction Management Association of America and American Institute of Constructors (Ohrn, 2002).

Worrisome but not surprising, whenever the construction industry is compared with the concepts of ethics, the result will trigger a reminder of bad reputation (Rapoport, 2013). This is due to alarming rate of reports regarding ethical issues in the industry. Common reports of unethical practices are related to bribery, abuse of client and company resources, favouritism, discrimination and harassment (Kang and Shahary, 2013). According to Adnan et al. (2012), most of the blame emanating from unethical conduct are often attributed to the main contractors as key players in the industry. Kleiman (2013) asserts that contractors can play an active role to solve ethical issues in the industry by training managers to become leading examples and by characterizing the company's ethical expectation which will eventually reflect on the industry's reputation as a whole. Therefore, it is imperative to address ethical issues at company's level.

Although efforts are being made to implement codes of ethics in construction organizations, corporate management of some organizations adopted a laissez-faire approach in implementing their corporate codes (Ho et al., 2004). Thus, setting measurable criteria for implementing ethical codes is a pivotal issue in construction organizations because it will enable construction companies to be ethic-minded rather than being blindsided. This study offers a much-needed synchronized perspective on this critical issue by presenting an approach for measuring implementation processes by adopting the process assessment approach method (PAAM) for measuring codes of conduct, illustrated by Nijhof et al. (2003). The framework includes thirty indicators extracted through a critical review of literature. In this study therefore, the processes of implementing codes of ethics and how to measure the extent of ethical code implementation are demonstrated. The study begins with a brief review of past studies, followed by the methodology adopted for analytical purpose and the findings from the results of the analysis are presented. The article concludes with suggestions for future research. The framework is useful for construction organizations willing to assess their ethical performance with respect to ethical codes implementation.

2. Review of previous studies

2.1. Implementation of codes of ethics

Codes of ethics in this study refer to corporate document that guides moral standards and influence the behaviours of company's employees and other stakeholders within construction organizations. There are two terms to describe the management of ethical codes within an organization according to McCabe et al. (1996): 1. "implementation" of ethical codes referring to *the extent to which an organization attempts to communicate its code to employees and ensure compliance* and 2. "embeddedness" of ethical codes, describing *the degree to which the code is integrated into the organization's culture*. Both the implementation and embeddedness as described here connote what is expected of an organization in the attempt to ensure that ethical expectation is properly met within a company. According to Kaptein and Schwartz (2008), implementation process of the codes of ethics determines the extent to which the conduct of management and employees is steered by ethical codes. Although codes cannot be effective unless distributed to employees (Weaver et al., 1999), the distribution alone is not sufficient because there is no certainty that the employees will read it (Kaptein and Schwartz, 2008).

A number of studies on the implementation of codes of ethics in Hong Kong have been reported in literature (Snell et al., 1999, Snell and Herndon, 2000, Snell and Herndon, 2004), using several firms across diverse sectors of the economy. The studies conclude that code adoption did not translate into any significant improvement in conduct, even some times after the adoption of codes. In line with this, Ho et al. (2004) point out that the failure of the code in influencing ethical conduct is inherent in the way and manner of implementing the code especially within construction organizations in Hong Kong. Ho (2010) reveals that few studies about codes of ethics focus more on creation, adoption and content of codes while the implementation aspect seems to be neglected. Meanwhile, according to Ho (2011), the existence of a corporate code is no longer sufficient to steer ethical conduct within construction organization.

A case study by Ho (2013) on implementation of ethical codes within construction organization in Hong Kong makes it clear that communication is an important tool to ensure effective implementation of ethical codes, this is supported by Kleiman (2013). Other instruments include the use of ethics ombudsman (Mathenge, 2012), the use of ethics committee, regular ethical audits (Suen et al., 2007), protecting whistleblowers (Lloyd and Mey, 2010) etc. In a nutshell, a recent study by Oladinrin and Ho (2014e) on strategies for improving ethical code implementation summarizes all the activities which steer effective implementation of codes and describes them as 'enablers for code implementation' in line with Nijhof et al. (2003) instrument. The strategies contain thirty items which must be complied with in the process of implementing codes of ethics within an organization.

Furthermore, a framework was developed by Oladinrin and Ho (2014a) incorporating all the enablers and six processes of code implementation. There are six sectors in the circle representing six processes of implementation. All the activities necessary to achieve each process of implementation are linked with their respective organization enablers (Leadership, Policy and strategy, Employees, Partnership and Resources, Process) based on EFQM classifications. The framework accounts for the basic components that contribute to success of code implementation within an organization as well as the processes for ensuring effective integration of the ethical codes enablers. The division of the processes in a certain respect is artificial because the processes are closely connected to each other. However, the application of each division has a considerable added value. Each of these processes separately contributes considerably to stimulating responsible behaviour.

2.2. **Measuring the implementation process of codes of ethics**

Helin and Sandström (2007) argue that the process of implementing codes of ethics is highly complex. In as much as this argument is true, it is important to note that the effect of codes of ethics on the conduct of individual and organization depends on "implementation strength" of the code (McCabe et al., 1996). This strength can be determined by measuring the extent of implementing the supporting instruments or indicators that aids code implementation within an organization. Unfortunately, studies focusing on the outcome of ethical codes are far more than those focusing on process (Montoya and Richard, 1994), such as ethical code implementation process (Oladinrin and Ho, 2014a). Although Nijhof et al. (2003) propose an approach for measuring ethical codes implementation, the approach was validated by a case study with less application of statistical tools. A study conducted in the US, on behalf of the Ethics Resource Centre reveals that most organizations lack approach for measuring code effectiveness (Kaye, 1992). Although some organizations claim to be implementing codes (McCabe et al., 1996), empirical support for measuring the extent of such implementation is lacking in construction research.

Webley (1988) found that many companies cannot sustain the code shortly after adoption. This is as a result of laxity in complying with code process (Sethi, 2002). Therefore, Nijhof et al. (2003) argue that if an organization wishes the codes of ethics to be rooted in its daily routine, it is important to give shape to, and manage the processes of implementation. Kaptein and Schwartz

(2008) argue for the needs to have a model for measuring effectiveness of ethical codes because of several mediating factors involved. In the same way, the current study argues for, and proposes a framework for measuring ethical codes implementation process within construction organizations. The factors depicted in the framework (Oladinrin and Ho, 2014a) represent the indicators to be measured as expected of any responsible organization willing to have a successful code implementation. For clarity purpose, the enablers associated with each process are numbered accordingly starting from the process of identifying and removing barrier (IRB) with the items tagged as "1" (i.e. LD1, PS1, PE1, PR1 and PP1), in the measurement model. For the coding process, tag "2" was assigned to all its enablers (i.e. LD2, PS2….PP2). The same procedure is applicable to other processes as hypothesized in Figure 1. The main task is to test whether the indicators for the enablers can substantiate the six processes and to test the influence of the processes (H_1-H_6) on ethical codes implementation. Although the complexity of measuring code implementation process is undeniable, this study proposes a reductionist view of the process so that the enablers' indicators could be understood completely in terms of the processes they are composed of.

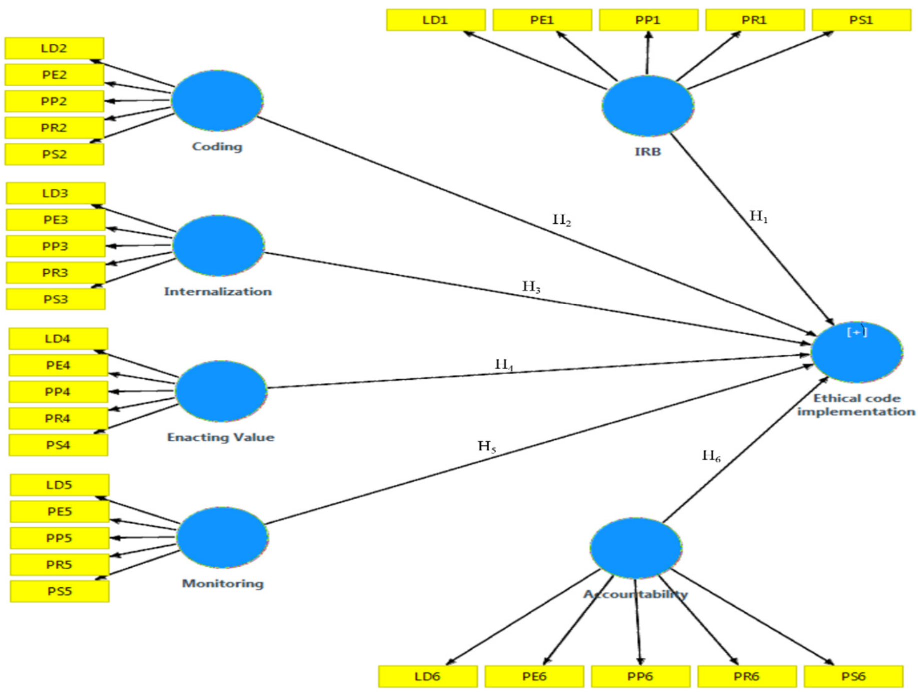

Figure 1. Hypothetical model for PLS-SEM analysis

3. Research methods

3.1. Questionnaire design

The use of questionnaire survey is considered suitable for this study because it has been used in similar research (Beeri et al., 2013, Majluf and Navarrete, 2011, Svensson et al., 2009). The questionnaire consisted of 30 variables previously developed on the basis of a review of the related literature contained in the framework by Oladinrin and Ho (2014a). There are two sets of questionnaires. For the first set, the indicators were represented by statements in the questionnaire and all the statements are in turn rated on a five-point Likert-type scale with points 1 and 5 representing strongly disagree and strongly agree, respectively (Doloi, 2009). This set was launched to solicit opinions of practitioners regarding their agreement on the 30 items included in the framework. The second set targeted construction companies in Hong Kong and was launched to determine the significance of the enablers regarding codes of ethics implementation, using five-point Likert-type scale ranging from 1 to 5, representing highly insignificant and highly significant respectively.

3.2. Participants and Procedures

Before embarking on organization-wide survey, a pilot study was conducted in one Construction Company in Hong Kong in order to validate the content of the questionnaire. The questionnaires were distributed and collected personally by the researchers due to the sensitivity of ethical issue (Beeri et al., 2013) and the increased response rate identified with personal delivery and collection methods (Ki et al., 2012). However, the participants were assured of the anonymity of the information provided.

For the first round of questionnaire survey, 260 questionnaires were administered to practitioners within construction companies in Hong Kong, out of which 176 were returned, representing 68% overall response rate which was considered satisfactory because it is more than the recommended minimum response rate of 30% of 107 questionnaires (Fellows and Liu, 2009). After the removal of outliers and missing values due to incomplete data, 166 completed questionnaires were deemed valid for analysis. For the second set of questionnaire, 100 questionnaires were sent to different construction organizations. In total, 53 questionnaires were returned after a thorough follow-up. It was believed that the questionnaire data is a reflection of the practices attainable in the respondents' organizations.

4. Data analysis and results

4.1. Partial Least Square - Structural Equation Modeling (PLS-SEM)

PLS has been adopted in various construction management related studies for statistical analysis (Memon et al., 2014, Rahman et al., 2013, Aibinu and Al-Lawati, 2010, Le et al., 2014). This is due to some of the advantages of PLS path modeling over conventional SEM with covariance analysis which include: minimal assumptions regarding population or statistical distributions of data sets is required (Henseler and Sarstedt, 2013); minimum sample size as small as 30 is sufficient (Wixom and Watson, 2001); more appropriate when dealing with real world applications and complex models (Wu, 2010). Enegbuma et al. (2014) assert that PLS path modeling is prevalent in strategic management research, a technique that is theory driven (Lauria and Duchessi, 2007), involving a systematic and sequential procedure in evaluating theoretical model (Rahman et al., 2013). Since this study describes a strategic approach to implementation of codes of ethics in construction organizations based on theoretical framework, PLS is adopted, using Smart PLS 3.0 software package for the analysis. There are two steps in PLS path modeling evaluation: the structural (inner) model and measurement (outer) model (Henseler and Sarstedt, 2013, Memon et al., 2013). This study is guided by these two steps.

4.2. **Analysis and results of PLS-SEM**

4.2.1. Measurement (outer) model

To ensure a satisfactory level of reliability and validity of a model, three common tests need to be conducted (Mohamed, 2002). First, the individual item reliability which is measured by the loadings or simple correlations of the observed indicators (manifest variables) on their respective latent constructs must be examined. Using 0.50 as a cutoff point (Chin, 1998), all the loadings are above the cutoff value ranging from 0.647-0.849 as shown in Table 1. Second measurement property is the composite reliability (CR) which is used to check the extent to which a latent construct is measured by its observed indicators. Composite reliability has the same interpretation as Cronbach's Alpha and the value of CR must be greater than 0.7 (Lowry and Gaskin, 2014). The composite reliability values ranging from 0.840-0.888 (Table 1) and the coefficient of reliability measured by Cronbachs Alpha values which must also be higher than 0.7 (Rahman et al., 2013) ranging from 0.765-0.842, show a satisfactory level of internal consistency.

Table 1: Construct and discriminant validity

	AVE	CR	Cronbachs Alpha	IRB	Coding	Internalization	Enacting Value	Monitoring	Accountability
LD1	0.561	0.865	0.804	0.788	0.519	0.386	0.331	0.303	0.297
PE1				0.743	0.517	0.357	0.258	0.266	0.250
PP1				0.722	0.537	0.503	0.365	0.336	0.406
PR1				0.746	0.478	0.335	0.356	0.285	0.362
PS1				0.744	0.513	0.408	0.301	0.263	0.230
LD2	0.572	0.869	0.811	0.578	0.723	0.556	0.406	0.391	0.479
PE2				0.512	0.833	0.589	0.297	0.407	0.450
PP2				0.610	0.804	0.552	0.427	0.480	0.489
PR2				0.461	0.758	0.581	0.380	0.470	0.472
PS2				0.408	0.649	0.379	0.282	0.321	0.259
LD3	0.614	0.888	0.842	0.423	0.635	0.792	0.463	0.524	0.493
PE3				0.362	0.491	0.806	0.511	0.527	0.600
PP3				0.372	0.484	0.690	0.599	0.496	0.517
PR3				0.474	0.539	0.771	0.461	0.500	0.580
PS3				0.473	0.629	0.849	0.497	0.528	0.559
LD4	0.515	0.841	0.765	0.356	0.443	0.553	0.727	0.468	0.567
PE4				0.358	0.303	0.420	0.647	0.433	0.452
PP4				0.238	0.301	0.431	0.748	0.592	0.545
PR4				0.280	0.294	0.447	0.767	0.573	0.491
PS4				0.306	0.347	0.414	0.693	0.559	0.472

	AVE	CR	Cronbachs Alpha	IRB	Coding	Internalization	Enacting Value	Monitoring	Accountability
LD5	0.610	0.886	0.839	0.331	0.444	0.561	0.577	0.747	0.492
PE5				0.313	0.488	0.489	0.577	0.811	0.587
PP5				0.307	0.486	0.631	0.624	0.840	0.602
PR5				0.278	0.273	0.399	0.575	0.718	0.506
PS5				0.300	0.461	0.467	0.488	0.782	0.523
LD6	0.587	0.877	0.824	0.493	0.539	0.607	0.524	0.565	0.726
PE6				0.169	0.353	0.460	0.518	0.494	0.764
PP6				0.208	0.362	0.479	0.549	0.524	0.750
PR6				0.293	0.417	0.511	0.482	0.505	0.773
PS6				0.422	0.547	0.620	0.639	0.581	0.815

Average Variance Extracted (AVE) measures the internal consistency of the construct to show the amount of variance that a latent construct captures from its observed items, relative to the amount of variance imputed by measurement errors (Fornell and Larcker, 1981). The value for AVE must be higher than 0.50 as stated by Hair et al. (2011). The AVE value for each of the constructs is above the threshold as listed in Table 1. This implies that more than half of the measured items' variances are accounted for by the observed items while less than half of the variances are due to measurement error.

The third test is the discriminant validity which indicates the extent to which a particular construct differs from other constructs in the model (Hulland, 1999). Discriminant validity of the indicators in this study were further determined by correlating the latent variable scores against the observed indicators (cross-loading) as illustrated by Lowry and Gaskin (2014). The general rule for this technique is that the loading of an indicator should be greater for the latent construct to which it was theoretically assigned than for any other latent construct in the model. Adequacy of discriminant validity is determined using a threshold of 0.100 for cross-loading differences, meaning that the difference between a given indicator under its assigned construct and its loading with other latent construct must exceed 0.100 (Lowry and Gaskin, 2014). This is demonstrated as shown in Table 1 in which all the observed variables are correlated against the latent constructs. The result shows that all the indicators loaded strongly with their parent construct than any other constructs. Having evaluated the measurement model, it can be concluded that the constructs achieved a considerable reliability and validity. The next step is to proceed to the evaluation of structural model.

4.2.2. Structural (inner) model

Inner model measures the structural relationship between latent or unobserved constructs by testing the research hypotheses so as to assess the model's predictive power. The hypotheses in this study set to determine the influence of each established process on ethical code implementation (H_1 – H_6) by examining the coefficient of determination (R^2) and the structural path coefficients. The level of significance was determined by bootstrapping technique using SmartPLS 3.0. This is demonstrated in Figure 2 in which four out of the six hypotheses (paths) were supported (significant) in accordance with the predicted/hypothesized directions (+) as presented in Table 2. The paths linking process of 'identifying and removing barriers' (H_1), 'coding' (H_2), 'internalization' (H_3), 'enacting value' (H_4) and 'accountability' (H_6) to 'ethical code implementation' (dependent variable) are positive and statistically significant (p <0.1). The path between 'enacting value' (observed construct) and 'ethical code implementation' (dependent construct) has the highest significant value (0.232; p<0.1) which indicates that ethical code implementation within construction organizations is greatly influenced by the process of enacting value. However, the expected influence of process of 'coding' (H_2) and 'monitoring' (H_5) were not supported, as 'coding' and 'monitoring' constructs were not significantly related to ethical code implementation. Despite the insignificant relationship, the two constructs agreed with the hypothesized direction (+) which implies that higher integration of coding and monitoring processes are associated with less positive ethical code implementation.

Table 2: Summary of path coefficients and significance levels

Paths	Path coefficient	T Statistics	P Values	Inference
IRB -> ECI (H_1)	+0.182	2.261*	0.024	Supported
Coding -> ECI (H_2)	+0.050	0.476	0.634	Not supported
Internalization -> ECI (H_3)	+0.229	2.207*	0.028	Supported
Enacting Value -> ECI (H_4)	+0.232	2.596*	0.010	Supported
Monitoring -> ECI (H_5)	+0.052	0.510	0.610	Not supported
Accountability -> ECI (H_6)	+0.202	1.792*	0.074	Supported

*indicates significant paths p<0.1 *Note: ECI = Ethical codes implementation*

The R^2 value of the latent construct for the inner model is 0.605 which indicates that the regression of the six independent latent constructs (processes) is substantially high, explaining about 61% of the variance in ethical code implementation. On the whole, the combination of all the six processes has predictive ability for 61% of ethical code implementation in construction organization. Following Cohen (1988) recommendation, R^2 is considered as being substantial at the value of 0.26, moderate for 0.13 and weak for 0.02, thus, the model in this study has a highly substantial satisfactory level. Also, with the statistical significance of the overall model, it can be concluded that the model signifies excellent predictive power.

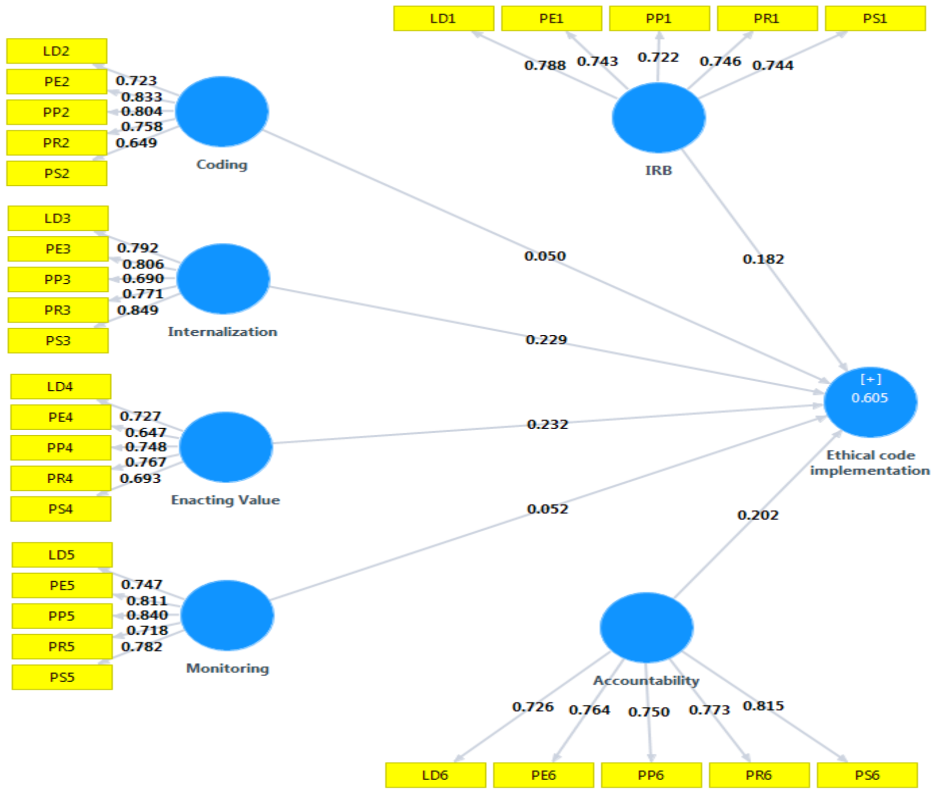

Figure 2. Validating the results of theoretical model

4.3. Fuzzy Synthetic Evaluation (FSE) method

Fuzzy concept has its origin in mathematics and is used to analyze problems characterized with uncertainty and imprecise definition (Li et al., 2013), to explain vagueness inherent in human cognitive process (Chan et al., 2009), and to address complex problems arising from imprecise nature of information within the real world system (Baloi and Price, 2003). The application of fuzzy techniques in construction management studies is becoming more prominent (Chan et al., 2014). For instance, FSE was used to evaluate; performance measurement (Yeung et al., 2011), model procurement selection for construction projects (Chan, 2007), risk factors in public–private partnership water supply projects in developing countries (Ameyaw and Chan, 2015), stakeholder satisfaction in construction projects (Li et al., 2013). FSE has been used in similar corporate ethics research (Sacconi, 2003). Due to vagueness and sensitivity of ethics in construction industry, the six processes of code implementation were selected for undertaking FSE analysis in order to determine the level of their implementation within construction organizations in Hong Kong.

4.4. Results of FSE analysis

Basically, there are three levels involved in FSE model. The analysis starts from level 3 which represents the membership functions (MFs) of the enablers, level 2 denotes MFs of the processes. Level 1 presents MF of overall implementation level. From the initial grouping, there are six processes of code implementation, having five enablers each with each set of enablers (level 3) forming the input variables for their associated process to arrive at level 2. The six processes in turn form the input variables for overall implementation. A full discussion of this analysis is outside the scope of this paper (interested reader can contact the authors). However, the final analysis of the processes, enablers and the implications of those indicators is presented to describe the extent of ethical codes implementation within construction organizations in Hong Kong.

To represent the result of implementation processes in a linguistic form, the following interpretation is adopted (Li et al., 2013):

(i) 'very low' ($IL \leq 1.50$); (ii) 'low' ($1.51 \leq IL \leq 2.50$); (iii) 'average' ($2.51 \leq IL \leq 3.50$); (iv) 'high' ($3.51 \leq IL \leq 4.50$); and (v) 'very high' ($IL \geq 4.51$), where IL is the implementation level of the processes (Table 3). The results show that the process of 'coding' ranked highest (3.80) in terms of implementation level, meaning that construction companies in Hong Kong embrace the practice of translating people's behaviours to match organization's ethical standard and target values. This is in relation with findings of Snell et al. (1999) that most business organizations in Hong Kong are actively involved in activities towards transforming their employees' ethical behaviour via the instrumentation of codes of ethics. Nijhof et al. (2003) found this aspect of code implementation process as second most relevant within the reported case study, the result which reveals a significant improvement in employees behaviour as a result of effort in implementing ethical codes. In essence, despite the insignificance influence (Table 2), the process of coding is prominent in terms of ethical code implementation within construction organizations in Hong Kong. The next one is the process of 'IRB' (identifying and removing barriers) which ranked second (3.77) which implies that the attention given to the 'IRB' process by construction companies is above average. The result is similar to Nijhof et al. (2003) in which the process ranked third in the case-organization. The process of 'accountability' ranked third (3.72) indicating that construction organizations do communicate their intention to be ethical to their stakeholders. Contrary to the findings in this study, Nijhof et al. (2003) found that process of accountability received the least attention in the case-organization in the attempt to implement codes of ethics. However, the internalization of such intention is lower than the expression of the intention itself, as the process of 'internalization' ranked fourth (3.64) which simply means that construction companies though appear to be ethically accountable, do not necessarily encourage employees to act in accordance with the content of ethical codes. On the contrary, Nijhof et al. (2003) found that the process of internalization received the greatest attention in the case-organization as it ranked first among the six processes of code implementation. The processes of 'monitoring' (i.e. checkmating employees behaviour against ethical codes) and 'enacting values' (i.e. making organizational ethical values explicit by weighing them) with implementation of 3.58 and 3.57 respectively, are slightly above average within construction companies in Hong Kong. Thus, these two processes require more attention within construction companies in the effort of acquiring ethical organizations. In total, overall implementation of codes of ethics within construction organizations in Hong Kong is relatively high (3.68) with significant room for improvement. In contrast, despite the adoption of codes of ethics in most of the construction organizations in Hong Kong, Ho et al. (2004) argue that reports of unethical behaviour seem to be increasing. This reflects an advancement and improvement in ethical practice within construction companies in Hong Kong over the last decade.

Table 3: Interpretation and ranking of the processes

Processes	Implementation level	Linguistic	Rank
Coding	3.80	High	1

IRB	3.77	High	2
Accountability	3.72	High	3
Internalization	3.64	High	4
Monitoring	3.58	High	5
Enacting values	3.57	High	6
Overall implementation	3.68	High	-

5. Conclusions

This study presented a model for assessing codes of ethics in construction organizations which was validated and evaluated. The model will enhance the understanding of construction practitioners on successful implementation and measuring the level of implementation of codes of ethics. Adopting fuzzy set theory, this study has equally demonstrated how to measure the extent of ethical code implementation within construction organizations. Looking at the six processes of ethical codes implementation, it can be seen that construction companies seem to have embraced the process of *coding, identification and removal of barriers* and *accountability* as they ranked at the top of Table 3 but, there is a limited attention on the last two processes in respect to ethical code implementation which require more attention.

The overall level of code implementation in construction organizations is considered relatively high leaving enough rooms for further improvement. However, the six processes concisely represent the key processes of integrating codes of ethics into the web of construction organizations and are believed to be capable of facilitating ethical behaviour if properly implemented. Although the measurement of the extent of implementation demonstrated in this study incorporates data from different construction companies, the framework can be used to measure code implementation within a single organization by following the same procedure as illustrated in this study.

Because the indicators for each enabler were identified through a literature review, there is possibility of having different descriptions for the same factors from different authors. The response to the self-assessment questionnaire used for measuring the extent of implementation is relatively low but it was adequate for statistical analyses. The essence of doing this is to test the model for the purpose of self-evaluation of construction organizations regarding codes implementation. Thus, the outcomes are not representative enough for the entire construction organizations in Hong Kong. However, the framework was used to demonstrate how to reflect the strengths and weaknesses of construction companies in Hong Kong with respects to ethical code implementation in order to identify areas requiring improvement. Although, this research study was conducted in Hong Kong, the methods used can be replicated in other countries of similar or different nature and the findings can as well be extrapolated because of some generic terms which are likely to be applicable elsewhere. The replication will allow international comparison as well as benchmarking by comparing the level of implementation of codes of ethics across different countries.

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Conceptions of Knowledge and Sharing From the Perspectives of the Libyan ICT SMEs' Employees: The Findings of Open-Ended Questions

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Abstract

Development and rapid changes in business and technology environments have changed the methods and resources which business firms employ to accomplish their aims and make their profits. This, in turn, has paved the way toward the emergence of new concepts such as knowledge sharing. It is a fact that knowledge is now seen as a major source in supporting not only the development of, but also the productivity purposes within, business organizations (including ICT firms). Knowledge is also seen as a major capital resource in achieving competitive advantage and innovation.

In Libya, ICT SMEs are either public or private. The business of these firms has been influenced by the rapid changes in the universal business environment and by the development of the technology sector. In addition, after the Libyan Revolution in 2011 a new trend towards promoting the knowledge economy was promoted by the Minster of Communication and the new government in order to stimulate the ICT sector and to lead the change from the current status of the Libyan economy towards a knowledge economy. In this sense, preparing ICT SMEs' capital resources to tackle such a mission requires an understanding of the meaning of knowledge and sharing as they are conceived by professionals who are working in the targeted firms.

This paper presents the themes which emerged from two open-ended questions concerning the meanings of knowledge and sharing as conceptions. The themes and the sub-themes were drawn from 118 responses that was the total number of received completed valid questionnaires. The findings suggest that the meanings of knowledge and sharing are various. However, in terms of knowledge, the following themes were recognized: the meaning of knowledge, the sources of knowledge, knowledge components, the method of knowledge creation, the condition of knowledge creation and the possible benefits. On the other hand, in order to understand the meaning of sharing, there is a need to understand the context of sharing, the motivation to share, the type of knowledge to be shared, the operation of sharing and its benefits. The extracted sub-themes showed the variations of the conceptions and their related themes. The themes and their sub-themes were compared and discussed with the findings in current related literature. The results suggest intersecting understandings and meanings.

Keywords:

ICT SMEs, Knowledge, Libya, Open-ended questions, Questionnaire, Sharing.

1. Variations in the conceptions of knowledge and sharing

Knowledge and sharing are complex conceptions which have been conceived, interpreted and understood differently in different periods, for example, whereas Drucker (1992) understood knowledge to be a mixture of values, information, people's experiences and perspectives, and contextual information, Sveiby (1997) saw knowledge as gravity; that it is not visible, but observable from its effects. Thus he believed knowledge to be invisible and an intangible asset which cannot be directly observed. The leaders of the organizations, perhaps do not explicitly recognize the importance of knowledge, in contrast to their more visible financial and capital assets. Fernândez-Armesto (1997) stated that knowledge reflects the " true " belief that one is accord with the way in which objects, people, processes and events exist and behave in the real world. However, "Who would know what truth is?" could be a very critical question.

Tsoukas & Vladimirou (2001) defined knowledge as "the judgment of the significance of events and items which comes from a particular context and/or theory" (P.976). It seems that there is a general agreement on the two types of knowledge as expressed by Nonaka (1994). These types of knowledge comprise tacit knowledge which is deeply rooted in action, commitment and involvement within a specific context, and explicit knowledge which can refer to codified knowledge that can be transmitted in formal, systematic and contextual language. O'Dell and Grayson (1998, p. 3) stated that tacit knowledge is that which can be found in the heads of employees, in the experience of customers and in the memories of past vendors. Sveiby (1997) linked the meaning of knowledge to its capacity to act.

Sveiby (1997) was able to identify a type of relationship between knowledge and individuals' behavior which could indicate that a powerful knowledge is one that which allows people to take actions and make decisions. Hunt (2003) linked the meanings of knowledge and people's capability to self-assess whether they do or do not possess some specific knowledge. Hence, Hunt (2003) suggested that, although individuals gain significant knowledge as a result of learning, knowledge remains a hidden power until the person uses that knowledge to do something – to perform some task, to understand something, to make a decision or to solve a problem.

To have a broader understanding of the meaning of sharing, a few dictionaries (e.g. the Oxford, Cambridge, business and online dictionaries) were analysed. Interestingly, it was found that actions such as give, have, use, occupy, or enjoy (something) jointly with another or others, collaborate, provide the meaning of sharing. It can be a noun and, in this sense, it can mean the full or proper portion or part allotted, or belonging to, or contributed, or owed by an individual or group. At the same time, sharing as a noun can involve technology and thus could suggest the meaning of sharing an electronic file or document that can be accessed by specific users on a computer network, for viewing, downloading, or making changes. Terms such as shared values, share ownership, and so on are used in the literature to provide different understandings on the meaning of sharing. For example, Porter and Kramer (2011) identify creating shared value in a business firm as an important idea because shared value can be either political or operational practices that improve the competitiveness and innovation of a business firm while concurrently advancing the economic and social conditions in the communities in which it operates. They added that shared value creation focuses on identifying and expanding the connections between societal and economic progress. This suggests that sharing requires something to be shared and, at the same time, it requires context and the fact that benefits will be acquired from sharing.

This paper provides a critical evaluation of sharing knowledge in ICT companies in Libya.

The paper is structured as follows: firstly the authors discuss the relationship between knowledge and sharing. Secondly, the findings from the responses to the two main open-ended questions and related discussions are presented.

- Articulating the relationship between knowledge and sharing in the context of Information and Communication Technology (ICT) SMEs: the perspective from the literature
- According to Nonaka (1994), due to globalisation and the shift from an information era to a knowledge era (which global markets and business organisations have experienced since the 1990s), the value of knowledge to a business organisation has increased rapidly. Knowledge has become a key asset for business organisations and has paved the way for new theories such as those in the area of knowledge management. Tsoukas (1996) added that the evolvement of the use of information & communication technologies to perform business functions has made modern organisations complex knowledge domains where both tacit and explicit knowledge exist throughout the organisation rather than residing in a single brain or text. Many researchers such as Davenport and Prusak (1998) and Ford (2001) have seen that the processes of knowledge management can be varied. They have emphasised that knowledge sharing is one of the most common processes that business organisations utilise as part of their knowledge management strategy.

Interestingly, Grant (1996) saw knowledge sharing not as one of the main activities of knowledge management but as a key element of the knowledge-based theory of an organization. Grant (1996) believed that the main motivation for the creation of an organisation is its superior ability to transfer and integrate multiple knowledge streams and to apply existing knowledge to future tasks. Ambrosini and Bowman (2001) and Felin and Hesterly (2007) indicated knowledge to be the key driver of an organisation's viability. Maybe this perspective can be supported by the fact that modern business firms consider the creation of unique and original knowledge to be a key strategic asset resource; therefore, knowledge sharing can be seen as a main element of organisational culture rather than one of the activities of knowledge management. Wang and Noe (2010) found that the level of KS (Knowledge Sharing) in Chinese software companies was influenced by an evaluation and reward system implemented by the top management team. Wang and Noe (2010) found that evaluation and evaluation plus reward had a positive relationship with knowledge sharing. Greater levels of knowledge sharing occurred in the evaluation-plus-reward condition compared with the evaluation condition. Wang et al. also discovered that knowledge sharing was influenced by the interaction between evaluation and reward, conscientiousness, neuroticism, and openness to experience.

Regardless of the theory to which knowledge sharing belongs, various studies have been conducted to examine the issues that influence the process of knowledge sharing in a business organisation. Research studies undertaken by researchers such as Hendriks (2004), Lichenstein & Brain (2006) and Al-Alawi et al. (2007) indicate that different elements within the organisational culture in a business can have a significant influence on the process of sharing knowledge. Therefore, an understanding of what those elements are and how they can influence the process of sharing knowledge in business firms is fundamental to controlling any potential obstacles during the process and to enhance best practice. Connelly et al. (2014) stated that employees in organizations face a great dilemma every time a colleague requests knowledge: should they share their knowledge?

From the perspective of Husted and Michailva (2002), knowledge in an organization would not be successfully shared without strong promotional systems that motivate and reward the individuals who practice KS. Hendriks (2004) insisted that motivation and desire to share would not only affect the capability to share, but it also affects the way in which an organisation works to create knowledge. Hendriks (2004) added that the flow of knowledge to be shared in an organisation relies on the collaboration and trust which organization leaders motivate and promote.

2. Methodological choices and data analysis process

Most researchers such as Saunders et al. (2007) and Crotty (2003) agree that research should be divided to include different elements including the philosophical stance (e.g. the epistemological and ontological positions) and the theoretical perspective (including the literature review) in order to select the appropriate methodological approach and data collection methods. The arguments between the schools of thought are based on to what extent researchers should bring in details the value of each element. For example, while the onion research model of Saunders et al. (2007) put forward seven elements that a researcher can utilise to be able to complete the study (philosophies; approaches; strategies; choices; time horizons; techniques and procedures), Crotty (2003) believed that four elements are adequate to help a researcher complete research successfully, and those elements are epistemology; theoretical perspective; methodology and method. From the perspective of the authors of this paper, the detailed model of Saunders et al. (2009) is more convenient especially for the first time researcher who needs clear guidelines to direct them carefully through the research journey. Such details would become less important when the researcher becomes more expert in carrying out research studies. Thus selecting the appropriate research model should take on board to what extent the researcher is expert in undertaking research.

Accordingly, in order to complete the research study successfully they are required to understand their philosophical perspectives of their research. According to Bryman (2008), there are three main philosophical perspectives which should be taken in consideration before making any decisions: these are ontology, epistemology and axiology.

Ontology philosophy refers to the formations of reality. In this sense, it is the art of being and the focus will be on “the study of what is” (Bryman and Bell, 2003). Epistemology philosophy: the most common understanding of epistemology as a philosophy is when it refers to what should be examined as acceptable knowledge (Bryman, 2008). Axiology philosophy goes back to Greek word ‘Axio’ which means ‘worthy’ and symbols meaning “science”. From the perspective of axiology, the main aim is to explain what researcher values go into it and the assumptions that are concerned with the value systems Miles and Huberman, 1994).

Researcher should identify those perspectives to help him or her decide if the research strategy is intending to be qualitative, qualitative or mixed According to Saunders et al. (2007) research approach can be either deductive or inductive. Gorman &Clayton (2005) agreed with Saunders et al. (2007) and stressed that the deductive approach requires starting with a theory (questions, hypothesis); they tend to be predictive as they start collecting evidence. Therefore, they are likely to rely on the deductive approach. On the other hand, the qualitative approach utilises an inductive approach. Researchers using this approach tend to be more interpretive, beginning with the evidence and then building up a theory based on it. Creswell (2009) suggested that, although each approach can be used to answer specific questions and to investigate the phenomenon from a different angle, each one of these approaches has different biases and he suggested that using a mixed research methods’ approach can help the researcher reduce the possible biases of each approach. Denscombe (2010) identified five different types of qualitative research strategies. These are: action research, grounded theory, ethnography, phenomenology and case study, and he added that each one has its own purpose.

Case study according to Yin (2009) is "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (P.18). He added that case study as a research strategy allows the researcher takes the position of either qualitative or quantitative or both approaches at the same time because data collection methods can be applied in varied ways to assist the researcher collect the required information. So, questionnaire, interviews, observation or any other data collection methods can be used in the case study research context based on the purpose of the study.

In the main study, the authors used a case study research strategy utlising Libyan ICT companies as cases. Within the case studies three different data collection methods were used, a questionnaire (using closed and open-ended questions), semi-structured interviews and document analysis. Table 1 demonstrates the number of distributed questionnaires, the number of responses received and the type of organizations.

Table 1: The total number of questionnaires distributed in Libyan ICT firms

Firm	Type of organization	Total number sent	Total number received
LTT	Public	150	33
AL-Madaer	Public	150	68
Roeaa	Private	25	10
Bit AL Shames	Private	25	7

As mentioned within the introduction section, the focus of this paper is to critically evaluate the conceptions of sharing and knowledge in ICT companies in Libya. Accordingly, the findings from the open-ended questionnaire survey that has been used to investigate these perspectives on knowledge sharing in Libyan ICT companies will be discussed in the following sections.

The authors analyzed the data collected from the open-ended questions thematically, utilising steps recommended by Braun and Clarke (2006):

1. Familiarize yourself with the data.
2. Generate initial codes.
3. Search for the main themes.
4. Review the themes created.
5. Define and name themes.
6. Write up the report.

Adopting a thematic analysis allowed for the creation of different themes and sub-themes. These are presented in the findings' section.

3. Presentation of findings

3.1. The findings and discussion

Tables 2 and 3 demonstrate the major themes and sub-themes which emerged from the analysis of the results from the two open-ended questions. These questions were "What is (your) understanding of knowledge?" and "What is (your) understanding of sharing?" Six major themes with seven sub-themes were created from the responses given on the understanding of knowledge and six themes with six sub-themes were created from the responses given concerning the meaning of sharing, as they were understood by staff who worked in the four ICT SMEs in Libya.

Table 2: Perspectives regarding "Knowledge" in Libyan ICT companies

The meaning of knowledge	The sources of knowledge	Major components of the concept	Possible benefits from adopting the concept	Condition of creating the concept	Method of creating the concept
Knowledge is every single piece of information existing in books and transferred into practice, including lessons to be learned	Theory and practical experience	Learned lessons, human experiences, communicat-ed values, theoretical knowledge	Improving the organization-al learning	Experiences and the ability to learn from mistakes	Seeking the best practice of learning
Being aware of things around us and being able to understand their reality and values	Observed and captured ideas and informa-tion	Informa-tion, observed values and experi-enced realities	Enhances the quality of services and products	Ability to read the information around us and to acquire the required skills to interpret it and benefit from it	Observation, understanding, making sense and being aware
Knowledge is acquired when humans communicate and work together	Communi-cation and sharing, team working values	Experience and shared values. Captured ideas and experiences	Improving ideas' exchange and the level of communi-cation	Being able to learn from mistakes, being able to share and communicate	Understanding other people's values, building up on the practice of communicatio n

Knowledge is a right for every single staff member that works in an organization	Rules and regula-tions, decisions, principles of the organiza-tion	Pure data and information, skills and experiences	Improving the awareness of the values based in the organization	Ability to access the literature of the organization	Understanding of the literature of the organization
Principles which matter to build up the meaning of life	Life experi-ences, human values and moral systems	Skills, cultural values, life aspects and experiences	Improving the quality of life	Ability to make sense of life events and build upon lessons learned	Understanding of the principles of life and making sense of lessons learned
The power of discovering un-discovered facts	Un-studied facts, life aspects	Facts and ideas	Innovating new ideas	Ability to observe uncommon values and learn facts. Having a creative mind	Observe and discover new facts and ideas
Not limited to specific ideas	Un-common ideas	Facts and ideas	Creating new solutions	Ability to think beyond common ideas	Create new solutions in order to solve problems.

In table (2) the first theme is that the meaning of the knowledge suggests that knowledge cannot be defined in a specific way as people see knowledge differently. This is similar to the argument of Hunt (2011) who insisted that knowledge does not have one meaning as it does not have one type. This could be related to the second theme which suggested that knowledge, in order to be created, needs a source (which can be varied). Individuals create knowledge from theory, practices and experiences, observed and captured ideas and information, interaction, communication, sharing, rules and regulations and values.

So creating knowledge is not an easy straightforward process; rather it is a complex process that involves different actions and behaviours. Thus knowledge is about knowing things and becoming familiar with the world around us. These ideas are consistent with the old English saying "Seeing is believing". In this vein, Hunt (2011) stated that knowledge provides an orderliness to our lives which allows us to conceptualize goals, to anticipate and perceive events, and to respond in accordance with changing needs, purposes and desires. For example, our perceptions depend both on the data we receive through our senses (eyes, ears, skin, etc.) and the knowledge we possess that allows us to interpret them (p.101). In the third theme, knowledge did not seem to be a simple concept that consists of only one aspect of conception, but it is a rich concept that encompasses a few components such as learned lessons, and values that have been observed, taught, interacted, communicated and shared. Knowledge also includes information, experiences, ideas, skills and facts. The question that can be asked here is how such components can be transferred and stimulated in order to support the everyday processes in business firms?

The literature on information systems suggests the use of a knowledge portal (KP) to assist in transferring information in business firms. Loebbecke and Crowston (2011) defined KP as “a type of portal that purposely supports and stimulates knowledge transfer, knowledge storage and retrieval, knowledge creation, knowledge integration, and knowledge application (i.e., the processes of knowledge management) by providing access to relevant knowledge artifacts. Repository-oriented components and the functionalities of a KP include a knowledge organization system, repository access, search, and applications and services.” This definition suggests that the different components of knowledge within a firm are not overly beneficial unless they are transferred and communicated. This leads to the fourth theme which is the benefit of knowledge.

Interestingly, from table 2, it can be seen that regardless of what knowledge means and from which source it is accessed, and regardless of the components of knowledge, knowledge is always useful because knowledge improves learning in firms, enhances the quality of services and products, improves communication, improves the awareness of values, helps innovate new ideas, and create new solutions. Haas and Hansen (2007) in their paper “Different Knowledge Different Benefits” stated that different types of knowledge are substitutes for each other and provide a micro-foundation for understanding why and how a firm’s knowledge capabilities translate into performance of knowledge work. Haas and Hansen (2007) added that firms should go beyond considering a specific strategy for sharing knowledge because not all types of knowledge can be shared in the same way. They suggested that developing a differentiated productivity model of knowledge sharing that explicates how different types of knowledge sharing affect different dimensions of task performance in firms could be a powerful framework that can enhance productivity and the quality of the services. This actually leads us to the last two themes which are the methods of creating the concept and the condition of the creation. The findings from the question suggested that creating the knowledge requires humans to have the ability to learn from their mistakes and to seek more practices of learning.

Thus, knowledge requires being aware of the world around us and being able to improve our skills as the world changes. Reading, observing information and ideas and being creative are also conditions for creating knowledge. Capturing such skills will allow individuals to create solutions to their problems and create new ideas. In this vein, Mitchell and Boyle (2010) stated that creating the meaning of knowledge in business firms is very much related to people’s ability to learn from their mistakes and also the ability to innovate new ideas in order to achieve better competition. It has been added that firms adopt knowledge sharing strategies to enhance the dynamics of learning and that the organization that wishes to cope dynamically with the changing environment must be able to create knowledge better and faster than its competitors and this can be acquired by learning and sharing.

Table 3: Perspectives regarding “sharing” in Libyan ICT companies

The meaning of the concept	Context of sharing	Motivation to share	Type of knowledge to be shared	Operations to undertake sharing	Benefits
Providing a powerful opinion when it is needed	Decision making debates	The desire to make a contribution	Idea, visions and opinions	Exchange ideas, provide advice, collaborate	Making better decisions

Providing new knowledge to build up prior knowledge regardless of the purpose of the interaction	Everyday life practice	The desire to help and share experiences and knowledge	Experience, ideas, visions and values	Communi-cation, personal interaction and providing lessons for others	Improving the quality of the workplace experience
Having the entrepreneur-ship to provide others with experiences and learned lessons as applicable	Working in the same workplace	Self-motivation to help other colleagues	Informa-tion, values, learned lessons, sources of inform-ation. Other people & contacts	Communi-cation, team working, organized events, exchange ideas	Improving the level of communi-cation, enhancing the awareness of the value of sharing, self-satisfaction
The art of team-working	Working in the same workplace	The desire to communicate and make differences	Varied types of information, values and solutions. The shared values embedded by the decision makers	Organized events	Solving social and practical problems,and giving the opportunity to communicate to develop the level of flexibility in the organization
Without sharing humans would not have their current knowledge	Life	The desire to enhance life	Shared ideas, informa-tion, experience, facts and risk takers' lessons	Communi-cation, collaboration and exchange of information and facts	Building up powerful life experiences
Using the acquired values and information in the right place and time	Life	The desire to solve problems	Shared values, information and experiences	Personal connection channels, and organized events, varied communicatio n methods	Making better decision, saving time and effort

In table (3) it can be seen that sharing allows individuals to gain many benefits including the ability to make quick and powerful decisions and, at the same time, sharing improves the quality of life not only in the workplace, but also in the individual's personal life. Just like knowledge, sharing is a complicated term that cannot be defined in a simple sentence, probably because sharing involves personal feelings and motivations.

The third theme suggests that which we can share in an X context would not be shared in context Z. Interestingly, Nonaka (1994) in his knowledge creation theory, emphasized the importance of the knowledge context and the stimulating conditions within an organization. Knowledge is generated in a given social context. As a consequence, knowledge is contextual, but these authors' findings suggest that sharing is the factor which is contextual or maybe both knowledge and sharing are contextual.

The third theme suggests that, to be able to share, an individual needs to have motivation. It seems that desire to share is the greatest motivation to share. As it can be seen from table (3), desire does not attract one side of the phenomenon, rather it attracts few angles (e.g. desire to solve a problem, desire to make a decision, desire to create a new life etc.).

The fifth theme is one of the most interesting themes because the notion of knowledge appeared in it, although, participators were not asked directly about it. This suggests that individuals unconsciously tend to share their knowledge. This idea was suggested by Swap et al. (2001). They stated that, often, inter-organizational knowledge is shared unconsciously by employees, incorporation having unconsciously taken place through informal interaction. This implies that the sharing of knowledge can also take place even where there is no specific intention to do so. Wabwezi (2011) also found that the greater part of knowledge sharing takes place informally, even in organizations in which knowledge sharing is highly institutionalized (as cited on Wabwezi p.16).

4. Summary of the findings and conclusion

The outcomes of the responses to the open-ended questions can be summarized as follows:

- Knowledge as a concept has different meanings and those meanings are complicated and can be gained from different sources.
- Knowledge encompasses many components such as lessons learned, communicated values, theoretical knowledge, observed issues and facts, life aspects and skills. Hence, the benefits of knowledge could enhance learning, productivity, quality, communication, innovation and creativity.
- Creating knowledge requires firms seek, share, communicate, learn, observe and understand different aspects of the workplace and life.
- The context of sharing is varied hence sharing involves providing different factors including powerful opinions, prior knowledge and experience, learned lessons learned, and values.
- People should have the desire to share their ideas, experiences and values.
- Sharing involves different actions such as advising, collaborating, exchanging, communicating, working in groups and creating channels of connections.
- Benefits of sharing are varied such as making better decisions, improving practice, improving the level of communication and making life experiences better.

In this paper, the themes and the sub-themes from the responses to the two open-ended questions were presented and discussed. The themes and the sub-themes suggested that knowledge and sharing are complicated and are connected conceptions which cannot be viewed in just one way. Values, lessons, experience and communication make up the meaning of knowledge. Knowledge should be shared in order for it to be extended and to be increased and, in order to share, individuals should have the desire to share taking on board the fact that the benefits of sharing knowledge will be extended as more knowledge is involved and more sharing is practiced. ICT SMEs in Libya primarily need to learn the meanings of knowledge and sharing in order to be able to understand the possible benefits from altering and practicing knowledge sharing.

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Exploring the impact of technology on skills in the UK Scaffolding Industry

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Abstract:

Traditionally a low-tech industry, the construction sector is experiencing unprecedented change prompted by low carbon policies and fuelled by the introduction of new technologies. Incremental technological advances in construction tools and materials are having an impact on the working environment of the construction site but little research has been done to understand what these changes mean for *emerging skills and knowledge requirements.* This paper explores the impacts of new technology on skills in the UK Scaffolding Industry and forms part of a larger research project seeking to understand and identify the new and emerging skills and knowledge requirements of selected site-based trades in the UK construction industry. Six semi-structured interviews were carried out with industry experts at the National Access and Scaffolding Confederation (NASC), the Access and Scaffolding Industry Training Organisation (ASITO), the Construction Industry Scaffolder Record Scheme (CISRS), the National Construction College (NCC) and with two technical directors of scaffolding firms involved with on-site scaffolding operations. It was found that the introduction of new technologies has resulted in mixed fortunes for the industry and its skilled operatives. Advances in *system scaffolds* have boosted job performance by reducing construction times but at the expense of deskilling the workforce that use them. There has also been a perceived increase in competition from *non-scaffolding* firms using new alternative technologies to provide access-to-height services traditionally provided by the scaffolding industry. Overall, the industry faces the challenge of maintaining a training path for the application of traditional skills (using traditional 'tube and fitting' scaffold) alongside a skills path that caters for new scaffolding systems products that are constantly developing and coming to market. The paper concludes that further research is needed to explore how skills will evolve in response to these new technologies and how training provision can adapt to the changing skill-profile of Scaffolders. Skill research identifying future training needs will support the future development and prosperity of the industry.

Keywords:

Construction, Scaffolding, Skills, Technology

1. Introduction:

Traditionally a low-tech industry, the construction sector is experiencing unprecedented change prompted by low carbon policies and fuelled by the introduction of new technologies. Incremental technological advances in construction tools and materials are having an impact on the working environment of the construction site but little research has been done to understand what these changes mean for *emerging skills and knowledge requirements.* Technology can change the nature of work faster than people can change their skills (Levy, 2010) so as the rate in the use of technology increases, research is needed to understand the ways it affects the nature of work and its impacts on skill and knowledge requirements. This paper explores the impact of technology on skills in the UK scaffolding industry.

Scaffolding is a type of access or supporting structure that is built-up of many individual parts (Harsco, 2011). It is a temporary structure usually seen on the outside of buildings made of metal poles and planks and used by workmen while building, repairing or cleaning a building (Oxford Dictionaries 2015). The purpose of scaffolding is to provide *safe access* and *sound platforms* from which to carry out works *on* a structure and facilitate the transportation of workers and materials *around* a structure. In many construction projects (particularly repair, maintenance or renovation projects) work cannot commence until adequate scaffolding is put in place. Scaffolding therefore is on the critical path of many construction projects. It can be found in all subsectors of the construction industry: in the construction of new buildings, in renovation work and in civil engineering projects. In addition to the construction sector, the scaffolding industry's reach extends into the energy sector, petrochemical sector, pharmaceutical industry and the entertainment industry. Lack of statistical records prevent a proper assessment of what proportion of scaffolding output can be attributed to each sector but the total revenues for the industry are estimated to be approximately £3bn per annum (IBIS*World* 2014). On general observation, scaffolding can be seen on almost every construction site, yet despite this, little has been written about skills development or the effects of technology on this specialist group. The industry has attracted almost no academic attention aside from Clarke & Winch (Clarke, 2006) who provide a brief assessment of scaffolding training to support their arguments in a paper highlighting the differences between the UK vocational education/training (VET) system and the VET systems of continental Europe. As the Construction industry recovers from the 2008 financial crisis, the demand for Scaffolders is expected to grow. The Construction sector's forecasting model (the CSN) predicts that Scaffolders will have one of the strongest growth rates in the sector over the next five years at 4.9% annual average (CITB, 2014). With demand expected to rise, this paper is a timely contribution to academic knowledge on the impact of technology on Scaffolder skills.

2. Research aims and objectives:

This research aims to understand how technological advances in scaffolding equipment and the introduction of specialist access machinery have influenced skill and knowledge requirements in the UK's scaffolding workforce.

The objectives of this research are to

- Discuss the technologies that have been introduced into the scaffolding industry
- Discern what challenges these technologies have posed for Scaffolder skill development and the future prosperity of the industry
- Determine further research opportunities into work skills in the Scaffolding industry

3. Literature review:

Technological developments are reshaping the *nature* of the workplace and the *nature* of many types of work (Levy, 2010). *Technology* can be defined as 'the application of scientific knowledge for practical purposes, especially in industry' (Oxford Dictionaries 2015). When we think of technology, we usually think of the rapid growth in the use of the Internet, networked computers and ‘smart’ devices. These forms of technology are highly visible and in everyday use but there are other forms of technology that capture less immediate attention like new advances in materials, tools, plant and equipment. It is technologies such as these that are featured in this research. Advances in materials, tools and equipment, typically promise greater accuracy, safer handling and improved labour-saving benefits to companies that use them.

3.1. **Technology and skills**

Opinions about the effects of technology on skills have shadowed industrial development and have been the subject of heated debate for hundreds of years. For example, as early as 1621, the protests of workers in Dutch woolen mills succeeded in banning weaving machines in parts of the Netherlands (Jaffe, 1968). Research on the impact of technology on skills has generated inconsistent and contradictory findings. The central arguments correspond to notions of *up-skilling*, *de-skilling, mixed effects* or *little net change* over time (Spenner, 1983). The reasons why findings point in several directions at once, can be explained by understanding that different studies often research the impacts of different types of technology (e.g. digital computers or automated machinery) and different authors often rely on different conceptions and measures of skill (Felstead, 2002, Grugulis, 2004, Vallas, 1990). Spenner (1983) argued that different research designs also tend to yield differing conclusions. He maintained that research findings depend critically on the unit of analysis selected. Spenner observed that large aggregate-studies generally suggested that the effects of technology yielded *little net change* over time whereas research designs using case studies, portrayed more volatile *up-skilling* and *de-skilling* results. A study by Flynn (Flynn, 1988) supports Spenner’s observations on case study research, but analysis of several aggregate studies (Felstead, 2002, Felstead, 2007, Kim, 2002) would challenge his conclusions of *little net change*. Flynn (1988) examined 197 case studies published over a 45-year period (between 1940-1985) and found a balanced amount of evidence supporting both *up-skilling* and *de-skilling*. This lends support to the *mixed effects* argument. Felstead et al (2002, 2007) however, examined several national surveys of workers aged 20-60 years in the UK (between 1986 – 2006) and found a general increase in the level of skill required by employees in work. This *up-skilling* trend related to a rise in job complexity (measured by rising qualifications demands and self-report) but not to elements of autonomy or discretion at work.

In a review on research findings published from the late 1980s to 2001, Kim (2002) concluded that most studies on the impacts of technology presented an *up-skilling* trend in the OECD economies. The evidence suggested a *‘strong complementarity’* between the adoption of technology and higher skills. In other words, the introduction of technology raised the skill demands of workers who used it, and higher-skilled employees improved the adoption-rate of new technologies into their workplaces. The evidence also suggested however that the impact of technology on skills varied with the type of technology adopted and the original skill-level of the jobs in question. Different forms of IT such as computer use appeared to have a positive association with *up-skilling* {see also (Autor, 2003)} but this was not necessarily the case, where studies were concerned with automation technology {see also (Cappelli, 1993, Doms, 1997)}. Cappelli (1993) found that the development of new office equipment (such as xerox-machines and automated switchboards) appeared to be associated with *deskilling* specific clerical jobs. For Kim (2002) the up-skilling affects of technology were much more likely to occur in higher-skilled jobs than in jobs traditionally associated with low skills.

So why does technology have differing impacts on different types of work? Levy (2010) suggests that the answer to this question lies in two closely related ideas: Firstly, all work involves *processing information* and secondly, all work involves *tasks* that are either *routine or non-routine*.

3.1.1. Processing information:

Human work involves cognitive processing whether it is on a conscious level (like an accountant who analyzes a spreadsheet) or an unconscious level (like a roofer, who on seeing clouds predicts rain). The cognitive processing in both cases involves updating the person's picture of the world in order to decide what to do next. Computer work also involves processing information but computers process information by executing rules. Programs may use deductive logic or inductive logic in carrying out operations, but deductive logic is a much simpler procedure. For a computer to use inductive logic, statistical modeling techniques (e.g. multiple regression analysis) are required to detect trends from historical data. Computer programs can execute vast amounts of actions using deductive logic, quicker and more reliably than humans, therefore a job that can be broken-down into a series of operations that follow rules and logical steps, has a strong chance of being automated by technology eventually. A good example would be ticket-selling machines replacing staff in train stations. When applying inductive logic, computers are also quicker than people but their outputs are not necessarily as reliable as human experts. The reliability of a computer modeling program rests on the assumptions made by the model's designers about certain conditions remaining constant or behaving in predictable ways (ILO, 2011, Rosewell, 2007). In Jobs where the conditions rarely remain constant and where information can be influenced by a myriad of different factors, technology is typically introduced *to assist* rather than *to replace* human skills. Jobs of this type are usually associated with higher-level skills (e.g. Doctors, Engineers, Economists).

3.1.2. Routine and non-routine tasks:

All work involves tasks that are either routine or non-routine. Routine-tasks involve repetitive operations that either change very little (regardless of the circumstances) or change in predictable ways. By contrast, non-routine tasks are less repetitive and less predictable because the *context* wields a great deal of influence over how they are performed. Routine tasks therefore are easier to program and automate than non-routine tasks because their operations can be broken down into logical steps and rules that cover any predictable contingencies. Many jobs traditionally requiring low skills involve repetitive work that is more amenable to automation than jobs associated with higher skills. A good example would be the introduction of technology into the automotive industry that has replaced many machinists associated with product assembly.

3.2. **Different conceptions of skill**

> *'Skill' is one of those terms that represent a relatively simple idea but like so many apparently simple ideas, it proves after some deliberation, to be a much more complex and ambiguous concept (Attewell, 1990).*

Scholars have described the concept as *'baffling'* (Payne, 2004) *'slippery'* (Chell, 2013, Payne, 2004), *'elusive'* (Esposto, 2008, Lafer, 2004, Toner, 2011) and *'confusing'* (Westwood, 2004). Indeed, some writers have gone further by referring to skill as a *'definitional minefield'* (Noon, 2007). The problem of complexity in defining skill is more than just a question of semantics. It stems from how different researchers with different backgrounds and perspectives focus on the concept, how they choose to define it and then measure it (Spenner 1983). In the work context, the term ‘skill’ was traditionally associated with manual labour and equated with the physical dexterity and ‘hard’ technical ‘know-how’ of the craft worker (Keep, 1999, Keep, 2004, Payne, 2000) but this is no longer the case. In the last three decades the use of the term has shifted away from hard technical expertise, and expanded to include softer, more interpersonal capabilities and attributes that would not have been considered as ‘skills’ in earlier times (Keep, 1999, Warhurst, 2004). Attributes now considered as skills include: attitudes to work, character traits and personal characteristics (Keep & Payne 2004, Noon & Blyton 2007, Payne 2004, Warhurst 2004). ‘Skill’ has undergone what Winch (Winch, 2011) describes as ‘concept inflation’ and its broadening use has become so diffuse and wide-ranging that it could be used to mean whatever an author wanted it to mean (Payne, 2000). But how did the use of the term ‘skill’ become so expansive? Keep & Payne (2004) argue that a general shift in the UK’s employment base from *manual* to *non-manual* work, contributed to its change in meaning. This shift is reflected in the decline of the country’s manufacturing industries and the growth of its service-sector. The growth in service-based occupations prompted a rise in the importance of *cognitive* and *interactional* activities over physical forms of skill. Employment in professional and administrative occupations steadily increased, requiring *relational skills* to manage customers (Payne, 2000, Westwood, 2004) and the growing use of information and communication technology (ICT) increased demands for handling information at work. ICT brought about greater levels of connectivity in the workplace and created new forms of work that favored more *analytical* and *interactional activities* (e.g. problem solving, communication and team working). It is because researchers have used such widely varying conceptions and measures of skill, that the empirical literature is rife with inconsistent and contradictory findings (Vallas, 1990).

4. Research methods:

This research adopted a qualitative research design and methodology to explore the impact of technology on skills in the UK scaffolding industry. Between September 2013 and August 2014, following a desk-study of the industry, six semi-structured interviews were conducted with key stakeholder bodies in the industry. Four interviews took place with industry experts at the National Access and Scaffolding Confederation (NASC), the Access and Scaffolding Industry Training Organisation (ASITO), the Construction Industry Scaffolder Record Scheme (CISRS) and the National Construction College (NCC) and two additional interviews were conducted with technical directors in Scaffolding companies. One company was a large scaffolding contractor responsible for multi-million pound projects throughout the UK and the other was a medium-sized scaffolding firm responsible for more modest projects based in Scotland. Two of the six interviews were conducted face-to-face at the interviewee’s workplace and four were carried out by telephone. Each interview lasted approximately 45-60 mins and was recorded to boost the effectiveness of data capture. Typed transcripts of conversations together with research notes were sent to interviewees following their interviews for validation purposes, as a means of improving the data-collection method’s integrity and transparency (Lincoln, 1985). Any necessary further clarifications were conducted by follow-up email correspondence. By interviewing key stakeholders and validating their views with other experts (representing different bodies within the industry), the researcher sought to boost the credibility, transferability and value of the findings (Gray, 2009).

5. Findings and discussion:

The two most common types of scaffold found in the UK are known as *tube and fitting* scaffolding and *system scaffolding*. *Tube and fitting* scaffolds are the traditional form of scaffolding whereas *system scaffolds* are considered to be newer forms of scaffolding technology. Tube and fitting scaffolds are comprised of plain lengths of steel tube and a variety of individual fittings/couplers. The fittings come in different shapes and sizes and incorporate bolts that when tightened, clamp the tubes into a rigid framework as the scaffold is erected up the façade of a building. In contrast, system scaffolds comprise of modular tubes of steel with a connection-system built-in. The tubes that form the vertical members of the system scaffold have connection points at standard distances apart, and the tubes that form the horizontal members have connection points at each end. Horizontal members are designed to lock into the vertical members like a 3D jigsaw puzzle. There are many different manufacturers of systems scaffold - all of whom design their products in slightly different ways. Much of the variation however comes down to the design of their connections. The three most popular connections are *cup*-like (e.g. Cuplok) *ring*-like (e.g. Peri-up Rosette flex) and *wedge*-like (e.g. Kwikstage) in design.

5.1. **Scaffolder skills**

Erecting traditional tube and fitting scaffolding is considered to require more skill than erecting other types of scaffold (Harsco 2011). This is the view of one of the largest Scaffolding contractors in the UK and many of the research participants broadly supported this view. Scaffolders trained to build tube and fitting scaffold need to constantly check that the tubes are *plumb*, *square* and *level* as they build the framework upwards (on each 'lift') and outwards (on each 'bay'). Consequently, this form of scaffolding takes longer to construct and relies on more communication, co-ordination and teamwork, than System scaffolds. Fewer skilled-tasks need to be performed when constructing Systems scaffolds. Being modular, all the tubes are of standard length and all connections have standard locations. This means that once tubes are clipped into place, all sections of the scaffold meet-up automatically. Once the 'base lift' (the first section of the scaffold, closest to the ground) of the framework has been properly established (to be *plumb*, *level* and *square*), each successive 'lift' can be assembled swiftly without the need for constant checking or adjusting. The integral connections in their design serve as a checking mechanism for build-quality as connections cannot be locked into place without the right conditions being satisfied. There are no statistical records that measure the usage of different types of scaffolding in the UK, but the research participants interviewed considered the use of tube and fitting scaffold to be in slow decline and the popularity of system scaffolds to be rising steadily.

So what does this mean for skills in the scaffolding industry? On the one hand *system scaffolds* have boosted job performance by cutting assembly times but this comes at a cost of deskilling the Scaffolders who build them. System scaffolds are erected and dismantled in exactly the same way, regardless of the structure they are built for. Their design dictates this. The systematic process of their construction therefore, establishes better levels of consistency across scaffolding jobs but also higher levels of routine (and monotony) than those experienced when building tube and fitting scaffold. As one participant in this study remarked*: "the system is so simple, its muppet-proof! Once it has been properly footed, you just keep building it like lego."* It must be acknowledged that routine and procedure forms a large part of building a scaffold. Indeed, to improve safety at working from height, the industry trains apprentices to follow certain routines and procedures on every job (e.g. The NASC's Safety guidance note: SG4 and the 'tunneling principle'). Notwithstanding this, when building tube and fitting scaffold, the physical task of assembling the framework is never exactly the same, as tubes and fittings are positioned in response to the architectural idiosyncrasies of the structures/buildings they are built for. System Scaffolding removes this element of variety from scaffolding jobs and thus what discretion (i.e. initiative and problem-solving) Scaffolders might apply, when constructing traditional scaffolds. The construction of tube and fitting scaffold also requires more co-ordination, communication and teamwork. System scaffolds reduce the need for these softer skills because the built-in design features, control how the framework gets built (and not the Scaffolders). Regarding this reduction in softer skills, one research participant remarked: *"You could build this stuff all day and not need to speak to your team-mates"*.

The *deskilling-aspect* of systems scaffolding poses both status and training challenges to the Scaffolding Industry and opens the door to other trades to compete for scaffolding business. The industry has worked hard to develop its standing and value amongst other trades in the construction sector since its recognition as *skilled*-work in the 1970s, by the social partners under the Joint Industry Councils (Clarke, 2006). It has for example, devised a formal training and registration system (the Construction Industry Scaffolder Registration Scheme – CISRS) to manage Scaffolder credentials, improve safety standards and develop Scaffolder skills. The de-skilling aspect of systems scaffolds however, potentially threatens this development work. Requiring less skill to build might, for example, exert downward pressure on wages or produce rivalries within the industry by creating a 2-teir system; with the upper tier reserved for (higher skilled-) tube and fitting Scaffolders, and the lower tier reserved for Systems Scaffolders. So far, careful management of the CISRS scheme has averted either of these possibilities from occurring, but the Industry has been left with a difficult training challenge: It must offer a choice of training routes that reflect the different types of scaffold available, without casting either route as being superior or inferior to the other. The CISRS scheme offers a choice of two apprenticeship pathways – one for tube and fitting scaffolds and one for systems scaffolds. The average time it takes to complete a CISRS apprenticeship is approximately 2 years regardless of what training route they take. Because systems scaffolds are easier to construct, it could be argued that training times could be reduced for this form of scaffold. Indeed, many System Scaffold Manufacturers offer technical training that develops competence in using their products within a few days. CISRS training timespans however remain the same for both training options. The industry justifies this situation by emphasizing the importance of safety and theory in the building of scaffolds and working from height. Although this is a reasonable explanation, Clarke and Winch (2006) couldn't find a unified body of theory related to the profession except for knowledge related to the measurement and setting-out of scaffolds to design specifications.

By requiring less skill to build, system scaffolds open the way for other trades to take business away from the Scaffolding Industry. This can be illustrated in a recent example of scaffolding needs at Bamburgh Castle, in Northumberland, England (Kemp, 2014, Morgan, 2014). In 2012-2013 the Castle hired a scaffolding contractor to gain access to its exterior walls at the start of an extensive maintenance programme. The contractor (who used a system scaffold for the job) needed to visit the castle every time the scaffold required adjustment or movement as the maintenance work proceeded. On discovering how easy the scaffold was to use, the Castle's manager costed a plan to train his own craftsmen and hire the system scaffold directly from the manufacturer. This resulted in a substantial cost saving to the Castle's maintenance budget but a significant loss to the revenues of the Scaffolding contractor. The System Scaffold manufacturer hired-out its products, trained the castle's craftsmen (within a couple of days) and provided on-going technical support for the duration of the maintenance project.

5.2. **Powered access technology**

The purpose of scaffolding is to provide safe access to height and safe platforms from which to work. Increasingly, advances in powered access machinery can perform these two roles quicker and more cost-effectively than a standard scaffolding solution. In addition, the training to operate this technology is significantly shorter than a typical Scaffolder apprenticeship. In the opinion of most interviewees for this research, powered access machinery has facilitated increasing competition from non-scaffolding firms to encroach on the traditional scaffolding roles in Construction. The two most common examples of powered access machinery are Mast Climbing Work Platforms (MCWPs) and Mobile Elevated Work Platforms (MEWPs). Mast Climbers consist of a hydraulic mast and a working platform that can move up and down. They can be free standing or attached to the façade of the structure they are providing access too. Mast Climbers are most useful on structures that have simple designs. Once installed, they require less workers to adjust and operate – saving on labour costs. Mobile Elevated Work Platforms come in the form of 'Scissors lifts' or Boom-type 'Cherry Pickers'. They can be used both outdoors and indoors, depending on the space availability and ground conditions (the surface must be firm and level). MEWPs are increasingly used to install safety netting and edge-protection systems around elevated work surfaces, in advance of other construction works taking place. These were roles that Scaffolders once performed almost exclusively on site.

6. Conclusions:

The introduction of new technologies has resulted in mixed fortunes for the Scaffolding industry and its skilled operatives. On the one hand, advances in system scaffolds have boosted job performance by reducing construction times and improving consistency of working practices across different jobs. On the other, they have led to a reduction in the number of skilled tasks needed when erecting a scaffold and increased the level of routine. Systems scaffolds are designed to be easier and quicker to build but their design dictates how the scaffold is built - not the Scaffolders. What discretion Scaffolders enjoyed using more traditional 'tube and fitting scaffolds' is eliminated by the modular design of System Scaffolds. This threatens to undermine the skilled status of Scaffolders trained to use systems scaffolds and opens the way for other trades to compete for scaffolding business. The introduction of powered access technologies also increases competition for scaffolding business. Mass climbing work platforms and Mobile elevated work platforms offer viable technological alternatives to scaffolding solutions and operatives don't need to be Scaffolders to use them. The industry faces the challenge of increasing competition from non-scaffolding firms taking advantage of these new technologies and the challenge of maintaining a training path for traditional skills (using tube and fitting scaffold) alongside a skills path that caters for newer systems scaffolds which are constantly developing and growing in popularity. Further research is needed to explore how skills in the scaffolding industry will evolve in response to these new technologies and how training provision can adapt to the changing skill profile.

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A Review of the Impact of an Integrated Health And Social Care System On People With Dementia

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Abstract:

Background: As England's demographic changes with an increasing ageing population so does the burden of long-term diseases such as dementia. Our current care system is no longer appropriate to deal with these changes. An integrated system, which can provide streamline care for both the health and social care needs is required. It is widely acknowledged that an integrated system can bring a number of advantages, which can be fundamental to its success. For that reason the Government have introduced a number of policies and related documents over the past two decades on developing an integrated health and social care service. However, a strong evidence-base demonstrating the positive impacts of an integrated care system is lacking, particularly in the case for older people with dementia. Aim: To evaluate the impact of integrated health and social care policy and its related documents on people with dementia. Objectives: To gain an understanding of integrated care policies, their related documents and their recorded impact on people with dementia. Method: Systematic literature review. Findings: There is little, if any evidence on the impact of integrated care on people with dementia.

Keywords:

Integrated care, policy, dementia

1. Introduction

England's population is changing, more and more, people are living to an older age, which has led to a rise in the number of people with dementia. Built upon the same need as 70 years ago, to meet the encumbrance of accidents, emergencies and diseases such as cancer, our current care system is no longer appropriate (Ham et al, 2011). People, specifically those with multiple care needs due to a chronic, long-term disease such as dementia, are being failed by a fragmented care system provided by the National Health System (NHS) and Local Authority (LA) in England. Issues include (DoH, 2013):

- "People having to re-tell their story every time they encounter a new service;
- People not getting the support they need because different parts of the system don't talk to each other or share appropriate information and notes;
- Older people discharged from hospital to homes not adapted to their needs, only to deteriorate or fall and end up back in A&E;

- Home visits from different health or care workers at different times, with no effort to fit in with people's requirements; and
- Patients' facing long waits in hospital before being discharged. Delayed discharges cost the NHS £370 million a year".

It is widely assumed that an integrated care system would address the problems that the current system has, and generate a number of advantages, which would be fundamental to its success (Humphries & Gregory, 2010, Lewis et al, 2010; Curry & Ham, 2010, Humphries and Curry, 2011). These advantages include, amongst others (Humphries & Gregory, 2010 and Humphries and Curry, 2011, pp.2.):

- "Better outcomes for people, e.g., living independently at home with maximum choice and control;
- Emphasis upon the prevention of illness and self care;
- More efficient use of existing resources by avoiding duplication and ensuring people receive the right care, in the right place, at the right time;
- Improved access to health and social care services;
- Improved experience of care services;
- Improved user satisfaction of care services; and
- A decrease in the overall expenditure."

For the above reasons the Government, academics and practitioners continue to develop policies, tools and strategies to support and/or maintain an integrated health and social care service delivery (e.g. Integrated Care Networks (ICN), Partnership for Older People Project (POPP) and "Sally Ford" of Salford. All of which take time and money to develop and maintain.

However, a strong evidence-base demonstrating positive impacts of integrated care systems is lacking (Ramsay and Fulop, 2008; Smith, E. et al., 2009; Curry and Ham 2010; Rosen et al., 2011). Moreover, as pointed out by Ramsay and Fulop (2008) most research into health and social care integration focuses upon "process measures" such as waiting times, admissions to hospital, or service responsiveness rather than "outcome measures" of the benefits to service users. In this regard, the impacts related to integrated care are assumed and not the result of substantiation evidence. (Armitage et al., 2009).

The purpose of this paper is to present the findings of a review into the impact of integrated health and social care governmental policies on people with dementia. This will be undertaken through a synthesis of policy based and impact literature.

2. Dementia disease – facts and figures

"Dementia is one of the most important issues we face as the population ages" (DoH, 2011). There are approximately 750,000 people in the UK living with dementia (DoH, 2011; APPG, 2011), just under half of these, have been diagnosed (APPG, 2011). "The number of people with Alzheimer's disease, dementia and senility is projected to increase by over 70% in England between 2010 and 2030" (Verne et al., 2011).

In this article dementia is considered as a condition, it is the result of brain damage from different diseases and conditions that cause a loss of brain function. It is, generally, a progressive disease whose symptoms ultimately become severe leading to death. The disease usually attacks the brain functions that can result in memory loss, mood changes problems with communication and reasoning and a decrease in the ability and skill in carrying out daily activities e.g. washing, dressing, cooking and caring for self (Alzheimer's Society, 2011; Dementia UK, 2011).

Several types of dementia exist, most common type being Alzheimer's disease, with it being responsible for 62% of all dementia cases. Alzheimer's causes the cells of the brain to die quicker than those in a healthy brain (Dementia UK), which leads it to be the greatest cause of 'progressive intellectual deficit in older people' (Wells, 1978 in Hughes et al., 1982, p. 566). The majority of people affected by dementia are older people. Over 95% of those who have dementia is aged 65 years or over (Victor, 2010).

3. Integrated Care

The concept of 'integrated care' can be understood in different ways. Through a concept analysis into the term 'integrated care', it is clear that much ambiguity exists and that the term is used interchangeably with the words 'partnership', 'inter-agency', 'collaboration', 'joint working', 'coordination of care' and 'continuity of care'. The shared fundamentals associated with it and its related terms are:

Integration is a type of process/set of processes (e.g. Real, Virtual, Vertical, Horizontal) of joint working between individuals and organisations at different levels (e.g. Macro, Meso, Micro). (Pruitt et al., 2002; Kings Fund, 2011; Valentijn, et al., 2013).

Integration is implemented to deliver improved outcomes to service users (Curry and Ham, 2010).

These two views represent the duality related to definition of 'integrated care', i.e. the former considers it as a 'process', whilst the later focus on the outcomes it generates. Thus, for the purpose of this article, integrated care means:

> *"Working together across boundaries to deliver a successful and streamlined service to the end-user".*

It is about putting the patient at the centre of care delivery through a coherent process/set of processes between organisations/people/services that enable greater transparency between partners as well as enhanced benefits for service users. Informing the process are a number of foundational tools and progressive approaches: creating an operational definition, shared values, goals and knowledge (Suter, et al., 2009).

Integrated care can be described as occurring across a continuum (Kodner and Spreeuwenberg, 2002) from co-operation between separate organisations, to multi-disciplinary networks coordinating care, to pooled funding, joint planning, management, and multi- disciplinary teams. Integration of care can happen at any point of the patient's journey from assessment to referral through to diagnosis, treatment and discharge. For that reason, a wide classification of integrated care according to a number of different types and levels exists that helps with defining the term. The different types include: real and virtual, vertical and horizontal, organizational and care coordination, full structural, integrated networks and hybrid. Whilst the levels are three tiers: Macro level, Meso level and Micro level (Pruitt et al., 2002, Kings Fund 2011, Valentijn, et al., 2013). These are presented below.

3.1. **Real and Virtual Integration:**

Real integration is the formal merging of services or organisations, with paper work such as contracts to declare this (Kings Fund, 2011). Real integration would involve an official agreement at the senior management for a full structural joining of two or more service organisations. The result would be that all those working within the different service organisations would belong to the same group. Official procedures, finances, human resources become shared by the newly created service organisation. Virtual integration, is less formal, it is the unofficial work between providers through partnerships, networks and alliances (Kings Fund, 2011). Virtual integration refers to the organisation of groups who share a goal but do not have mutual ownership. The level of virtual integration can differ and it can involve official governance contracts or be built on loose alliances (Curry and Ham, 2010)

3.2. **Vertical and Horizontal Integration:**

Vertical integration refers to integrating care across distinctive levels within a same service organisation. For instance, integration between social, primary and secondary care at different stages of the care economy or integration along the care pathways and supply chain (Ramsay, A., Fulop, N. and Edwards, N. 2009, Rumbold, B. and Shaw, S.E. 2010, Shaw et al, 2011). Distinctively, horizontal integration refers to the collaboration of care providers, for instance, care delivered by a multi-disciplinary team such as grouping outpatient clinics within a geographic network of providers (Ramsay, Fulop and Edwards, 2009; Rumbold and Shaw, 2010; Shaw et al 2011).

3.3. **Macro, Meso and Micro Levels:**

This classification refers to the scale of integration. Macro level is the top level of integration at policy level where service providers seek to deliver integrated care across all available services to the whole population; Meso level is the middle level, i.e. *healthcare organisation and community* level and it refers to service providers aim to deliver integrated care to a particular group of people that have the same health issue, it is disease orientated (e.g. NHS); Micro level refers to, *patient interaction*. Through care approaches such as coordination and care planning the service providers deliver integrated care to service users (e.g. Doctors). (Pruitt et al., 2002; Kings Fund, 2011; Valentijn, et al., 2013). Each level should be considered when delivering a fully effective and efficient integrated system, as each interacts and influences the others. However there are systems, which focus on only one or two of the levels.

4. Research Method

There are several challenges in designing a research method for the aim of this article. Ideally, finding identical cases of standardised integration where to collect information would provide relevant insights on its impact. Alternatively, a case study would also generate the sought evidence of impact. However, there are known issues related to the lack of standardised approaches when it comes to implementing integration that create barriers to the collection of reliable evidence. There are also issues around the extent that integration is realised or not, i.e. the difference between how integration occurs and how it is perceived to occur. Finally, there are epistemological difficulties of establishing a cause-effect relationship between integration and outcomes and different measures of impact have different realisation spans.

Considering the issues raised above, a systematic literature review was chosen as the appropriated method for evidence gathering and the formation of a critical viewpoint regarding the problem investigated as well as the research approaches being used in this field. Systematic reviews differ from traditional narrative reviews by adopting a replicable, scientific and transparent process which aims to minimize bias through exhaustive and time-consuming literature searches of published and unpublished studies and by providing an audit trail of the reviewer's decisions, procedures and conclusions (Cook et al., 1997; Tranfield et al., 2003). Findings from this process will feed into the development of a conceptual framework and the next stages of research that will be focused on gathering primary evidence. A conceptual framework is a way to focus and bring together the information and data obtained from the literature review. The framework also highlights the main areas to be researched. The conceptual framework is the 'researchers map of the territory being investigated… as the explorer's knowledge of the terrain improves the map becomes correspondingly more differentiated and integrated' (Miles and Huberman, 1994, p.32-33). The conceptual framework developed for this article corroborated the gap in impact studies of integrated care for people with dementia and therefore justifies the need for research in this area.

As discussed by Codinhoto et al., (2009), despite the benefits of this approach, not all steps of a systematic search can be applied to social sciences research. Therefore, the resulting process for the extensive review included academic and political articles on the impact of integrated health and social dementia care polices only. This review is encompassing of articles from a range of domains including management, service and healthcare. Details about each step taken as part of the systematic review are presented below.

1. To identify policies related to the integration of health and social care. Through a literature search using appropriate key words. The keywords were derived from the different terms used interchangeably with integration as identified through the concept analysis in integration. They are: partnership, inter-agency, collaboration, coordination of care, continuity of care and joint working, these were used along with the words integration, health care and social care. No Boolean operators were used. The databases used for these key word searches were: Department of Health, www.parliament.co.uk. The searches took place between July and January 2012. Only policy related documents were required from this search and so an inclusion and exclusion criteria had to be used. Any documents other than policy for example papers, reviews or notes were excluded and all policy related documents such as Bills, Acts, Strategies, white papers, green papers were included. There was no date restriction on this search.
2. To highlight and provide details of those related to dementia care. This involved reviewing the identified policies and identifying if dementia was on the agenda. This began in January 2012 and lasted one month. Content identification was done using 'word search' tool. The terms 'dementia' and 'alzheimers' were used to identify relevant documents.
3. To collect evidence of the impact of these policies through a review of impact studies. This was achieved through review of literature. The keywords used were the titles of the policies (e.g. The New NHS: Modern and Dependable) plus the words audit, review, impact and

evaluation. Boolean operators were used if they were within the title of the policy. Google Scholar, NHS Evidence, The Policy Press and Social Care Online. These searches began in December 2011 and ended in April 2012. For this step the inclusion and exclusion criteria was based upon the reading of identified abstract/synopsis to make an informed decision as to whether the document was a review of a specific policy.

4. To raise awareness regarding the methods used in the impact studies. This was done by ensuring only those peer reviewed were included, as it was assumed that the method is valid if it has been through this process.Steps 1 to 4 of the systematic research process were concluded in 2013 and the conceptual framework was developed. This allowed the researcher to gain a thorough understanding of the impact of integrated health and social dementia care related policies on people with dementia. The review and process also provided an overview of the elements that are required to develop an integrated health and social care system for people with dementia. These findings will be presented in the next section.

5. Findings

Through undertaking the systematic review and developing the conceptual framework detailing policy and its related documents concerning integrated dementia care and the impact they had, the following issues were highlighted:

5.1. **Facts and figures:**

The review revealed that, from the 1980s to 2011, 32 policies (and related documents) linked to integrated care were published; 17 out of those were specifically linked to dementia care and integration, 4 of the 32 documents were related to integrated care for older people with complex needs but not specifically dementia. Out of the 17 relevant policies 15 recorded little or no evidence of impact.

The below timeline provides an overview of when the 17 relevant polices and related documents were published.

Figure 1: Integrated Dementia Care Policy Timeline

It can be seen from the timeline that there has been a steady increase in policies relating to integrated dementia care, highlighting its priority to the Government.

The first policy to have recorded impact was The National Service Framework for Older People published in 2001. This policy was dementia and integrated care specific; although the impacts recorded do relate to older people they are not specifically to people with dementia. Impacts include: decrease in "explicit" age discrimination through the accessibility to services to most older people, increase of older people stopping smoking and receiving flu jabs has increase, increase in the number of older people remaining in their own homes inclusion of older people in other organisations' activities (Commission for Healthcare Audit and Inspection, 2006).

The second policy related document to have recorded impact was Living Well with Dementia: A National Dementia Strategy (2009). This document was also dementia and integrated care specific, however the impact recorded was not on the person with dementia but instead on the methods of working of the organisations, with 90% of PCTs working with LAs to develop and/or deliver a joint dementia strategy (APPG 2011).

Having refreshed the 2009 National Dementia Strategy in September 2010 the Government set "Quality Standards" through NICE, to ensure high quality, cost-effective patient care. However the body that is to assess whether the guidelines are in fact being followed have not yet been developed (2011).

From the data within the conceptual framework, using mapping techniques, the different areas of integration could be identified and grouped according to similarity and dissimilarity criteria, to develop categories that could then form a taxonomy of integrated dementia care. The taxonomy was made of four elements: people, finance, control and infrastructure. Each element is required for integrated dementia care to occur successfully, therefore impact of integrated care could be measured according to the taxonomy.

The work of Kodner and Spreeuwenberg (2002) similarly identified categories within integrated care they included: Funding, Administrative, Organisational, Service delivery and Clinical. As did Hudson et al., (1997) who categorised the barriers to integrated health and social care specifically for older people with mental health into: Structural, Procedural, Financial, Professional, Status and legitimacy. Parallels between these two existing categorisations of integration within healthcare could be made with the data within the conceptual framework.

Table 1 provides a definition of each of these categories and illustrates the links between the categories identified by Hudson, et al., (1997), Kodner and Spreeuwenberg (2002) and the ICTPD. Only four categories were identified in the ICTPD instead of the five identified by the previous authors. The ICTPD's people category overlaps the two categories identified by (Hudson et al., 1997) "status and legitimacy" and "professional"; and the two corresponding categories identified by Kodner and Spreeuwenberd (2002) "Organisational" and "clinical" categories. The boundaries between these two categories were not definite and the definitions blurred

Table 1. Integrated Care Taxonomies and Definition

Hudson	Kodner	ICTPD	Definition
Status and legitimacy	Organisational	People	Ways that individuals and professional groups work vertically and horizontally across the system to provide an integrated patient focused service.
Professional	Clinical		
Structural	Service delivery	Infrastructure	Methods that are in place across the different agencies to deliver and promote integrated working (e.g. ICTPD systems, training)
Procedural	Administrative	Control	Top down control through strategies and ways of working specifically integrated ways. The way government and administrative functions are structured and devolved.
Financial	Funding	Finances	The funding mechanisms and financial resources for delivering care. Funding of care is condition related.

The ICTPD can now be used to guide a number of other issues in the research, such as the choice of case study and the classification of the barriers and enablers to integrated care delivery to older people with dementia. It was also used to identify the areas that the impact studies looked into.

The impact study into The National Service Framework for Older People (2001) looked into the people and infrastructure categories. Whilst the second impact study on Living Well with Dementia: A National Dementia Strategy focused upon the financial categories. It would be the author's recommendation for any impact study to be as comprehensive as possible it should look at the 4 categories within the ICTPD.

6. Discussion and Final Remarks

This research is part of on-going PhD research, focused on identifying the impact of integrate health and social care delivery on the wellbeing of people with dementia. Research in this area is very much needed as demographic changes towards an ageing population increasing the number of people living with dementia in the UK and other parts of the world.

The systematic review has been carried out with the objective of further understand care integration and the impact it has on people with dementia. From the review a number of issues have arisen:

- There is a lack of clarity regarding the term integrated care;
- Very little evidence exists on the impact of integrated care on dementia care;
- Integration within health and social care can fall into four key areas they are people, control, infrastructure and finance.
- Lack of follow up from policy into practice, integration is consistently promoted from the top, health and social care organisations are left to their own devices to put it into practice;
- The timeline generated show that policies relating to integrated dementia care have become more frequent in recent years.
- Steps have been achieved in many areas of dementia care, such as raising awareness regarding people living with dementia e.g. dementia friends.
- Government focus has only recently moved to dementia as illustrated by the timeline.
- Integration can be categorised into four key areas: People, control, infrastructure and finances.
- The conceptual framework corroborated the gap in impact studies of integrated care for people with dementia and therefore justified the need for research in this area.

Governmental policy and its relating document should act as an enabler of new of integrated care systems. However, as the literature suggests, there is a gap between policy and its practical implementation (Jarrett et al, 2009), which is further widened by a real confusion over the term integrated care and integration. Integrated care is further hindered by a number of barriers, which include: overly bureaucratic governance arrangements, limited resources, inadequate leadership, professional and institutional barriers and protracted decision-making processes (Williams and Sullivan, 2010).

Evidence does show, however, that the Government has not ignored the lack of success in delivering an integrated care system, but has taken action. This action has taken form in the introduction of new ways to support an integrated care system, for instance one of its most recent pledges to make “joined-up and coordinated health and care the norm by 2018 – with projects in every part of the country by 2015” (DoH, 2013).

The Government aim to achieve the above, joined-up care by 2018, by establishing a consensus on the definition of “what people say good integrated care and support looks and feels like” (DoH, 2013), Finding a definition for this is something that has not been done before. They also hope to develop “pioneer” areas by September 2013 from which they can learn innovative and practical approaches to delivering integrated care as quickly as possible. Finally as there is little evidence around the impact of integrated care they have pledged to develop new methods to measure user's experience of integrated care.

The fact that the Government is continuing to consider different ways to integrate health and social care implies: indicates that health and social care are still not integrated. In this regards, Kings' Fund (an independent charitable organisation) suggest a different approach, which follows the example of successful local initiatives. It involves placing the end user at the centre of the system, a single system that acts as a whole to provide that end user with the service they require.

This paper has presented the impact of high-level integrated care, through looking at policy documents as well as a taxonomy for integrated dementia care. Future stages of the research will include identification of barriers and enablers to integrated care and a case study to generate primary evidence into the impact of an integrated process on people with dementia (Yin, 1999). A further step will be to investigate the extent different initiatives are positively or negatively impacting on people with dementia so to accelerate the implementation of good practices. The impact search was restricted to documentation published up to 2012. For that reason, impact would have been harder to measure for some of the later documents; therefore a further review into impacts, where more time had passed since the publication of policy would be beneficial.

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A conceptual Framework for Incident Command System in the United Arab Emirates

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Abstract:

Disasters that have affected the Middle East, as well as the preparedness of organizations to deal with future disasters, are among the most important topics. A successful response to an emergency requires effective coordination amongst commanders under time pressure and situations that entail critical decision making. The Incident Command System (ICS) is a formalized management structure that provides efficiency and direction during emergency response, as well as co-ordination between multiple agencies. The management of incident command efforts is divided into three core levels: operational, tactical and strategic. The aim of this research is to investigate capability and competency of commanders within incident command system training related to emergency response in the United Arab Emirates (UAE), to increase a capacity building of the emergency commanders during response to emergencies. With this in mind, this paper reviews the international standard of emergency management in general as well as the UK incident command system framework in particular.

Keywords:

Disaster Management, Emergency Management Life Cycle (EM), Emergency Preparedness and Training, Incident Command System

1. Introduction

The United Arab Emirates (UAE) is prone to different types of hazards. Although some of these hazards are man-made, some are natural and include earthquakes, flooding. Fujairah Emirate has suffered from natural disasters in the last 15 years than any other emirates, most of the natural hazards have occurred in Fujairah. Moreover, strong rainfall in the UAE environment results in high level of flooding. An example of flooding that happened in Al Qurayah, in December 1995, also the Sharm flood in 2009 (Dhanhani, 2010). Disasters that have affected the Middle East, as well as the preparedness of organisations to deal with future disasters, the co-operation between organisations to initiate a national disaster plan in the country, are among the most important topics discussed at a conference recently held in Abu Dhabi, the UAE's capital (Al-Awadi and Saidani, 2010).

Earthquake risk, one of the main disasters facing UAE, is caused by the fault line connecting the Iranian highlands and the UAE, which is known as Zagros Fault, a site of increased seismic activity. The UAE is more exposed to natural hazards than other Middle East countries (Wyss and Al-Homoud, 2004). The Zagros Mountains comprise a folded belt that extends for about 1500 km in a northwest-southeast direction along the western part of Iran (Malkawi et al., 2007). Located near the edge of the Arabian Plate and close to major causes along the collision zone, the UAE is close geographically to Iran and lies to the south of one of the most active zones in the world. The March 2002 earthquake in Masafi has raised awareness of earthquakes (Wyss and Al-Homoud, 2004).

A survey of UAE ministries and Civil Defence indicated that there is a need for appropriate procedures, through the use of exercises and drills, to test the effectiveness of emergency procedures. Additionally, although there is a federal plan for disaster preparedness, there is little focus on natural hazards. There is also a lack of clarity regarding the responsibilities, between the operational and federal levels, for responding to a disaster (Dhanhani, 2010). Posing another significant problem within the UAE, drought continues to be an issue that has claimed half of all recorded losses; similarly, floods and earthquakes have the potential to damage the country (Dilley, 2005). Cyclone Gonu, the strongest tropical cyclone on record in the Arabian Sea, highlights the potential for large storm surges, as well as the vulnerability of the shallow coastline between Muscat, the Sultanate of Oman and Al Fujayrah, UAE. The storm-surge flooding hazard is expected to increase (Fritz et al., 2010). These factors stress the need to address and reduce the risk of natural disasters and to investigate key challenges to training needs assessment in the UAE. The need for training has become more evident than before (McClelland, 2002).

2. Aim and Objectives

The aim of this paper is to investigate the incident command system training related to emergency response in the United Arab Emirates, to increase a capacity building of the emergency commanders during response to emergencies.

To achieve the aim of the research, the following specific objectives have been formulated in order to facilitate the achievement of the aim of this research:

- To identify the existing Incident Command System (ICS) protocols of emergency response agencies.
- Critically evaluate the literature review on the existing practice approaches and models of Incident Command System (ICS).
- To identify the current Incident Command System training processes within the emergency teams in the UAE.

3. Literature Review

3.1. Emergency Management Life Cycle (EM)

Natural and man-made disasters have recently grown to a significant extent. Examples of these disasters include floods, tsunamis, earthquakes, which have presented huge challenges to the public. Hence, the severity of damage caused by disasters and lacking preparation for such occurrences indicates that people should increase their knowledge of disaster management (Xu and Zlatanova, 2007). A disaster is an emergency that cannot be managed by using local existing resources. It is a large-scale incident which affects many people and properties, and it also requires outside assistance when the community cannot respond to the event on its own (Madry, 2015). An emergency can be defined as *'a series of natural or human incidents that endangers people, property and the natural of built environment'* (Madry, 2015). Every emergency is unique, most emergencies are unexpected and unpredictable in terms of time and location (Alexander, 2005). In an emergency, response agencies are often assigned non-routine missions, such as rescuing injured individuals, saving lives and preventing damage to property (Subramaniam et al., 2012). Emergency management is categorized by four main phases: mitigation, preparedness, response and recovery. All these phases are essential components in addressing different hazards (DuVernoy, 2002).

Mitigation is considered the first phase of emergency management, it covers the activities that actually eliminate or to reduce the probability of a disaster. It also pertains to the long-term activities that are intended to reduce the effects of a disaster (Johnson, 2000). Preparedness is regarded as the third phase of emergency management. It focuses on all the preparations and plans that support and enhance response and rescue operations. These types of activities should be undertaken before an emergency occurs. Some of the emergency forces involved in this stage are the police, ambulance and fire departments, which prepare and collaborate with one another during emergency situations (Zlatanova et al., 2007). Johnson (2000) states that in the preparedness phase, governments and individuals develop action plans to save lives and property and reduce disaster damage.

Response phase is the fourth crucial phase, which aims to save lives and property. It also entails all the activities that response agencies should embark on during and after an emergency. Immediacy of action contributes to managing the effects of an emergency and ensuring stability after an event occurs. The response stage is therefore considered the phase in which plans are transformed into action (Doyle, 1996, Ford and Schmidt, 2000). Recovery is the final phase of emergency management. It involves special arrangements that are designed to restore all societal infrastructures, such as water, electrical power and transportation services (Subramaniam et al., 2010).

In the United State, The Federal Emergency Management Agency (FEMA) has described four main phases of emergency management (EM): mitigation, preparedness, response and recovery (Tierney and Cigler, 2009, DuVernoy, 2002). Whereas, the UK has adopted a concept in which civil protection based, which is Integrated Emergency Management (IEM). This is a holistic approach includes six main steps namely: anticipation, assessment, prevention, preparation, response, and recovery. Emergency Preparedness in the UK covers all four first steps, whereas Emergency Response and Recovery includes the last two steps: response and recovery (Government, 2013). Anticipation and assessment includes risk assessments. Prevention measures adopted as a result of assessment of the risk. Preparedness includes preparation of plans. Response often means the initial response to an incident achieved by emergency services. Recovery covers all activities for both community and those involved with the response (CabinetOffice, 2004).

In the US emergency preparedness cycle is essential for effectiveness response. The six vital activities for responding to incidents are: Plan, Organise, Equip, Train, Exercise, Evaluate and Improve (Homeland, 2008, FEMA, 2010, FEMA, 2011). However, in the UK plan preparedness cycle contains eight elements which are: Direction, Information gathering, Plan writing, Consultation, Publication, Training, Validation and Confirmation or revision (CabinetOffice, 2004, CabinetOffice, 2011).

According to the CabinetOffice (2013) there are three main levels of emergencies.

- Significant emergency (Level 1): This has a wide-ranging of focusing and requires support from central government. Examples of an emergency include most severe weather problems.
- Serious emergency (Level 2): This has long threat and impact, requires support from number of local departments and agencies. Examples of an emergency at this stage might be terrorist attack, widespread urban flooding and an outbreak of animal disease, such as H1N1, and responding to London Underground bombings.
- Catastrophic emergency (Level 3): This has the potential of widespread impact and requires support from central government immediately. For instance, natural disaster or industrial accident such as Chernobyl.

3.2. **Emergency Preparedness and Training**

Emergency response is a complex activity which requires experts from multiple agencies. An effective response requires training and education for all team members who are likely to serve during an emergency or disaster (Homeland, 2008). Operational emergencies are unsafe environments, so to make these places safer for emergency commanders, they should be trained how to stay safe during these types of events. There are two main factors to this approach: organisational responsibility and individual or personal responsibility. The organisation has to supply the training programmes and sufficient equipment to ensure that all individuals are able to remain safe. The individual has to take a chance on the procedures and training programmes provided by the organisation to remain safe (Lamb et al., 2014).

The quality of the response to emergency efforts is associated with the staff's knowledge, skills, and abilities to put them into practice in a range of disaster situations (Schaafstal et al., 2001). Training and exercises are essential tools because disasters are uncommon, making previous practice particularly vital elements in emergency management (Sinclair et al., 2012).

The U.S. Department of Homeland Security has developed a system based on Emergency Management Assessment Programme (EMAP) standards to respond to disasters, which include 17 important programme areas: programme management; laws and authorities; hazard identification, risk assessment and impact analysis; hazard mitigation; resource management; mutual aid; planning; direction, control and coordination; communications and warning; operations and procedures; logistics and facilities; training; exercises, evaluations and corrective action; crisis communications, public education and information; and finance and administration (www.emaponline.org) (Sutton and Tierney, 2006)

Emergency training is intended to develop people's capacity to respond to demands during a disaster. Furthermore, it is a vital element in increasing job ability by exercising a specific skill. Training must focus on a number of procedures that will take place during the emergency (McEntire and Myers, 2004). Therefore, a comprehensive training programme should be required. According to (Wilson, 2000) it should have seven basic steps, as follows:

- Identify the training needs.
- Identify those who need training.
- Identify the training method to be used.
- Prepare the training materials.

- Deliver the training programme.
- Evaluate the effectiveness.
- Review or audit the process for the future.

3.3. Incident Command System (ICS)

The Incident Command System ICS was developed in the aftermath of the Southern California wildfires in 1970. There were over 600,000 land burned and over destroyed 772 buildings within 13 days (Lutz and Lindell, 2008). The command structure used by the police service based on the (GSB) hierarchy of command, which stands for Gold, Silver and Bronze commanders. Therefore effective command based on the existence of:

- A role within an appropriate framework (GSB);
- Training, exercise and experience;
- Systems to support effective decision making (National Policing Improvement Agency NPIA, 2009).

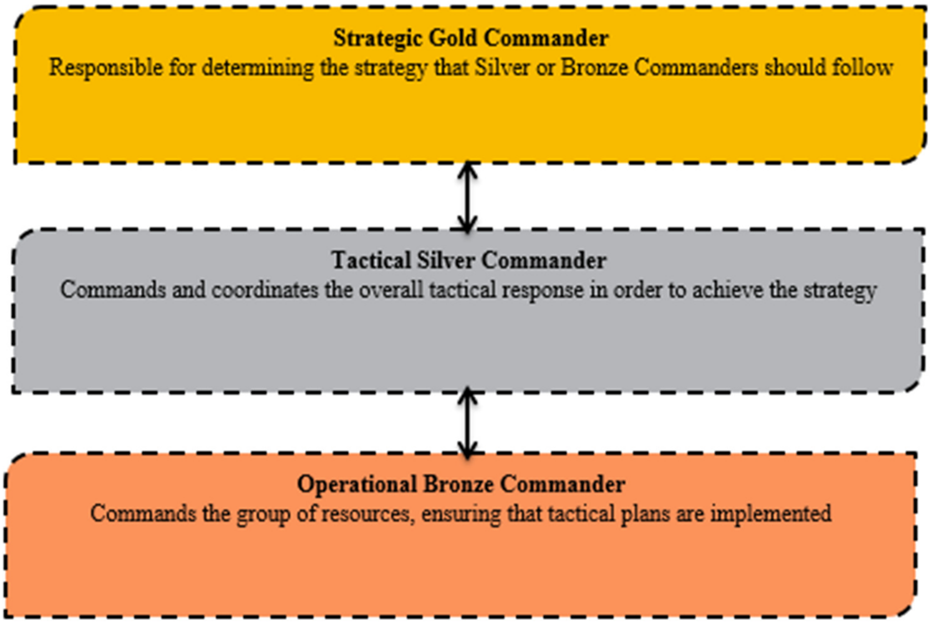

Figure 1: GSB UK Framework (Source: National Policing Improvement Agency NPIA, 2009)

ICS is a formalised management structure that provides efficiency and direction during emergency response, as well as co-ordination between multiple agencies. It has been used in all levels of federal, state, local and many private sectors (Herrmann, 2007). ICS has been standardised for organisation emergency response structures and networks that are specifically designed for increasing teamwork effectiveness (Lutz and Lindell, 2008). According to Lutz and Lindell (2008), ICS increases organisational effectiveness through 14 main features, such as common terminology, management by objectives, reliance on an incident action plan and chain of command.

The ICS is structured into four main categories: planning, public information, operations and logistics (Bearman et al., 2015). Furthermore, FEMA has documented also four main elements which illustrates the role of Incident Commander at ICS structured: Finance, Operation, Logistics and Plans (FEMA, 2011, Herrmann, 2007).

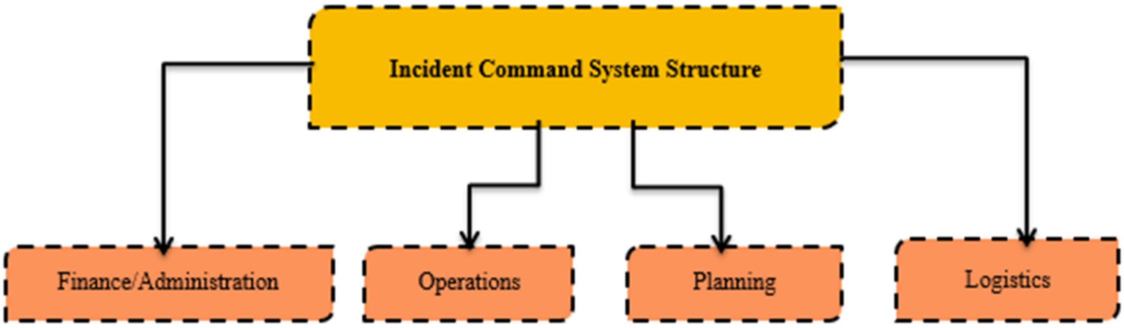

Figure 2: Incident Command System (Source: Bearman et al., 2015)

Table 1: The ICS components and responsibilities (Source: Herrmann, 2007).

ICS Component	Responsibilities
Incident Commander	• Set objectives and priorities • Assume overall responsibility at the incident or event
Operations Section	• Implement the Incident Action Plan (IAP) • Manage tactical operations at the incident site
Planning Section	• Collect and evaluate information. • Develop Incident Action Plans. • Maintain resource status
Logistics Section	• Provide support to meet incident needs. • Provide resources and all other services needed to support the incident.
Finance/Administration Section	• Monitor costs related to incident. • Provide accounting Procurement Time recording cost analyses.

Emergency training has received global attention as a high priority issue. For instance, the FEMA in the US recognises the importance of preparing individuals for a wide range of potential disasters; it states that the quality of response efforts is associated with the knowledge and skills of the staff and agencies during disaster situations (Schaafstal et al., 2001). FEMA has established a website for emergency training targeted at both government officials and emergency managers. This website covers many training programmes related to emergencies; it also includes special programmes for emergency managers (www.training.fema.gov).

FEMA supports the Community Emergency Response Team (CERT) course by sponsoring Train-the-Trainer (TTT) sessions which are useful for the fire, medical, and emergency management community. The objectives of TTT are to prepare attendees to promote these training sessions in their community, government groups, and first responder agencies. FEMA believes that the CERT course will improve the ability of the responders to deal with emergencies. Seven teams of Hawaiian residents have participated in CERT training sessions since 1997, which not only increased their awareness of how to respond to disasters but also made them more effective and efficient in their response (Prizzia and Helfand, 2001).

Another important example programme of increasing the quality of individual competency is the Hydra Immersive Simulation system. This is a tool that enables the ability to monitor leadership and decision-making during emergency events. The Hydra system depends on computerised scenarios which demonstrate uncertainty and time pressure during an emergency; for more details, visit (http://www.hydrafoundation.org/). Its main objectives include developing the decision-making skills of fire fighter, police officers, members of the military, and private sector workers in the UK and internationally (Alison et al., 2013). It is a tool that delivers training to all emergency commanders, from fire officers to a multi-agency services, at either operational, tactical or strategic level of command (Lamb et al., 2014). One example of a Hydra exercise is 'Operation Pandora'. Its main objective is to test and train police officers by simulating scenarios involving competing incidents at different times, which the officers have to respond to as if they were real situations. Furthermore, the exercise defines the roles of gold, silver and bronze command and increases officers' abilities to manage a real emergency event (Alison et al., 2013).

Another type of training tool is XVR, which is a software program produced by the Dutch company E-Semble that simulates training scenarios; for more details, visit (http://www.xvrsim.com/). E-Semble is the most famous simulation software company in the European market. XVR is used by instructors of police departments, fire departments, and private industry in over 22 countries (Lamb et al., 2014, Hosseini and Izadkhah, 2010).

Table 2: Approaches of Emergency Management in the US and UK

Country	Approach	Number of Cycle	EM Lifecycle
US	Comprehensive	Four	Mitigation, Preparedness, Response, Recovery
UK	Integrated EM	Six	Anticipation, Assessment, Prevention, Preparation, Response, Recovery

Table 3: Emergency Preparedness Cycle in in the US and UK

Country	Number of Cycle	Emergency Preparedness Lifecycle
US	Six	Plan, Organise, Equip, Train, Exercise, Evaluate, Improve
UK	Eight	Direction, Information gathering, Plan writing, Consultation, Publication, Training, Validation, Confirmation or Revision

The components of the incident command system have various key elements; these elements will be a basis for my future work in doctoral research. There will be further international investigation about the incident command system in order to see whether it would be a suitable structure approach to emergency response in the UAE.

4. Conclusion and Future Work

This paper has addressed the UK and the US emergency management EM lifecycle. In addition, it reviewed emergency preparedness cycle which illustrates activities for effective responding to incidents in both countries. Furthermore, this paper attempts to identify the current incident command system in the UK and identify the key elements that affect the incident command system in the UA. Then, it aims to suggest a conceptual framework to the training needs of emergency preparedness in the UAE. Finally, it attempts to increase the interest of improving the performance of emergency teams globally and particularly in the UAE.

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Disaster Response Management Stemming From War Operation and Terrorism In Iraq

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Abstract

Iraq has experienced various disasters either natural or manmade. Within the context of manmade disaster, war and post-war conflicts have crippled many essential services needed to reduce risks, manage hazards, and respond to disasters. This has impacted on the response phase, which is considered one of the critical phases in the Disaster Management life cycle. Due to the salient of the research model of behavioural response to disaster, which applicable to terrorism events, the effect of war and terrorism in Iraq has been highlighted during the response phase. Because of the lack of empirical data in this field, this research aims to present the significance of disaster management in general and in particular, the response management phase by doing a systematic review of the literature of disaster response management. In order to achieve the aforementioned aim, data collection included information obtained from literature relating to disaster response management. This literature contains central and local government ordinances, reports and regulations along with journal papers and books. Findings show that the paradigm shift in disaster management thinking in Iraq has not changed as regards the adoption of an all-risk disaster reduction system to replace their reactive disaster response operational mechanisms. Furthermore, the government of Iraq has traditionally responded in a reactive manner to disasters associated with flooding, earthquakes, drought, conflict and industrial accidents.

Keywords:

Disaster response management, Iraq, Terrorism, War operation

1. Introduction

Disasters are as old as human history but the dramatic increase and the damage caused by them in the recent past have become a cause of national and international concern (Dey & Singh, 2006). ‘Disasters’ have become a common word to people all over the world. The whole world is prone to natural disasters as well as to abrupt man-made ones, which have been occurring repeatedly in recent history (Palliyaguru, Amaratunga, & Haigh, 2013). They appear to be increasing in frequency. Figure 1 clearly shows a rise in disaster numbers each decade from the 1950s to the end of the 20th century (Aitken & Leggat, 2012). Statistics indicate that the number of natural and manmade disasters has climbed inexorably over the past decade. From 1994 to 1998, the reported disasters average was 428 per year but from 1999 to 2003, this figure went up to an average of 707 disaster events per year showing an increase of about 60 per cent over the previous years. The biggest rise was in countries of low human development, which suffered an increase of 142 per cent (Dey & Singh, 2006). The post-Cold War era has brought many changes in international relations and new challenges for the global community. Not the least of these are the responses to both natural and human-caused disasters in situations of armed conflict. There are now more than 35 armed conflicts world-wide that inflict over 1,000 civilian or military deaths (Jenson, 1997).

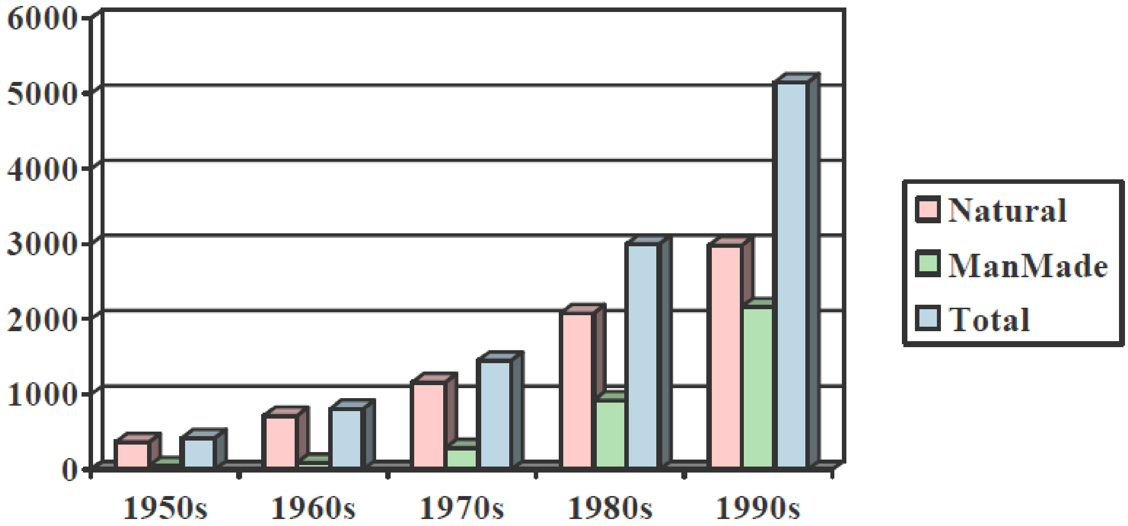

Figure 1. Frequency of Disasters Each Decade (Aitken & Leggat, 2012, p. 146)

Most noticeable, is the fact that disasters are large intractable problems that test the ability of communities and nations to effectively protect their populations and infrastructure, to reduce both human and property loss, and to rapidly recover (Altay & Green III, 2006). Thus, it is argued that natural and man-made disasters, such as earthquakes, floods, plane crashes, high-rise building collapses, or major nuclear facility malfunctions, pose an ever-present challenge to public emergency services. As a result timely interaction and coordination of public emergency services are required by disaster response and recovery efforts in order to save lives and property (Meissner, Luckenbach, Risse, Kirste, & Kirchner, 2002). Moreover, maintaining a balance between theoretical and practical significance is needed in disaster studies. Thus, linking practical problems that emerge in disasters with broader social science theories and other perspectives on disasters such as organizational crisis response should be sought by researchers (Lindell, 2013; Mitroff, 2005).

In disaster research literature, the response phase is identified as the most critical phase of the three phases (prevention, response, recovery). It is worthily mentioned that lives might be saved and the effects of the disaster might be mitigated due to the disaster managers' decisions in the response phase (Hale, Dulek, & Hale, 2005). As a result responding to disasters has become an essential part of modern life. Moreover, effective response to both natural and man-made disasters requires evaluating and exploring the current response management system prior to, during, and after potentially catastrophic events as well as initiating activities that will lessen their impact upon society.

Table 1: Top 10 Countries Ranked by Terrorism Risk, 2010 (Coppola, 2006, p. 118)

Rank	Country
1	Iraq
2	Afghanistan
3	Pakistan
4	Somalia
5	Lebanon
6	India
7	Algeria
8	Colombia
9	Thailand
10	Philippines

Continuing terrorist attacks worldwide are likely to sustain attention to disaster response management, particularly in Iraq. According to statistics, (see Table 1), Iraq is considered the top terror -prone country in the world and, therefore, disaster management is considered to be one of the most significant concerns in this country.

This paper provides a background study on the concept of disasters and its components in general and disaster response management in particular. It focuses on disaster response management within the Iraqi context.

2. Aim

The present paper aims to contribute to the existing knowledge on disaster response management, a field of study that is still largely underexplored in the context of the Middle East and in the context of war and terrorism more specifically, by reviewing its literature, through a systematic review methodology.

2.1. **Disaster Definitions**

Disasters are commonly known as "sudden events, which bring serious disruption to society with massive human, property, livelihood, industry and environmental losses, which exceed the ability of the affected society to cope using its own resources" (Eshghi & Larson, 2008; Shaluf & Ahmadun, 2006) cited in (Palliyaguru, Amaratunga, & Haigh, 2010). In a similar way Vasilescu, Khan, and Khan (2008) define disaster as " a sudden adverse or unfortunate extreme event which causes great damage to human beings as well as plants and animals. Disasters occur rapidly, instantaneously and indiscriminately". However, Fritz (1961, p. 655) and Lindell (2013, p. 797) state that a disaster is "an event concentrated in time and space, in which a society or one of its subdivisions undergoes physical harm and social disruption, such that all or some essential functions of the society or subdivision are impaired". From these definitions, it is apparent that disasters have different characteristics and impacts but have a common element, which is their severity. Thus, no definition of disaster is universally accepted (Shaluf, 2007).

2.2. **Types of disasters**

Disaster phenomena have been studied by research centres all over the world. Sometimes different terminology may be used to classify disasters by different researchers. The views of academics on disaster types are summarized below.

Disasters are mainly classified by many researchers into two groups: natural disaster and manmade/technological disaster (Biswas & Choudhuri, 2012; Fischer III, 1998; Goolaup et al., N.D.; Iyer & Mastorakis, 2006; Moe & Pathranarakul, 2006; Zimmerman, 1985). Figure 2 illustrates the types of disaster. However, certain research such as Moe and Pathranarakul (2006) call man-made disaster by a different name; that is “technological disaster”. On the other hand, Shaluf (2007) classified it into three groups: (natural, man-made and hybrid) disasters as shown in Figure 3. Similarly Hood and Jackson (1992, p. 112) categorized it into purely natural disasters, hybrid disasters and purely social disasters. What follows is a description of these types.

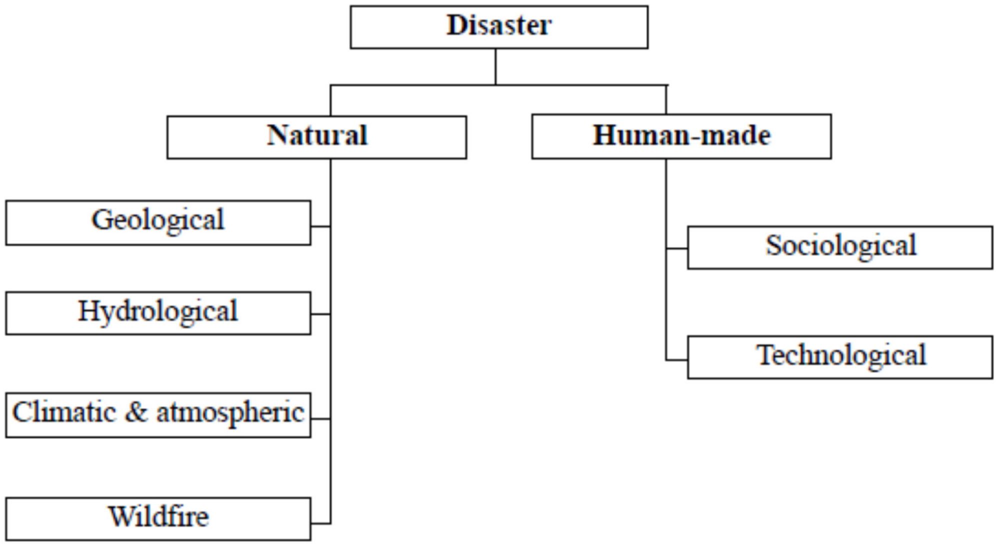

Figure 2. Types of Disaster (Biswas & Choudhuri, 2012, p. 13)

2.2.1. Natural Disaster

Before proceeding to examine the concept of man-made disaster, it will be necessary to understand the concept of natural disaster. Broadly, a natural disaster has been defined as a consequence when humans are affected by a natural hazard (e.g., volcanic eruption or earthquake). Human vulnerability, caused by the lack of appropriate emergency management, leads to environmental, financial, or human impact (Biswas & Choudhuri, 2012, p. 14). In a similar way Pelling et al. (2004, p. 98) defined it as “a serious disruption triggered by a natural hazard causing human, material, economic or environmental losses, which exceed the ability of those affected to cope”.

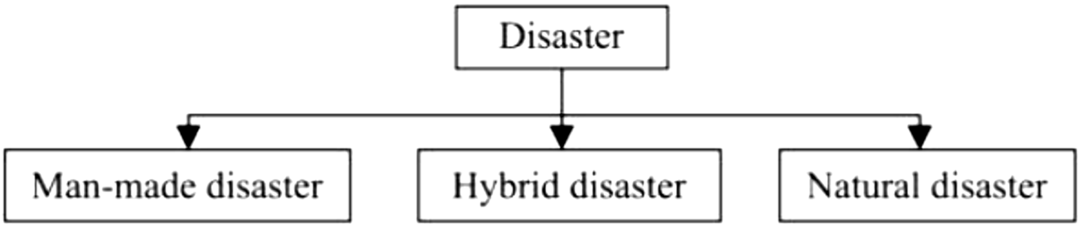

Figure 3. Types of Disaster (Shaluf, 2007, p. 705)

2.2.2. Human-made Disaster

A major term of interest for this study is that of human-made disaster. Human-made disaster has been defined as human action, error, negligence, or involving the failure of a system which caused disasters (Biswas & Choudhuri, 2012, p. 14). Similarly, Goolaup et al. (N.D., p. 25) define it as "emergency situations of which the principal, direct causes are identifiable human actions, deliberate or otherwise. Situations in which civilian populations suffer casualties, losses of property, basic services and means of livelihood as a result of war, civil strife or other conflicts, or policy implementation are mainly involved in it. People are forced to leave their homes, in many cases, giving rise to congregations of refugees or externally and/or internally displaced persons as a result of civil strife, an airplane crash, a major fire, oil spill, epidemic, terrorism, etc." Iyer and Mastorakis (2006, p. 3), in a similar way, define it as the result of various untoward incidents. Shaluf (2007), on the other hand, defined it as those catastrophic events that result from human decisions.

Whereas the frequency and severity of natural disasters should be acknowledged, Harding (2007) states that human-made disasters are broader in scope and consequences. Furthermore, human-made disasters provoke a serious disruption of the agriculture, economy and health-care sectors of a society, typically producing long-lasting effects that perpetuate underdevelopment. To sum up, disaster management has traditionally emphasized natural hazards rather than man-made technological hazards (Zimmerman, 1985). This paper will shed light on human-made disasters stemming from war operations and terrorism in Iraq.

2.2.3. Types of human-made / man-made disasters

Biswas and Choudhuri (2012) categorized man-made disasters into two types technological and sociological. Technological disasters are the results of failure of technology, such as transport disasters, engineering failures, or environmental disasters. Sociological disasters have a strong human motive, such as war, riots, criminal acts and stampedes (Biswas & Choudhuri, 2012, p. 14). However, the International Federation of Red Cross and Red Crescent Societies (2003) classified it by its occurrences, that can be sudden or long-term. Sudden man-made disasters include mine, structural and building collapses when this occurs independently without any outside force. Moreover, land, sea, and air disasters are all man-made disasters. Long-term man-made disasters tend to refer to international and national conflicts. Nevertheless, Turner and Pidgeon (1997) cited in Shaluf (2007, p. 707) categorized it due to its causes: (see Figure 4)

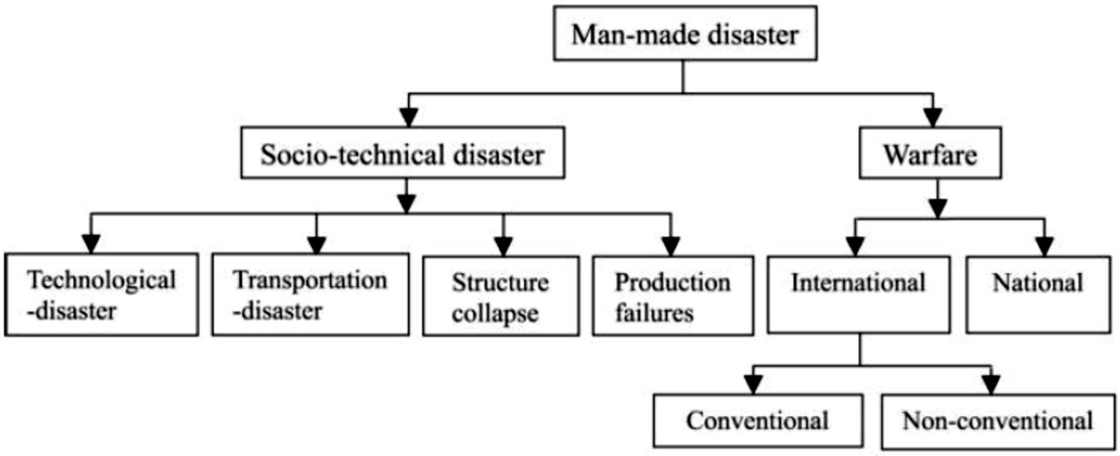

Figure 4. Types of Man-made Disaster (Shaluf, 2007, p. 705)

2.2.4. Hybrid disasters

According to Shaluf (2007) hybrid disasters are a result of both human error and natural forces. The extensive clearing of jungles causing soil erosion, and subsequently heavy rain causing landslides is considered one of many examples of hybrid disasters. In a similar way Hood and Jackson (1992) cited in Shaluf (2007, p. 710) defined it as a compound of human decisions and volatile natural forces (e.g. floods ravage communities built on a known floodplain).

To sum up, sometimes natural and/or man-made disasters trigger subsequent disasters such as displaced people, and haze (International Federation of Red Cross and Red Crescent Societies, 2003). The subsequent disasters have social and economic impacts. Furthermore, the disruption of normal community functions through human made disaster must be recognized for its broad-based, long-term impact (Harding, 2007). For this reason war operations and terrorism in Iraq has been highlighted in this research.

a. War operations

Before proceeding to examine the concept of terrorism, it will be necessary to shed light on the concept of war. From the review of disaster literature, it can be seen that publications about disasters in general are numerous, but those addressing disaster management plans for wartime in the Middle East particularly are fairly recent and are few in number (Moustafa, 2013). Moustafa (2013, p. 18) defined war as “an organized and often prolonged conflict that is carried out by states or non-state actors; it is generally characterized by extreme violence, social disruption, and economic destruction”.

b. Terrorism

As far as war is concerned, terrorism is the most salient hazard due to a remarkable upsurge in terrorist acts during the past decade particularly in Iraq (see Table 1). After the events of 11 September 2001, our world has been changed for ever. It becomes a more dangerous and uncertain place, and no-one is safe or immune from the threat of terror.

Terrorism is defined in many ways by many scholars and institutions. According to Frykberg and Tepas 3rd (1988, p. 569) terrorism is the unlawful exercise of random and ruthless violence against property or individuals, usually innocent civilians, in order to intimidate governments or societies for political or ideological purposes. In a similar way Panzer, Butler, and Goldfrank (2003, p. 2) defined terrorism as the illegal use or threatened use of force or violence to instil fear in populations, and intended to coerce societies or governments by inducing fear in their populations. While Miron and CERNUŞCA (2008, p. 65) and Romanian Law (535/2005) defined terrorism as "the unlawful use or threatened use of force or violence against people or property to coerce or intimidate governments or societies, often to achieve political, religious, or ideological objectives".

In the case of Iraq, it is widely agreed that terrorists did not have a hold on any part of Iraq before the US invasion. However, it is also generally believed that Iraq contains quite a few terrorists and terrorist organizations. Therefore a step back will be suggested rather than forward (Fischer III, 2005). As a result, violence in Iraq has become normalized, ranging from the Iraqi and US military assaults and sectarian militias, threat of suicide bombings, to violent street crime (Wong, al-Saiedi, & Silva, 2005).

As discussed above, terrorist threats and war attacks are a reality in Middle East countries particularly in Iraq. Accordingly, terrorism and war operations are the main reasons leading to the increased number of disasters in Iraq. So, to have an overall picture about Iraq's disaster management when responding to terrorist threats and war attacks, the next section will highlight disaster management.

3. Disaster Management

The following is a brief review of disaster management definitions. Lettieri, Masella, and Radaelli (2009, p. 117) defined disaster management as administrative decisions and the body of policy, the actors, the operational activities and technologies that relate to the several phases of a disaster at all levels. (Dey & Singh, 2006; Vasilescu et al., 2008) agree with this view, stating that it includes all the activities which help to avoid, reduce impact or recover from disaster loss, and these can be implemented before, during or after a disaster.

3.1. **Disaster Management Cycle**

Goolaup et al. (N.D., p. 27) define the disaster management cycle as "a cycle with phases that reduce or prevent disasters". Whereas Iyer and Mastorakis (2006, p. 3) define it as a logical, integrated and progressive sequence of activities as a cycle of preparedness and action followed by disaster management. Iyer and Mastorakis (2006, p. 3) identify the stages of disaster management as, risk reduction, readiness, response, and recovery. Gospodinov and Burnham (2008, p. 28) divided the disaster cycle into four phases, namely, response, reconstruction, mitigation, and preparedness see Figure 5. These divisions use the same concepts but in different terms.

Figure 5. Disaster Cycle (Gospodinov & Burnham, 2008, p. 28)

3.2. **Disaster response management**

Having defined what is meant by the disaster management cycle, disaster response management definitions will be reviewed. According to EMA (2004, p. 32) response is an "action taken in anticipation of, during, and immediately after an emergency to ensure that its effects are minimised, and that people affected are given immediate relief and support". In the same way, Vasilescu et al. (2008, p. 47) defined response activity as initiatives taken in response to a disaster with the purpose to achieve early recovery and rehabilitation of affected communities, immediately after a disaster strikes. Goolaup et al. (N.D., p. 50) agree with this view, stating that disaster response is "the sum total of actions taken by people and institutions in the face of disaster. These actions commence with the warning of an oncoming threatening event or with the event itself if it occurs without warning". Using a narrower concept, the World Health Organization (2002, p. 22) defined it as a set of activities implemented after the impact of a disaster. On the other hand, Iyer and Mastorakis (2006, p. 3) define it as "The core of the initial response to a disaster provided by the emergency services and thereafter, depending on its nature and scale by the local authorities and voluntary and utility services.". While Coppola (2006, p. 305) stated that the beginning of response processes is as soon as the hazard event has become imminent and lasts until the emergency is declared to be over.

As Baharin, Shibghatullah, and Othman (2009) stated, the response phase is one of the critical phases in the Disaster Management System life cycle. Furthermore, due to the salience of the disaster research model of behavioural response to disaster as applicable to terrorism events (Fischer III, 1998a, 1998b, 2005). The focus of this study is at the response phase of man-made disasters in Iraq.

The key problem with this phase is it is widely believed by the public that the behavioural response to disaster is deviant and chaotic (Fischer III, 1998a, 1998b). Previously, Fischer III (2005) noted that the behavioural response is actually very altruistic. While Comfort (2002) mentioned that the effective mobilization of response to extreme events on a large scale is considered one of the least understood problems in public management. He also stated that the knowledge base to support response operations in such an event needs to be scalable.

Regarding the effectiveness of the organizational response, Fischer III (2005) presented three factors which affected the organizational response, namely: the extent to which emergency plans are rehearsed; the degree of prior disaster experience; and the level of prior planning. Whilst

Comfort (2002) listed three different factors, namely: pre-disaster planning among organizations to identify what information will be required; how this information may be accessed and rapidly searched, exchange, and absorption of valid information regarding sudden, damaging events transmitted through a network of organizations that crosses disciplinary, organizational, and jurisdictional boundaries required for this process.

On the other hand, Cardona (2005) believed that in order to reduce vulnerability, all types of risk management capabilities need to be strengthened. Furthermore, existing risks and likely future risks should also be identified. This cannot be achieved without an adequate measure of risk and monitoring to determine the effectiveness and efficiency of corrective or prospective intervention measures to mitigate or prevent disasters. Similarly, Ugwu and Ihejirika (2013) emphasised that when disaster occurs the need assessment process has become an initial process to follow up; it is a problematic or daunting task to understand the required need to administer more accurately and swiftly in such situations. Cardona (2005) also mentions that the lack of a comprehensive conceptual framework of disaster risk to facilitate a multidisciplinary evaluation and intervention resulted from the difficulty in achieving effective disaster risk management. Most existing indices and evaluation techniques have not adequately expressed risk and are not based on a holistic approach that invites intervention. To sum up, Cardona (2005) stated that evaluation and follow up should be undertaken using methods that facilitate an understanding of the problem and that can help guide the decision-making process.

So for all these reasons, research and evaluation provide disaster practitioners with the knowledge needed for preparedness and response. They also provide good platforms to exchange knowledge. As humanitarian crises become more complex, with new and varied actors on the ground, strong partnerships and collaboration between experts, organisations, and disciplines is vital to build capacity.

4. Disaster's in Iraq

Iraq is exposed to various forms of natural and human made disasters, as listed in Table 2.

Table 2: Natural and Human Induced Vulnerabilities Faced by Iraq (Humayun & Al-Abyadh, N.D., pp. 9)

Natural	Human Induced
Earthquakes	IDPs and refugees
Floods	Terrorism/civil unrest
Land Slides	Toxic environmental pollution
Sand Storms	Landmines & Unexploded Ordnance (UXO)
Drought	High risk structural collapses
Depletion of Natural Resources	Transport and industrial accidents
Health Epidemics	

The country is increasingly susceptible to natural disasters including floods, drought, epidemics, desertification, sandstorms, earthquakes, soil salination of fertile lands, destruction of marshlands, and chemical and industrial hazards (Humayun & Al-Abyadh, 2014, N.D.).

Table 3: Top Ten Natural Disasters in Iraq (1900 – 2011) (Goodyear, 2009, pp. 13-14) (Humayun & Al-Abyadh, N.D., pp. 9-10)

"EM-DAT: The OFDA/CRED International Disaster Database (www.em-dat.net)"

DISASTER	DATE	TOTAL POPULATION AFFECTED
DROUGHT	1969	500,000
FLOOD	11 MAY 1967	260,000
FLOOD	MAY 1968	150,000
FLOOD	4 FEBRUARY 2006	41,890
FLOOD	5 NOVEMBER 2006	18,000
FLOOD	10 JANUARY 2004	8,000
EPIDEMIC	14 AUGUST 2007	4,696
FLOOD	2011	2,001
EPIDEMIC	7 AUGUST 2008	892
FLOOD	27 JULY 1991	600
EARTHQUAKE	10 SEPTEMBER 2008	500

The following tables' No. 3, 4, 5 summarises the impact of ten major natural disasters in Iraq since 1900. These tables reveal that hydrological, meteorological or climatological events induced 76 percent of all natural hazards in Iraq. An approximate of 45 percent of deaths and 80 percent of economic losses was accounted by these disasters (Humayun & Al-Abyadh, 2014, N.D.).

Table 4: Top Ten Natural Disasters in Iraq for the Period 1900 to 2009 Sorted by The Number of People Killed (Goodyear, 2009, p. 14)

DISASTER	DATE	PERSONS KILLED
EPIDEMIC	14 AUGUST 2007	24
EARTHQUAKE	27 JULY 1991	20
FLOOD	5 NOVEMBER 2006	20
EPIDEMIC	7 AUGUST 2008	11
FLOOD	10 SEPTEMBER 2008	4
EPIDEMIC	1 JANUARY 2006	2
EPIDEMIC	AUGUST 1978	1

The effects of war in Iraq are coupled with the susceptibility to natural hazards which has exposed the people of Iraq to multiple human made disasters. Such disasters have included Sulphur Dioxide release due to Sulphur stockpiles, depleted uranium, Industrial and military legacy of contamination and dangerous waste, unexploded ordnance and land mines, military scrap yards, land pollution and dangerous waste by Oil industry, fire, and surface water pollution by oil spills due to sabotage of oil pipelines.

Table 5: Top Ten Natural Disasters in Iraq for the Period 1900 to 2009 Sorted by The Economic Damage (Goodyear, 2009, p. 14)

DISASTER	DATE	DAMAGE IN (OOO'S US $)
FLOOD	MARCH 1954	50,000
FLOOD	11 MAY 1967	5,000
FLOOD	MAY 1968	3,000
DROUGHT	1969	2,000
FLOOD	4 February 2006	1,300

The continuing effects of conflict, displacement and severe poverty have exacerbated the exposure of the Iraqi people to these disasters. Many essential services needed to manage hazards, reduce risks and respond to disasters have been crippled by war and post-war conflicts (ibid).

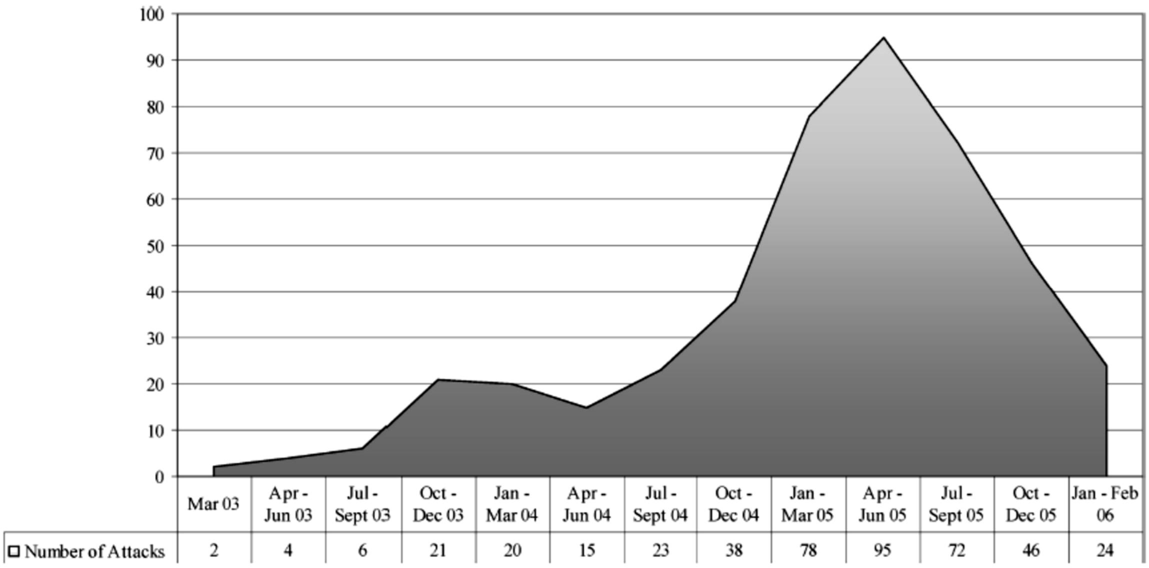

Figure 6. Number of Suicide Attacks in Iraq by Quarter, 2003–2006 (Hafez, 2006, p. 601)

According to Hafez (2006) 443 suicide attacks took place in Iraq between 22 March 2003 to 20 February 2006. See Figure 6. Moreover, due to the development of insurgency after the U.S.-led invasion in March 2003, the lethality of suicide attacks increased. See Figures 7.

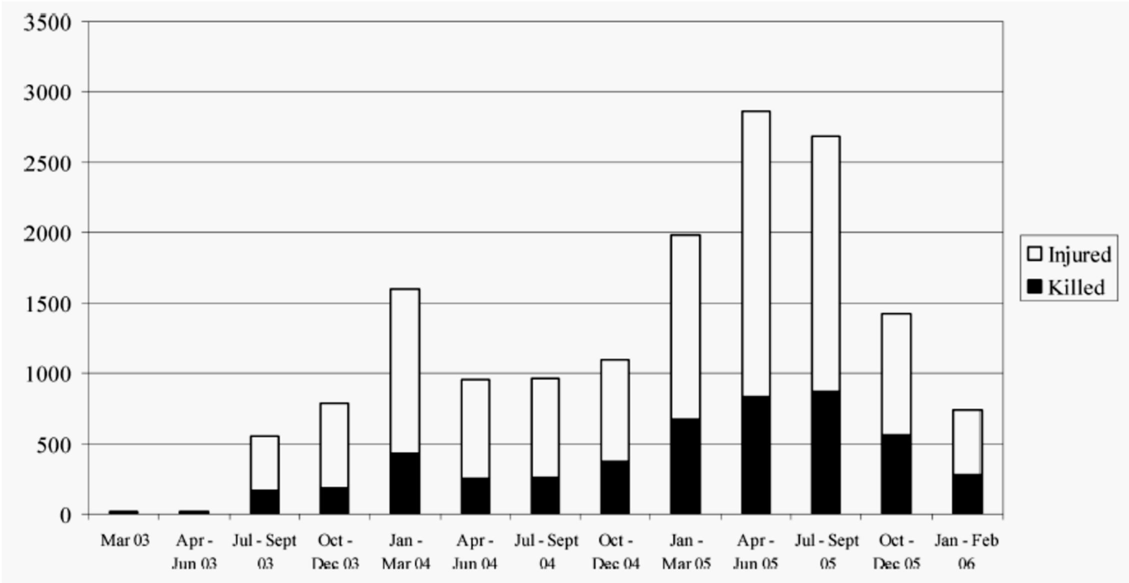

Figure 7. Number of Persons Killed and Injured in Suicide Attacks by Quarter, 2003–2006 (Hafez, 2006, p. 606)

The post war transitions in Iraq have affected the institutional capacities of the state to respond in an efficient manner. Furthermore, it appears that the lack of a national platform to organize the efforts of multiple institutions at all tiers of government have serious limitations for the current institutional and legislative systems for disaster risk reduction (DRR) (Humayun & Al-Abyadh, 2014, N.D.).

5. Conclusion

This paper presents an overview on disaster definitions and its types. It provides the existing knowledge with a background on the disaster response management due to war operation and terrorism in Iraq. It revealed that disasters have various definitions. Furthermore, different terms have been used to describe the types of disasters; however, the natural and man-made disasters cover all types of disasters.

Iraq has experienced multiple crises and disasters in the last decade. Thus Iraq is considered one of the top man-made disaster-prone countries in the world and, therefore, disaster management is considered to be one of the most important issues in this country.

At the end, it can be stated that, successful management of disasters depends on effective disaster response management, especially in large scale disruptive disasters such as wars and terrorism.

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Disruptive Innovation: A Potential Approach to Transform Public Organisations' Performance in Iraq to Successfully Attract FDI

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Abstract

Infrastructure development is considered a key facilitator for achieving economic growth in developing countries and has a direct impact on the growth and overall development of an economy. However, meeting the significant infrastructure investment needs will require greater involvement of Foreign Direct Investment (FDI) in the forms of transactional companies (TNCs) and multinational companies (MNCs).

There are however a number of factors (external and internal) that affect the flow of FDI to developing countries. External factors include political, social and economic stability, market size, business conditions, etc. Internal factors are mainly related to the quality of the government institutions of the host country which is reflected by their level of transparency, bureaucracy and corruption. These institutional factors have a significant impact on the level of FDI flows to developing countries. Such factors are a result of, rather than a cause for, an underdeveloped institutional framework.

In Iraq, development of infrastructure is conducted as part of the government procurement by the public sector organisations. The World Bank ranked Iraq 156 out of 189 countries in its 2015 overall "ease of doing business" category. Transparency International ranked Iraq 170 out of 175 in its 2014 Corruption Perception Index. There are number of models BEMs such as EFQM, PDCA, etc., which can improve the current performance of organisations. However, this approach is a lengthy one and the implementation of which can jeopardise any improvement due to the lack of quick wins. Thus, this paper suggests that "Disruptive Innovations" can be a viable approach for improving the quality of Iraq government organisations in the shortest period possible and with less resistance to change. Such an approach can help achieve the commitment of top management to engage in a large scale public sector reform programme.

Keywords:

Bureaucracy, Corruption, Disruptive Innovations, FDI, Public Sector Reform

1. Introduction

Economic growth is the best way to help raise people's income, reduce poverty, create jobs and build more stable future in the developing world. Stimulating and sustaining economic growth is not an easy task for developing counties given the challenges they are facing such as weak institutions, high unemployment, poor infrastructure, a lack of access to financial services and unsuitable laws and regulations (Greening, 2014b). So as to improve their conditions some countries such as the People's Republic of China (PRC) and East/Southeast Asian countries have made swift improvement in their macroeconomic situations, investment, exports and employment over two and half decades because of vast investment in infrastructure (Straub, Vellutini and Warlters, 2008, Chatterjee, 2005).

Infrastructure development is considered a key facilitator for achieving economic growth in developing countries (Greening, 2014a). According to Nataraj (2012) developing the infrastructure will have a direct impact on the growth and overall development of an economy. Since it contributes to production growth by stimulating economic activity, productivity and enhancing the quality of life (WorldBank, 1994). Conversely, lack of infrastructure, creates hiccups for sustainable growth and poverty reduction (Sahoo, 2011). However, Sahoo (2011) argues that infrastructure development requires developing countries to have adequate financial resources, strong planning, coordination, decentralisation, private sector participation and commercialisation of service providers. Moreover, meeting the significant infrastructure investment needs of developing countries will require greater involvement of Foreign Direct Investment (FDI) in the forms of Transactional Companies (TNCs) and multinational companies (MNCs) (UNCTAD, 2008).

FDI and its relation to economic growth have been discussed widely in the literature. According to Saravanamuttoo (1999) and Klein, Aaron and Hadjimichael (2001) FDI is considered as a key pillar of sustainable economic growth. It also offers non-financial benefits, particularly positive spillovers such as productivity gains, knowledge and technology transfers and human capital enhancement (BKPM, 2010, OECD, 2002, Wang, Gu, Tse and Yim, 2013). Yet, in order to attract FDI, developing countries need to understand investors' requirements and work rigorously to address them. Of those number of FDI determinants, institutional factors, such as non-transparency, bureaucratic red-tape and corruption, are found to have a significant impact on the level of FDI inflows to developing countries. Since such factors directly reflect the quality of the institutional framework of host countries' government organisations, see (Drabek and Payne, 2002, Habib and Zurawicki, 2002, Dahlström and Johnson, 2007, Al-Sadig, 2009). Therefore, in order to successfully attract MNCs to foster FDI inflows, developing countries need first to improve the institutional framework of their public organisations in line with best practices of world class organisations. This paper aims for proposing a strategic approach that can help public organisations to transform their current organisational framework into one that are accepted internationally in a reasonable period of time and with less resistance to change.

2. Literature review

2.1. FDI and Economic Growth

FDI is a key ingredient for successful economic growth in developing countries. This is because the very essence of economic development is the rapid and efficient transfer and adoption of "best practice" across borders. FDI is particularly well suited to effect this and translate it into broad-based growth, not least by upgrading human capital (Klein *et al.*, 2001, Akinlo, Akinsokeji and Oziegbe, 2013). Therefore, many countries around the world have realised that attracting foreign direct investment (FDI) is essential to the process of economic development and to the prosperity of their citizens. It lay foundation for local investors, SMEs and entrepreneurs to prosper in a more efficient, market driven and professional atmosphere, consequently, enabling them to add value to their economies (Asfour and Murphy, 2006). Nevertheless, attracting FDI is not an easy task; it requires a careful understanding to the common needs and requirements of international investors which affect the FDI flows to developing countries. These factors will be discussed in the following section.

2.2. Factors Affecting the FDI Flows to Developing Countries

There are number of factors that affect the investment inflows to a country, the Multilateral Investment Guarantee Agency (MIGA) categorises investor needs under three levels of importance: (Asfour and Murphy, 2006)

- **Critical factors** which relate to**:** Political and Social Stability, labour costs, utilities costs, labour availability and utilities reliability
- **Important factors** which relate to**:** Real estate, business conditions, infrastructure, market Access, e-Taxes
- **Less Important factors** which relate to**:** Living conditions.

Other requirement stated by OECD (2008) include market size and real income levels, skill levels in the host economy, the availability of infrastructure and other resource that facilitates efficient specialisation of production, trade policies, and political and macroeconomic stability of the host country.

On the other hand, the literature has also showed that, there are three interrelated institutional factors that have been found to increasingly reduce the FDI flows to developing countries which are; non-transparency, bureaucratic red tape and corruption of host country institutions (Drabek and Payne, 2002, Onyeiwu, 2003, Dahlström and Johnson, 2007). According to Finel and Lord (1999) transparency is a mechanism that facilitates the release of information about policies, capabilities and preferences to outside parties or the market. Transparency, particularly in the public sector, also implies outside access to the mechanisms by which decisions are made and implemented (Lebovic, 2006). Thus, The lack of transparency, on the other hand, facilitates arbitrariness, helps to mask bribery (Zurawicki, 2003) and imposes transaction costs on the conduct of business in which any additional information that is pertinent for making an investment decision will have to be secured at extra time and cost (Seyoum and Manyak, 2009).

According to Drabek and Payne (2002) there are strong reasons to believe that transparency in economic policy-making and in the activities of government institutions is vital in attracting foreign investment. Drabek and Payne found that on average a country could expect 40 percent increase in FDI from a one point increase in their transparency ranking. While, non-transparent policies translate into lower levels of FDI and hence lower levels of welfare and efficiency in the host country's economy. This has been seen in a number of countries such as Indonesia, Nigeria or Slovakia where the lack of transparent policies has been suggested to be one of the main reasons why foreign investors have demonstrated extreme caution to invest and for capital flight. This reflected a growing suspicion of investors about the intentions of governments concerned and their commitments to policies in the countries concerned (Drabek and Payne, 2002).

Additionally, the literature has shown that non-transparency is a composite of number of factors and from those that are most important are corruption and bureaucratic red tape. For example, according to Drabek and Payne (2002) economic policy-making will be seen as non-transparent if it is subject to *corruption and bribery*. Bribery is non-transparent not only because it is normally illegal but also because the non-transparency strengthens bargaining positions of the beneficiaries from these illicit payments. Wei (2000) and Smarzynska and Wei (2000) indicated that host country corruption can have a negative effect on the volume of FDI inflows since it increases the costs of operation in the host country for MNEs and reduces the profitability of investment. Payments to the host country officials do not have a market value and, hence, raise the cost of goods/services when compared to a competitive market. This can be a major disincentive for foreign investors (Habib and Zurawicki, 2002). Johnson (2006) also concluded that host country corruption reduces FDI inflows.

Moreover, Drabek and Payne (2002) believes that bureaucratic inefficiency within the government is another aspects of non-transparency and can be a major hurdle to business. If the quality of government service is unpredictable, companies' exposure to additional risks is increased. Moreover, their ability to cover against these risks impeded due to the unpredictable nature of government service. Onyeiwu (2003) added that corruption/bureaucratic Red Tape is a very significant factor that explains why MENA countries receive less FDI than other countries. Rivlin (2001) also argues that even in the presence of a conducive macroeconomic environment, corruption and bureaucratic red tape can deter foreign investors from investing in a country (Rivlin, 2001 - p.191). Apart from raising the cost of doing business, corruption slows down the process of obtaining the business permits necessary for operating in the host economy, (Onyeiwu, 2003 added). In fact, according to Al-Sadig (2009) a one-point increase in the corruption level leads to a reduction in per capita FDI inflows by about 11 percent. Al-Sadig found that corruption has a negative impact on the level of investment and economic growth, on the quality of infrastructure and on the productivity of public investment, on health care and education services, and on income inequality. All those factors are also found to be important determinants of FDI location. Therefore, foreign investors would tend to avoid investing in countries with high levels of corruption.

Besides, from the institutional context, there are a number of empirical papers on institutions, corruption and FDI many of which use measures of perceived corruption to reflect institutional quality (see, e.g., Mocan (2004), Caetano and Caleiro (2005), Abramo (2007) and Dahlström and Johnson (2007)). Other studies on FDI, corruption and institutions include those by Habib and Zurawicki (2002), mentioned above, Egger and Winner (2006) and Hakkala, Norbäck and Svaleryd (2008), who all found corruption to be detrimental to FDI. Therefore, according to (Tingvall, 2011) acknowledging that corruption can be viewed as a general index of institutional quality, evidence suggests that weak institutions (a corrupt environment) hamper ingoing FDI. Also as Dahlström and Johnson (2007) put it corruption is a result of, rather than a cause for, an underdeveloped institutional framework. Indeed, according to Al-Sadig (2009) the results show that the country's quality of institutions is more important than the level of corruption in encouraging FDI inflows into a country. For example, ceteris paribus, a country with sound institutions is able to attract as much as 29 percent more per capita FDI inflows than a country with poor institutions.

Equally important, according to (Brack, 2013) public/government procurement is the acquisition of goods and services from a third party on behalf of a public agency, such as a public sector organisations or local authority. Also, according to OGC (2008) it includes much that supports the work of government and ranges from routine items (e.g. stationery, temporary office staff, furniture or printed forms), to complex spend areas (e.g. construction, Private Finance Initiative projects, aircraft carriers or support to major change initiatives). It also includes a growing spend where the private and third sectors provide key services directly to citizens in areas such as welfare-to-work, further education, social care and health. Such services may also be provided by the public sector directly, and in some cases even this public provision can be handled through procurement mechanisms. A public body may bid for government work against private sector firms through a formal competitive process (OGC, 2008). Government procurement is an important economic activity involving large amounts of public money in most countries around the globe (OECD, 2010). According to WBG (2012) Foreign Direct Investment (FDI) can also be affected by public procurement policies. This is supported by the cross-section analysis of Mardas, Papachristou and Varsakelis (2008) which indicated that it is statistically significant determinants of FDI. Furthermore, as a government activity, it is particularly vulnerable to corruption (OECD, 2010). Consequently, as stressed by Rivlin (2001) that corruption and bureaucratic red tape significantly reduces FDI inflows even in the presence of a conducive macroeconomic environment. In the Cameroon, for example, the high-level officials in charge of the execution of public investments declared that administrative and bureaucratic red tape was the reason for the insufficient financial execution rate of the investments. The insufficient qualification of the employees in charge of the follow up of the contracts was included in the description of the administrative red tape (Le messager 2008 cited in OECD (2010)).

Additionally, governments that intend to address their infrastructure investments needs through attracting FDI, in forms such as PPP, PFI, etc., Kadarisman (2015) stress that the function of government institutions is to regulate and facilitate public service developments. Related government ministries and agencies are the ones responsible for programs and project developments beginning from the planning stage, devising of project tender and contracting procedures down through supervision on their execution stage. According to Dahlström and Johnson (2007) multinational morporations (MNCs) get into contact with host country institutions as soon as they start activities in a foreign economy and institutions naturally have a large effect on the continuous operations of the MNCs. Thus, key to attracting MNCs to foster FDI inflows is when government organisations adopt high quality practices to achieve high quality performance to effectively and efficiently interact with MNCs. Accordingly, apart from creating a conducive macroeconomic environment, governments in the developing world are also required creating a conducive organisational environment (excellence in practices to achieve better performance) to attract MNCs to foster FDI inflows to address their infrastructure needs.

Thus, by leveraging public procurement to attract FDI, developing countries are required to focus more on improving the quality of the practices and performance of their public organisations responsible for the delivery of public procurement. By doing so, they will actually be fighting the root cause of the main symptoms of weak institutions, which are non-transparency, bureaucratic inefficiency and corruption, and which will enable them to attract MNCs and foster FDI inflows, as depicted in figure 1.

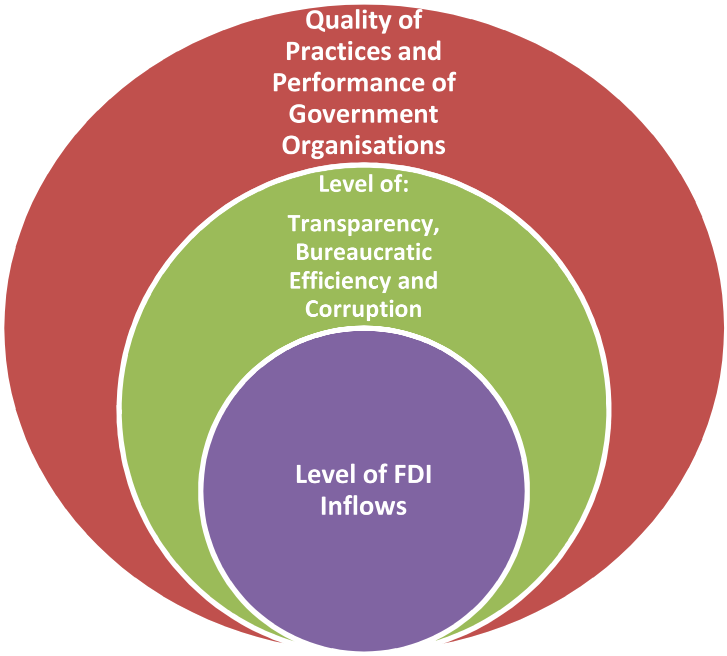

Figure 1: Spheres of Influence of the Factors Affecting FDI Inflows to Developing Countries

3. Public Procurement and FDI: The Case of Iraq

In Iraq, public procurement, which is defined in the Public Procurement Law of Iraq as "procurement of goods, services and construction services by the State of Iraq acting through Ministries or federal agencies, governmental units including Regions, Governorates; and all other subdivisions of the State of Iraq that may commit public funds", plays an even more important role in supporting the reconstruction and rehabilitation of the national economy and the development of the private sector as well as providing the necessary infrastructure for the Government of Iraq (GOI) to execute its investment budget (OECD, 2010, JAU, 2014).

Despite the GOI large budget, totalling IQD 138.4 Trillion ($ 118.3 Billion) in 2013 alone, of which 93% is from Oil revenues (JAPU, 2013), however, the budget execution rate was and still low. According to JAU (2014) for the fiscal years (FY) 2009 and 2010, 2011 and 2012, and 2013 GOI allocated about 75%, 70% and 60%, respectively, of its annual budgets for operational expenditures (primarily salaries, pensions, and office expenses), with the remainder allocated for investment expenditures. For the fiscal years from 2009–2012, the GOI consistently executed its operational budget with an execution rate ranging among 80%–90%, while investment budget execution rates were generally lower 60%–70% with some ministries reportedly failing to execute even half of their annual budgets. For example, in FY 2011, the execution rate fell to less than 50% in key development ministries including Communications (16%), Agriculture (23%), Oil (32%), Industry and Minerals (40%), Municipalities and Public Works (47%). This is alarming since not only do these development ministries receive a significant amount of the total investment budget, but this also indicates inadequacies in operationalising these funds into approved projects (JAU, 2014). As a result, about 60% of Iraqi households are suffering from the lack of at least one of the following: access to improved drinking water source, access to improved sanitation facility, a minimum of 12 hours of electricity from the public networks a day, or food security (JAPU, 2013).

According to JAU (2014) one of the main challenges that limit the ability of the GOI to spend its investment project budget apart from security issues is public corruption. The World Bank ranked Iraq 156 out of 189 countries in its 2015 overall “ease of doing business” category. Transparency International ranked Iraq 170 out of 175 in its 2014 Corruption Perception Index. According to OECD (2010) representatives from various agencies and institutions of the Government of Iraq (GOI) demonstrated their awareness of the problem of corruption in procurement and have asked for the identification of good international practices to help Iraq fight corruption and promote integrity in public procurement. Other factors that hinder the budget execution as a whole include implementation delays due to the underdevelopment of the financial sector and the limited capacity of private contractors, unnecessary delays in approving the budget, allocative inefficiencies across sectors and ministries, poor planning, particularly on the local government level and poor procurement processes. It can be argued that these factors are the symptoms of weak organisational performance and are just the tip of iceberg. Underneath that come the organisational practices which are the causes/enabler/drivers of that weak performance. Accordingly, it can be concluded that the weak practices of Iraq government organisations is the umbrella that lumps together the main factors that cause the low execution rate of Iraq’s national budget.

The Government of Iraq, as the primary commercial actor, continues to rely on cash allocations through budget provisions, taking advantage of high oil revenues, to fund projects at the ministerial level and local government level. According to JAU (2015) Iraq is an Oil dependant country. Oil revenue remains the main source for state revenue with a share of 93% and 84% materiality of total state revenue in 2013 and 2015 respectively. However, Blanchard (2010) argued that continued fluctuations in oil prices and production may jeopardise Iraq’s fiscal stability and the sustainability of its reconstruction and development plans. The recent drop of oil prices has supported this argument. According to Bowler (2015) the recent fall of global oil prices has significantly affected Iraq’s oil revenue and thereby affecting its national budget. Iraq deficit has exceeded $19.36 billion which is just about 19.5% of total expenditure (Parker, 2014). Besides, the large amount of operational budget and the sudden increase of budget deficit has significantly affected the amount of fund available for key development sectors making it even more difficult for Iraq to meet its urgent infrastructure needs such as the 2 Million housing units and other important services such water and electricity shortage (IAU, 2014, Sait and Nkuuhe, 2013). This means that oil should no longer be the only source of revenue for Iraq. FDI can be an important source of private external finance. Thus, attracting MNCs to foster FDI inflows to build the infrastructure should become a priority for GOI to bridge the deficit gap, meet its various infrastructure shortages to address the citizens’ needs as well as benefiting from FDI positive spillovers.

Considering that Iraq infrastructure investment needs cannot be addressed by the sole reliance on oil revenue, according to USDC (2013), the Iraq Council of Representatives is considering legislation to establish an Infrastructure Development law that would allow the government agencies to enter into contracts with MNCs on infrastructure projects, improving services in areas like water supply, power and education, etc. This law would basically obligate government agencies to attract FDI and take out “loans” with MNCs tasked with the jobs and then repay them annually at a later date, for example in contracts similar to PPP, PFI, BOT, etc.

Yet, as discussed earlier attracting FDI is not an easy task, it requires developing countries to create environment enabled for MNCs to foster FDI inflow. Hence, improving the performance of government organisations responsible for the delivery of public procurement, projects beginning from the planning stage, devising of project tender and contracting procedures down through supervision on their execution stage, should be Iraq’s main priority. Since, it is the main key for sustainable investment flow in the short and long term as well. This will help Iraq to, first, achieve a high execution rate of the national budget and, second, enable them to attract MNCs and foster FDI inflows. However, understanding what drives improvement/change initiatives and the available improvement methodologies is, therefore, critical to the success of any change/improvement programmes and this will be discussed in the next section.

4. Organisational Improvement Methodologies

According to Talwar (2011) despite their limitations, business excellence models (BEMs), such as EFQM, Baldrige, PDCA, etc., are a comprehensive means in which the level of organisational excellence can be thoroughly monitored and assessed. They provide an internal mechanism for making improvements to face the competition. BEMs recognise excellent organisational performance and have emerged as a tool for the promotion of productivity and quality improvement strategies. They are subjected to changes according to external environment evolution and are considered a contemporary way to attain excellence. They focus on number of factors including leadership, people, organisational strategy, organisational processes and performance management which could bring a tremendous impact on the improvement and achievement of their organisational goals. However, according to Sokovic, Pavletic and Pipan (2010) such models is a long-term, strategic tool where all organisational aspects and areas can be monitored, assessed and improved. Therefore it cannot be used as a tool for day-to-day business, since its positive effects can be seen in the long term. They are more complex and demanding methodologies and therefore need more time and resources for their proper implementation. Therefore, they should be introduced properly with strong support and commitment of top-management and appropriate training of the people included.

Furthermore, it is well known that people are resistant to any sort of change. This is especially true in the case of transformational change. There are many factors that contribute to this matter such as; fear of the unknown, habit, the possibility of job insecurity, threats to social relationships, and failure to recognise the need for change (Nadler (1980) cited in Longo (1997)). The importance of identifying these factors prior to change is therefore critical to success. Depending on the existing organisation's culture and the degree to which the proposed change differs from that culture, an organisation may or may not be ready to successfully absorb the change. This is especially difficult when there is no apparent performance crisis in the organisation i.e. no serious threat to the existence of the organisation.

Moreover, the issue of leadership is also critical when discussing transformational changes, which often occur in the implementation of quality improvements. Resistance to change is especially relevant if the vision of a leader differs from the values and beliefs of the existing organisational culture. If that is the case, then cultural issues must be addressed. This is the part of the process improvement that is easy to be overlooked in major change efforts in organisations. If the organisational culture fails to assimilate the vision and its implications, desired change will never become accepted and will ultimately fail (Almaraz, 1994). Therefore, issues of organisational culture, leadership and people of Iraq public sector has to be taken into account before initiating a change/improvement programme.

Al-Tameemi and Alshawi (2014) have benchmarked the practices and performance of a government organisation, which is responsible for budget execution, in Iraq using a standard benchmarking tool called PROBE. Clear evidence of the PROBE tools' ongoing effectiveness and broad applicability lies in their resonance and compatibility with the principles embedded in definitive frameworks such as the Baldrige criteria and the EFQM Excellence Model, and in contemporary implementation methodologies such as Lean Thinking, Six Sigma and Best Value (PROBE, 2015). In their paper, Al-Tameemi and Alshawi (2014) focused on the practices and performance in relation to the organisations and culture which include management style, service culture and employee/people management and their impact on the internal service quality of the organisation. Al-Tameemi and Alshawi concluded that the performance of public organisations in Iraq is greatly affected by the weak practices related to their leadership and people. Their findings show that the overall practices and performance of the government organisation in question is far behind that of those world-class organisations working in the same field. Their findings suggest that in order for the government organisations to improve their overall performance they are required to adopt new practices (best practices) similar to those of world-class organisations. Best practices for such organisations can include adopting new technologies to facilitate interaction between these public organisations and their customers such as the use of e-procurement, adopting new management styles where employees are empowered to deal with service problems, etc.

However, the findings of Al-Tameemi and Alshawi (2014) has shown that there is a little attention paid by top management for the development of service culture. The organisations leadership team does not communicate and reinforce clear values and high performance culture. They emphasise that the leadership team do not develop a service mindset throughout the organisation or drive service culture by example such as focusing on anticipating and exceeding needs that actively drive up the ambition of the community. Moreover, the executive and non-executive/members do not reach to a solid consensus on priorities for best use of resources for best possible service to the community. There is no shared plan or vision statement and customers service expectations and satisfaction not known. Quality values are not quite part of the core values of the organisations' employees because the organisations have not either defined its quality values such as customer focus in its mission and goals nor are quality values embedded in the organisations culture. The blame culture is a barrier to the gathering of facts and solutions to the problems tend to be "quick fixes". There is no measurement of employee satisfaction, neither the organisation captures the voice of the customer nor there informal means such as employee feedback and customer complaints are being exploited. In addition, Al-Tameemi and Alshawi (2014) stressed that there is no feedback or recognition of service performance at employee level in their organisation. Employees were not aware of neither formal process for getting external and internal feedback on individual service performance against expectations nor there 360 º (including upwards) appraisals is used in the organisation. The organisation lacks a formal people-development plan that is linked to organisational/service need and involvement is almost blocked by attitudes of both management and employees, in aspect such as the decision making process. The employees have not been explicitly and appropriately empowered to deal with service problems/failures, and to take immediate decisions to resolve problems without recourse to supervisors.

Consequently, given such an organisational culture, introducing best practices and advance technologies to improve the organisation performance will have a significant impact on how such public organisations currently work. Introduction of such change to such an old and weak business model will be very alarming to the people who currently operate this business model since it will/may have a direct impact on their positions and matters of interests, force them to change their habits/ways of doing things and adopt new ways, change to their social relationship, etc. Thus such a change initiative may/will face a huge resistance, especially from those (corrupt bureaucrats) who are having a "monetary gain" from this complicated system. Furthermore, since benefits of such change initiatives only appears in the long term (as argued above), thus, following such an approach can jeopardise any improvement due to the lack of quick wins, and may/will ultimately fail.

Besides, since the situation in Iraq is calling for an immediate need for FDI to engage in the development of the country. Accordingly, an alternative approach is required that can "disrupt" the current business model, designed to execute public procurement, and pave the way for the adoption of best practices. An approach that is able provide a radical change to the current organisational performance and help attract MNCs and foster FDI inflows. The following section will shed light on the available apparoches that can be used to "disrupt" the performance of government organiastins in Iraq.

5. Disruptive Innovation: An Approach to Transforms The Performance of Iraq Public Sector

According to (Eggers, Baker, Gonzalez and Vaughn, 2012) because of shortages in public fund that is facing most governments around the world, leaders are challenged to "do more with less". However, following such an exercise inevitably resulting in a difficult trade-off, between price or performance. In order to break such unavoidable trade-off, leaders are required to look at the public sector in an entirely new way. Looking away from the public sector, many industries have been able to steadily lower prices while, at the same time, improving products and services. So why does the public sector seem so immune to the kind of innovation that allows getting more for less over time? Certainly, because government is a monopoly that lacks both competition and profit motive, as do the political incentives to increase spending and protect incumbents over upstart providers. The ultimate reason for this difference may be what is present in the private sector and absent in the public sector, a phenomenon called disruptive innovation (Eggers et al., 2012). According to Eggers and Gonzalez (2012) disruptive innovations have helped reshaping number of industries to deliver more for less and most of the world today looks fundamentally different than it did just a decade or two ago because of disruptive innovations.

5.1. What is Disruptive Innovations?

First articulated by Harvard business professor Clayton Christensen "Disruptive innovation describes a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up market, eventually displacing established competitors"(Christensen, 2015). It "is not a breakthrough innovation that makes good products better; it has very specific definition that is, it transforms a product that historically was so expensive and complicated that only few people with a lot of money and a lot of skills had access to it. A disruptive innovation makes it so much more affordable and accessible that a much larger population have access to it" (Christensen, 2012).

The concept of this theory is about teaching any industry giant how to survive in their market when there are other businesses that can provide customers with services similar to theirs yet more affordable. The idea is to let businesses not to pay their attention on one market direction and not to focus only on increasing the efficiency of their products to target those that can pay more, where there are other businesses (Disrupters) that can provide products (Disruptive Innovation) that are much affordable and can serve the same purpose. Eventually, they will not only attract the other customers that the former businesses (Disrupted) have overlooked, however, they will "sooner or later" overtake those high paying customer too and thereby destroying the market of those former businesses. Example of disruptive innovations are the steel mini-mills and how it have significantly disrupted the market of the integrated steel mills and the laptops and PCs and how they have gradually destroyed the market of the mainframe computers (see for example Bower and Christensen (1995), Christensen (1997), Christensen, Raynor and Anthony (2003), Christensen

(2013)). Another example of disruptive innovations is the Lexus and how Toyota has used it to disrupt the marketplace of the incumbents of luxury cars at that time such as BMW, Mercedes (see Liker (2004)).

So the theory teaches the industry/sector giants how to avoid ending up like the integrated mills and mainframe computer companies. To do that, such companies are required to do their own disruptive innovation. To succeed, they must develop their own disruptive innovations and treat them as a separate unit with different business model and growth expectations and ask what job do customers need to get done and then segment customers by job not by product, market size or demographics. Then they need to develop basic low-cost/transparent ways/solutions to get the job done for customers. Eventually these new "Disruptive" solutions will help these companies to dominate the market again, keep or increase their customers and ultimately keep their businesses alive (HBR, 2013).

After reviewing numbers of researches on disruptive innovations, Barahona and Elizondo (2012) synthesised and summarised the characteristics of Christensen's disruptive innovations. These disruptive innovations:

- Face no demand at the beginning, the client base is small and the service or the product can be costly.
- Are not initially attractive to the best clients.
- Exceed the current abilities of typical clients at some level.
- Are at a new level of competition.
- Change the meaning of quality and improvement compared to the traditional model.
- Address potential sectors/clients that under the prevailing logic would not have access to the current product or service.
- May have small initial profit margins.

Thus, what is really needed now more than ever is for government of Iraq to follow the path of disruptive innovation to find new (disruptive) ways to deliver its national budget so to gradually destroy the old ways of executing public procurement.

5.2. **Disruption of the Public Sector in Iraq**

As discussed earlier, the Iraq government organisations are not able to successfully execute their allocated budget nor are they able to provide the necessary services to the Iraqi citizens. Number of reasons behind that including, corruption, relying on an underdeveloped private sector companies (see WorldBank (2012)) to execute public contract, unnecessary delays in approving the budget, allocative inefficiencies across sectors and ministries, poor planning, particularly on the local government level and poor procurement processes. MNCs can help the government in the successful execution of public contacts, introduce better and more affordable services to citizens, build the capacity of both the public and private sectors by transferring best practices as well as fund those projects that the government can only afford in the long term when utilising certain procurement systems such as PPP, BOT or similar.

However, the realisations of such hopes entirely depend on the government ability to develop an environment attractive to MNCs. Along with the establishment of right policies, developing such an environment will require the government to break the mould of the existing organisational culture and adopt best practices to produce performance that is accepted by those internationally recognised MNCs. The adoption of best practices may entail adopting new (disruptive) technologies, such as e-procurement, which according to Christensen (1997), may entail business model disruptions, for the public sector organisations, as they change the relationship of the organisation with its customers and suppliers, disrupt the traditional way of doing things within the organisation and the financial arrangements created for its current marketing and technology. Thus, following the disruptive innovation approach can well help the government of Iraq in its quest for finding a better way to deliver the services that its people desperately needs and make them more accessible and affordable.

5.3. **Implementing Disruptive Innovations**

The requirements to improve the performance of Iraq government organisations seem to fit with the characteristics of disruptive innovations, see table 1.

Table 1: Rationale on the compliance of public sector improvement initiative with the characteristics and conditions of Disruptive Innovation

Characteristics of a Disruptive Innovation	MNCs Enabled Environment Rationale
Face no demand at the beginning, the client base is small and the service or the product can be costly.	Big local contracting companies in Iraq (especially those with political power) have adapted to the current traditional system of public procurement and consider its complexity and non-transparency as an advantage against their international rivals (MNCs). The latter group does not seem to consider Iraq public organisations as their potential clients because there is no certainty that they can sell their products/services to the public organisations given the ambiguity of the buying process (procurement system) of the public sector.
Are not initially attractive to the best clients.	Currently the best clients for these public organisations are those big "local" companies that know how to let the public sectors buy their services despite its complicated system. Therefore, introducing a change programme to improve the public sector performance and simplify procedures so that to attract MNCs, is not something those big "powerful" companies would ask for.
Exceed the current abilities of typical clients at some level.	Such a public sector reform (disruptive innovation) will be more than satisfactory for those clients tier (MNCs) that are not/slightly being served by the Iraqi public sector.
Are at a new level of competition.	Assuming that this change initiative (disruptive innovation) will be conducted through separate organisations, in the beginning these newly established public organisations, which will adapt the public procurement best practices, will not be under competition to attract the clients of those old public organisations that are still operate under the old system. Because the targeted clients tier (MNCs) are not/slightly being served by those old organisations which have no interest/ability/capacity to attract them.

Characteristics of a Disruptive Innovation	MNCs Enabled Environment Rationale
Change the meaning of quality and improvement compared to the traditional model.	The current processes and criteria for setting priorities (values) of these old public organisations have been followed because they are thought to sustain the current performance. Typically, key processes that are thought to have worked well in the current system (such as the planning cycle, procurement processes, etc.) will impede what needs to be done by the new system. Also, the criteria for setting priorities and making decisions that are inherent to the business model of the new organisation often must be very different from those that are useful in the old organisation. That is why disruptive innovations often need to be managed as independent business units. A key to nurturing a new system is recognising when to leverage the parent/old organisation's resources, processes and values, and when to create new ones.
Address potential sectors/clients that under the prevailing logic would not have access to the current product or service.	By adopting best practices to execute the public procurement in Iraq, the new public organisations will have the leverage to attract those potential clients (MNCs) that were not satisfied before with the performance of those old public organisations.
May have small initial profit margins.	The profit margin for the central government/local government/public organisations that receive public fund, is perceived in: a) how much percentage of their allocated budget they can execute during the fiscal year, b) how much percentage of successful projects they can deliver during the fiscal year (i.e. projects that are on or ahead of planned time and budget, fit to purpose and aligned to Iraq/city strategic plan. According to number of researchers, such as Al-Tameemi (2009), Batool (2011), Faiq, Rana and Shaymaa (2013), about 75% of projects are considered failed and that is due to the poor planning and implementation methods adopted by the public and private sector in Iraq), c) how much percentage of their "strategic" projects are being implemented/funded by MNCs, d) how much percentage of the population are receiving the required service. So, initially these profit margins that are supposed to be achieved by the new organisations that will adopt the new system will be small because they will not directly take over all the market "work" from those which operate under the current system. However, this will happen gradually until these disruptive (new) organisations will eventually be fully accountable for delivery of various types of public services. At that time, those bureaucrats that used to operate the old system will have no choice but to blend in with the new system or retire.

(Note: these rationales are prepared based on (Christensen and Overdorf, 2000, Christensen, Johnson and Rigby, 2002, Christensen et al., 2003, Barahona and Elizondo, 2012))

According to Barahona and Elizondo (2012) public entities, by their very nature, are less flexible when making structural changes. In view of this, the adoption, implementation and diffusion of a disruptive innovation within a public organisation is more prone to non-compliance or failure, than the success and satisfaction of interested parties. Thus, in order to implement disruptive innovation, Christensen and Overdorf (2000) developed a matrix (see figure 2) which is designed to help managers understand what kind of team should work on the project and what organisational structure that team needs to work within. For example, in region C in figure 2, there is a disruptive change that does not fit the organisation´s existing processes or values. This complexity could pose challenges and opportunities within the organisation, obligating it to change management practices and giving rise to new organisational forms. This means that a viable introduction of a new best practices based on a disruptive technology makes the case for a new and independent organisation with other values and skills, not threatened by the new possibility of how to do things, and that does not see the possible market in the same way as the threatened entity.

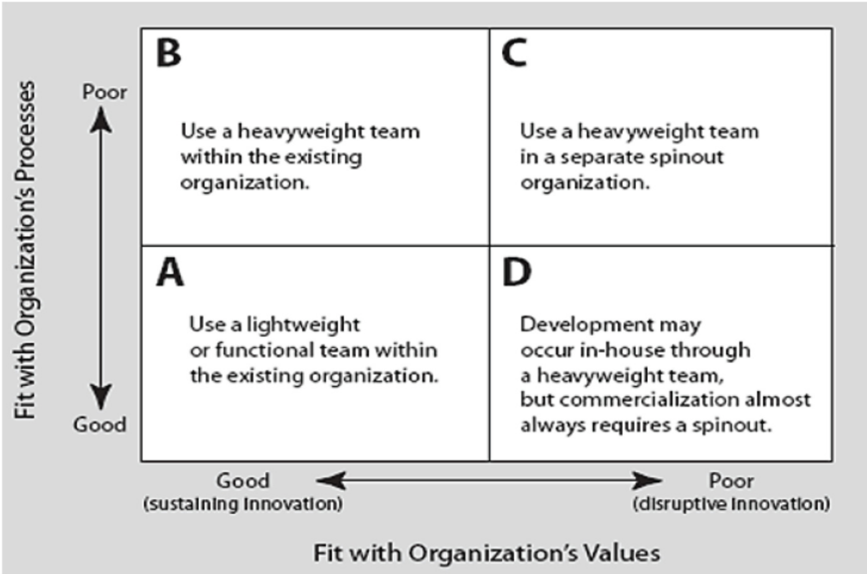

Figure 2: Organisational Considerations of Sustained and Disruptive Innovations, source: (Christensen and Overdorf, 2000)

It does not keep anything from the one it is replacing. At the highest level, it may have a contact or two that facilitate the use of some resources; but the new one "forgets" how the original one did things and how it saw its clients. Otherwise, there is a risk that the new organisation will remain immersed in the assumptions, values and decisions of the parent company (Barahona and Elizondo, 2012).

Based on the above discussion, the type of innovation/change required to improving the performance of Iraq public organisations does not seem to fit with their current processes and values and thereby this type of innovation/change fits in region C of figure 2. The organisations' existing processes do not seem to be suited to getting the new job done effectively nor will their values seem to permit the organisations to allocate the resources the new initiative needs. Therefore, using a heavyweight team in a separate spinout organisation to work with MNCs seems to be a viable approach to implement such a disruptive innovation to Iraq government organisation.

A practical example of this theory was presented by Cook (2014) about the cornerstone behind china's economic development and growth. He mentioned that someone can ask the question of whether it is possible that government policies can be set through a discovery base or through experimentation approach? And one country did this and that was china. In 1980s china's economy was a wreck and people are starving on the street and they could not generate the work or jobs to even feed their people. The government at that time has done many things but one innovative thing they did that is when they run experiments to have a set of assumptions of a better way to change this miserable situation but instead of legislating them they tested them first. They took Shenzhen city, for example, and put fence around it and run Shenzhen with different economic rules while the rest of the country run base on communist economic rules. Shenzhen was run under more free market rules with foreign investment allowed and what happens is that the Chinese economic miracle started there. Jobs were creating, companies, investment and people from other cities started to cross the fences to get to Shenzhen. Eventually, when that success formula has been proven they expanded it to the rest of china.

Another example is laid out by Liker (2004) about the development of Lexus which were meant to disrupt the market of the kings of luxury cars in Europe and America and was one of the best examples of the Toyota Way in action. Liker explains that Toyota is known as a very conservative company even by Japanese standards, although it is thought to be a very innovative company given its domination of the auto industry. Conservative means in this case as conservative politically, conservative styling, conservative financially, conservative in changing their ways etc. Yukiyasu Togo was a successful Toyota executive in charge of Toyota Motor Sales at the time. Togo thought that making high-quality, fuel-efficient, and economical cars was fine, but he saw no reason why Toyota could not also make luxury vehicles competing with the best in the world. To do this, Togo realised Toyota would need a new sales channel and name. He took his idea to management. At first he faced resistance. At Toyota this was not unusual. Building a luxury car meant breaking the mould from sturdy and reliable but basic Japanese built cars to competing with the kings of luxury in Europe. Also the development of a luxury car would mean simultaneously developing a vehicle and a brand: a car company within a car company. But after some debate it was clear that Toyota was not living up to its challenge of staying a step ahead of trends in the market and the concept for the Lexus was born. In order to convince such a conservative management that this idea will work they needed to build a prototype car that shows a quality, efficiency and effectiveness better than the competitor's luxury cars. In order to achieve this they entrusted this mission to a one of the best engineers in Toyota who in turn worked with the best engineers in different departments and created a team which worked separate (spinout organisation) from the parent company. This team eventually has generated the first Lexus car that has changed Toyota's production path since then (Liker, 2004).

Therefore, in order to stop wasting the public fund, improve budget executing rate, open the prospects for international corporations (MNCs) to come, join and help in the development of Iraq infrastructure. Government leaders should focus on establishing "new" and "separate and independent" organisations/units/departments built on world-class best practices, with the aim to disrupt the old public procurement system, seek top management and main stakeholder buy-in and gradually expand the new system to eventually replace the old one. The new and separate units will work based on new business model, resources, quality values and objectives and aim first for targeting MNCs until, eventually, the new system will get entirely accountable to execute the allocated budgets from central government.

Nevertheless, a detailed framework to implement such an approach (disruptive innovation) will require number of questions to be answered including:

- What are the main factors which affect the government organisations performance in executing their allocated investment budgets?
- How complex is the current business process map of these organisations?
- How satisfied are the local companies with current processes and procedures of the public procurement system?

- What are the weaknesses and strengths of the public organisations' overall practices and performance compared to those of world-class organisations?
- How satisfied are employees with the current public procurement system and what their suggestions for improvement are?

The Answer to these questions will be the clue for the development and successful implantation of such an effective approach. The researcher is intended to answer these questions in subsequent publications.

6. Conclusion

Attracting investment is still seen as a major tool to bring about prosperity and growth to developing and developed countries alike. However, the major challenge for developing countries is how to attract investment. This paper has shown that apart from economic and social stability, market size, etc, MNCs are mostly deterred from countries having poor quality institutions. Thus, in order to attract MNCs and foster FDI, developing countries, such as Iraq, are required to create environment enabled for FDI by working at improving the quality of their public institutions. To do so and in order to break the mould of the existing organisational culture this research paper suggested following the disruptive innovation approach. This approach will focus first on having top management consensus for change by building a separate unit based on world-class best practices of organisations working in the same field. This Unit's main clients are MNCs and will focus on illustrating the difference in performance between the new and old system. The successful operation of the unit will help achieve consensus among the organisations' key stakeholders and pave the way for large scale change that will eventually help in getting rid of the old system.

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The Paradigm of Facilities Management in the Control of Healthcare Associated Infections

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Abstract

Previously known as "Nosocomial Infection" or "Hospital acquired infection", Healthcare associated infections (HCAI), compared to other types of infections, are infections not present and without evidence of incubation at the time of admission of a patient to a hospital or other healthcare facilities. HCAI could be acquired through endogenous (internal) or exogenous (external) sources of infection with the latter falling within the remit of facilities management service delivery practice. Through sustained media publicity of the imposed economic and socio-cultural burden of HCAI, the profession of healthcare facilities management has moved from being a subject that existed in the shadow of the clinical sphere to a scientific discipline with a high political profile.

The assortment of infection-causing bacteria resistant to antibiotics, changes in statutory obligations, and demographic pressures have meant that an adaptable infection control framework in healthcare facilities management remains a challenge. Existing practices in mitigating the prevalence of HCAI could be argued to have become too "paper centric" as against "practice centric" relative to the reality of the dynamics of infection causing organisms resistant to antibiotics. While quite a number of good practice compliance monitoring tools has been developed over the years, in an efforts to curtail the acknowledged systemic threat of HCAI, the extent to which knowledge attained from the use of such tools are implemented to tackle this problem remained elusive. This paper presents findings from a literature review and a pilot questionnaire survey, as part of ongoing PhD research which seeks, to develop a conceptual good practice knowledge management process framework in facilities management service delivery practice for the control of exogenous HCAI. The outcome of this research is anticipated to enhance better understanding and optimisation of contemporary good practice compliance monitoring tools, adopted for the creation, storing, sharing, and usage of captured good practice knowledge in facilities management services for the control of exogenous HCAI.

Keywords:

Built environment, Facilities management, Healthcare associated infection, Knowledge management

1. Introduction

There have been several radical changes on how healthcare is delivered globally in response to emerging technologies, demographic pressures and aging healthcare facilities that no longer support efficient and safe care delivery. The increasing recognition of the relevance of the healthcare environment on patient recovery outcomes, and the escalating emergence of new strains of multi-resistance bacteria to antibiotics, are other influencing considerations. However, set objectives imposed on hospital management are still expected not to be compromised in the delivery of quality healthcare outcomes to the required standard.

Through sustained media publicity of the prevalence of healthcare associated infection, the public and government are now more aware of the avoidable morbidity and mortality associated with these infections, as a consequence of non-compliance with good infection control protocols. At present, the profession of healthcare facilities management has moved from a relatively low profile function that existed in the shadow of the clinical sphere, to a scientific discipline with a high political profile, having an impact on patient recovery outcomes and the prevention of the prevalence of healthcare associated infection in healthcare facilities. Hence, there is a need for the identification of infections resulting from external (exogenous) and internal (endogenous) sources for a targeted management approach.

Previously known as "Nosocomial infection" or "Hospital acquired infection", Healthcare associated infections (HCAI) remain a burden to both developed and developing countries (World Health Organisation (WHO), 2011). Compared to other types of infections, healthcare associated infection is described as infection not present and without evidence of incubation at the time of admission to a hospital or other healthcare facilities (ECDPC, 2012; NAO, 2009, 2004, 2000; Ayliffe et al., 1999). These infections occur in both adult and paediatric patients, without gender, religion and race discernment.

The prevalence rate of HCAI varies between 5.7-19.1% (World Health Organisation, 2011; Department of Health, 2008a). This variation is dependent on several influencing factors including per-capita income, challenges in the management of knowledge gained from compliance monitoring tools, non-availability of appropriate healthcare facilities and relevant collaborative surveillance tools, as well as inadequate man-power resources. In the World Health Organisation (2011) survey of the prevalence rate of Healthcare Associated Infection in high, middle and low income countries, it was reported that, HCAI is a major cause of death worldwide. An estimated 5-15% of hospitalised patients acquire these infections in developed countries, with an estimated 4,384 children's deaths attributed to HCAI. In the report, the UK was ranked 11^{th} highest country of the fourteen (14) surveyed countries, with a prevalence rate of 9% behind first place Germany with a prevalence rate of 3.6% of developed countries surveyed.

Quantifying the exact financial burden of healthcare associated infection, as well as the attributed level of those infections that are acquired from internal or external sources, remains a challenging issue in the healthcare sector (Scott, 2009; Stone, Braccia, & Larson, 2005). Hence, the cost of healthcare associated infections are often related to additional diagnostic tests and treatments, additional hospital stays, cost of setting-up isolated rooms for the infected, associated cleaning and material costs and costs of managing post discharge complication (Storga, Mostashari, & Stankovic, 2013; De Angelis, Murthy, Beyersmann, & Harbarth, 2010; Scott, 2009). The challenging and conflicting financial repercussions of HCAI on the NHS, has led to heightening calls for more surveillance and accurate reporting of the prevalence of healthcare over the years in the UK (Department of Health, 2013a; Health Protection Agency, 2010; House of Commons Public Account Commitee, 2009; National Audit Office, 2000). Despite this challenges, it was investigated and documented that HCAI approximately costs the NHS £1 Billion per year. HCAI costs Europe approximately €7 billion euros annually, with increased lengths of hospital stays for illnesses associated to HCAI ranging between 5 to 29.5 days (National Institute for Health and

Clinical Excellence, 2011a; World Health Organisation, 2011; De Angelis et al., 2010; National Audit Office, 2009). The reality of healthcare associated infection is acknowledged to be as familiar as is distressing (Clancy, 2013).

1.1. An overview of HCAI in the UK

The occurrence and adverse complications from healthcare associated infections (HCAI) have been well recognised by successive government and healthcare professional bodies including: The British Medical Council-BMC; Infection Control Nurses Association-ICNA; Hospital Infection Society-HIS; Infection Prevention Society (IPS) and British Infection Association- BIA. The amplified concerns about the adverse consequence of HCAI led to the publication of the first national guidance on infection control in hospitals in 1959, and subsequent policy guidance on the role of infection control teams in 1988 by the Department of Health, in collaboration with the then Public Health Laboratory Service (now part of the Health Protection Agency) in the UK (NAO, 2009).

Towards the close of the 20th century, reducing the burden of healthcare associated infections had become more of a government priority in England (HPA, 2011). The widely referred "Cooke Report" (1995), which was the first publication on measures and recommendations aimed at the control and prevention of infection in UK hospitals, was published by the Department of health (NAO, 2009; Weston, 2008). This was widely acknowledged then as the definitive framework for the control of healthcare associated infections, and gave NHS chief executives overall responsibility for ensuring the establishments of infection control arrangements in their various hospitals to improve implementation of HCAI policy guidance (NAO, 2009; Weston, 2008).

Both the National Audit Office (NAO) and The House of Common Committee on Public Account published investigative reports into the NHS approach to the control of healthcare associated infection in England. These acknowledged the limited compliance with infection control protocols in-spite of expert committee reports and the plethora of guidance in the control of HCAI (HC, 2009; NAO, 2000). It was further stated in the reports that the rate of compliance was limited because many hospitals only had limited understanding of the scale and cost of the prevalence of healthcare associated infections in their hospitals.

Literature documents that, the mortality rate of HCAI in the UK is approximately 5,000 each year, while 15,000 other deaths are attributed to healthcare associated infection as the underlying cause (Department of Health, 2013; Healthcare Protection Agency, 2012; World Health Organisation, 2011; House of Commons Public Account Commitee, 2009). The national prevalence survey of HCAI conducted in the UK between 1981 and 1996 estimated that 9% of patients in hospitals had an infection that was acquired in hospital which equates to 100,000 patients acquiring HCAI per year (Weston, 2008).

Comparably, the World Health Organisation (2011) overall prevalence survey of HCAI in high income countries affirmed the UK prevalence rate of 9%. However, the Point Prevalence Survey of the Health Protection agency (HPA, 2011), suggested a reduction from 9% to 6.4% of patients that acquired these infections while in hospital. This reduction is estimated to have saved the NHS between £45 million and £59 million a year when compared to the annual cost of treating HCAI estimated at £1 billion per annum in previous reports. The substantial proximity of the percentages over the years, despite the huge investment aimed at bringing the incidence of HCAI to the barest minimum in NHS hospitals, draws concerns and buttresses the need for this research which focusses on a non-clinical approach through the enhancements of good practice in knowledge management of facilities management service delivery practice in NHS hospitals through a targeted management approach of those infections that are acquired from sources outside the body.

2. Literature Review

2.1. The Functional Overview of the Management Science of the Built Environment: FM interface

The built environment is a significant part of any nation's wealth (Paiho, 2010; Fewings, 2009). Bartuska & Young, (2007) stated that the built environment is as old as the beginning of time, dating back to when humans first fashioned stone tools, created clothes, discovered fire for warmth, modified caves for shelter, and formed comparative communities. It encompasses buildings of all types, transport infrastructure, public utilities, other built structures and modifications to the natural environment/landscape (Brandon, Lombardi, & Bentivegna, 1997). In other words, the term built environment embodies all human-made creations both past and present, including future plans to support quality living. A built environment created without supportive qualities can have unhealthy influences on people including decreasing the ability to learn and recover from ill health, as well as to perform and enjoy life activities (Paiho, 2010; Fewings, 2009; Bartuska & Young, 2007). Characteristically, the built environment is universal and a creation of the human mind, as a result of human purposes to provide the context for all human endeavours. Hence, it is everything humanly created, made, modified, constructed, arranged or intended to serve human needs, wants and values. The management science of the built environment for the purpose of this research is defined as the management of energy, water and the natural surroundings to enhance the functionality of the built facilities in meeting user expectations and specifically in the reduction of Healthcare associated infections in hospitals, and other healthcare facilities.

Traditionally, a model of the management science of the built environment (figure, 1.0) to ensure the functionality and performance of the built facilities could be viewed from the seven professional disciplines of:

- Infrastructure management,
- Estate management,
- Real estate management,
- Corporate Real Estate Management,
- Asset management,
- Facilities management,
- Total Facilities management.

These professional disciplines have sequentially evolved over the years to meet the economic and social demands of the built environment, and human activities that are in a continual state of change.

Figure 1. A model of the management science of the built environment

2.2. The Healthcare Environment

The design of the healthcare environment is complex and challenging as there are interrelated issues to be addressed including the variety of users, the frequent technological changes to support diagnostics and treatment, as well as the nature of the services which ultimately focus on caring for people health and well-being (Codinhoto, et.al 2009). The healthcare environment can pose a significant infectious hazard as there are diverse populations of micro-organisms that do not only arise from the patient but are deposited by visitors (Department of Health, 2008). A body of clinical evidence derived from case reports and infection outbreak investigations, suggests a link between contaminated environments and the transmission of microorganisms that cause healthcare-associated infections in hospitals (Gillespie et al., 2013). Thus, The British Institute of Facilities Management (BIFM, 2014) echoed that bringing facilities management into hospital design, construction and environmental assessments may boost performance. Compared to other built environment design objectives, achieving design excellence in the provision of fit-for-purpose, patient-centred, care environments has been acknowledged to underpin the delivery of modern health service delivery (NHS Estate England, 2005). Healthcare environments include all the physical surroundings of patients and healthcare staff, the physical structures, fittings, furnishings, equipment and supplies.

2.3. The paradigm of Facilities management

The term facilities management (FM) has gone through many phases of definitions and interpretation in response to the changing phase of the management of the built environment to serve human needs, wants and values. As a consequence, the scope and definition of FM is now more encompassing of the traditional management sciences, and of other management disciplines outside the built environment including Human resource management. The International Facilities Management Association (IFMA, 2009) defines FM as a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, places, process and technology. This definition acknowledges the multidisciplinary nature of FM and the management of the workplace environment which is effectively coordinated through the use of information technology. However, Nunnington & Haynes, (2010) criticised this definition for the lack of connection to the core business strategy.

The British Institute of Facilities Management (BIFM), defines facilities management as the integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of its primary activities. As such, the practice encompasses multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace (BIFM, 2009). This definition, like that provided by IFMA also, suggests that facilities management encompasses different professional disciplines within the built environment. However, the BIFM definition goes further to include a linkage between the workplace and its potential impact on the occupiers and also stresses how well-managed facilities can support the organisation to improve the effectiveness of its core activities in-order to achieve the organization's set objectives.

The inter-professional service interface that characterises the perceived scope and definition of facilities management could be argued to be a result of the built environment professions' challenges to establish a coherent and proactive professional service team on a long-term partnership for a targeted management approach to built facilities. De Toni et al., (2009) stated that the management of a broad and deep range of facilities services requires not only specific skills and capabilities but also the ability to adjust to the dynamic aspect of a continuous increase in service quality demand, and the changeability of end user's needs. Compared to other management professions within the built environment, facilities management could be argued to be more suited to managing the changing phase of healthcare facilities for the control of exogenous HCAI, including facing the challenges of the emergence of antibiotic resistance bacteria among other factors in the prevalence of HCAI,

2.4. **Healthcare Facilities Management Interface in the control of HCAI**

The Centre for Facilities Management (CFM), University of Strathclyde (Alexander, 2007), defined healthcare facilities management as the process by which a provider unit creates and sustains a caring environment and delivers support services to meet healthcare objectives at best cost. Hospitals are acknowledged to be amongst the largest and most complex of all modern institutions to run. They require huge bureaucratic structures to manage, coupled with political and financial pressures that are influenced by public scrutiny in the face of media focus on maximising value for the resources involved in public institutions. Unlike other modern institutions, Hosking & Haggard, (1999) stated that modern hospital facilities management is not a soft option.

The scope of facilities management service delivery practice is considerable, and the flexibility of the practices allows for it to be bespoke and directed towards achieving set objectives. The healthcare environment where the facilities management discipline is applied comprises three basic components - buildings, equipment, and people. Each of these components is acknowledged to be a potential medium for the harbouring of infectious organisms that encourages the prevalence of healthcare associated infections (Joint Commission on Healthcare Organisation - JCHO, 2009). As a consequence, the professional guidance and contribution of the facilities manager at the design phase of healthcare facilities, to optimise the functionality of the facilities constituent element at the occupancy phase, has been acknowledged as facilities management service delivery practice is centred on these three components.

Compared to facilities management practice in other industries, the provision of healthcare facilities management services is unique, dynamic and constantly changing to support the delivery of healthcare services (Department of Health, 2011, 2013b; Codinhoto et al., 2009). The facilities management service delivery concept in the prevention of the occurrence of HCAI has had increasing recognition since the work of Florence Nightingale at the military hospital in Scutari in present day Turkey in 1854. It was stated that the principles that Florence Nightingale conceptualised, upheld and promoted in terms of the vital role and the impact that hygiene and environmental cleanliness on patient recovery outcome still holds good to date (Payne & Rees, 2000). Nightingale's notations about the importance of clean air, adequate lighting, ventilation, sanitation and environmental cleanliness are the foundations for the concept of "the healing environment" Stichler, (2011). Her work provided the recognition that infectious diseases could be transmitted from patient to patient, patient to carer, and carer to patient.

Within the scope and limitations of this research, the interface of facilities management functions are typically grouped into hard and soft FM at the occupancy phase of the facilities under varied themes (figure 2.0). These are closely delivered as a targeted management approach for the prevention of healthcare associated infection.

Figure 2. Typical facilities management service functions in the NHS

2.5. **Knowledge Management (KM) in Facilities Management Service Delivery**

Knowledge management is perceived as a conscious strategy of providing the right knowledge to the right people at the right time, and helping people share and put information into action in ways that strive to improve performance (Grayson, 2012; Dell et al., 1998).

Knowledge management is characterised into two elements of tacit and explicit knowledge (Davenport, 2008; Nonaka & Takeuchi, 1995). These two elements of knowledge differ on the basis of whether the knowledge is embedded or has been transcribed into a second or third party element. Duffy, (2000) and Nonaka & Takeuchi, (1995) define tacit and explicit knowledge as follows:

- Tacit knowledge is non-verbalised, intuitive, and unarticulated. It resides in human mind, behaviour and perception. It evolves from people's interactions, and requires skills and practice to acquire this knowledge
- Explicit knowledge is structured, expressed in writings, drawings and documents. It can also be captured and shared through information technology

The healthcare environment is where different professional groups are broadly classified into clinicians and non-clinicians where varying job roles, behaviors and values congregate and engage in a collaborative practice. The objective of this interface is to achieve set objectives and provide value for money relative to performance and quality (Nicolini, Powell, Conville, & Martinez-Solano, 2008; Nilakanta et al., 2009; Sheffield, 2008). Each of these groups often exhibits both an explicit and a tacit knowledge interface in their contribution to contemporary issues and promote the relevance of their respective professional practice. The World Health Organisation, (2009) acknowledged that a huge gap still existed between the knowledge accumulated over the past decades and the various adopted good practice compliance monitoring strategies in the prevention of healthcare associated infection. This gap is acknowledged to be more in poor resource settings which have resulted in breaches in infection control measures that undermine advances and investment gained over the years. As a paramount service provider with the responsibility of maintaining environmental cleanliness, the extent to which lessons learnt from adopted good compliance monitoring tools for the control of HCAI are interpreted into everyday practice to improve service delivery remains a challenge in FM service delivery for the control of exogenous HCAI.

Findings from the literature reviewed evidenced that there are several perceptions of knowledge management protocols as well as plethora of infection control strategies for the control of healthcare associated infections in hospitals settings. Thus, there is a need to promote collaborative processes for identifying and accessing existing knowledge, to explore new knowledge opportunities, and to provide enabling environments to experiment with the acquired knowledge. This research is aimed at exploring knowledge derived from artefacts (explicit) as well as those derived from experience (tacit) that are not obvious to others across NHS hospitals in England. This is to develop a good practice knowledge management process framework for the sustainable targeted management approach for the control of healthcare associated infections in hospitals.

3. Research methodology

A research methodology is a way of describing how a researcher goes about the task of conducting research, unfolding a particular style and employing different methods. Hence, there is no single research strategy that could be considered as the 'best' in all circumstances (Denscombe, 2010; Fellows & Liu, 2003). The aim of this research points to the development of a good practice knowledge management framework in facilities management service delivery practice in the control of healthcare associated infection in NHS hospitals. The main study will employ both qualitative and quantitative survey methods in a sequential exploratory mixed methods protocol (figure 3.0).

As illustrated in figure 3.0, the research begins with the exploration of a synthesis of primary and secondary literature including previous research and theories pertinent to the research subject domain. This was aimed at exploring the interface between healthcare facilities management and the prevalence of healthcare associated infections in healthcare facilities. Further insight into the influencing factors in the prevalence of healthcare associated infections was identified, and was used to guide the causal patterns in the design of the pilot study semi structured interview questions. This was used to further explore the research subject matter, thus, providing a contextual and conceptual background from where the main research survey was developed.

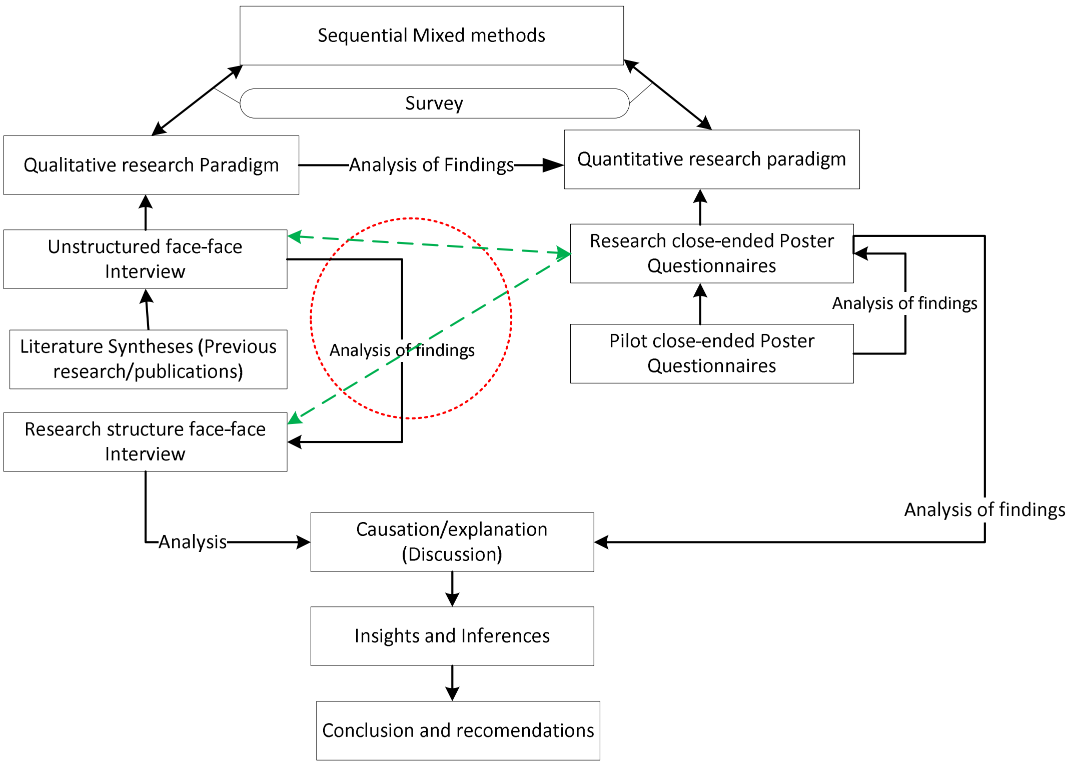

Figure 3. Adopted research method - Sequential Mixed method

Given the complexity and dynamism of infection causing micro-organism's resistance to antibiotics, an effective knowledge management interface in managing lessons learned from adopted infection control tools, as well as the management of communication among cosmopolitans working for the National Health Service, remains a constant challenge that cannot be ignored. Despite some perceived disadvantages associated with a mixed method, including the argument that the researcher needs to be skilled in the use of these methods; some of the perceived benefits of mixed method research noted by Easterby-Smith et al., (2012) include:

1. It increases confidence and credibility of results and allows the researcher to be more confident of their results.
2. It increases validity and uncovers deviant dimensions of the investigated phenomenon.
3. It demonstrates generalization as it throws new perspectives on research questions.
4. It provides deeper insights that explain why things take place
5. It presents a greater diversity of views and provides better (stronger) inferences.

4. Findings and Discussion

The divergences of tools that are currently being used for the monitoring of compliance with effective infection control policies in FM service delivery to the NHS include:

1. Environmental audit tools developed by Infection control Nurses Association (ICNA),
2. The NHS National standard of cleanliness audit tools developed by the National Patient Safety Agency (NPSA),
3. Patient Led Assessment of the care Environment (PLACE),
4. Infection Control Team (ICT) bespoke audit tools integral of the NHS National Standard of Cleanliness (ICT+NHS),
5. Facilities Management team bespoke good practice compliance audit tools (checklist and tick box) (FM tools),

The efficacy of the use of these tools will be explored as part of the objectives of this research towards the achievement of the research aim. The preliminary findings have further justified the relevance of the anticipated research outcome that is aimed at the development of a good practice knowledge management framework in FM services delivery to the NHS, for a targeted management approach of infections that could be acquired from sources external to the body as a compromise of FM service delivery practice.

5. Conclusion

It is acknowledged that compared to other building management disciplines, one unique characteristic of facilities management is the recognition that it is the management practice that has within its scope of service provision a focus on user satisfaction (Strup, 2010). Thus, while other built environment management professions (Infrastructure management, Estate Management, Assets management, Corporate Real Estate Management etc.,) could practice within the sphere of uninhabited or empty properties and care for the property, the practice of facilities management has the duality of managing occupied properties and the unique function of liaising between the Client and the occupier of the property to ensure the satisfaction of both stakeholders.

Amidst the various contexts in which the management professions of the built environment have been explored, and the seemingly conflicting management approaches, there is a need to adequately explore what differentiates facilities management in concept and context in healthcare. This could be achieve by adopting a more strategic review of the adopted good practice compliance tools, and the management of the knowledge gained from such tools, for the creation, storing, sharing, and reuse of the knowledge for the control of HCAI that could be acquired as a compromise of FM service delivery practice. The next phase of this research will be to further explore, through qualitative (face-face interviews) means, the findings from the quantitative approach to support the achievement of the research aim and objectives.

It is anticipated that findings from the research will provide practitioners and policy makers within NHS and other healthcare establishments with knowledge management strategies to support their adapted infection control tactics. Hence, it could be use as a supporting process for developing their bespoke infection control strategies for the sustainable targeted management approach of HCAI in FM service delivery practice.

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ID 009

Public-Private Partnership Project Evaluation Using Decoupled Net Present Value: A Toll Bridge Case Study from Vietnam

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Abstract

Net Present Value method (NPV) is being widely used to evaluate projects because of its simplicity to investors. In the NPV method, risks are accounted for by adjusting a "risk-free rate" to form a risk-adjusted discount rate (RADR), and then the RADR is used to devalue cash flow with time. However, it has been argued that time and risk are different variables, and they should be separated in evaluating projects, otherwise evaluation errors can be generated, especially for projects which require long-term investment. To minimize the limitations of NPV, Decoupled Net Present Value method (DNVP) has been developed as a new tool to assess projects. In DNPV, risks are decoupled from the time value, and they are quantified and treated as a cost to the project. Public-Private Partnership projects (PPPs) typically demand long-term investments. Consequently, PPPs should be an environment in which the limitations of NPV are exposed, and the robustness of DNPV can be proved. In a PPP project, the separation of time and risks could result in a significantly different evaluation compared to the evaluation made by NPV. Nevertheless, DNPV has not been applied to the area of PPPs. Therefore, this paper will describe the use of DNPV to evaluate projects, in comparison with NPV. One transportation PPP projects in Vietnam was re-evaluated by DNPV. The findings show that the chosen project is much more valuable to investors in the evaluation made by DNPV than they are in the evaluation made by NPV. These findings can lead to significant changes in other aspects of PPPs. For example, the franchise operational period could be shortened compared to that established using NPV. Hence, the findings of this paper have identified a new area for the future research.

1. Introduction

The development of an economy leads to the demand for the development of infrastructure system. However, a government's budget is not an unlimited resource. Therefore, the PPP forms are becoming an increasing trend, especially in developing countries, such as some countries in Southeast Asia. There are many different terms for a PPP project. For example, in the UK it is called as PFI or PF2, and in the USA it is P3. Though, these terms are different, they basically refer to similar forms of project. Basically, a PPP project is *"A long-term contract between a private party and a government agency, for providing a public asset or service, in which the private party bears significant risk and management responsibility"* (World Bank Institute and PPIAF, 2012).

Similarly to other forms of construction project, a PPP needs to be evaluated to ensure that it can bring value for money. As, mentioned, a PPP contract usually lasts for a long time. For example, it can be 20 years for a concession toll road. This, in turn, can create additional risks both in terms of technical and market risks. Besides, these risks may change through the life cycle of the project.

Therefore, the evaluation needs to be able to ensure that sufficient future cash flows will be generated. However, the evaluation is not about financial aspects alone. The investors usually employ experts to evaluate associated risks, together with financial aspects to make a sound investment decision. Essentially, due to the limited financial resources of an investor, a method which can compare alternatives to select the most attractive project is vital.

Although a number of innovative evaluation techniques have been developed over the last decades, the application of these techniques in practice is still limited. One of the most popular techniques which is being used to evaluate projects is the Net Present Value (NPV) technique. This technique has been popular because of its simplicity. However, this method has also been criticized because of its weaknesses, which are criticized in following sections. In order to resolve weakness of NPV method, and to bring theory closer to the practice, a new method, DNPV, has been developed by Espinoza *et al.* (2013). The practical use of DNPV method has been investigated in some studies with some landfill projects and solar projects. However, it has not been applied in the field of PPPs. This paper will attempt to apply the DNPV method to the PPPs, and a toll bridge project will be used as an example.

2. Literature Review

2.1. NPV Techniques

In NPV methods, all future cash flows are discounted with a given discounted rate and then they are summed. The equation below shows how NPV is measured:

$$NPV = \sum_{t=0}^{n} \frac{NCFt}{(1+r)^t} \quad (1)$$

Where NPV = Net Present Value; NCF_t= Net Cash Flow generated in year t, r=risk discounted rate. Risk discounted rate can be the sum of the risk free rate, (which is often considered as the government bonds), and a risk premium rate (to cover risks such as technical, commercial) (Doctor *et al.*, 2001). If the NPV is positive, the project is considered as profitable and rate of return will be higher than the minimum required rate of return, and vice versa. As stated, this method allows investors to compare different projects with different risk profiles (Budnick, 1988). Besides, it is also well-known for its simplicity. However, NPV has been criticized in a number of aspects. For example, regarding the discounted rate, McSweeney (2006), observed that using a single discounted rate is fraught with drawbacks which can generate incorrect estimation of a project. Moreover, the discount rate is criticized to be more concerned with the source of finance than the project itself, and it is difficult to account for specific risks in this discount rate. This can lead to unreasonable results which seem to be difficult to explain (Pergler *et al.* 2008). Furthermore, this method seems to make unreasonable distinction between the risky project and the long term project (Žižlavský, 2014). In order to resolve the weakness of NPV, a number of developed methods have been modelled. For instance, risk-adjusted NPV by Stewart *et al.* (2001), or stochastic NPV in which NPV is stochastic variable with probability distribution (Chapman and Cooper, 1987; Raftery, 1994). Although, these methods have been developed to resolve the weakness of NPV, one of the common features of these methods is the conjunction of discounted rate for risk and time value (Halliwell, 2011), Espinoza *et al.* (2013). A number of researchers have stated that adding risk and time together cannot be valid approach because they can be entangled (Zeckhauser and Viscusi, 2008).

2.2. **DNPV technique**

In contrast to NPV methods, DNPV treats risk and time separately. In this method, an investor is viewed as an insurance provider, and investor forecasts synthetic insurance premiums as compensation for risks predicted. The value of compensation is seen as synthetic insurance premium, and risks are treated as the cost of the project. According to Espinoza *et al.* (2013), DNPV can be measured as:

$$\mathrm{DNPV} = \frac{(\underset{\cdot}{V}_t - \underset{\cdot}{I}_t - \underset{\cdot}{R}_t)}{(1+r)^t} \quad (2)$$

Where $DNPV_t$= Decouple Net Present value of a project at year t; $\underset{\cdot}{V}_t$=Revenue of the project at year t; $\underset{\cdot}{I}$= Expenditure of the project at year t; r= risk free rate, and $\underset{\cdot}{R}_t= \underset{\cdot}{R}_{Vt} + \underset{\cdot}{R}_{It}$ which presents for the expected total cost of risk at time t. This can be forecasted as sum of all sources of risks. From the equation, it can be recognised that it is crucial to estimate the value of $\underset{\cdot}{R}t$; $\underset{\cdot}{R}t$ can be measured as:

$$\underset{\cdot}{R}_{Vt} = \eta_V \, \underset{\cdot}{V} \quad (3)$$

$$\underset{\cdot}{R}_{It} = \eta_I \, \underset{\cdot}{V} \quad (4)$$

η_V and η_I are parameters presenting the riskiness of the project. More specifically, they identify the cost raised due to lower than expected revenue and higher than expected expenditure. Espinoza *et al.* (2013) proposed 3 methods to estimate risk parameters. They are heuristic method, probability based methods, and stochastic methods (option pricing). In the simplest level, risk parameters are estimated by using heuristic data. By using this method, investors estimate the value of risk parameters based on recorded data, literature reviews, or experience. In the probability based method, the value of η is estimated by using probability distribution. In the third methods, real option pricing method bonds (Black and Scholes, 1973) is used. These methods take into account the variation of revenues or expenditure. On the revenue side, the risk parameter can be seen as a put option, and on the expenditure side, it can be seen as a call option.

$$\frac{C}{S} = e^{\delta T} N(d_1) - \frac{X}{S} e^{rT} N(d_2) \quad (5)$$

$$\frac{P}{S} = \frac{X}{S} e^{rT} N(-d_2) - e^{\delta T} N(-d_1) \quad (6)$$

Where S is stock or any other instrument, and in this paper, it the traffic demand; X is the price that is exercised during the time T; C and P are call and put option; and:

$$d_1 = \frac{\ln\left(\frac{S}{X}\right) + \left((r-\delta) + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}} \quad (7)$$

$$d_2 = d_1 - \sigma\sqrt{T} \quad (8)$$

Where δ= dividend paid by the stock, bond, or other instrument. It can be also seen as the cost that investors have to pay to hold the option or to remove the competitors (Leslie and Michaels, 1997).

2.3. Application of DNPV technique

As discussed previously, the practical use of DNPV method has been researched in some studies with landfill and solar projects. For example, a landfill gas project was used as a case study for this method in Espinoza and Morris (2013), and a solar project was also tested in Espinoza and Morris's paper in 2015. The significant difference between evaluations by NPV and DNPV was also discussed. The authors concluded that DNPV allows the investors to evaluate alternative risk allocation mechanisms. However, this new technique has not been discussed in the field of PPPs in the transportation infrastructure sector. This paper will attempt to apply the DNPV method to the PPPs, and a toll bridge project will be used as an example. The findings of this paper can identify fertile areas for future research.

3. Finding and discussion

The project used as a case study in this paper is the Yen Lenh Toll Bridge Project which is a BOT project. Yen Lenh Bridge is located in No 38 national highway, and it crosses the Red river connecting Ha Nam province and Hung Yen Province in Vietnam. The bridge is 2229.95m long and 15m wide, and clearance for ships is 80m wide and 10m high. The project was planned in 2000 in order to boost the development of Ha Nam and Hung Yen provinces. It was planned to use financial resources both from the government and private investors. More specifically, two approach systems were constructed using the government's financial budget, and the main bridge was constructed under a (Build – Operate – Transfer) BOT contract, and the operation stage was planned to last 17 years and one month at the time of signing the contract in 2002. The construction started in June 2002 and finished in September 2004 which was 10 months earlier than scheduled. However, in 2012, the project was re-negotiated because investors reported that from 2005 to 2012 the revenues were under estimation, and the main reason was identified that the traffic demand was insufficient. After the negotiation, the operation period was accepted to extend until 2026 which is 4 year longer than the in the original contract in 2002.

It is important to note that in 2012 the project was also re-evaluated by the government using NPV, and in this paper, the project was re-evaluated by DNPV with actual data from 2005 to 2012 to make comparison between two evaluation techniques.

Table 1: Risk identification analysis

<table>
<tr><th>Source</th><th>Parameter</th><th>Potential Risk</th><th>Risk mitigation</th></tr>
<tr><td rowspan="2">Revenue</td><td>Demand</td><td>Lower demand than expected</td><td>Using real heuristic data to forecast the demand
Obtain government guarantee to extend the contract</td></tr>
<tr><td>Tariff</td><td>Restriction and change in tariff</td><td>Obtain government guarantee about tariff</td></tr>
<tr><td rowspan="3">Expenditure</td><td>Maintenance cost</td><td>Higher maintenance cost than forecasted</td><td>Assume the cost contingency by investor
Define clearly responsibility for reasons of damages in the contract</td></tr>
<tr><td>Administration cost</td><td>Higher cost than forecasted</td><td>Assume the cost contingency by investor</td></tr>
<tr><td>Tax</td><td>Tax change</td><td>Obtain tax guarantee from the government</td></tr>
</table>

Table 1 shows part of the risk management plan by investor. With the analysis from the table 1, in this paper, on the revenue side, the risk parameter was calculated for the risk of lower demand than expected. On the expenditure side, the expenditure cost during the concession period in this project is forecasted as the percentage of the total revenue. From the actual report of the Special Purpose Vehicle (SPV), it can be seen that the expenditure cost for the concession period has been always equal to the forecasted cost. Therefore, the risk premium for this period seems to be zero. However, according to the contract, the contract will be amended if the cost during the operational period exceeds 10 per cent of the agreed cost. Therefore, in this paper, the risk parameter on the expenditure side was assumed as zero, 5 per cent and 10 per cent, respectively. Three different scenarios are presented following three different risk parameter values. It is important to note that the risk parameter on the expenditure sides for this project is only the cost during the operational period because the project was re-evaluated from the year of 2012, and at that time the actual costs for construction period were already determined.

Because the historical data is available, the risk premium was determined by using the third method - the real option method. As mentioned previously, the risk premium on the revenue side can be seen as a "put option" and the risk premium on the expenditure side can be seen as a "call option". Table 2 and figure 1, below, show yearly revenue and yearly demand variation of the project from 2005 to 2026. The statistics from 2005 to 2012 are confirmed, and from 2012 to 2026 are forecasted. Although the data about the actual traffic demand from 2006 to 2012 is not available, the price per unit was constant from 2006 to 2012. Therefore, the variation of revenue also reflects the variation of traffic demand.

Table 2: Yearly revenue through the project life cycle

Year	Revenue (£)	Variation
2005	399323.3	-14.50%
2006	512960.6	28.46%
2007	519993.9	1.37%
2008	548309.091	5.45%
2009	606878.788	10.68%
2010	842451.515	38.82%
2011	979321.21	16.25%
2012	1217297.79	24.30%
2013	1375546.48	13.00%
2014	1554367.515	13.00%
2015	1709804.27	10.00%
2016	1880785	10.00%
2017	2068863	10.00%
2018	2275749	10.00%
2019	2503324.45	10.00%
2020	2753656.88	10.00%
2021	2973949.45	8.00%
2022	3211865.4	8.00%
2023	3468814.64	8.00%
2024	3746319.79	8.00%
2025	4046025.394	8.00%
2026	4369707.42	8.00%

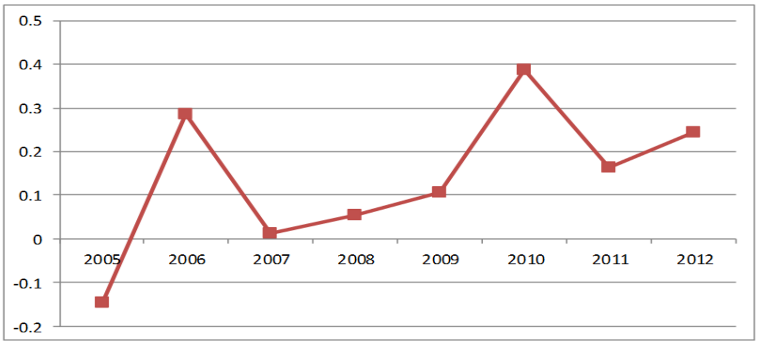

Figure 1: Yearly variation of demand from 2005 to 2012

The original total investment was £9,551,048.99. By the time of 2012, it had made some revenue. Deducting these made revenue from 2005 to 2012, the deducted investment cost which is the exercise price is £8,403,976.77. The total future cash flow (S) is 21,760,545.45. Figure 1 shows the yearly variation of demand from 2006 to 2012 which creates the annualized standard deviation: 22.70%. From data, variables can be determined. *T:* 14 years from 2012 to 2026; *r:* 6.875 % (PG Bank, 2012). In terms of δ, this parameter can be seen as the cost to keep the option alive (Leslie and Michaels, 1997). For example, the cost lost to remove the competitors. In this paper, this cost is assumed as zero as Vandoros and Pantouvakis (2006) suggested for infrastructure projects which do not pay dividends. From these numbers, together with the equations (7) and (8) above, the risk parameter on the revenue side is 13.59%.

In the renegotiated contract in 2012, all values of cash flows were converted to their value in 2005 which was the year that the concession started. Therefore, in order to compare the evaluation DNPV to NPV, in the first comparison in table 3, all values of cash flows are also converted to their value in the year of 2005.

Table 3: DNPV and NPV comparison with ɍ=6%, r=6.875%, η_v=0. 13.59, η_I=0

Year	Converted year	Revenue	Expenditure						Income	PV of Income	Rvt	Rit	Decoupled CF	PV of DCF	Accumulated DNPV	Accumulated NPV
			Operational Cost	Maintenance	Tax	Investment	Bank Interest	Total								
		1	2	3	4	5	6	(7)=(2)+(3)+(4)+(5)+(6)	(8)=(1)-(7)	-9	(10)=ηx(1)	11)=γ x(7	12	13	14	15
2002	-3					9880.19	806.22	10686.41	-10686.41	-12727.69			-10686.41	-13045.49	-13045.49	-12727.69
2003	-2					101255.00	9109.23	110364.23	-110364.23	-124005.25			-110364.23	-126060.95	-139106.44	-136732.94
2004	-1					51890.48	14774.78	66665.26	-66665.26	-70665.18			-66665.26	-71248.50	-210354.94	-207398.11
2005	0	13177.67	1120.10	263.55	1317.77	2731.05	15712.11	21144.58	-7966.91	-7966.91			7732.20	7732.20	-202622.74	-215365.02
2006	1	16927.70	1438.85	338.55	1692.77		19201.15	22671.33	-5743.63	-5418.52			-5219.03	-4883.30	-207506.04	-220783.54
2007	2	17159.80	1458.58	343.20	1715.98		20604.72	24122.48	-6962.68	-6196.76			-6608.99	-5786.06	-213292.10	-226980.30
2008	3	18094.20	1538.01	361.88	1809.42		28083.53	31792.84	-13698.64	-11501.64			-14205.93	-11637.01	-224929.11	-238481.94
2009	4	20027.00	1702.30	400.54	2002.70		20828.23	24933.77	-4906.77	-3886.62			-4930.06	-3778.74	-228707.85	-242368.56
2010	5	27800.90	2363.08	417.01	2780.09		27837.70	33397.88	-5596.98	-4182.39			-8203.76	-5883.45	-234591.30	-246550.95
2011	6	32317.60	2747.00	646.35	3231.76		29253.99	35879.10	-3561.50	-2510.72			-5437.62	-3648.82	-238240.12	-249061.66
2012	7	40170.83	3414.52	803.42	6427.33	3357.21	27948.75	41951.23	-1780.40	-1184.07			-165.48	-103.90	-238344.02	-250245.73
2013	8	45393.03	3858.41	907.86	7262.89		22608.48	34637.63	10755.40	6748.07	6168.91	0	28468.72	16724.72	-221619.30	-243497.66
2014	9	51294.13	4360.00	1025.88	8207.06		21838.58	35431.52	15862.60	9389.05	6970.87	0	28460.65	15644.43	-205974.87	-234108.61
2015	10	56423.54	4796.00	846.35	9027.77		17776.51	32446.63	23976.91	13388.58	7667.96	0	24778.67	12744.32	-193230.55	-220720.03
2016	11	62065.90	5275.60	1241.32	9930.54		16642.46	33089.92	28975.97	15264.18	8434.76	0	24655.17	11865.08	-181365.47	-205455.85
2017	12	68272.49	5803.16	1365.45	10923.60		15340.88	33433.09	34839.40	17314.11	9278.23	0	24154.86	10876.54	-170488.92	-188141.74
2018	13	75099.73	6383.48	1501.99	12015.96		13852.56	33753.99	41345.74	19384.50	10206.05	0	23547.94	9921.18	-160567.75	-168757.24
2019	14	82609.71	7021.83	1652.19	13217.55		12197.42	34088.99	48520.71	21460.76	11226.66	0	22862.33	9012.70	-151555.05	-147296.48
2020	15	90870.68	7724.01	1363.06	14539.31		10396.22	34022.60	56848.08	23720.72	12349.33	0	21673.27	7994.34	-143560.71	-123575.76
2021	16	98140.33	8341.93	1962.81	15702.45		8452.15	34459.34	63680.99	25067.79	13337.27	0	21122.07	7289.85	-136270.87	-98507.97
2022	17	105991.56	9009.28	2119.83	16958.65		6361.10	34448.86	71542.70	26568.41	14404.25	0	20044.61	6472.97	-129797.90	-71939.56
2023	18	114470.88	9730.03	2289.42	18315.34		4151.23	34486.01	79984.87	28022.20	15556.59	0	18929.42	5719.62	-124078.28	-43917.36
2024	19	123628.55	10508.43	2472.57	19780.57		1928.33	34689.90	88938.66	29395.38	16801.12	0	17888.78	5057.48	-119020.80	-14521.98
2025	20	133518.84	11349.10	2002.78	21363.01			34714.90	98803.94	30807.54	18145.21	0	16569.69	4383.20	-114637.59	16285.56
2026	21	144200.35	12257.03	2884.01	23072.06			38213.09	105987.25	31176.72	19596.83	0	18616.26	4607.80	-110029.79	47462.28

Table 3 demonstrates a significant difference between the value of DNPV and NPV at the end of the concession period. The valuation by NPV demonstrates that the project can make profit at the last two years of the concession period. In fact, in the contract it says that the last two years are the time to make profit for the investors. In contrast, the evaluation by DNPV demonstrates that the project cannot make the profit with the negative numbers. This seems to contradict to the statement mentioned at the beginning of the paper that DNPV considers project more valuable than NPV does. However, it is important to note that the comparison in table 3 is not a fair comparison. The most important reason which make NPV evaluation show the high result in table 3 is that the government used the extremely wrong risk discount rate in re-evaluating this project. More specifically, the time of the renegotiation was 2005. However, the parties still used the risk discount rate used in the contract in 2002 to convert the cash flows to their value in 2005. According to MOF (2014), PG Bank (2012) the risk free rate in 2005 was 6.875%. Therefore, the risk discount rate must be higher than this number. However, in the renegotiated contract, parties used the rate of 6%. This, indeed, led to the overestimating of the valuation of the project. The unfair comparison in table 3 is to show how the incorrect selection of discount rate can lead to the extremely incorrect evaluation.

Because of this, in order to make fair comparison between DNPV and NPV, the comparison was recalculated with all cash flows converted to the year of 2012 which is the time of renegotiated contract, and the discount rate is re-determined. The discount rate used is 15.7% which was used in some other Vietnamese BOT projects in 2012. Table 4 compares DNPV to NPV re-calculated with new risk discount rate. In 2012 the government bond rate was 9.5% which is used as risk free rate (PG Bank, 2012). Using these numbers to re-measure the risk parameter on the revenue side, and the new risk parameter is 9.25 %.

Table 4: DNPV and NPV comparison with ɍ=15.7%, r= 9.5%, η_v=0.0925, η_I =0

Year	Converted year	Revenue	Expenditure						Income	PV of Income	Rvt	Rit	Decoupled CF	PV of DCF	Accumulated DNPV	Accumulated NPV
			Operational Cost	Maintenance	Tax	Investment	Bank Interest	Total								
		1	2	3	4	5	6	(7)=(2)+(3)+(4)+(5)+(6)	(8)=(1)-(7)	-9	(10)=ηx(1)	11)=γ x(7	12	13	14	15
2002	-10					9880.19	806.22	10686.41	-10686.41	-45937.30			-10686.41	-26483.36	-26483.36	-45937.30
2003	-9					101255.00	9109.23	110364.23	-110364.23	-410042.21			-110364.23	-249778.70	-276262.07	-455979.51
2004	-8					51890.48	14774.78	66665.26	-66665.26	-214075.25			-66665.26	-137788.37	-414050.43	-670054.77
2005	-7	13177.67	1120.10	263.55	1317.77	2731.05	15712.11	21144.58	-7966.91	-22111.76			7732.20	14594.93	-399455.50	-692166.53
2006	-6	16927.70	1438.85	338.55	1692.77		19201.15	22671.33	-5743.63	-13778.01			-5219.03	-8996.52	-408452.02	-705944.54
2007	-5	17159.80	1458.58	343.20	1715.98		20604.72	24122.48	-6962.68	-14435.88			-6608.99	-10404.12	-418856.14	-720380.41
2008	-4	18094.20	1538.01	361.88	1809.42		28083.53	31792.84	-13698.64	-24547.71			-14205.93	-20423.32	-439279.46	-744928.12
2009	-3	20027.00	1702.30	400.54	2002.70		20828.23	24933.77	-4906.77	-7599.68			-4930.06	-6472.83	-445752.29	-752527.80
2010	-2	27800.90	2363.08	417.01	2780.09		27837.70	33397.88	-5596.98	-7492.39			-8203.76	-9836.51	-455588.80	-760020.19
2011	-1	32317.60	2747.00	646.35	3231.76		29253.99	35879.10	-3561.50	-4120.65			-5437.62	-5954.19	-461542.99	-764140.85
2012	0	40170.83	3414.52	803.42	6427.33	3357.21	27948.75	41951.23	-1780.40	-1780.40			-165.48	-165.48	-461708.47	-765921.25
2013	1	45393.03	3858.41	907.86	7262.89		22608.48	34637.63	10755.40	9295.94	4198.86	0	30438.78	27797.97	-433910.50	-756625.31
2014	2	51294.13	4360.00	1025.88	8207.06		21838.58	35431.52	15862.60	11849.71	4744.71	0	30686.82	25593.14	-408317.36	-744775.60
2015	3	56423.54	4796.00	846.35	9027.77		17776.51	32446.63	23976.91	15480.79	5219.18	0	27227.45	20737.89	-387579.47	-729294.81
2016	4	62065.90	5275.60	1241.32	9930.54		16642.46	33089.92	28975.97	16169.80	5741.10	0	27348.83	19023.14	-368556.32	-713125.01
2017	5	68272.49	5803.16	1365.45	10923.60		15340.88	33433.09	34839.40	16803.66	6315.20	0	27117.88	17226.03	-351330.29	-696321.35
2018	6	75099.73	6383.48	1501.99	12015.96		13852.56	33753.99	41345.74	17235.77	6946.73	0	26807.26	15551.34	-335778.96	-679085.58
2019	7	82609.71	7021.83	1652.19	13217.55		12197.42	34088.99	48520.71	17482.10	7641.40	0	26447.59	14011.59	-321767.37	-661603.48
2020	8	90870.68	7724.01	1363.06	14539.31		10396.22	34022.60	56848.08	17703.08	8405.54	0	25617.06	12394.14	-309373.23	-643900.40
2021	9	98140.33	8341.93	1962.81	15702.45		8452.15	34459.34	63680.99	17139.95	9077.98	0	25381.36	11214.70	-298158.53	-626760.44
2022	10	105991.56	9009.28	2119.83	16958.65		6361.10	34448.86	71542.70	16643.00	9804.22	0	24644.64	9944.46	-288214.07	-610117.44
2023	11	114470.88	9730.03	2289.42	18315.34		4151.23	34486.01	79984.87	16082.03	10588.56	0	23897.46	8806.36	-279407.71	-594035.41
2024	12	123628.55	10508.43	2472.57	19780.57		1928.33	34689.90	88938.66	15455.76	11435.64	0	23254.26	7825.88	-271581.83	-578579.65
2025	13	133518.84	11349.10	2002.78	21363.01			34714.90	98803.94	14840.23	12350.49	0	22364.41	6873.43	-264708.39	-563739.42
2026	14	144200.35	12257.03	2884.01	23072.06			38213.09	105987.25	13758.99	13338.53	0	24874.56	6981.64	-257726.75	-549980.43

In table 4, both evaluations by DNPV and NPV show that the project is not profitable. However, it is very worth noting that there is still a significant difference between two evaluations. More specifically, the number calculated by NPV is 53.14 per cent higher than that calculated by DNPV technique. Similarly, the scenarios for the risk parameter of 5 per cent and 10 per cent on the expenditure side also show the significant difference between evaluation made by NPV and DNPV. In the scenarios, in which the risk parameter on the expenditure side is 5 per cent and 10 per cent, the number made by DNPV is 53.00 % and 29.44% higher than that by NPV, respectively. Although, risk parameter on the expenditure side was increased to 10 per cent which is the limit level that the contract can be renegotiated, the DNPV evaluation still shows a much higher number than NPV evaluation. One of the possible reasons for this difference, as Espinoza *et al*. (2013) criticized, is that the assumption of risk discount rate is somehow arbitrary. Besides, time value has been double counted with the project risk in the NPV evaluation. Figure 2 shows the difference between evaluation by DNPV and NPV in different scenarios of risk parameter on the expenditure side (η_I), and the risk parameter on the revenue side is 9.25 % in all scenarios.

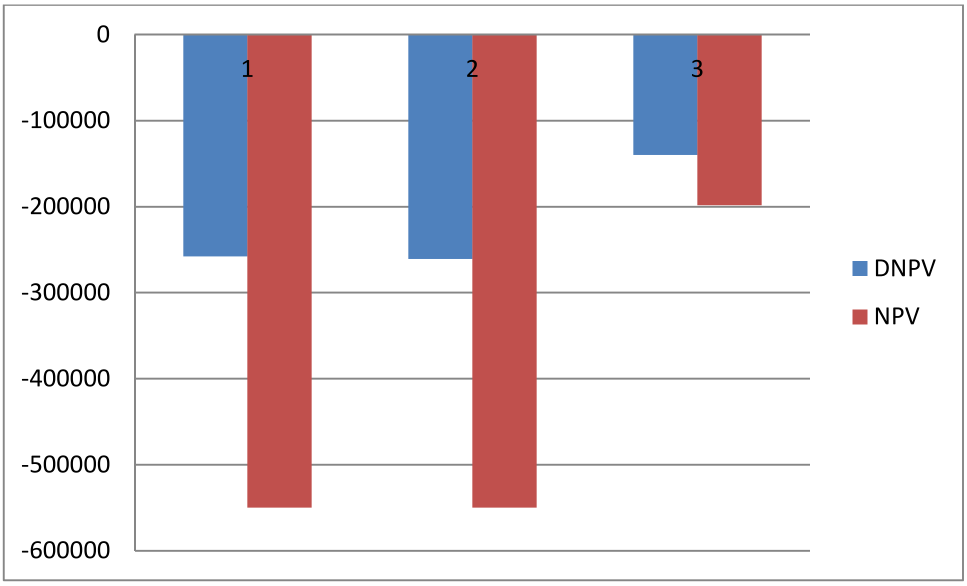

Figure 2: DNPV and NPV comparison with different scenarios of risk parameter on the expenditure side

4. Conclusion & Future research

The main purposes of this paper are to investigate the application of DPVN which was developed by Espinoza *et al*. (2013), to the area of PPPs in transportation sector in Vietnam, and from that to identify the gap for future research. It is recommended that NPV and DNPV should be used together to evaluate projects. A toll bridge project was used as a case study. Basically, instead of using the discounted rate to measure NPV, risk parameters were identified based on three stated methods. These risk parameters allow the investors to treat risks as a cost of project. The results have demonstrated that there is a significant difference between the evaluation by NPV and DNPV technique. More specifically, in the DNPV evaluation the project is considered more valuable than it is in the evaluation by NPV. One of the main reasons for this difference can possibly be the incorrect assumption about the discounted rate in NPV. Besides, because the risk and time value are integrated in a single parameter in NPV, the time value can be double counted Espinoza *et al*. (2013). In fact, the findings of this paper have identified spaces for future research. For example, the difference in the evaluation can lead to the difference in identifying the concession period, toll adjustment mechanism, or project re-negotiation, and future research can explore these areas. In addition, limitation of this paper also needs to be addressed. The first limitation is that due to the recorded data, this paper assumes the risk parameter on the expenditure side. The future research need to identify this parameter also based on three stated methods. Besides, future research should evaluate project from the construction period because the cost contingency for this period may have a significant impact on the final result of DNPV, and NVP.

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The Importance of Tacit Knowledge Integration within Traditional Project Environment: A Critical Review

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Abstract

Project knowledge mostly remains in minds of involved individuals of project team and is not captured and transferred across the project in order to be used in future projects, mainly in construction industry. The successful completion of a project requires a rigorous understanding of each stage that can be enhanced through integrating knowledge between all individuals involved in project, specifically between detailed design phase and execution (construction) phase. This is where there are issues about performances in terms of traditional procurement. The construction industry suffers from lack of knowledge integration between its phases especially in traditional procurement system, because many professional designers at design phase are not skillful in construction means and methods, and have little experience and tacit knowledge in construction practices. The fact that the design and construction process are separated means common disputes exist between design and construction phase. The construction industry will lose its knowledgeable and skilled workforce and there is no efficient strategy by which knowledge can be integrated across project and between team members. This paper aims to highlight the importance of tacit knowledge integration within the project environment. A critical literature survey and review of existing published data will be carried out to explain challenges within the traditional project environment, existing practices in terms of knowledge management practices and the way in which knowledge integration can be adopted for better performance.

Keywords:

Construction Industry, Traditional Procurement, Knowledge Integration, Tacit Knowledge

1. Introduction

Knowledge is considered as the most valuable asset that should be effectively managed in order to create added wealth (Shokri-Ghasabeh and Chileshe, 2014). The availability of accurate and timely knowledge enables project members and organisations to respond rapidly to problems and facilitate processes. Therefore, the competitive advantage of organisation and successful completion of a project lie in the ability of effectively managing knowledge (Kivrak *et al.,* 2008). Knowledge Management (KM) plays a significant role in survival and performance of organisations, specifically in project-based industries like construction.

Researchers(Kazi and Koivuniemi, 2006; Shokri-Ghasabeh and Chileshe, 2014) believed that project knowledge mostly remains in minds of involved individuals of project team and is not captured and transferred across the project in order to be used in future projects, mainly in construction industry. This means that knowledge is not integrated between project team members. In other words, knowledge integration is the process of capturing, sharing, transferring and reusing knowledge within project environment in order to improve project performance. As the nature of construction project teams and projects are temporal, the continuity of using the same staff and professionals for the future projects will decrease, which leads to lose project knowledge (Shokri-Ghasabeh and Chileshe, 2014). Researchers also believed that the construction industry will lose its skilled and knowledgeable workforce and there is no efficient strategy by which knowledge can be integrated across project and between team members (Kanapeckiene *et al,* 2010; Shokri-Ghasabeh and Chileshe, 2014). Within this context, the failure to integrate the knowledge will result in increasing the possibility of "reinvent the wheel", which means spending more time and cost.

The successful completion of a project requires a rigorous understanding of each stage that can be enhanced through integrating knowledge between all individuals involved in project, specifically between detailed design phase and execution (construction) phase. This is where there are issues about performances in terms of traditional procurement (Love *et al.,* 2013). The construction industry suffers from lack of knowledge integration between its phases especially in traditional procurement system, because many professional designers at design phase are not skillful in construction means and methods, and have little experience and tacit knowledge in construction practices (Cheng, 2009; Love *et al.,* 2013; Aziz *et al.,* 2014). The fact that the design and construction process are separated means common disputes exist between design and construction phase. The construction industry will lose its knowledgeable and skilled workforce and there is no efficient strategy by which knowledge can be integrated across project and between team members. This paper aims to highlight the importance of tacit knowledge integration within the traditional project environment. A critical literature survey and review of existing published data carried out to explain challenges within the traditional project environment, existing practices in terms of knowledge management practices and the way in which knowledge integration can be adopted for better performance. The paper is organised as follows. Initially, the concept of KM and its components are discussed. Then, KM in construction is briefly discussed followed by the concept of knowledge integration and challenges of its component in construction project. Further, the relationship between these challenges and the impact of knowledge integration on traditional-based project performance is discussed.

2. Knowledge Management

The concept of explicit and tacit knowledge was introduced by Polanyi (1966). The explicit knowledge could be articulated, codified, stored and distributed in certain media, whilst the tacit knowledge is hard to be captured and distributed because it is associated with experiences and skills of individuals (Easterby-Smith and Prieto, 2008). As knowledge is a critical resource, KM is a fundamental and mandatory issue that brings success to organisation (Binney, 2001). According to Wilson (2002, 2003), KM is not only about managing knowledge but it also covers a wide variety of practices. KM is defined as "any process or practice of creating, acquiring, capturing, sharing, and using knowledge, wherever it resides, to enhance learning and performance in organisations" (Armstrong, 2009). The aim of KM is to capture and distribute knowledge within projects and organisations environment before it is forgotten or lost in order to improve effectiveness of all primary activities. In other words, effective KM will be a main source of competitive advantage of organisation by reducing time and cost of project, improving project's quality and performance (Kivrak *et al.,* 2008). KM is a wide concept that consists of various processes such as creating, securing, capturing, coordinating, combining, retrieving, and distributing knowledge (Kivrak *et al.,* 2008). The term knowledge integration is the process of capturing, sharing, transferring and reusing knowledge within project environment in order to improve project performance.

2.1. **Knowledge Capture**

Hari *et al*. (2005) state that capturing knowledge is the process of turning personal knowledge into corporate knowledge in order to be shared among involved individuals in projects. Therefore, identifying the critical knowledge sources in project is prerequisite for capturing knowledge. Egbu *et al*., (2003) considered involved individuals in projects are the most important knowledge source. However, Kivrak *et al.* (2008) state some knowledge sources of companies that could facilitate the knowledge capture process. They are listed according to their importance; *Colleagues, Company's experience, Personal experience, Company documentation, Current project documentation, Project team meetings, Intranet, Personal library, Clients, Internet, Knowledge brokers external to the firm, External events* (conferences, seminars).

Considering these sources will facilitate the knowledge capturer to use a proper approach. According to Shokri-Ghasabeh and Chileshe (2014), different approaches for capturing knowledge from projects have been proposed by researchers among which the following studies have been investigated: Von Zedtwitz (2003), Carillo (2005), Williams (2007), Kululanga and Kuotcha (2008), Fuller *et al.,* (2011) and Henderson *et al.,* (2013). However, all the mentioned studies highlighted the benefits and impacts of capturing knowledge on performance of organisations, but it has not being prioritised in organisational culture.

2.2. **Knowledge Sharing**

Knowledge sharing is one of the important aspects of knowledge management (Riege, 2005). There has been various definition of knowledge sharing by researchers. Hickins (2000) describes knowledge sharing as the process of capturing tacit knowledge of individuals and transform it into shareable form. It is also defined as "activities of transferring or disseminating knowledge from one person, group or organisation to another" (Lee, 2001, p.324). According to Berggren *et al.* (2011), knowledge sharing is "the process of developing trans-specialist understanding through creation of overlapping knowledge fields". The important factor that was ignored by researchers is the difference of knowledge sharing and knowledge transfer which is the unidirectional flow of knowledge from one group, department or a project to another.

2.3. **Knowledge Transfer**

Knowledge transfer is a critical process in KM that enables knowledge to transfer (Cranefield and Yoong, 2007). It is the process of moving, skills and experience from one knowledge entity like individual, group or organisation to another in order to assimilate and accumulate new knowledge, develop new ideas, processes and practices in the receiving unit (Szulanski, 2000; Carlile and Rebentisch, 2003). Studies on practitioners and project learning have pointed out that there is a need to transfer knowledge within and between projects (Schindler and Eppler, 2003; Walker, 2004; Bower and Walker, 2007). As project knowledge and experiences can be used in other projects, it would be necessary to share the captured knowledge across projects in order to avoid unnecessary rework (Carrillo, 2005). Knowledge transfer plays a significant role in project-based organisations. Most project-based organisations tend to embark on rework thereby repeating the same mistakes again (Desouza and Evaristo, 2006; Landaeta, 2008). In fact, lack of effective knowledge transfer will lead captured knowledge from previous project, not being efficiently reused in other relevant projects and will cause time loss, errors, unnecessary rework that will affect project performance.

3. Knowledge Management in Construction

The UK construction industry has in excess of 1.5 million employees and constitutes approximately 20 per cent of total enterprises in UK. This industry plays a significant role in gross domestic product (GDP) of the UK that contributes around 8 per cent (Construction 2025, 2013). Furthermore, 99 per cent of organisations are SMEs in this industry and construction activities are highly knowledge-intensive which require an effective management (Hari *et al.,* 2005).

According to Latham (1994) and Egan (1998) report, UK construction industry has suffered from performance problems and has been in transition to overcome this issue. In order to improve overall performance of construction industry, two core factors, knowledge and learning, should be more considered (CRISP, 1995; OST, 1995). The term 'knowledge management' and the way in which to achieve it are a new category and essential in knowledge-based industries like construction (Carrillo *et al.,* 2000; Hari *et al.,* 2005). KM has a vital role in improving efficiency of project delivery and competitiveness of organisation (Egbu, 2005; Sheehan *et al.,* 2005; Fong, 2005).

Many researchers (Hari *et al.,* 2005; Bessick and Naicker, 2013; Ekambaram *et al,* 2014) have investigated the major drivers and challenges of KM in the construction industry. Kamara *et al.,* (2002) and Carrillo *et al.,* (2004) state the need to improve performance and the need to share valuable tacit knowledge are main drivers in the UK construction industry. Therefore, implementing KM in construction organisations confront with challenges such as capturing, sharing, transferring and reusing information and knowledge across projects, due to the nature of construction projects which are unique, short-term, project-based or task-oriented. However, people who worked on these projects, both in design and construction team, tend to disperse after the project ends. This means their experiences and the knowledge they have acquired through the project will be wasted and not be used in future projects (Kasvi *et al.,* 2003). This issue is more sensible in traditional-based construction projects as their nature is based on the separation of design and construction process. The traditional construction process approach has been criticised for several issues such as: *failure to form effective teams, separated approach to project delivery, time delay, lack of communication and coordination, rising costs, rework and wastages* (Aziz *et al.,* 2014). However, it is necessary to put in place the structure that facilitates participation and interaction of involved people in design and construction process to integrate knowledge, in terms of capturing, sharing, transferring and reusing, across the traditional-based construction project environment in order to improve project performance. Therefore, project manager needs to consider challenges that confronts with these processes.

4. Knowledge Integration in Construction

The knowledge integration procedure is critical to project performance (Nonaka and Takeuchi, 1995), especially in project-based industry like construction. Several studies have been conducted on knowledge management in construction projects, but only few of them focused on knowledge integration between different construction projects (Adenfelt and Maaninen-Olsson, 2007; El-Gohary and El-Diraby, 2010). From working perspective, knowledge integration is defined as the process that leads to a practical solution by contributing expertise and knowledge of all involved parties. According to Mitchell (2006), knowledge integration is the ability to integrate internal and external knowledge to respond to environmental change. In other words, the knowledge integration process should enhance the dynamic capacity of organisations in a way to pretend environmental changes affect the project performance. Knowledge integration in this study is the process of capturing, sharing, transferring and reusing knowledge within project environment.

The construction industry has been suffered from low efficiency of project delivery due to its failure to form effective teams and to implement united approach to deliver a project (Evbuomwan *et al,* 1998). Adenfelt and Maaninen-Olsson (2007), investigated the way in which project performance is positively influenced by integrating knowledge between projects. According to their studies, three main factors were identified which are;

- Knowledge integration depends on interaction between the projects and the organisational context of the projects
- Knowledge integration depends on concerned actors' "time for reflection", "the nature of the activities in the project", and "interest and motivation of the involved actors"
- The role of knowledge management for integrating knowledge

Despite the positive influence of these factors on project performance, they should be investigated in terms of challenges that exist in knowledge integration sub-processes.

4.1. **Knowledge Capture Challenges in Construction**

Knowledge capture process, like other sub-processes of KM, confronts with challenges. After thorough review of literature, these challenges are mainly categorised from three perspectives; *Social issues, Technical issues* and *Process issues* (Hari *et al*., 2005).

Social issues include challenges like; people, communication and networks, culture, motivation and structure.

- *People issues*: most of tacit knowledge usually captured through informal network in project team. Unfortunately, involved individuals in project usually depend on professional's help to find appropriate document. This gives professional the feeling of overwhelming by receiving too many calls which will waste their time. This means tacit knowledge of experts has not been captured in order to help team members to find key documents.
- *Communication and networks issues*: It is one of the main social challenges in capturing knowledge, specifically in construction projects that are based on traditional procurement route. Separation of project phases (design and construction phase) and separation of sites would have affect the process of capturing knowledge. Therefore, establishing a network between people involved in project and across project's phases will develop a knowledge base for project team members.
- *Culture* is the main barrier to capture knowledge in construction industry. Individuals and experts are reluctant to share their knowledge, because they consider knowledge as power. Furthermore, they also do not tend to learn from others' experiences, because they fear of negative impact of admitting mistakes among their team members. However, there is a need for project manager to review both successful and failed projects after their completion with involved experts in order to uncover what they can teach.
- *Motivation issue*: It is the responsibility of project manager to improve the awareness of the team members about the importance of capturing knowledge and its impact on project performance and implementation of work tasks. The project manager should understand the expectations and needs of project members in order to motivate them about their jobs and cooperate in knowledge capture process

- *Organisational structure issues*: The flexible and decentralised organisational structure will prepare and enable the project environment for project members to easily and freely exchange their knowledge and share good/best practices. However, the certain use of techniques and technology for capturing knowledge depends on size and structure of the organisation.

Technical issues: highly focus on explicit knowledge and is all about IT perspective. In other words, technology is used to capture, transfer, share and reuse knowledge. Hari *et al*., (2005) identified some technological issues;

- Lack of IT software's and technical support
- Practical difficulties in accessing the intranet and website from site offices
- Lack of standardisation of the system
- The technologies have had to compromise one way or another between simplicity and specificity in capturing and publishing knowledge

Process issues: The knowledge capture process should be controlled and customised. The knowledge manager should determine the time of capturing tacit and explicit knowledge, when to make tacit to explicit knowledge, when to leave knowledge in its native form, make sure that all involved individuals in project have access to explicit knowledge about procedures and processes.

Furthermore, codification and dissemination of knowledge are also important. Capturing and maintenance of knowledge can be costly and time-consuming; therefore, the knowledge manger should keep track of decisions, rationale and discussions of professionals and team members in short-term projects.

4.2. **Knowledge Sharing Challenges in Construction**

Knowledge sharing process in construction industry depends on personal and informal communication (Styhre *et al.,* 2004). Researchers and practitioners have neglected studying the process, barriers and actual practice of knowledge sharing in construction projects (Styhre, 2009; Johansson, 2012). However, researchers investigate other processes of KM in construction industry like; capturing, codifying and transmitting knowledge (Johansson, 2012).

Researchers have identified three main challenges that affect knowledge sharing process in organisation and project which are; culture, trust and motivation (Smith, 2001; Stenmark, 2001; Bartol and Srivastava, 2002; Ipe, 2003; Riege, 2005; Fong and Chu, 2006; Wang and Noe, 2010; Bessick and Naicker, 2013). Organisational culture is highlighted as the most important factor in knowledge sharing process that creates link between knowledge sharing and business problem (McDermott and O'Dell, 2001). However, collaboration among involved individuals in projects and mutual trust along with having culture of support are other initiatives and success factors that will facilitate knowledge sharing process.

Generally, researchers categorised knowledge sharing barriers into three types; lack of supporting culture, lack of mutual trust and lack of motivation and time for sharing knowledge (Kivrak *et al*., 2008; Bessick and Naicker, 2013). Existence of supporting culture is highly important in sharing knowledge among individuals in organisation and project. This is mainly dependent on attitudes of knowledge manager to encourage and motivate knowledge holders; and build reward and recognition systems by using different techniques and technologies. However, knowledge manager should consider this issue that knowledge holders are reluctant to share their knowledge when they feel their job is insecure. Therefore, mutual trust and the awareness of knowledge holders about the importance of knowledge sharing on project performance should be improved. In addition, McDermott and O'Dell (2001) determined that lack of time will prevent knowledge holders from sharing their knowledge in temporal-based project, like construction project, even when the available technology is efficient.

4.3. **Knowledge Transfer Challenges in Construction**

Construction organisations are reluctant to invest in knowledge transfer and required infrastructure support, due to their low profit margins and conservative nature (Cheng, 2009). In fact, organisations are not aware of the importance and benefits of knowledge transfer on project performance. In construction projects, the main challenge of transferring knowledge is to transfer knowledge of design intent and rationale to individuals in construction team. The involvement of multiple organisations in a project means that the transfer of knowledge from one phase to another depends on the kind of contract type or procurement strategy adopted for the project (Kamara *et al.,* 2002). The awareness of construction organisation members has been seen to be relatively low as regards the importance of tacit knowledge and knowledge transfer. It is necessary to improve this awareness and encourage them to implement knowledge transfer activities through incentives such as; increasing salaries, promotions, personal growth and acknowledgements. However, it is highly dependent on the organisational culture and should also be based on trust (Cheng, 2009).

Cheng (2009) identified three main barriers in implementing knowledge transfer in construction projects which are; *Insufficient Time of Members, Organisational Culture Challenge* and *Lack of Standard Processes*. There are several challenges for knowledge transfer between projects. Ekambaram *et al.,* (2014) highlighted five main challenges:

- *Lack of incentives to share information and knowledge*: it is necessary for project's members to be motivated to share their knowledge, otherwise no/inadequate knowledge will probably be shared
- *Attitudes* – lack of awareness/willingness to share knowledge: organisations need to consider and prioritise knowledge transfer in their culture and project process
- *Low stability or continuity in relations between collaborating organisations*: this stability can develop trust between individuals which is mainly important for effective knowledge transfer
- *Time pressure*: usually project members have no time for sharing and transferring their knowledge because they will be recruited in another project once it is complete or they are involved in several projects at the same time or within a certain time-period.
- *Inadequate information systems*: lack of having effective and efficient information systems like knowledge database, documentations and reports will have negative impact on knowledge transfer process

These challenges are interconnected. Comparing these with the previous mentioned challenges will reveal that the culture of organisation is the main challenge for transferring knowledge which is mainly affected by trust. Organisational culture should prioritise and increase the awareness level of its members on the importance of knowledge transfer. This is highly dependent on having a standard working process and existence of trust between project members. However, organisational culture besides effective standard process will moderate the time pressure challenge.

In order to have a better understanding of the proposed terminology of knowledge integration, its process and challenges of each sub-process are illustrated in Figure 1.

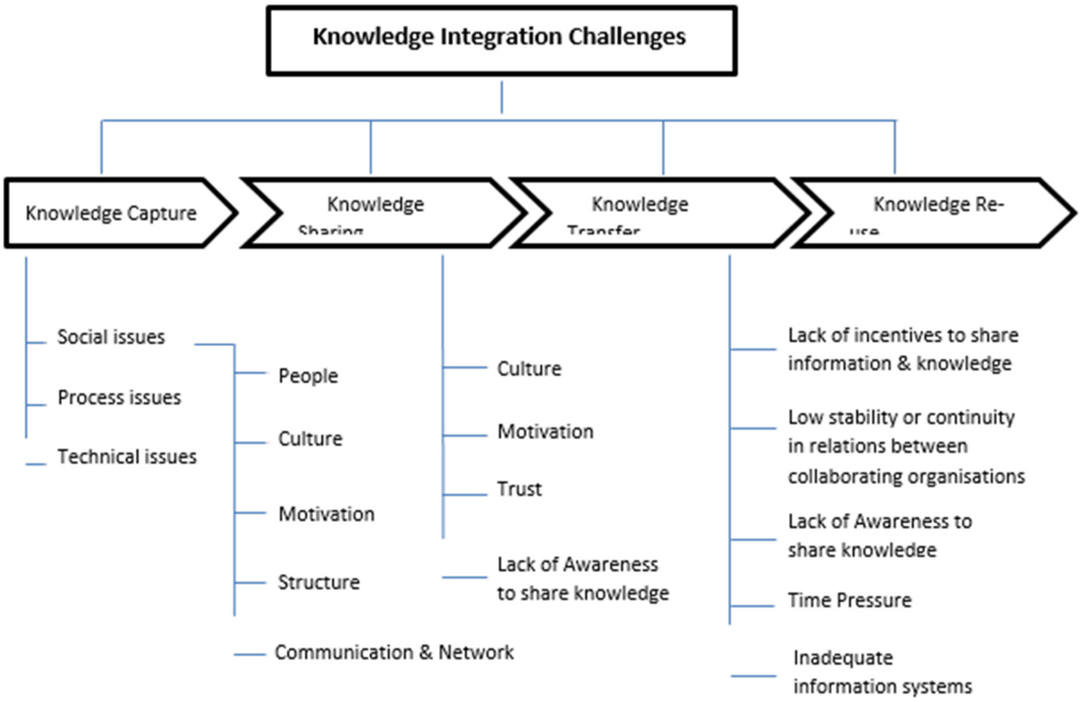

Figure 1. Knowledge Integration Process and Challenges

5. Discussion

The unique characteristic of traditional procurement system, separated method, in construction industry is the separation of responsibility of the design phase and the construction phase in the implementation process of the project. Generally, construction projects undertaken through this system confronts with challenges. Designers are not motivated and well experienced to effectively manage cost and time of project. Furthermore, they have no direct experience of managing construction work and construction team is unable to involve in design process until too late. However, it should be said that good communication and motivation to share knowledge usually do not exist between project members across and among project phases. Considering these challenges deduce that there is a lack of management expertise to effectively manage knowledge in projects undertaken by traditional procurement system.

Due to the lack of KM in traditional procurement system, construction projects undertaken through this system confront with number of issues; failure to form effective teams, separated approach and time delay to project delivery, lack of communication and coordination, rework, wastage and rising cost (Nasrun *et al.,* 2014). In other words, these issues will affect project performance. Comparing these problems with challenges of knowledge integration in construction project that were mentioned before, will infer that traditional procurement system suffers from poor project performance. However, these challenges are similar to challenges of knowledge integration sub-processes.

Most of the studies on KM in construction industry only considered one or two components of KM (Fong and Chu, 2006; Cheng, 2009; Ding and Ng, 2010; Johansson, 2012). However, for improving the performance of construction projects undertaken on traditional procurement system, it would be better to have a holistic view rather than a very narrow set of views on very particular process. In other words, focusing and doing research purely on each component would not lead to improvement. However, it is critical to capture tacit knowledge of individuals and professionals involved in projects and reuse it in future projects, because most of knowledge and experience exist in the mind of involved participants in projects. In essence, for being competitive and improve project performance it is necessary to capture, share and transfer knowledge and experiences that are achieved from previous projects in order to reuse in future projects (Hari *et al.,* 2005; Lee and Egbu, 2005). Researchers state that the construction industry is poor in capturing, sharing and reusing tacit knowledge (Woo *et al.*, 2004). Therefore, there is a need to have a holistic view and establish a process to improve the performance of construction projects undertaken by traditional procurement system. Thus, the terminology of knowledge integration is proposed as the process of capturing, sharing, transferring and reusing knowledge within project environment in order to improve the project performance.

However, this critical review research not only extends previous research on knowledge integration, but also enables stakeholders to be aware of key challenges and barriers that exist in construction projects with respect to tacit knowledge integration.

6. Conclusion

Despite the fact that most of the studies investigate the positive impact of each sub-process of KM on performance of construction project, it has not been prioritised in organisational culture and project process to capture, share and transfer tacit knowledge of project's members. Finally, comparing challenges of knowledge integration process will reveal that they are in common and barriers such as organisational culture, insufficient time, and lack of standard processes, mutual trust and lack of collaboration among employees impact the knowledge integration process in terms of capturing, sharing and transferring tacit knowledge and make it difficult to fully benefit from this asset. It should mention that the term 'knowledge integration' is an attempt to provide a better demarcation to an existing terminology.

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ID 012

Experiences of Collaboratively Procured Building Contracts in the UK and the Importance of Human and Organisational Factors

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Abstract:

Over many years there have been widespread calls from government, academia and industry to collaboratively procure construction projects. These are in most cases a response to low levels of client satisfaction, and poor time and cost predictability resulting from traditional procurement systems. Notwithstanding these, there are reports that such collaborative approaches have not always lived up to expectations in terms of achievement and the extent of benefits and positive effects that have been experienced in others sectors such as manufacturing, and this is reflected in recent declining trends in participation. Exploratory interviews were conducted with a group of construction professionals who have had extensive experience with both collaboratively and traditionally procured construction projects. Coding and analysis of the resultant data indicated that collaborative procurement routes do have many advantages over traditional adversarial routes in most cases, but not all. Human factors are seen as important and trust clearly plays a pivotal role in forging good collaborative working relationships within teams. Organisational factors are, however, vitally important alongside this to provide the right environment for collaboration to succeed. Further research is recommended to examine the repercussions of this shift in both practice and philosophy.

Keywords:

Collaboration, Integration, Partnering, Trust.

1. Introduction and a Review of Literature

1.1. Collaborative Working and Procurement in the UK Construction Industry

There has long been an academic view and general perception that there is a silo mentality within the construction industry which relates to a general lack of integration of design and construction (Cartlidge, 2004, p.11). This is also supported by Latham (1994, p.17) in that the separation of design and construction may result in a lack of coordination. Collaborative working at an early stage between contractors and design teams has been 'post Latham' regarded as a means to bridge the gap between design and construction and thereby reap the benefits of both traditional competitively tendered single stage and design and build contracts.

Perceived benefits could emanate from the early intervention of contractors, and include early starts on sites, utilisation of contractors' management skills, buildability, contractors' procurement knowledge, supply chain knowledge, contractors' health and safety expertise, dispute avoidance, clients' involvement in the procurement of subcontractors, reduced tender costs and improved team working between contractors and design teams (Egan, 1998; Egan, 2002; Lann *et al.,* 2011; Chan *et al., 2004;* Hansen and Nohria, 2004; Critchlow, 1998; HM Government, 2013). Furthermore traditional procurement methods may be less suitable on complex and challenging projects which are reliant on greater contractor cooperation and interface especially at the design stages. In such cases more collaborative procurement routes could have a positive impact on the project success (Eriksson and Westerberg, 2010). Some employers however are still of the mind that competitive and open procurement systems, that truly market test prices, are the only way to assure stakeholders of lowest possible initial capital cost (Ross, 2011; Gadde and Dubois, 2010).

Whilst there is a wealth of previous studies relating to collaborative procurement, this research is designed to be unique in specifically considering the importance and influence of human and organisational factors on collaboratively procured projects. Using key performance indicators such as cost predictability, quality, value for money, risk and project duration, this study seeks to explore whether collaborative procurement routes do in fact deliver improvements and more successful outcomes for projects.

1.2. **Overall Context and Background to Collaborative Procurement within the UK Construction Industry**

It is suggested that collaborative working reduces the negative aspects of construction procurement, minimising conflicts and disputes through increased cooperation, and developing relationships built on trust (Larson, 1997; Challender *et al*., 2013; Walker 2009). This in turn could bring about an increase in through sharing expertise, knowledge, ideas, innovation, best practice, and promoting efficiencies and improvements in decision making (Hansen and Nohria 2004; Tam 2000; NAO, 2001).

In recent years, however, collaborative procurement has also attracted its critics. The RICS (2005), for instance, reported that successful experiences in collaborative procurement 'are largely anecdotal and focus on the experiences of exemplar organisations.' They argued that the focus on success rather than failure had presented an unbalanced view and false impression in terms of the contribution that partnering and collaborative procurement has had within the construction industry, and therefore raised questions around reliability. A similar argument was presented by Morgan (2009), formerly Procurement Director at BAA, who concluded that with major capital projects, procurement routes that promote alliances and partnerships are not always appropriate. Morgan found that partnering projects are often open to abuse owing to the scale of the commercial interests involved, do not guarantee success, and clients may be paying far too much for their products. A perhaps more controversial augment is presented by Alderman and Ivory (2007) who describe partnering at its worst as 'a disruptive smokescreen behind which to conceal business as usual while at the same time motivating suppliers and contractors to go the extra mile.'

2. Methodology for Data Collection and Analysis

In order to further explore collaboration and partnering, within a contemporary period of economic austerity, and also examine the role of trust within this context, a qualitative study was undertaken (Flick, 2009). This approach enabled the exploration of key themes, understandings and attitudes of those who work within this environment on a daily basis.

Semi-structured in-depth interviews (Gillham, 2005) were held with eight North West UK construction professionals from different construction industry disciplines; a client project manager, property lawyer, architect, quantity surveyor, main contractor, subcontractor, mechanical and electrical engineer and a structural engineer. A purposive sampling strategy was employed which involves a judgmental, selective or subjective technique where the sample is usually quite small and therefore not deigned to be representative of the population at large. The lead researcher used his judgment to select professionals with experience in many different types of construction procurement including partnering, and all who have had experience in representing client organisations. However, beyond these two criteria, the sample was one of convenience. Whilst the small sample size does not allow for generalisation, it does provide insight into the perceptions of those working within the construction industry during the economic crisis, and their understanding of trust in collaborative working. Consultations were carried out to plan and formulate the format and structure for the interviews. A 'pilot' interview was conducted to obtain feedback on the data collection tool, and tease out any difficulties with the way it was designed and administered.

The interviews were undertaken in a period of austerity; late 2012 to early 2013. They were digitally recorded, transcribed verbatim, coded qualitatively and sorted (Silverman, 2001; Langdridge, 2005). Qualitative coding is the careful selection of single words or short phrases to summarise larger sections of text; the codes thus become the basis for sorting. In the sorting process, like coded sections of text were brought together to allow the researcher, as an analyst, to interpret and condense the raw data. Examples of the codes included 'informal engagement', 'closer interaction' and 'good team working' whereas examples of the main themes included factors that instill trust and potential barriers to collaborative working. Codes which are deemed to be related are given umbrella 'theme' titles; example themes included 'factors that instill trust' and 'potential barriers to collaborative working.' As recommended by Taylor and Bogdan (1998), the raw data was summarised in tables; codes were listed, themes developed, content analysis data presented, key literature sources identified, data consistencies and inconsistencies noted and propositions made. The tables became a plan to develop a narrative to construct a contemporary picture of partnering and collaborative working in austere times.

3. Findings and Discussion

3.1. General Findings

Whilst there is academic consensus that collaborative working can create an improved working environment, facilitating better individual and team performances, it was met with some scepticism from some of the construction professionals interviewed. Suspicion of realisable benefits has emerged from the research accordingly. For example, cost savings for clients from collaborative working are perceived by some of those interviewed as being exaggerated over time and certainly have not been realised on all projects. Whilst shared ethos built upon trust between partners is supported theoretically, according to those interviewed, rarely is there realisation in practice. Whilst the construction professionals found collaboratively procured contracts can facilitate successful projects in some instances the study also uncovered negative experiences in sharing information, inequitable working relationships and prompt payment initiatives, leading to organisational mistrust in some extreme cases.

3.1.1. Quality Control and Time

The construction professionals reported that collaboratively procured contracts on longer projects, which potentially involve sophisticated and challenging phasing and programming to best suit specific employer's requirements, could potentially offer more scope than traditional procurement routes in reducing overall project durations. This was explained in terms of enhanced teamwork and contractors working alongside clients with common objectives to achieve phased handover dates; especially when working within live building environments, where disruption to the overall end-users' operations is a key issue. In this way they concurred that construction programme timescales could possibly be improved at the early design stages by working with contractors to specify the most suitable and conducive materials and construction techniques to suit the nature of projects. Furthermore through improved team integration they considered that collaboratively procured contracts have the potential to raise levels of quality and performance through reduced conflict, allow more efficient deployment of resources, increase job satisfaction and facilitate fewer defects on completion.

Interviewees generally agreed that specialist input and value engineered solutions at an early stage could shorten pre-tender periods whilst enhancing quality control, giving greater client satisfaction. They also concurred with Walker (2009) and Erikson *et al.* (2010) that procurement routes should be tailored to the nature of projects especially with the growing trend for more demanding deadlines and project outcomes in recent years where traditional procurement routes may be deemed less effective and unsuitable. Views were also presented that partnering could be more successful than traditional procurement routes where health and safety issues on projects represent greater risks to programme and quality. This was explained through the intervention of contractors at preliminary design stages with the associated benefits of early dialogue to address and overcome such issues.

3.1.2. The Importance of Trust

The study suggests that possibly the strength of trust is more dependent on individual personal relationships, developed from mutual respect, rather than simply 'good' working relationships. According to those interviewed trust generated from previous relationships and dealings between individuals at senior levels is regarded as critical in the cascading of trust throughout organisations, and between those currently operating partnering arrangements. Not surprisingly at an operational level, ‘human’ factors such as integrity, honesty, consistency, reliability and competency are regarded as important in facilitating trust and good collaborative working. Such factors are suggested by Thuraujarah et al (2006) and Coulson-Thomas (2005) and confirmed by the interviewees, to be vital for the greater integration of project teams. Yet, hard factors are also put forward by those interviewed as crucial in collaboratively procured contracts: experience, technical ability, education and competence of individuals, management systems, resources, and commitment of the organisations.

The interviewees all agreed that a 'culture' of trust allows projects to move forward effectively, and creates an environment where problems can be shared and therefore solved more easily. In this regard, they believe that trust is not something that can be engineered through contractual conditions, nor through procurement routes alone, but needs to be developed, built up and earned over time. Notwithstanding this, they concurred that where trust is compromised, this could lead to a downward cycle of mistrust where working relationships may become untenable. The study also highlighted the belief from those interviewed that the perceived return to short-term contracts and the constant quest for lowest initial bid price could be jeopardising the development of trust between organisations. However, where long-term organisational collaboration links to potential future work-stream, the development of trust within such relationships may become 'incentivised' and consequently active in practice.

3.1.3. Client Risk, Value for Money and Construction Cost Predictability

Those interviewed suggested that collaboratively procured contracts can potentially provide more effective open book mechanisms for developing final contract sums with contractors, to ensure that tendering processes are fully transparent, fair and appropriate in most cases. They outlined that there are still too many instances of contractors in traditional contracts inflating the value of claims for variations. For this reason collaborative working under partnering may offer an alternative procurement route in managing such claims to lessen risks of overspend and potential contractual disputes. In this way commercial issues could possibly be identified earlier and addressed accordingly to avoid potential delays and protracted disputes through early dialogue and communication.

Some of the interviewees did, however, not share the positive views of the other construction professionals and reported that collaborative working has been tainted by inequitable working arrangements which potentially give little or no benefits to partnering organisations. In some cases, anecdotal evidence was presented of organisations that suffered financially under partnering and such reports could reinforce fears and anxieties over risks within the industry, promoting a reluctance to move away from traditional working methods. Arguably this disparity of power between clients and other organisations may have allowed the former to use the power derived from scarcity of work in the construction sector to use a 'take it or leave it approach' and potentially to intimidate contractors into accepting unfair returns under the banner of a collaborative arrangement. The temptation to abuse power by their construction clients to secure gains at the expense of others, appears to possibly have become too much to resist in some cases. The project managers felt that such a shift in philosophy during operational partnering frameworks, rendered organisations highly vulnerable to exploitation as they are virtually held to ransom; to accept revised or reduced terms, or be cast back into 'the other' competitive cut-throat market place. Such exploitation through partnering frameworks may increase the risk of this procurement option, reducing its attractiveness and contributing to a reduction in willing partners. Other concerns emerged from the study including the potential fears or unwillingness of partners to share information that could be regarded as commercially sensitive.

3.1.4. Project Complexity and Specialism

The construction professionals concluded that collaboratively procured contracts are best suited to large or complex projects where, in the early stages especially, the expertise of contractors in value engineering and project logistics would be extremely beneficial. As an example, one of the interviewees referred to a refurbishment scheme on a museum which incorporated a sophisticated and complex mechanical and electrical installation. It was explained that the building services were designed around the specialist's requirements for a technologically advanced building management system. For this reason, partnering presented the most appropriate and suitable options to ensure that interfaces of specialists' expertise were introduced early in the life of that particular project. Conversely where projects are less complicated the project managers deduced that benefits from partnering may be significantly reduced, since early contractors' specialist advice may represent essential rather than desirable inputs. This tends to confirm findings from Hacket *et al.* (2007) and Egan (1998) that for some simpler projects, collaborative procurement routes may not be a suitable option, particularly where contractors and subcontractor's expertise and inputs in the early design are less critical.

The duration of projects may also have some influence over the success of partnering in practice. For instance one of the construction professionals advised that shorter projects do not facilitate enough time to build strong working relationships and for partners to become familiar with each other's ways of working. Furthermore there was a view that more controlled financial management on projects through partnering and collaborative working could be achieved on projects with longer contract durations. The explanation for this was that longer projects can give rise to more variations as clients' requirements change over time and partnering can facilitate more cost effective solutions than under traditionally procured contracts. One interviewee also suggested that longer projects provide more time for reflection on alternative building systems and ways of working which could provide the most suitable context for value engineering. It was also felt that when managing clusters of many projects of short duration strategic partnering may be more desirable than project partnering, as trust can be generated within encouraging contexts, where the developmental nature of this collaborative process aligns with the long-term vision of integrated teams.

3.2. Conclusions and Summary

Collaboratively procured contracts can, according to the interviewees, bring about reduced project durations, improved cost certainty, improvements in quality of build and benefits to project management and construction innovation in some contexts but not all. The construction professionals strongly felt that assessing the suitability of projects to collaboratively procured contracts is critical to realising the potential benefits in practice. Certainly on very complex projects it was generally accepted that the early intervention of contractors, subcontractors and suppliers was essential for many collaboratively procured contracts to encourage project success where more traditional forms of contract, based on separation of design and construction may be mostly unsuitable. Other than organizational factors, less tangible and softer human factors and outcomes that could be used as key performance indicators to measure success of projects through partnering arrangements. These include motivation, teambuilding, trust and respect and were felt to be more likely to be generated through partnering and in doing so create the right environment for successful projects. Perhaps the most surprising outcome from this study is that the practitioners regarded the individuals deployed on projects having more influence on success than the choices of partnering *per se*. They believe that both traditional and collaborative procurement could both produce successful outcomes provided that the right individuals are employed, with suitable experience, expertise, motivation and proactive attitudes to team working.

The study clearly highlights the issues and some barriers to successful implementation of collaboratively procured contracts including factors related to fairness, cooperation and sharing information. Perhaps BIM as a management tool in encouraging greater collaboration could assist in changing the culture of the UK construction industry and facilitate integration across the whole supply chain to address perceived deficiencies. Certain elements of best practices for collaboratively procured contracts have also been highlighted in this study. These include ensuring that the nature of the project and partnering are appropriately matched as a test of suitability and compatibility and choosing the most suitable contractors through a robust selection process. This will then hopefully ensure the right choice of partners who are committed to 'the spirit of collaboratively procured contracts' and not just those individuals and organisations that 'pay lip service' to its philosophies and values. Without this commitment it was felt that partners will feel propelled to 'collaborate' by the terms of the contract only which could risk reversion back to old traditional adversarial behaviours.

One of the limitations of this study is clearly that it was based on a very small sample of interviewees. This has reduced the reliability and validity of the study and the study findings clearly are not representative of the population at large accordingly. It is intended that further quantitative work with a larger sample and broader range of experienced construction professionals may need to be undertaken to interpret existing data more effectively.

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ID 026

Barriers to Affordable Public Housing delivery in Nigeria

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Abstract

Housing is the most important need of individuals next to food and clothing. It is also one of the key contributors to the economy of every nation. The availability of affordable public housing has reached an alarming state in Nigeria. Numerous government policies have been developed to resolve the massive shortage through numerous housing reform programmes including Nigeria. Despite these efforts, suitable and affordable housing remains unavailable to average Nigerians. There are presently some affordable housing delivery programmes which employ public private partnership efforts and numerous private finance initiatives which could only provide about 3% of the needed stock. This has exposed the need and necessity for a comprehensive solution to the problem. Furthermore the quality of the existing housing stock is also under substantial scrutiny in terms of design and the standard of living in neighbourhoods. Many limiting barriers have been identified as the main issues limiting the progress of a successful transition to affordable public housing provision in Nigeria. These barriers range from difficult land accessibility and cost, availability of housing cheaper finance, poor planning and design, infrastructural decay, poor government housing policy, programmes and implementation, urbanization, political commitment and corruption in distribution and allocation. These barriers have greatly limited the progress of affordable public housing provision in Nigeria. The main aim of this study is to identify the barriers to the supply of affordable public Sector housing in Nigeria and develop a model to provide lasting solutions and improvements. This study will contribute both professionally and academically. It will seek to inform and empower the government, developers and other stakeholders operating in the area of affordable public housing provision and identify the range of barriers limiting their efforts to achieving success in affordable housing provision in Nigeria.

Keywords:

Barriers, Affordability, Public Sector, Housing, Delivery

1. Introduction

A house is more than a roof overhead: it gives a sense of security, empowerment and hope. Housing is one of the basic needs of every individual as it helps to provide shelter. It is defined as buildings or other shelters in which people live. To nations it is a critical factor in the social and economic fabric. Housing symbolizes one of the most basic human needs. As a unit of the environment, it has a deep effect on the health, efficiency, social behaviour, satisfaction and general welfare of the community (Onibokun, 1998 in Kabir & Bustani, 2009). To most groups, housing means shelter but to others it means more as it serves as one of the rudimentary indicators of a person’s standard of living, and his or her place in the society (Nubi, 2008). Housing is also very fundamental to welfare, survival and health of individuals. This is one of the more reasons why international concern has been growing over the deteriorating housing conditions in urban areas of developing nations, Central and East Europe (UN, 1996 as reported by Aribigbola, 2011).

In the new millennium, there are different barriers overwhelming affordable public housing delivery, resulting in rapid urbanization with deepening poverty, environmental degradation and increasing presence of slums, which pose tremendous challenges for achieving adequate shelter for all. Also the challenges faced in human settlements cannot be met by governments, private sector or civil society alone. It requires the actions of all sections of the society. It has also been confirmed that the threat of homelessness is greatest in Africa, Asia, and Latin America because that is where population is growing fastest. The existing formal housing supply channels are often hopelessly inadequate and ineffective for low-income group. The commitment and efforts of the poor are often limited, given the rate of urbanization and limited resources faced by these developing nations (UN-Habitat, 2008).

Figure 1 below highlighted the projected growth of world slums which indicated that Africa, Latin America, The Caribbean and Asia will be worst hit by the impending slum expansion.

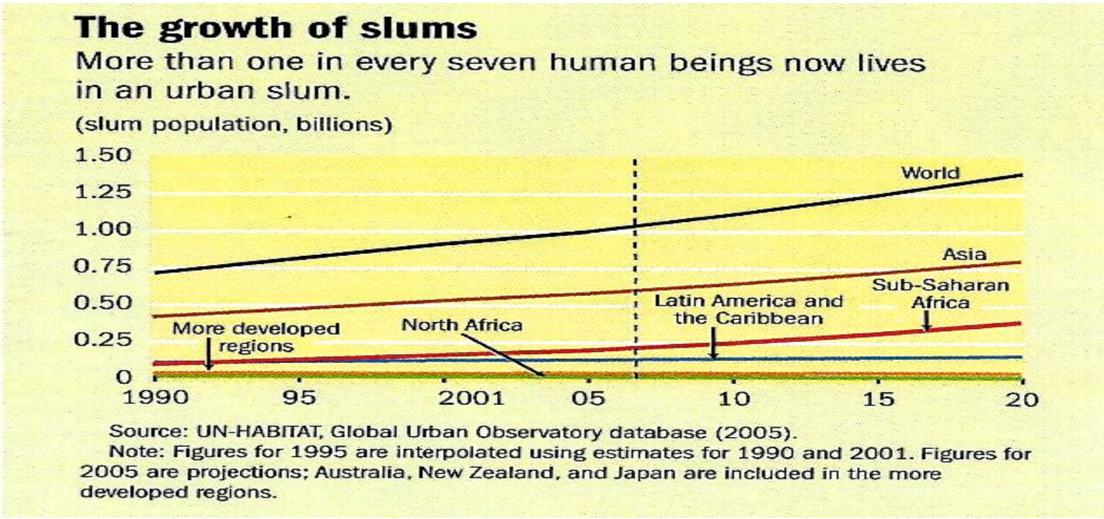

Figure 1. Projected world slums growth from 1990 – 2020

As a result of this, inadequate housing condition has become a challenge that has continued to receive attention from governments, professionals, developers and individuals in most developing countries including Nigeria. As a part of the human tradition which seeks to investigate, describe, understand, proffer solutions and take actions to improve living conditions, enhance individual and collective well-being, both public and private sectors have continued to take actions aimed at addressing social and economic challenges posed by inadequate public housing provision, and the greater part of these challenges are the different barriers limiting the smooth advancement of affordable public housing delivery efforts by governments and other collaborating partners.

2. Aims

The aim of this study is to examine the barriers to the supply of affordable public Sector housing in Nigeria and develop a model to provide lasting solutions and improvements. This paper describes the progress of the research so far and takes the form of a review of the relevant literature.

3. Objective of the Research

The objectives of the study are:

- To review the history of public sector housing delivery in Nigeria
- To evaluate the funding mechanisms for public sector housing provision
- To identify the barriers to accessibility of public housing for low-income earners.
- To develop a model to improved affordable public housing provision in Nigeria.

4. Literature Review

This is a review paper in furtherance of the research. In order to develop the research approach and the research instruments, and to provide a context for this study, a review of available literature was carried out. The review analysed a range of relevant documents, including the policy and strategy documents, past and present guidance on affordable housing provision produced by both international and local scholars, and other documents from government establishments, private institutions, corperate bodies and other organizations standing as stakeholders in the industry. A series of other research and good practice studies into affordable public housing provision in Nigeria and the evaluation of past government efforts were also examined. Finally, a series of past and recent academic journal papers on affordable public housing provision from some developed and developing economies were also examined. The findings from the literature reviewed were used to develop the understanding of this study, which also recognised the need for more research in this study area.

4.1. **Concept of Housing Affordability:**

The term 'housing' is used at a number of levels and is a multi-dimensional concept. It refers to the activity, a process of residing, as well as to the objects of dwellings and their environment. Housing is a physical structure as well as a social structure, functioning at different spatial scales (homes, neighbourhoods, cities and other settlements, region and countries). It is also a sector of the economy and an important category of land use in cities and other settlements. Linkages with the national economy and with the overall urban system are an integral part of the understanding of the concept of housing (UN-Habitat, 2013).

However, over the last fifteen to twenty years the term 'housing affordability' has come into widespread popular usage. Although housing policy statements often include some statement such as the provision of decent housing for all at 'affordable costs', governments have often been reluctant to clearly define what they mean by affordable housing. Bramley (1994 as cited in DTZ, 2004) suggests that the lack of official clarity on definitions reflects inherent ambiguities in the housing affordability concept as well as political caution or expediency. Governments have set objective benchmarks for measuring housing affordability as a necessary prerequisite for intervention.

The term "housing affordability" has come into widespread usage within the past years. In this context, 'affordability' is defined as being able to pay without incurring financial difficulties. Stone (2006), states that affordability is not an inherent characteristic of housing, but rather a relationship between income and relative prices. This argument can easily be extended to goods and service. Therefore, the ability to pay is a key component of housing affordability. Therefore the affordability of an item usually means the amount of financial stress the purchase would place on the purchaser. Affordability can generally be thought of as a scale, which in itself is a relationship between income and relative prices (Robinson et al, 2008).

The United States Department of Housing and Urban Development (HUD) as Policymakers specified that for a housing system to be reasonably priced, the family should not pay more than 30% of its full income on rent payment and services, where they possess their own home that is not higher than 30% on their mortgages, insurance, taxes and utilities. Housing becomes affordable only if it meets this 30% test (Daramola, 2006).

A review of urban housing in Nigeria identifies that rental expenditure accounts for about 60% of the income of an ordinary worker with the remaining 40% for food, clothing, health, transport and other requirements; a level that places the wage earner into extreme insufficiency (Eke, 2004). This considerably exceeds the United Nations description of inexpensive housing and spesifically poses a greater barrier to affordable public housing provision in Nigeria.

4.2. **Definitions:**

Housing affordability refers to the capacity of households to meet housing costs while maintaining the ability to meet other basic costs of living (Burke, 2004).

However, Maclennan & Williams, (1990) put it this way, “Affordable housing is concerned with securing some given standard of housing (or different standards) at a price or rent which does not impose, in the eyes of some third party (usually government), an unreasonable burden on household incomes”.

Hulchanski, (1995) also suggested that a household is said to have a housing affordability problem when it pays more than a certain percentage of income to obtain adequate and appropriate housing.

The U.S. Department of Housing and Urban Development (HUD) also defined affordable housing as “housing available for rental or purchase to low- or moderate-income households in which the occupants pay no more than 30 present of their income for total housing costs, including utilities.” They further explained that families who pay more than 30 present of their income for housing are considered cost burdened and may have difficulty affording necessities such as food, clothing, transportation and medical care.

This exposed the reason why many families of most developing economies such as in Africa, Asia and Latin America are suffering in extreme poverty because funds meant for food, clothing and other life necessities are all channelled to alleviate housing problems.

Therefore for the purpose of this paper, The Scottish Government, (2014) definition of affordable housing is adopted because it exposes a clear understanding of affordable housing which they broadly defined as housing as “housing of a reasonable quality that is affordable to people on modest incomes”.

4.3. **Barriers to Affordable Housing**

Barriers to affordable housing are the various factors affecting housing cost which impedes the provision of affordable public housing. Although many factors affecting cost of housing are beyond government control, according to the literature reviewed, below are the barriers identified below are limiting affordable public housing provision in Nigeria and some other developing economies.

4.3.1. Access to Land, Availability and Cost:

Land is a basic requirement for sustainable housing delivery. The main problems associated with the acquisition of land for housing are availability, lack of political will on the part of government, accessibility, ownership rights including security of tenure, and absence of land use plans. These constitute great obstacles to development in the public and private sectors of the economy (FGN, 2012).

Land is an asset that grants its owner access to loans to build their houses or set up small businesses in cities, but the insecurity posed by land tenure in Nigeria is making it difficult for people to enjoy the whole benefits of land ownership. Secured land rights for all citizens will further improve and attract private investments which will contribute to rapid housing developments in affordable housing systems; it will also help to reduce unnecessary land conflicts which always arise as a result of insecure land deals. It will also enable good planning and improvement in environmental management as well as improved household living conditions (UN-Habitat, 2006).

With the broader understanding of what policy represents, it is now plain to most Nigerians that the government abused a level of trust given to them because of the housing policies especially the Land Use Act (1978). This was further justified by Aluko, (2012) who implied that the Land Use Act has not succeeded in making land readily available to Nigerians because the process of accessibility to land is long, tortuous and expensive. Mabogunje, (2010) also stated that the Land Use Act of 1978 was meant to usher in new land reform in Nigeria, it soon became a cog in the wheel of development over the year. The Act is seen to be a problem instead of a solution to developmental issues and therefore needs to be reviewed to improve the availability and access to land for housing development. The ownership issue which has limited private individuals made the use of vacant land as security for loan facility very unattractive and risky to the financial institutions. Some sections of the Act are so limiting, especially the revocation of right of occupancy in Section 5(2) over undeveloped lands which technically do not attract any compensation except for the ground rent paid in the year of such revocation. Such power granted to the government by this Act made undeveloped land unsafe and unattractive for mortgage loanS which also reduced the potential for raising funds for additional housing development (Sa-Aadu & Malpezzi, 1996). However, land is a scarce resource governed by a wide range of rights and responsibilities, not everyone’s right to land is secure (UN-Habitat, 2012).

It is proposed by UN-Habitat, (2013) that a variety of tenure types should be available, including customary forms of tenure, all providing adequate security of tenure in order to guarantee the welfare of households and stimulate improvements and expansion. Special attention should be accorded to the equal rights of women, young people and the elderly as well as social and ethnic minorities. Land tenure types other than freehold ownership should be encouraged, including leaseholds, cooperatives, and shared leaseholds.

4.3.2. Access to Finance:

Housing finance is a critical factor in the housing delivery framework. It is the engine that drives the housing sector and generally refers to the money required for the development of housing units, provision of housing infrastructure and purchase or acquisition of housing units. Accessibility to large pools of long term funds at low rates is imperative for mass housing development but it is impossible to mobilize such funds in the absence of a well-developed and efficient housing finance system (FGN, 2012).

The long term absence of mortgage banks, as seen in the developed economies like UK, New Zealand and USA, can be responsible for this occurrence. Even with the creation of primary mortgage institutions in Nigeria, the banks are still unable to lend at low interest rates. The Federal Mortgage Bank of Nigeria (FMBN) which is the apex housing finance institution suffers from lack of funds. The FMBN and Private Mortgage Institutions (PMI) should be restructured to enable them to attract private capital and instill consultation with various stakeholders in the housing industry so as to articulate a responsive approach to address housing finance challenges of various socio-economic groups in the society. Financial intermediaries and institutions such as PMIs and cooperative societies play a strategic role in enabling public and private sector housing. Nubi, (2000) further implied that the gap between income and shelter cost in Nigeria is very wide. This has eliminated the low-income earners from the housing market. He suggested that the high cost had been attributed to the following; rising cost of building materials, inflation rate in the economy and excessive profit of developers influenced by high cost of interest on bank loan.

Moreover, the important category of private housing developers does not have access to institutional finance and cannot secure loans. Most of the resources for embarking on the dwellings come from personal savings (Onibokun, 1990). This finding indicates that finance is part of a greater barrier to affordable housing provision in Nigeria and must be seriously dealt with through policy harmonization.

The development of a feasible mortgage finance scheme in Nigeria is powerfully tied to overall financial development. A well planned housing finance structure can make a significant influence towards an impactful inexpensive housing distribution to all Nigerians regardless of their social standing or economic position. Interest tariffs in Nigeria are very high. If the rates go as high as 10% in most of the advanced nations, there will be an excess supply in the housing market as fewer people will be unprepared to purchase at such a level of interest on loans. The global economic down turn from 2008 has forced mortgage rates down to as low as 3% in some countries, especially the UK and USA, but the case of Nigeria is different with interest rates reaching as high as 18 to 22 percent. Obamuyi, (2007 as cited by Ojiako and Ogbukwa, 2012) implied that most people were unable to access loans for reasons which included lack of collateral security, high interest rates and untimely delivery of credits by banks.

Alao (2009) noted that it is absolutely difficult for a low-income earner to service any loan at such high interest rate, therefore the higher the interest rate, the lower the level of demand on available housing supply.

Governments need to give attention to the underfunded mortgage institutions so that finance for housing development could be made available and reachable for the generality of the Nigerian populace. As clearly explained by Onabule (1996 as cited in Nubi, 2000), 245 Primary Mortgage Institutions were established in Nigeria under the National Housing Policy (NHP) between 1991 and 1996. Unfortunately, only 54 are now operating, mainly in South West part of the country and Abuja

4.3.3. The Planning system, Design and other institutional issues:

Planning regulations and building codes are capable of inhibiting housing production by the private sector in the country. In most cities in Nigeria, building and planning regulations emanate from the Town and Country Planning Laws documents. The documents are based on the Town and Planning Acts of 1959 and the Town and Country Ordinances of 1946. These were largely formulated in line with British colonial planning legacies (Habitat, 2001).

Planning regulations and building codes need to consider that over 70% of Nigerians are low income earners while about the same proportion are believed to be below the poverty line (Ajayi et al, 2005).

Planning regulations and building codes should reflect the socio-economic culture and technological contexts of development in the country. It is necessary to review the regulations and codes since they should foster rather than negate private and affordable housing initiatives. In Australia and UK for instance, planning is seen as a form of regulation to occupy an equivocal position with respect to housing affordability. Planning obligations and similar tools are considered potentially valuable tools in meeting the housing needs of low-income households. Many Australian and UK territories/councils have established housing affordability strategies that incorporate an explicit planning dimension (Slatter & Beer, 2004).

Planning is an activity of government which is broader than simple development control and one which is part of the wider regulation of political and economic structure. A range of interventions in the development process are both justified and indicated in other to achieve affordable housing.

Planning instruments and policies in Nigeria, if well positioned, will encourage significant volumes of affordable houses to deliver. An effective planning system is a necessity to efficient housing supply. An unwieldy planning system adds to the cost of housing for all groups within society, and especially those who can least afford additional charges. Housing affordability remains a problem of housing policies and governments that seek to sidestep the problem by directing all policy attention to planning responses which will not generate the policy need to ensure that all households, especially low-income earners, can afford adequate and appropriate housing (Slatter & Beer, 2004).

An effective planning system should be able to support a significant number of affordable housing units. UK was able to deliver significant affordable housing into its housing system through the help of planning contributions and planning obligations introduced by Barker (2004 & 2006). Nigeria can thus restructure its planning system, borrowing ideas from the impact the Barker introduction made in the UK housing system.

4.3.4. Residential Infrastructure:

Virtually all Nigerian cities suffer from inadequate technical and social infrastructures. In many cases, especially in the secondary and intermediate urban centres, basic organized infrastructures are practically non-existent in most areas, usually those inhabited by the low income group. The problem of infrastructure in public housing should be seen in the sense of a general crisis. Infrastructures should be made available in large housing estates to avoid the transformation into slums (Ogunshakin & Olayiwola, 1992).

The provision of residential infrastructure can encourage housing development and supply (World Bank, 1993). It not only enhances the value of houses and hence makes a site attractive to housing developers, but also encourages other developments and prevents the formation of poor environmental situations caused by lack of environmental infrastructure services. Many parts of Nigerian cities, particularly the suburban localities, lack environmental facilities. Although town planning law indicates procedures for installation of infrastructure, they are usually implemented only in Government acquired developments (Ogu, 1999). This has become a limitation to mass housing development because developers are only attracted to areas where there are suitable residential infrastructures.

Most residential developments, particularly in the suburban localities in Nigeria took place without being preceded by the provision of infrastructure services. This has left these areas with residential and environmental quality implications. It is possible to foster partnerships between communities and municipal authorities to ensure that improvement programmes respond to the priorities of the particular localities involved (Habitat, 2001). Since residential infrastructure is mostly what attracts private developers to invest in mass affordable housing projects, government should create the needed enabling environment to improve the entire housing system.

4.3.5. Government Policy:

There is a huge gap in housing policy formulation and implementation in the country and government must take cognizance of the socio economic circumstances and conditions of the people and reflect it in the policy.

It is argued that there is need for a shift from public to private provision of housing. The performance of the Nigerian government as a provider of housing units is not laudable. They should enable partnerships with private sector providers, including self-help builders who account for over 90% of the housing stock in the country. Therefore, central to future housing policies should be the utilization of institutional, financial and informal private developers, to gain access to finance, building plots, building materials, and favourable planning regulations which would be able to make a significant impact on housing in Nigeria (Habitat, 2001).

The "enabling approach" has often been guided by an inadequate understanding of the breadth of policies and areas affecting the supply of affordable housing. This has limited the areas of reforms of the regulatory framework to those directly implicated in housing production, with insufficient inclusion of urban planning, urban economy, land markets and fiscal mechanisms, that would encourage efficient use of urban land, urban services, public spaces, building materials and components industries, regulations concerning local economic activities, and others (UN-Habitat, 2013).

There is often a wide gap between what is on paper and what is happening on the ground in most Nigerian housing programmes. For example, only 13.3% success was recorded in the federal government's housing program in the Third National Development Plan (Mabogunje, 2002). The government policies and programs are inconsistent due to the frequent changes of policies with change of government without proper assessment of the existing ones. Given the repeated failure of direct public housing by government, closer attention should be paid to other forms of subsidies that could be more effective in providing decent housing to low income-earners. The existing conventional housing affordability methodologies and indicators with their many limitations need to be improved upon. Thorough understanding of local realities and context should guide housing policy (Oniboku, 1983). If government will focus on making enabling and realizable housing policies and monitor implementation, greater success will be achieved in affordable housing system.

4.3.6. Urbanization:

Predictions based on robust data and analysis indicates that the world will become a planet of cities, expanding its urban boundaries at a much higher rate than the rate of population growth. The urban debate will be entrenched in current global reality marked by several sustainability challenges (UN-Habitat, 2013).

According to the United Nations Population Division, the world passed the significant seven billion mark in 2011. It also issued long range projections to 2150. According to the medium-fertility scenario, world population will stabilize at slightly fewer than 11 billion persons around 2200. The world is currently experiencing a rapid population growth. With rapid population increase, many problem manifest themselves, among them is shelter (Osuide, 1988).

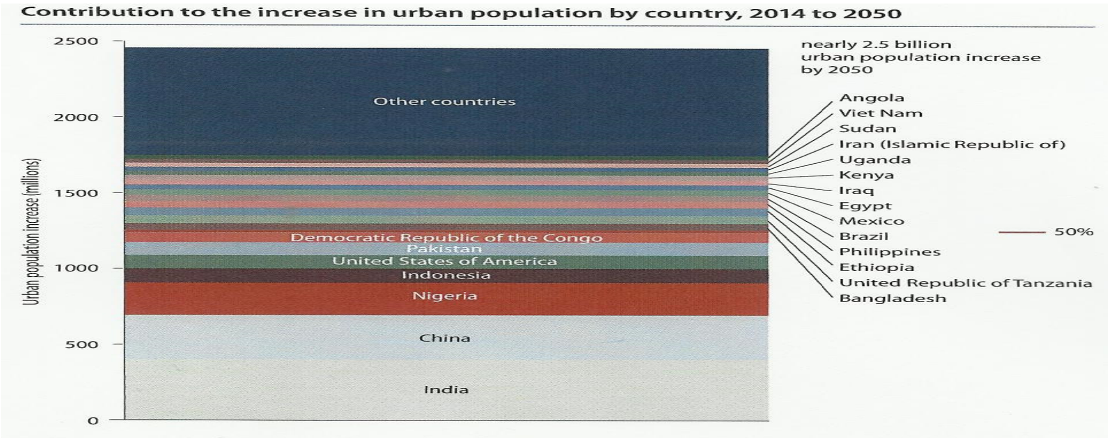

Figure 2: Countries contributing to urban Population from 2014 – 2050
Source: UN- World Urbanization Prospect 2014

Figure 2 highlighted countries proportional contribution to the world urban population. According to the sequence, Nigeria came third after India and China.

A substantial share of this increase in world population is from Africa, which already has a myriad of problems to grapple with. According to United Nations Centre for Human Settlements (HABITAT), six out of every ten city dwellers in developing countries, or almost one billion people will be living in squatter colonies without any promise of permanent, decent shelter by the end of the century. It went further to estimate that as of now, more than one billion people are either literally homeless or live in extremely poor housing and unhealthy environments. Almost 100 million people have no shelter whatsoever; they sleep in the streets, under bridges, in vacant lots, alleys and doorways (Osuide, 1988).

Presently, urbanization has become one strong barrier in the Nigerian housing situation. The development and physical growth of towns have been accompanied by urban sprawl, environmental contamination, worsening scarcities in up-to-date simple services, and overall urban decline. Urbanization applies additional burdens on urban services, and most Nigerian cities tend to have lost their original dignity, social cohesion and administrative efficiency (Aluko, 2010).

It was analysed that an increase of 1% in the urbanization rate, produces in the long run an increase in the nationwide crime rate of 8%. Although the model imperfectly represents the full dynamics of the process, the increase in crime rate becomes greater when the continuity of the urbanization process is taken into account. In a country where the urbanization rate is increasing by 0.5% points per year, a reasonable estimate in view of the experience of many developing countries over the last two or three decades, includes the nationwide robbery rate would increase by approximately 60% in 20 years (Bourguignon et al, 2006).

UN-Habitat, (2013) highlighted that economic growth tends to offset the adverse effect of urbanization. In other words, only if urbanization proceeded without sufficient rapid economic growth would crime develop. This is the case with Nigeria where a rapid rate of urbanization has occurred without economic growth

4.3.7. Political Commitment and Leadership, Corruption in Distribution and Allocation:

Concerns about the impact of regulatory barriers on the housing market have existed for decades. Politicization of housing is a major issue in Nigeria. Government involvement, what Onibokun (1983) referred to as the "game of numbers" has created a huge barrier.

The problem did not only lie in the conditions of allocation and payment but the corruption that swept the distribution of funds and the available housing stock (Ikpala, 1985 as cited by Olayiwola, 1992).

The level of corruption, political pressure, and official indecision have so far resulted in the non-allocation of many of the public housing units completed years before by the past governments which finally became homes for squatters. The gap in allocation of completed government public housing units, with delays up to many years in most cases, as government always refer the delays to lack of provision of infrastructure always remains the method which government officials use to play a dubious game in the corrupt allocation of the completed projects to themselves. World Bank, (2003), United Nations, (1999 as cited in Nwaobi, 2004), noted that corruption is one of the greatest challenges of the contemporary world. It undermines good government, fundamentally distorts public policy, leads to the misallocation of resources, harms the private sector and particularly hurts the poor. Corruption respects no national boundaries and it increases poverty around the globe by distorting political, economic and social life. Nwaobi, (2004), also stated that Nigeria is one of the poorest countries in the world, but several factors contribute to the persistence of national poverty, and corruption is definitely one of them. Oil and Gas have brought wealth to Nigeria but these industries have historically provided opportunities for corruption on a massive scale.

The whole issue of delays in the allocation and distribution of completed public housing project points to corruption and political pressures.

5. Conclusion

From literature, it can tentatively be concluded that many barriers are limiting government efforts towards effective provision of affordable public housing in Nigeria. There is a huge gap in land accessibility, ownership and security of tenure. The insecurity posed by land tenure in Nigeria is making it difficult for people to enjoy the whole benefit of land ownership. Housing finance is another critical issue. Access to long term loan and repayment rate is a limitation on its own hindering the low income group access to affordable public housing. The Nigerian public housing system also lack good planning, design and some other enabling institutional factors such as planning regulations and building codes. Lack of good government policy formation and unfocused implementation is another setback. There is often a wide gap between what is on paper and what is happening on the ground in most Nigerian housing programmes. Urbanization which influenced a robust city expansion in Nigeria is an additional burden which is compressing the available housing stock. The level of corruption, political pressure and unclear system of allocation of the completed public housing units is another challenge Nigerian public housing system is facing. Previous efforts and policies aimed at delivering affordable public housing, especially to the low income groups in Nigeria is failing because of the strong resistance posed by several barriers hindering progress to a successful public housing system. These revelations from literature suggests the need for more research to be carried out on this study area to enable identification of in-depth solutions to the ravaging problem and enable progression to the provision of affordable public housing in the Nigerian public housing system.

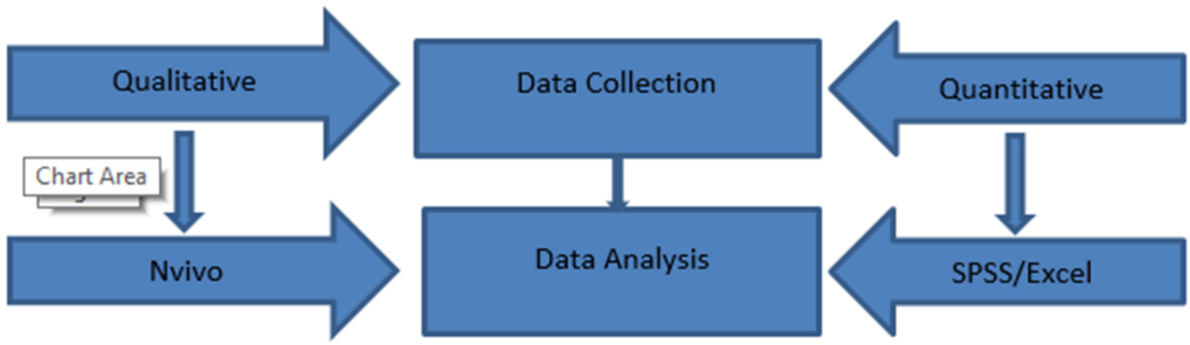

Figure 3. Research Design for Next Stage of the Research

The next stage of the research is data collection and analysis. The study will employ multiple methods, using both qualitative and quantitative techniques in data collection with more emphasis on quantitative methods. It must be noted that a questionnaire survey would be used as main data collection instrument of this study to collect primary data as this enables the researcher to examine and explain relationships between the constructs (Saunders et al, 2007). Quantitative data will be collected through questionnaire surveys of selected government officials, policy makers and residents, while semi-structured interviews and documents will be employed to collect qualitative data from selected developers and policy makers who are directly involved in the provision of affordable public housing in Nigeria. The primary data collected will be analyzed with the help of NVivo, SPSS and Excel.

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Building Resilience of Construction Supply Chain to Disruptions: Development of a Conceptual Framework

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Abstract:

The research into global supply chains indicates that the increasingly global marketplace brings greater complexity and interconnected risks for all players, and that key players worldwide are still vulnerable to supply chain disruptions. One of the industries which are driven by supply chains and affected by disruptions is the construction industry. Recent evidence suggests that supply chain disruptions had caused adverse impact on the construction industry in various developing countries, with increasing report on project performance deficiencies such as cost and time overruns, poor quality of work, technical defects, and health and environmental issues. The exposure of supply chains in developing countries to formidable disruptions could cause adverse impact to other nations if not handle appropriately. It is therefore important for key players in developing countries to develop a way to build resilience capability across their construction supply chains in order to deal with these disruptions significantly. This area still requires further research due to the lack of in depth studies addressing this issue.

This paper presents the development of a conceptual framework that describes the key issues to consider in assessing and building resilience of construction supply chain to disruptions based on the review of existing literature. This includes the identification of disruption phases, supply chain vulnerabilities, and how the disruptions can be mitigated through the development of capabilities. The pathogenic influences are also considered in the study to identify the root cause of supply chain disruptions. These are hidden vulnerabilities that remain dormant in a system until an actual failure occurs. By combining the pathogenic influences with the supply chain's vulnerability and capability factors, the level of supply chain resilience to disruptions can be assessed and the areas that need to be improved can be highlighted.

Keywords:

Construction Industry, Disruptions, Resilience, Risk Management, Supply Chain Management

1. Introduction and Main Focus

The modern world has changed and it is now a highly interconnected one. With the innovation and growth and the interdependence of the global economy through global communications and advanced technology, organisations from various regions are more interconnected than ever before. Countless benefits come along with these advances, including unprecedentedly high international trade, lean supply chains that deliver low cost consumer goods and an improved standard of living in many developing countries (Kosansky and Taus, 2014). However, the uncertainty, complexity, and transparency of this interdependent global economy have also amplified collective exposure of supply chains to catastrophic events and disruptions.

Within a global context, risk can occur from any direction, including supply chain disruptions, geopolitical risk, natural catastrophes, and unforeseen events. It is important to note how interconnected risks have become in a global economy and how these risks are beyond an organisation's control. For instance, Figure 1 illustrates the underlying connections between the recent global risks based on a survey done by the World Economic Forum 2014. It shows how risk can cascade from one point to another and how events from completely unrelated sectors could also be the root cause of disruptions that occur in another industry. As an increasingly global marketplace brings greater complexity and risks for all players, it important for a supply chain to continue its function to supply the world's population with essential goods, regardless of whether or not disruption strikes (Kosansky and Taus, 2014).

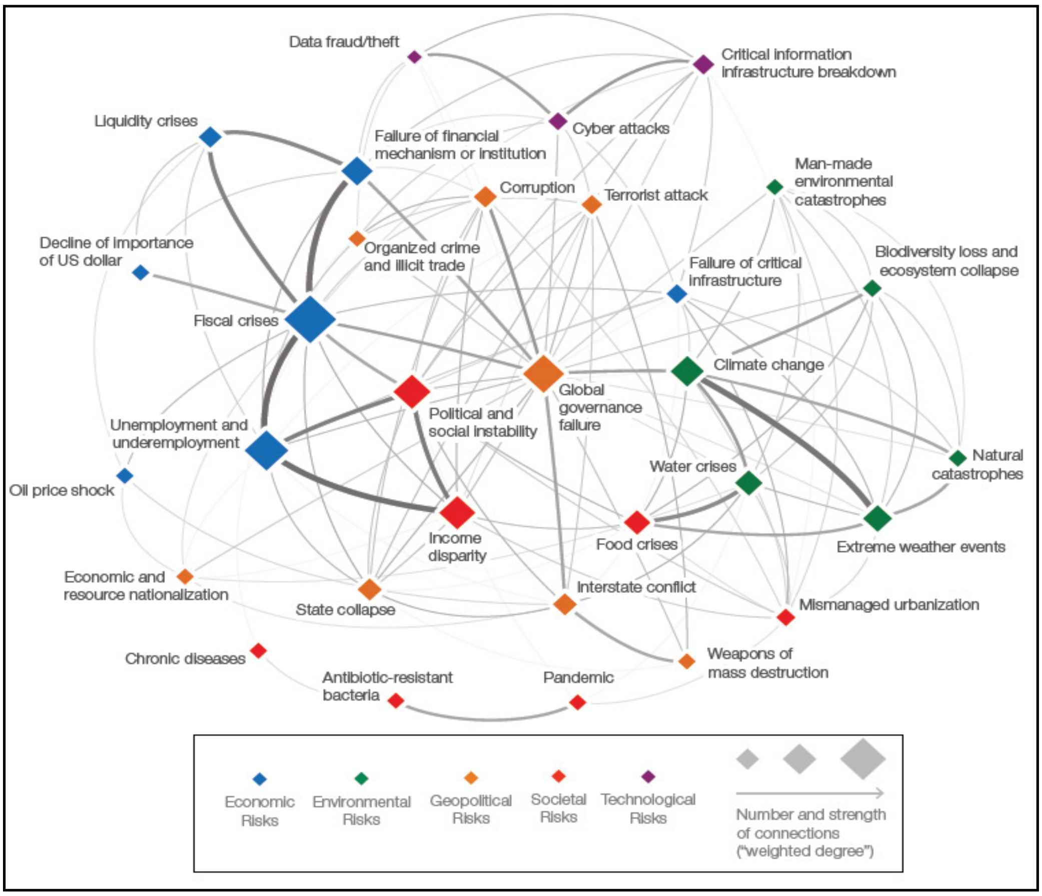

Figure 1. The global risks 2014 interconnections map (World Economic Forum, 2014)

One of the industries which is driven by supply chains and affected by interconnected risk of disruptions is the construction industry. Looking at the worldwide view of construction supply chain disruptions, the recent Business Continuity Institute (BCI) supply chain survey (BCI, 2013) reported that product quality incidents are the top cause of disruption in the engineering and construction sector, followed by unplanned information technology outage, adverse weather conditions, new laws or regulations, and transport network disruption. Based on the survey, loss of productivity was the primary consequence of these supply chain disruptions, followed by high customer complaints. This shows that key players in the construction industry worldwide are still vulnerable to supply chain disruptions.

Furthermore, supply chain disruptions had caused adverse impact on the construction industry in various developing countries, with increasing report on project performance deficiencies such as cost and time overruns, poor quality of work, technical defects, poor durability, and inadequate attention to safety, health and environmental issues (Ofori, 2012; Abdul-Rahman et al., 2007). The needs and dynamics of developing countries differ from that of developed countries in terms of the challenge to get the required resources, the difficulties in communication and coordination due to cultural diversity especially in multi-national project teams, the lack of infrastructure to facilitate scheduling and logistics, and the shortage of supply of the required professional skills. This goes to show that supply chains operating in the dynamic environment in the developing countries are exposed to formidable disruptions, some of which may not be an issue in the developed nations, but could potentially have an adverse impact to other nations if not handled appropriately.

Although it is impossible for supply chain managers to eliminate all the risks in construction, the challenge now is how to make systems and supply chains sufficiently resilient so that they can bounce back and thrive from catastrophes and disruptive events. As risks are increasingly shared across local, regional and national boundaries, building resilience towards disruptive events requires key players to not just focus on their self-interest, but to also take into consideration the interest of others. Thus, instead of a silo approach, all parts of the supply chain need to work together to build resilience to disruptive events and improve project performance.

This research will therefore continue to investigate this area by presenting the development of a conceptual framework that describes the key issues to consider in assessing and building resilience of construction supply chain to disruptions based on existing literature review. This will allow the project team to have a better understanding on their supply chain disruptions and develop an appropriate action plan required to utilize their supply chain capabilities and overcome their vulnerabilities in the effort to improve project performance.

2. Literature Review

2.1. **Supply Chain Disruptions**

Supply chain in the face of disturbances is a subject that, in recent years, has motivated the interest of numerous researchers and practitioners. Some researchers refer to disturbances as "disruptions" (Ponomarov & Holcomb, 2009), while others refer to it as "risk" (Chopra & Sodhi, 2004), "uncertainty" (Mason-Jones & Towill, 1998) or even as "crisis" (Loosemore, 2000). In the context of this study, the term used is disruption, which is defined as a foreseeable or unforeseeable event, which affects the usual operation and stability of an organisation or a supply chain (Barroso et al., 2008). It is an event that takes place at one point in the chain and can adversely affect the performance of one or more elements located elsewhere in the supply chain and the normal flow of goods and materials within a supply chain (Craighead et al., 2007). The supply chain risk is, then, the expected exposure to the potential impact of disruptions which is usually characterized by the likelihood of a disruption and the impact of disruption if it occurs (Zsidisin et al., 2005). By looking at disruptions as a process, the existing literature can be categorised into three main phases; the pre-disruption, during disruption and post-disruption phase, as tabulated in Table 1.

Table 1: Summary of disruption phases from previous literature

Authors (Year)	Disruption Phases			Area of Study
	Pre-Disruption	During Disruption	Post Disruption	
Berg et al (2008)	1. Proactive Risk Management - Identify, evaluate, manage and monitor risks	2. Reactive Risk Handling - Incident/ accident handling - Execution of contingency plans	3. Results and Outcomes -Achievement of business objectives - Cost of risks	Assessing supply chain risk management programs
Billa et al (2006)	1. Detection 2. Forecasting 3. Warning	4. Response	5. Reaction	Flood management planning
Blackhurst et al (2005)		1.Disruption Discovery	2. Disruption Recovery 3. Supply Chain Redesign	Managing supply chain disruptions
Cockram and Van Den Heuvel (2012)	1. Pre-crisis Preparation	2. Crisis Response	3. Post-crisis Recovery	Crisis management
Pyke and Tang (2010)	1. Readiness	2. Responsive-ness	3. Recovery	Mitigating product safety risks via 3Rs
Sheffi and Rice (2005)	1. Preparation	2. Disruptive Event 3. First Response 4. Initial Impact 5. Time of Full Impact	6. Preparation for Recovery 7. Recovery 8. Long-term Impact	Supply chain view of the resilient enterprise

Despite the differences in terminology used by researchers from different disciplines in Table 1, there is a level of agreement that the pre-disruption phase involves the proactive approach of identifying, assessing and mitigating the risk of disruptions by assigning the necessary treatments to the risk identified. In the crisis management literature, Cockram and Van Den Heuvel (2012) believe that managers should have a wide range of proactive resilience activities in place at the pre-crisis phase to both prevent and mitigate the impact or duration of the crises occur. In the context of this study, this phase is equivalent to the risk management process before construction begins on site.

During the disruption, effective reactive response is important to reduce the spread of the impact of disruption. The response should include the implementation of the contingency plans set up at the pre-disruption phase. Berg et al (2008) termed this as the 'reactive supply chain risk handling', which directly defines the success of the risk management process (see row 1 of

Table 1). However, Sheffi (2005) argues that in some cases, the pre-planned contingency measures might not be able to contain the disruptions from spreading, hence alternative responses that is outside of the traditional work routines and standard operating procedures are usually required to handle such disruptions.

The subsequent post-disruption phase involves the recovery and learning process. It involves dealing with the long-term effects or impacts of an event and how to return to "business as usual" or the new "normal", if major change has taken place (Cockram and Van Den Heuvel, 2012). The management should review the disruption management procedure, so that the company can take corrective actions to prevent or reduce the likelihood of future disruptions (Pyke and Tang, 2010). The supply chain can then be re-designed to become more resilient in future (Blackhurst et al., 2005).

Looking at existing literature in the construction field, the researchers find that little works are presented on 'post-disruption' activities on the response of the supply chain following an actual disruption. Busby and Zhang (2008) suggested that risk analysis should not simply be a consensual analysis of threats and consequences; it should also involve inspecting how different actors response to these threats, and how some of these responses are themselves threats in other actors' eyes. It is therefore important for this study to consider an integrated approach of both pre and post disruption stages to build resilience of construction supply chain to disruptions. A summary of the integrated disruption phases for this study is presented in Figure 2. The construction supply chain's response to disruptive events can be assessed against these disruption phases.

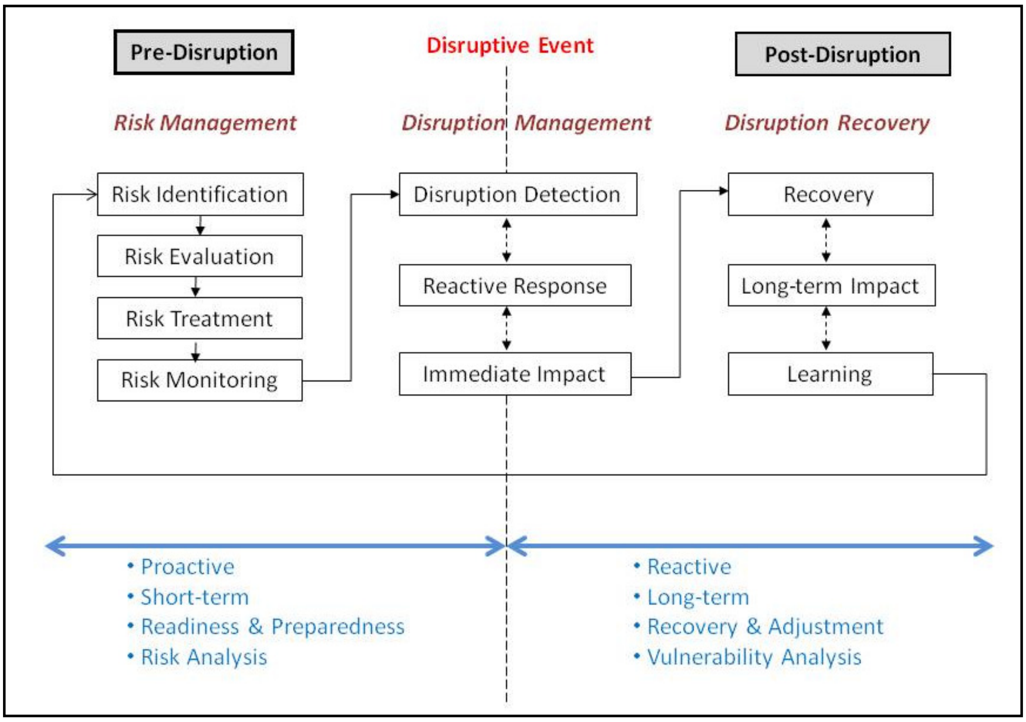

Figure 2. Summary of the integrated disruption phases

2.2. Supply Chain Resilience

Resilience is a multidisciplinary concept, and the idea of resilience has indeed been a considerable interest of various industries in different countries, such as social, ecological, computing and engineering sciences (Peck, 2005; Ponomarov and Hollcomb, 2009; Pettit et al., 2010; Limnios and Mazzarol, 2011). Limnios and Mazzarol (2011) highlighted two opposing concepts of resilience, as either offence (adaptation) or defense (resistance) to internal or external disruptions. A system may be adaptive in reacting to disruptions by changing its structure, processes and functions to increase its ability to persist. On the other hand, a system may also be very resilient in terms of its ability to resist change and maintain its current structure and processes. In this case the system is able to tolerate disruptions and absorb shocks rather than adapt to change.

In the supply chain context, Peck (2005) defines supply chain resilience by relating it with the ability to recover from or adjust easily to adversity or change (i.e. supply chain disruptions). Fiksel (2006) proposes a similar definition, but considers that a resilient system will have the ability not only to "survive and adapt in face of turbulent change", but to also "grow" or thrive in the face of disruptions. Supply chain resilience in this study is therefore defined as the supply chain's ability to react to the negative effects caused by disruptions that occur at a given moment in order to maintain the supply chain's objectives or recover to a better state (Barroso et al., 2008).

Pettit et al (2010) suggested that supply chain resilience can be assessed in terms of two dimensions; vulnerabilities and capabilities (see Figure 3). The researchers believe that empirical studies can provide management insight into linkages between each vulnerability and a set of successfully employed capabilities to combat that vulnerability. The assessment of the capabilities and vulnerabilities could benefit this study considerably in determining the construction supply chain's level of resilience and subsequently, develop a comprehensive resilience response framework to improve project performance. The following sections provide further discussion on the vulnerability and capability factors.

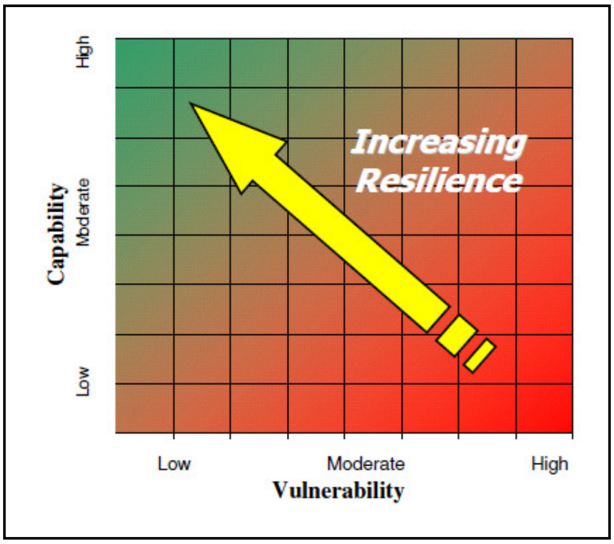

Figure 3. Measurement of resilience (Pettit et al, 2010)

2.3. Supply Chain Vulnerability

The term vulnerability is often confused with risk (Ezell, 2007). The main difference between vulnerability and risk is that vulnerability highlights the notion of susceptibility to a disruption by defining the characteristics of a system that will change the possibility for harm (Ezell, 2007; Brooks, 2003), whereas risk focuses on the likelihood and severity of consequences to a disruption. This was highlighted in Einarsson and Rausand's (1998) study where they argue that unlike risk analysis, vulnerability analysis focuses on the whole disruption period including the actions to mitigate, restore and restart the activities after a disruption occur until a new stable situation is obtained. Apart from that, while risk includes positive and negative impact, vulnerability is seen as a combination of a disruption and the resulting negative consequence. Svensson (2000) defined vulnerability as the existence of random disruptions that lead to deviations in the supply chain of components and materials from normal, expected or planned activities, all of which cause negative consequences for the involved manufacturer and its subcontractors.

In the context of this study, supply chain vulnerability is defined as the "fundamental factors that make an enterprise or supply chain susceptible to disruptions" (Pettit et al, 2010). According to Sheffi and Rice (2005), reducing these vulnerability factors mean reducing the likelihood of a disruption and increasing resilience; the ability to bounce back from a disruption. The basic premise is that supply chain characteristics are antecedents of supply chain vulnerability and impact both the probability of occurrence as well as the severity of supply chain disruptions (Wagner and Bode, 2009).

In determining the vulnerability parameters for this study, the vulnerability factors are grouped into four main categories as described below (McManus, 2008; Christopher and Peck, 2004; Einarsson and Rausand, 1998):

a) Organisation Vulnerability - Vulnerabilities arising from within the organisation that are under direct control of the organisation
b) Operational Vulnerability - Vulnerabilities arising from the supply chain network that the organization has little or no control of
c) External Vulnerability - Frequent changes in external factors that are beyond the organization and its supply chain's control
d) Financial Vulnerability - Negative financial impact caused by the market and economy that are beyond the organisation and its supply chain's control

Future work of this study will include the analysis of these factors to determine the quadrant or area in Figure 4 that the supply chain members are most vulnerable at in the effort to build supply chain resilience. The supply chain vulnerability may derive from sub-factors occurred within the organisation, external to the organisation but within the supply chain network, or from factors external to the supply chain network, as depicted in Figure 4**.** These sub-factors are further discussed in the following sections.

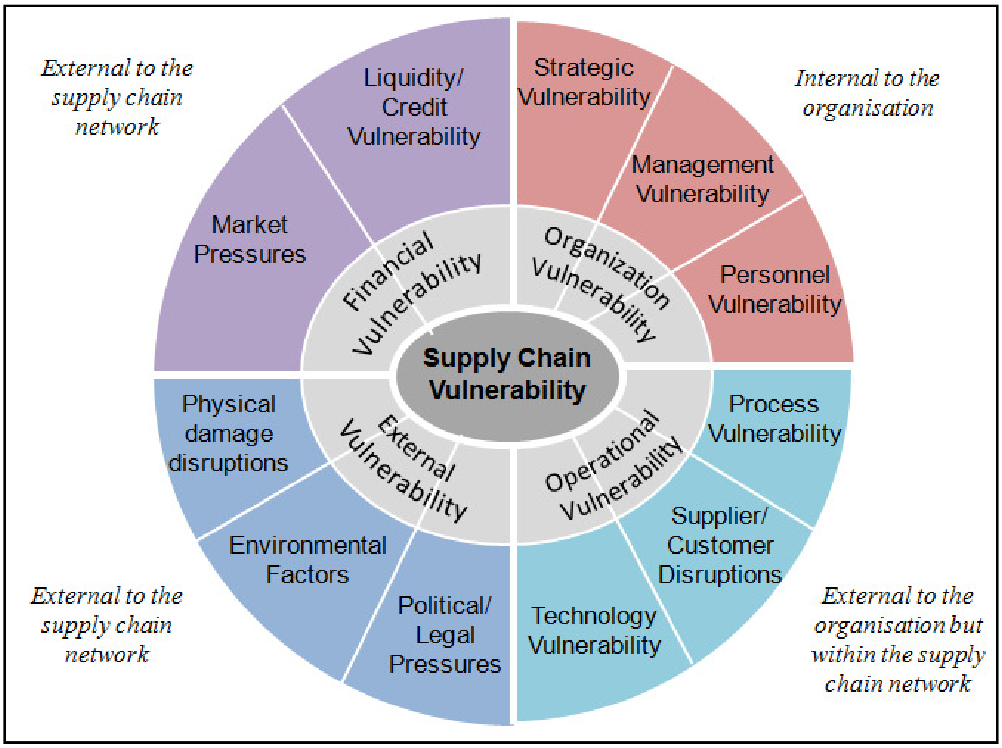

Figure 4. Supply chain vulnerability factors

2.3.1. Organisation Vulnerability

In this study, 'strategic vulnerability' refers to the inadequate business decisions undertake by the firm on the products or services that the firm supplies that cause the failure of the firm to achieve their business' objectives when disruptions occur. This range from the decision to outsource operations to different suppliers that can bring about significant risks to the firm, operating at a geographically concentrated area that can expose the firm to higher risk of disruptions, and the high degree of complexity of the products that can increase the risk of failures (Pettit et al, 2010).

On the other hand, 'management vulnerability' refers to the management level of the firm in executing the business decisions. Vulnerability can arise from inadequate management oversight, late information and decision making, and budget overruns due to poor planning of the firm. Lastly, 'personnel vulnerability' relates to the staff within the firm. Factors such as the shortage of skilled workers, labor disputes, hazardous working conditions, and the loss of key personnel during operations can influence the vulnerability of a system (Einarsson and Rausand, 1998).

2.3.2. Operational Vulnerability

The 'process vulnerability' refers to vulnerability arising from any link of the supply-production-distribution chain in Figure 5. In construction, during the production process, materials are combined with labor, information, technology, and capital to produce the completed project (Benton and McHenry, 2010). There is a high level of interdependence between the supply-production-distribution chain in delivering construction projects which can create vulnerability in the supply chain. Project quality, budgets, and completion times can easily be affected if disruptions occur. Therefore, it is important to manage vulnerability within this chain to mitigate disruptive events in construction projects.

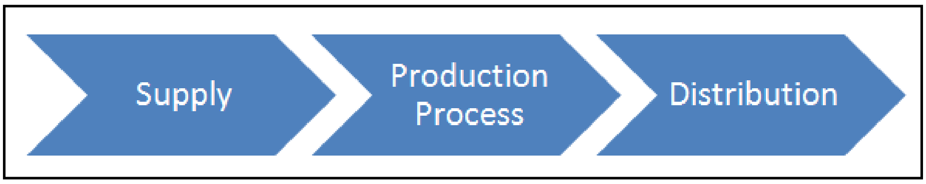

Figure 5. Supply chain elements (adapted from Sheffi and Rice, 2005)

Meanwhile, the 'supplier or customer disruptions' relates to the susceptibility of suppliers and customers to disruptions (Pettit et al., 2010). Significant disruptions faced by suppliers and customers in the supply chain can affect a firm's ability to produce their products or services, especially in an interconnected environment such as the construction industry. Lastly, 'technology disruptions' includes the vulnerability of the supply chain to technology changes in the industry and the unexpected technology failures faced by the supply chain during operations.

2.3.3. External Vulnerability

According to Pettit et al (2010), external pressures are influences, not specifically targeting the firm, that create business constraints or barriers. This includes 'political or legal pressures' such as changes in government regulations that can pose significant external pressures by enforcing limitations and adding expenses to operations, 'environmental factors' including natural disasters and health pandemic, and 'physical damage disruptions' involving accident or deliberate threats such as piracy and theft aimed at disrupting operations or causing human or financial harm (Pettit et al., 2010).

2.3.4. Financial Vulnerability

'Market pressures' in this category involves fluctuation in material prices that may rise above acceptable levels and make it impossible to continue a cost effective production (Einarsson and Rausand, 1998). A system may also be vulnerable to price pressures from competitors offering the similar products or services at a lower price, resulting in the loss of business opportunity. Lastly,' liquidity or credit vulnerability' involves issues relating to money and management of monitory assets that might be affected by changes in financial and economic policies (Pathirage et al, 2012).

Taking into account the issues discussed above, a summary of the supply chain vulnerability sub-factors collected through a detailed literature review is presented within the stated categories in Table 2 below. Although these factors are classified into 11 categories, it is worth noting that certain factors may overlap and have very close links.

Table 2: Summary of supply chain vulnerability factors

Vulnerability Category	Supply Chain Vulnerability Factors	Sources
Organisation Vulnerability		
V1. Strategic vulnerability	Degree of outsourcing	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Peck (2005)
	Reliance upon specialty sources	Pettit & Fiksel (2010), Svensson (2000)

	Innovation (competition)	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Sheffi & Rice (2005), Peck (2005)
	Concentration of capacity	Pettit & Fiksel (2010), Wagner & Neshat (2010)
	Complexity	Pettit & Fiksel (2010), Wagner & Neshat (2010), Peck (2005)
V2.Management vulnerability	Inadequate management oversight	Sheffi & Rice (2005)
	Timing of business decisions	Sheffi & Rice (2005)
	Visibility of disruption to stakeholders	Pettit & Fiksel (2010)
	Reliance upon information flow	Chowdhury et al (2012), Pettit & Fiksel (2010), Blackhurst et al (2008), Sheffi & Rice (2005), Peck (2005)
	Budget overruns/Unplanned expenses	Sheffi & Rice (2005)
Operational Vulnerability		
V3. Personnel vulnerability	Human resources	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Sheffi & Rice (2005), Einarsson and Rausand (1998)
	Labor disputes	Chowdhury et al (2012), Pettit & Fiksel (2010), Blackhurst et al (2008)
	Potential safety hazards	Pettit & Fiksel (2010), Sheffi & Rice (2005), Einarsson and Rausand (1998)
	Loss of key personnel	Blos et al (2009), Sheffi & Rice (2005), Einarsson and Rausand (1998)
V4. Process vulnerability	Scale/extent of supply network	Pettit & Fiksel (2010), Wagner & Neshat (2010), Sheffi & Rice (2005), Peck (2005), Svensson (2000)
	Unpredictability of demand	Chowdhury et al (2012), Pettit & Fiksel (2010), Wagner & Neshat (2010), Blackhurst et al (2008), Peck (2005), Sheffi & Rice (2005), Svensson (2000)
	Raw material availability	Chowdhury et al (2012), Pettit & Fiksel (2010)
	Utilities availability	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Sheffi & Rice (2005)
	Reliability of equipment	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Sheffi & Rice (2005), Peck (2005)
	Production capacity	Chowdhury et al (2012), Pettit & Fiksel (2010), Blackhurst et al (2008)
	Distribution capacity	Chowdhury et al (2012), Pettit & Fiksel (2010), Wagner & Neshat (2010)
	Product quality problem	Blos et al (2009), Chowdhury et al (2012), Blackhurst et al (2008)
	Transportation disruption	Chowdhury et al (2012), Wagner & Neshat (2010), Blos et al (2009)`

V5. Supplier/ customer disruptions	Supplier disruptions	Chowdhury et al (2012), Pettit & Fiksel (2010), Wagner & Neshat (2010), Blos et al (2009), Blackhurst et al (2008), Sheffi & Rice (2005), Peck (2005), Svensson (2000)
	Supplier capacity	Pettit & Fiksel (2010), Wagner & Neshat (2010), Sheffi & Rice (2005)
	Loss of key supplier	Wagner & Neshat (2010), Blos et al (2009), Sheffi & Rice (2005)
	Customer disruptions	Chowdhury et al (2012), Pettit & Fiksel (2010), Wagner & Neshat (2010), Blos et al (2009), Sheffi & Rice (2005)
V6. Technology vulnerability	Technology decisions	Blos et al (2009), Sheffi & Rice (2005)
	Unforeseen technology failures	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009)
External Vulnerability		
V7. Political/ legal pressures	Exposure to political disruptions	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Blackhurst et al (2008), Sheffi & Rice (2005), Peck (2005)
	Political/Regulatory changes	Pettit & Fiksel (2010), Blos et al (2009), Peck (2005), Sheffi & Rice (2005)
V8.Environment factors	Natural disasters	Chowdhury et al (2012), Pettit & Fiksel (2010), Blackhurst et al (2008), Peck (2005), Svensson (2000)
	Health pandemic/spread of disease	Chowdhury et al (2012), Pettit & Fiksel (2010), Sheffi & Rice (2005)
	Public Reputation	Pettit & Fiksel (2010), Sheffi & Rice (2005)
V9. Physical damage disruptions	Piracy & theft	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Blackhurst et al (2008), Peck (2005)
	Accident in plant (fire, property damage, boiler explosion, operator accident)	Chowdhury et al (2012), Blos et al (2009), Sheffi & Rice (2005)
	Terrorism & sabotage	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Blackhurst et al (2008), Sheffi & Rice (2005), Peck (2005)

Financial Vulnerability		
V10. Market pressures	Fluctuations in prices	Chowdhury et al (2012), Pettit & Fiksel (2010), Blos et al (2009), Blackhurst et al (2008), Sheffi & Rice (2005), Einarsson and Rausand (1998)
	Price pressures (competition)	Pettit & Fiksel (2010), Sheffi & Rice (2005), Einarsson and Rausand (1998)
V11. Liquidity/ credit vulnerability	Finance policies & procedures	Sheffi & Rice (2005)
	Lack of financial resources	Sheffi & Rice (2005)

2.4. **Pathogenic Influences**

In addition to the supply chain vulnerability factors discussed above, it is important to consider the underlying reasons as to why a supply chain member might be more vulnerable in certain area than the other. Previous studies tend to look at vulnerability in a static condition without considering the latent conditions, thus missing some of the key driving forces that influence the dynamics of supply chain vulnerability.

In studying the latent conditions in projects, Busby and Hughes' (2004) introduced the term "pathogens", whose greatest conceptual value is that they remain dormant in the system until an actual failure occurs. Essentially, before the problem becomes apparent, project participants often remain unaware of the impact upon project performance that particular decisions, practices or procedures can have (Love et al, 2011). This means that participants may be carrying out defective practices that have not yet resulted in a failure and so are continuously exposed to the same risk of error. These pathogens can be defined by the following properties (Busby and Zhang, 2008):

a) It is inherently the cause of some recognizable organizational breakdown or failure, for example, an inability to complete a project or significant conflict among project participants.
b) It is created by social actors, and not merely an intrinsic vulnerability, for instance, an authority structure, contract or agreement, procedure, or practice.
c) It only becomes clearly problematic and part of an observable breakdown after a prolonged period; it may exist at the start of a project but only bring about failure in later stages.
d) It only becomes problematic upon the occurrence of some triggering event or condition which it predates, for instance, a contractual agreement that impedes recovery from an error or environmental event.

Busby and Hughes (2004) found 8 main categories of pathogen from their studies as shown in Table 3 below.

Table 3: The main categories of pathogen (Busby and Hughes, 2004)

Category	Description
Practice	Pathogens arising from people's deliberate practices
Task	Pathogens arising from the nature of the task being performed
Circumstance	Pathogens arising from the situation or environment the project was operating in
Convention	Pathogens arising from conventions, standards, routines and codes of practice
Organisation	Pathogens arising from organizational structure or operation
System	Pathogens arising from an organizational system
Industry	Pathogens arising from the structural property of the industry
Tool	Pathogens arising from the technical characteristic of the tool

Considering the increasing complexity of construction projects and its uncertain environment, there is a need to obtain a clear understanding of these pathogens listed in Table 3 that influence the vulnerability of the supply chain to disruptions. While disruptions in construction are often difficult to foresee and is hard to be eliminated entirely, these pathogens, however, can be identified and mitigated before a disruptive event occurs. Although these pathogens are hidden and may not be causing any problem at the moment, they might trigger later on and cause cascading impact to the supply chain and its operation. The identification of these pathogens in this study will therefore help the researchers to assess how vulnerable the project organisations are to making significant errors, thus providing the foundation to build appropriate strategies for their prevention.

2.5. Supply Chain Capability

Supply chains need to have capabilities to create resilience against disruptions (Christopher and Peck 2004). According to Pettit et al. (2010), capabilities are attributes that enable an enterprise to anticipate and overcome disruptions. These capabilities can prevent an actual disruption, mitigate the effects of a disruption or enable adaptation following a disruption.

Flexibility is one of the important capabilities mentioned by existing researchers (Christopher and Peck, 2004; Sheffi, 2007; Pettit et al, 2010) to improve supply chain resilience to disruptions. In construction, flexibility in project is the capability to adjust the project to prospective consequences of uncertain circumstances within the context of the project (Husby et al., 1999 as cited in Olsson, 2006). In other words, flexibility is the possibility for construction and technical changes with minimum cost and disruption. Flexibility can be improved by using alternative suppliers in the event of a single or multiple-supplier disruption. Alternate distribution channels are also important to consider when a supply chain faces transportation disruptions.

Another key capability factor is the supply chain's efficiency. Efficiency is linked to the immediate outcome of a project. It is a question of doing things right and producing project outputs in terms of the agreed scope, quality, cost and time (Olsson, 2006). As stated by Pettit et al. (2010), the capability to produce outputs with minimum resource requirements is important to improve efficiency. The elimination of waste, such as unnecessary output of overproduction, is one of the ways to improve system efficiency. By controlling these wastes, project can be completed on time and within cost with fewer disruptions. Bottlenecks in the process must also be reduced, as they are the key cause of the loss of efficiency in construction that hampers the progress of the production process.

Apart from the flexibility and efficiency capabilities within the supply chains discussed above, other main capability factors (such as adaptability, capacity and visibility) mentioned by previous researchers are also considered to be assessed in this study. The main categories of capability factors from Pettit et al. (2010) Supply Chain Resilience Assessment and Management (SCRAM) tool are adapted in this study as it involves a comprehensive list of factors that are applicable and useful for the assessment of construction supply chains' resilience. The definition of the capability factors are summarized in Table 4 and the related sub-factors from the detailed literature review are listed in Table 5 below.

Table 4: Definition of the main capability factors (adapted from Pettit et al., 2010)

Main Capability Factors	Definition
Flexibility	Ability to quickly change inputs/outputs or the mode of receiving inputs/delivering outputs
Capacity	Availability of resources to enable sustained production levels
Efficiency	Capability to produce outputs with minimum resource requirements
Visibility	Knowledge of the status of operating resources and the environment
Adaptability	Ability to modify operations in response to challenges or opportunities
Anticipation	Ability to detect potential future events or situations
Recovery	Ability to return to normal operational state rapidly
Dispersion	Broad distribution or decentralization of resources
Collaboration	Ability to work effectively with other entities for mutual benefit
Market Position	Status of a company or its products in specific markets
Security	Defense against deliberate intrusion or attack
Financial Strength	Capacity to absorb fluctuations in cash flow

Table 5: Summary of supply chain capability factors

Capability Category	Supply Chain Capability Factors	Sources
C1. Flexibility	Product commonality (modularity, interchangeability)	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009), Sheffi & Rice (2005)
	Multiple sources	Pettit et al (2010), Ponomarov & Holcomb (2009), Sheffi & Rice (2005), Peck (2005), Cranfield (2002)
	Alternate distribution channels	Chowdhury et al (2012), Pettit et al (2010), Blackhurst et al (2008), Peck (2005)
	Multi-sourcing	Pettit et al (2010)
	Fast re-routing of requirements	Chowdhury et al (2012), Pettit et al (2010)
C2. Capacity	Reserve capacity (materials, assets, labor, inventory)	Chowdhury et al (2012), Pettit et al (2010), Sheffi & Rice (2005), Peck (2005), Christopher & Peck (2004), Cranfield (2002)
	Redundancy (assets, labor)	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009), Sheffi & Rice (2005), Peck (2005), Christopher & Peck (2004), Cranfield (2002)
	Backup energy sources/communications	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009), Sheffi & Rice (2005)
C3. Efficiency	Waste elimination	Chowdhury et al (2012), Pettit et al (2010), Sheffi & Rice (2005), Cranfield (2002)
	Labor productivity	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009)
	Asset utilization	Pettit et al (2010)
	Product variability reduction	Chowdhury et al (2012), Pettit et al (2010)
	Failure prevention	Pettit et al (2010)
C4. Visibility	Business intelligence gathering	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009), Blackhurst et al (2008), Sheffi & Rice (2005), Cranfield (2002)
	Products, Assets, People visibility	Chowdhury et al (2012), Pettit et al (2010), Peck (2005), Cranfield (2002)
	Collaborative information exchange	Pettit et al (2010), Ponomarov & Holcomb (2009)
C5. Adaptability	Process Improvement, Lead time reduction	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009), Sheffi & Rice (2005), Christopher & Peck (2004), Cranfield (2002)

Capability Category	Supply Chain Capability Factors	Sources
	Seizing advantage from disruptions	Pettit et al (2010), Sheffi & Rice (2005)
	Alternative technology development	Pettit et al (2010), Ponomarov & Holcomb (2009), Peck (2005)
	Learning from experience, Reengineering	Chowdhury et al (2012), Pettit et al (2010), Sheffi & Rice (2005), Peck (2005)
C6. Anticipation	Monitoring early warning signals	Chowdhury et al (2012), Pettit et al (2010), Sheffi & Rice (2005), Peck (2005)
	Forecasting	Chowdhury et al (2012), Pettit et al (2010), Blackhurst et al (2008)
	Deviation, Near-miss analysis	Pettit et al (2010), Sheffi & Rice (2005), Peck (2005)
	Contingency planning, Preparedness (Training/ Exercise plans)	Pettit et al (2010), Ponomarov & Holcomb (2009), Sheffi & Rice (2005)
C7. Recovery	Crisis management	Pettit et al (2010), Sheffi & Rice (2005), Cranfield (2002)
	Resource mobilization	Pettit et al (2010)
	Consequence mitigation	Chowdhury et al (2012), Pettit et al (2010)
C8. Dispersion	Distributed decision-making	Pettit et al (2010), Sheffi & Rice (2005)
	Distributed capacity & assets	Pettit et al (2010), Sheffi & Rice (2005), Cranfield (2002)
	Decentralization of key resources (including data)	Pettit et al (2010), Sheffi & Rice (2005)
	Geographic dispersion of markets	Pettit et al (2010)
C9. Collaboration	Communications - internal, external	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009), Blackhurst et al (2008), Sheffi & Rice (2005), Peck (2005), Cranfield (2002)
	Postponement of orders	Pettit et al (2010)
	Risk sharing with partners	Chowdhury et al (2012), Pettit et al (2010), Ponomarov & Holcomb (2009)

Capability Category	Supply Chain Capability Factors	Sources
C10. Market position	Market share	Chowdhury et al (2012), Pettit et al (2010)
	Brand equity	Pettit et al (2010)
	Customer relationships	Pettit et al (2010), Ponomarov & Holcomb (2009)
	Customer communications	Pettit et al (2010), Ponomarov & Holcomb (2009)
C11. Security	Access restriction	Pettit et al (2010), Sheffi & Rice (2005), Cranfield (2002)
	Employee involvement in security	Pettit et al (2010), Sheffi & Rice (2005)
	Cyber-security	Chowdhury et al (2012), Pettit et al (2010), Sheffi & Rice (2005)
C12. Financial	Insurance	Pettit et al (2010)
strength	Portfolio diversification	Pettit et al (2010)
	Financial reserves & liquidity	Pettit et al (2010)

3. Conceptual Framework

The factors discussed above are conceptualised in Figure 6 below. The conceptual framework shows the overall links between the key issues discussed in the literature review. The upper part of the conceptual framework represents the phases identified in the disruption management literature, and the lower part represents the factors identified from the supply chain resilience literature. The interactions between these two parts are represented explicitly in the framework.

It is evident in the literature that in order to develop resilience, a supply chain needs certain capabilities to respond to the vulnerabilities it is facing. For example, referring to Figure 6, « increasing flexibility in production » (capability) can reduce the supply chain's vulnerability to « unplanned changes in demand » (vulnerability). Apart from that, the pathogenic influences are also included in the framework. For instance, « the use of conventional tool » (pathogen) can trigger the supply chain's vulnerability to « changes in construction technology » (vulnerability), that in turn can cause « delay in project delivery » (disruption consequence). By tackling these pathogens, the supply chain vulnerabilities can be reduced and the risk of disruptions to occur can be avoided in the first place.

This framework will be a useful guide for the researchers to fulfil the study's aim of building resilience of construction supply chain to disruptions. The framework can also be expanded later on in the study to develop the pathogen mitigations and proactive and reactive capability measures to tackle the supply chain's critical areas of vulnerability.

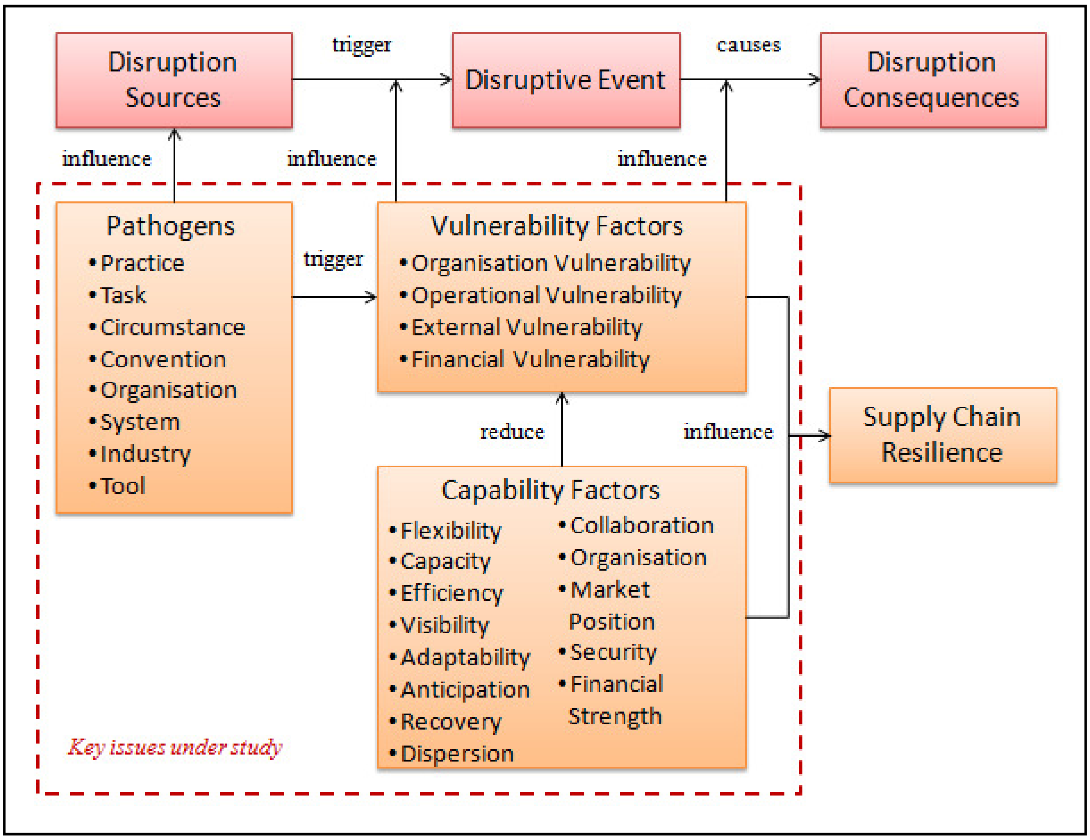

Fig 6. Conceptual framework of the study

4. Conclusion and Future Work

This paper has discussed the relevant link between the disruption management and resilience literature in terms of how building resilience to disruptions can help supply chains to adapt, survive and grow in the face of disruptions. To date, there is still a gap in the literature on how supply chain in the construction industry can build resilience to disruptions in projects. By analysing the vulnerability and capability factors and by bringing the pathogenic influences into the study, the level of supply chain resilience can be assessed in a different approach, hence providing significant new knowledge to the existing construction and resilience literature. Future work of this study will include assessing the factors identified in this paper in the Malaysian construction industry context, in the effort to build supply chain resilience to disruptions.

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Waste Factors Impacting on Delivery Cost Performance of Design and Build Low-cost Housing Projects in Nigeria

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Abstract:

The Design and Build (DB) procurement strategy has been described, severally, as the strategy of choice in the delivery of Low Cost Housing (LcH) projects in Nigeria, occasioned by its reputation for enhanced cost reduction. However, the inability by the client organisations and developers alike to deliver affordable LcH in Nigeria has attracted renewed scrutiny into the efficacy of this procurement strategy. Surprisingly, such scrutiny has failed to examine the various waste factors which may be responsible for the high delivery costs experienced on such projects. Therefore, it has become imperative that such waste factors be identified. Extant literature has highlighted the relationship between waste factors and delivery cost within the realm of building projects generally but with little emphasis on Design and Build Low-cost Housing (DBLcH) projects particularly in Nigeria. It is the purpose of this study to identify the waste factors significantly impacting on the delivery cost performance of DBLcH Projects. Adopting an exploratory sequential mixed method design, an extensive review of literature was conducted and employing content analysis, 50 waste factors across various construction projects were identified. The factors were classified according to the stages where they originate, namely; design, pre-construction and construction and presented to DBLcH projects experts for validation through questionnaires. The emerging data was analysed using appropriate statistical analytical techniques. Findings revealed that waste factors originating from the design stage possessed the most significant impact upon delivery costs performance of DBLcH projects. It is hoped that the waste factors identified through this study provides a platform that would engender the development of appropriate contemporary approaches towards effective cost management within the context of DBLcH project delivery in Nigeria.

Keywords:

Cost performance, Design and Build, Low-cost housing Delivery project, waste factor

1. Background

LCH are defined as housing designed and constructed to be affordable for the population set within the low and middle incomes. The evolution of Low Cost Housing (LcH) policies across the globe can be traced to the intervention of successive governments towards addressing housing challenges (UN, 1945 cited in Federal Ministry of Land Housing and Urban Development (FMLHUD), 2012; Un-Habitat 2011). In Nigeria, such policies are targeted at delivering housing affordable to meet the basic needs particularly of the low and lower-middle incomes in the country for which the development of LcH projects form a apart (FMLHUD), 2012). Therefore, Low cost housing projects in Nigeria are characterized by 1-3 bedroom prototype mass housing, achieved by meeting certain criteria within regulated basic specifications in terms of size, aesthetic design, quality and at affordable costs.

Apparently in a bid to provide LcH to the target beneficiaries, collaborations between government and private sector developers under the DB procurement strategy have been initiated and stimulated. This is owing to the well voiced benefits of the strategy particularly as it pertains to project cost and time reduction (Mohammed & Dahiru, 2012; Idaike et al., 2015). However, over the past decade, it would appear, that such DBLcH projects are characterized by poor delivery cost performance (Akinde, 2012; Taiwo & Olotuah, 2013) (See Figure 1, where £1= ₦303.00 April, 2015 exchange rate).

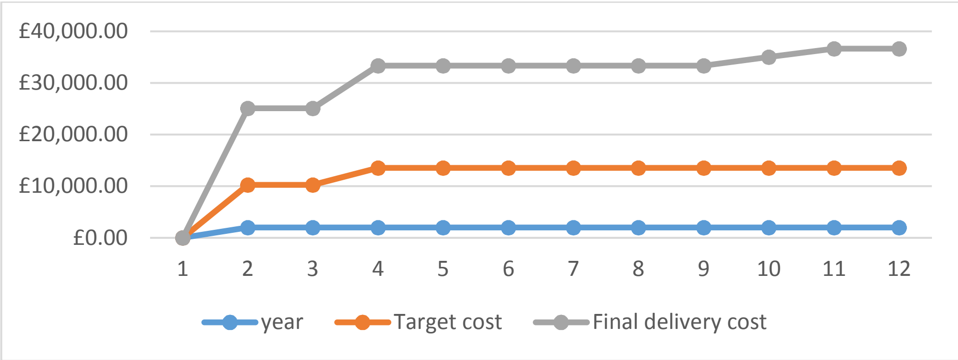

Figure 1.Trend of Target and Final Delivery Cost of DBLcH in Nigeria
Source: Adapted from Akinde (2012)

At such, many Low and Low-medium income group seem to be pressured to the brink of seeking substandard and slum accommodations because of the inability to afford the high costs of such houses delivered (Makinde, 2014). According to a report by Okonjo- Iweala, (2014) the delivery costs of many of such projects in Nigeria are higher and more expensive when compared to other peer nations. The report revealed that the project costs of such houses are 28 and 50 percent higher in comparison to like projects in South Africa and India respectively. Consequently, this trend have attracted increased inquest into the inability of client organisations (Government agencies) and DB contracting organisations as well as the efficacy of the DB procurement strategy to deliver LCH at affordable costs. Surprisingly, there are only quite a few of such investigations focused on identifying waste factors that may be responsible for the high delivery costs experienced in the projects.

Based on the presumptions that improving the delivery performance of DBLcH projects particularly in a country like Nigeria is very essential towards realizing the National Housing policy objectives on affordability and increased LcH housing supply. It is imperative to identify the waste factors significantly impacting on the delivery performance of DBLcH projects in Nigeria, and this is the purpose of this study. It is presumed that such identification would provide a veritable platform for the development of contemporary approaches towards achieving effective cost management of DBLcH and generally LcH projects in Nigeria. This paper therefore presents the questionnaire findings identification of the waste factors significantly impacting on delivery cost performance of DBLcH projects from project team (client, contracting and consultancy organisations) involved in such projects. The following sections of the paper reviews extant literature on areas of DB procurement strategy in LcH project delivery and the concept of waste factors. The adopted methodology is discussed afterwards followed by the data analysis. The emergent findings are then discussed and the paper concluded.

2. Literature Review

2.1. Design and Build Procurement Strategy in Low–cost Housing Project Delivery

Delivery performance on Construction projects including LCH projects have mainly been centered on the basic criteria of cost, time and quality (Oladapo 2001; Hwang & Lim, 2013). Therefore in achieving such project delivery performance criteria, optimizing appropriate procurement strategies is necessary (Daniel, 2006) but sadly, In Nigeria, procurement of projects within these constraints has continued to be a challenge to the design team, the contractors, and managers of investments alike(Idiake et. al., 2015). In Nigeria, LcH project delivery within the confines of cost time and quality are paramount is a major criteria for project performance particularly towards realizing the objective of affordability as promulgated in the Nigerian Housing policy. In view of this, government and private sector developers have engaged in collaborative efforts which have engendered the influx of various procurement strategies, besides the hitherto prevalent design bid build strategy (Babatunde, Opawole & Ujaddighe, 2010). Amongst such strategies adopted in such project delivery is the DB.

The DB is a procurement strategy according to Walker and Rowlinson (2008) is identified as an integrated system whereby a client contracts a DB organisation to manage both the design and construction process as a single point of contract. Thus the contractor is responsible for the development of full working design, obtaining statutory approvals and finally construction for a lump sum (Masterman, 2002). Although there are variants of this strategy, it is not considered within the scope of this paper. Various studies such as Chan (2000), Moore and Dainty (2001), and Hale, Shrestha and Gibson (2009) have highlighted several advantages of the DB particularly towards; the facilitation of cost and time reduction of the overall project. Eriksson (2010) further identified this strategy as an offspring of lean construction core elements. Thus, an increase level of client-contractor relationship throughout the project duration is achieved towards maximizing value and reducing cost. This is based on its process integration overlapping design and construction.

Similarly the delivery process of DB construction projects in Nigeria involves an early contractor involvement at the early in the design stage commissioned to develop full designs and execute the actual construction of the project. On LcH project delivery, such projects are initiated by the government at federal and state level hinged on the National Housing policy. Government parastatals (housing authorities and ministries) are commissioned at the state and federal levels to acquire, map out land for development and prepare conceptual brief based on the requirements as established in the housing policy. Thereafter, DB contracting organisations are engaged under a memorandum of agreement to fully develop designs and see to the practical construction of the project up to handover (FMLHUD, 2012; Gemade, 2012). Studies by Oladinrin, Olatunji and Hamza (2013) and Idiake (2015) on DB projects delivery in Nigeria have espoused on the improved delivery performance on such projects in comparison to other procurement strategies. However, they have also identified some challenges affecting its efficacy particularly within the confines of cost. Apparently Akinde (2012) have identified one of such challenges as construction waste incurred in the delivery of the projects.

2.2. The Concept of Waste and Lean Construction

According to views espoused by Josephson and Saukkuriipi (2007) waste is one major factor significantly impacting on a project's overall delivery cost. Serpell and Alarcon (1998) defined waste as any construction process or activity that incur cost but do not directly or indirectly add value to the construction projects. Tersine (2004) in similar context described waste to include undesirable time, money and/or resources consumed with non-value- addition to the product from the perspective of the client. In Lean construction philosophy waste is described as any inefficiency requiring increase in the use of project resources than those considered necessary in the production of a building without creating value to the client (Koskela, 1992; Aziz & Hafek, 2013). Thus, it can be deduced from these definitions that poor project cost performance is also a product of waste. Therefore within the context of this paper, any direct or indirect action within the project delivery process that results in additional cost above the minimum that would have been required to deliver the project is referred to as waste.

Previous studies such as Liker (2004) and Formoso et al. (1999) have highlighted waste types that occur on building projects namely; defects, waiting time, unnecessary inventory, unnecessary movement, unnecessary transport, overproduction and unnecessary processing waste and “others” which implies waste of any nature different from the listed types. Drawing from such literature, Akinde (2012) apparently identified some waste types on DBLcH projects delivered in Nigeria.

One of the core elements of lean construction is hinged on waste elimination towards improved project delivery cost performance. Lean construction is the term used to define the application of lean thinking to the design and construction process creating improved project delivery to meet client needs and improved efficiency for constructors (Lean Construction Institute UK, 2015). The concept of waste reduction/elimination in contemporary lean construction is holistic throughout the whole project delivery process (Hines, Holwe & Rich, 2004). Thus, identifying waste the causes of waste is a potential impact towards its elimination to achieve construction cost effectiveness.

2.3. **Waste Factors on Construction Projects**

Over the past decade, there has been generic identification of factors across various construction projects, in developed, developing countries and Nigeria causing waste. Some identified waste factors from previous studies are shown in Table 1. This is has been set out to identify and understand the root causes of waste on the projects. It would however appear, that there is a paucity of literature within the context of Low cost housing project delivery and particularly in DBLcH project delivery in Nigeria. Furthermore, the level of impact of such identified waste factors on project delivery cost are not standardised and as such will vary in different contexts, projects or regions. Therefore, the information accruing from the aforementioned studies on waste factors provides a platform for this study to actualise its objective.

Table 1: Waste factors identified from publications

Waste factors	Sources
Design-related	
Errors in design and specification	[3], [4], [5], [8], [14], [18]
Design Changes	[1], [2], [3], [4], [6], [18]
Designers lack of experience	[3], [5], [9], [13], [18]
Poor coordination and communication	[9], [12], [14], [18]
Last minute changes in client requirements	[1], [6], [18]
Delay in drawing revision and distribution	[6], [18]
Selection of low quality materials	[17], [18]
Time constraint	[6], [17]
Available market Standard sizes; Designers unfamiliarity with alternative products	[3],[18]
Poor consideration of site conditions	[10]
Preconstruction-related	
Method of tendering adopted; Incomplete contract documents	[3], [6]
Errors in cost/ quantities estimates	[14], [18]
Procurement system adopted	[11]
Type and form of contracts adopted	[6],
Construction related	
Poor supervision; Poor Site Management	[1],[4],[9],[6],8],[13],[15], [17], [18]
Rework; variations	2],[5],[8],[10],[12],[14],[18]
Inadequate work planning and scheduling	[2],[4],[5], [9],[15],[18]
Incompetent subcontractors	[2],[5],[8],[13],[15],[18]
Poor communication and coordination	[7], [14], [8], [12], [18]
Inclement Weather conditions	[4], [6], [7], [14]
Poor access road	[6], [12], [18]
Incompetent labour	[15],[17],[18]
Inadequate equipment	[2],[5],[18]
Material ordering errors; supplier errors; Lack of material management system; Waste from overproduction	[3], [6],[18]
Over allowances of project resources	[3], [18]
Contractors negligence	[16], [18]
Insufficient and slow information flow	[7], [18]
Delivery methods; Material damage from transportation; Inappropriate material storage; Poor quality materials; poor material handling	[17],18]
Mistakes during construction	[15], [18]
Unforeseen ground conditions; Vandalism and burglary	[5], [18]
Time pressure to complete work	[5]

Source: Compiled by Author from [1]Poon, Wong, and Cheung (2004); [2]Polat and Ballard (2004), [3]Kulathunga et al. (2005), [4]Faniran and Caban (2007), [5]Nazech, Zaldi and Trigunarsyah (2008), [6] Osmani, Glass and Price (2008), [7]Senaratne and Wijesiri (2008), [8]Wang, Kang and Tam (2008),[9]Wan, Kumaraswamy and Liu (2009),[10]Al-Hajj and Hamani(2011),[11]Gamage (2011), [12]Llatas,(2011), [13] Lu,Yuan, Li, Hao, Mi, and Ding(2011), [14]Wahab and Lawal (2011), [15]Nagapan, Rahman, Asmi, Hameed and Zin (2012), [16] Ahankoob, Khoshnava, Rostami and Preece(2012),[17]Kareem and Pandey (2013), [18]Adewuyi and Otali (2013).

3. Methodological process

Drawing from views espoused by Creswell, (2015) an exploratory sequential mixed method design was employed to collect and analyse data presented in this paper. The findings from the first qualitative phase informed the procedure in the second quantitative phase. The qualitative phase involved a search in abstracts of articles using primary key words comprising of *waste*, *construction*, *building,* and *projects* across Scopus and Google Scholar electronic data bases, dated between January, 2004 and December, 2013. Eighteen commonly cited publications were purposively selected based on the comprehensiveness of the listed waste factors inherent. Subsequently, fifty (50) waste factors were identified employing content analysis and were used to develop the questionnaires arranged on a 5 - point Likert scale. The 5 point Likert scale was adopted because it allows useful choices to be selected from the listed answers (Tourangeau et al 2000).

In the quantitative phase, four questionnaires each were distributed to fifty-seven (57) purposively selected organisations comprising of government housing authorities/Corporations, Consultancy and DB contracting organisations targeting, project managers, quantity surveyors and designers who are presumed to possess the requisite knowledge as it pertains to delivery cost performance of such projects. This was due to the lack of a well-articulated database of key organisations involved in DBLcH projects. So the researchers employed experiential knowledge and publicly available information on completed LCH projects within the past decade situated in the South East zone of Nigeria. The selection of the South East geopolitical zone of Nigeria was hugely premised on the prevailing housing situation and its position as a flagship (pilot) for government intervention in the LCH provision. It is presumed that any innovations introduced within the zone as it concerns LCH project delivery can be easily generalised to other zones of the country. Respondents were asked to rate the level of impact of the identified waste factors on delivery cost performance of DB LcH projects and provide other waste factors not captured in the questionnaire relative to such projects. The Weighted Average mean score (WA) across the group was used to determine and rank the level of significant impact of such factors identified by respondents. A decision rule that WA of factors within 3.5 – 4.49 was high impact and 4.5 – 5.0 very high impact was adopted. Therefore any factor whose WA falls within the range is regarded significant. Kruskal-Wallis Test was also conducted to determine any significant differences in the perception of the different groups of respondents on the waste factors significantly impacting on delivery cost performance of DBLcH projects in Nigeria.

4. Data analysis

4.1. Questionnaire Distribution and Response Rate

Table 4 shows the analysis of the Questionnaire Distribution and Response Rate. A total of 220 questionnaires were distributed (Client 24, Consultancy 52 and contracting 47) and 123 returned questionnaires were used for the analysis. This represented a total response rate of

55.91 percent and a reliability test of responses using Cronbach alpha yielded an acceptable co-efficient of 0.77.

Table 2: Summary Questionnaire Distribution and Response Rate

	Organisation	Distributed Questionnaire	Returned Questionnaires	Response rate (%)
1	Client	40	24	60
2	Consultancy	112	52	46.43
3	Contracting	68	47	69.12
		220	123	55.91

4.2. Length of Experience on DB Low-cost Housing Project Delivery

The analysis of the data in the pie chart as shown in Figure 2 revealed that 64 percent of the respondents and their organisations had over 10 years' experience in the delivery of DBLcH projects as shown. The relevance of investigating their length of experience gives a clear picture of their level of involvement and influence on such projects. This is needful to support that the data they provided were reliable, credible, coherent, consistent and can be used for further analysis.

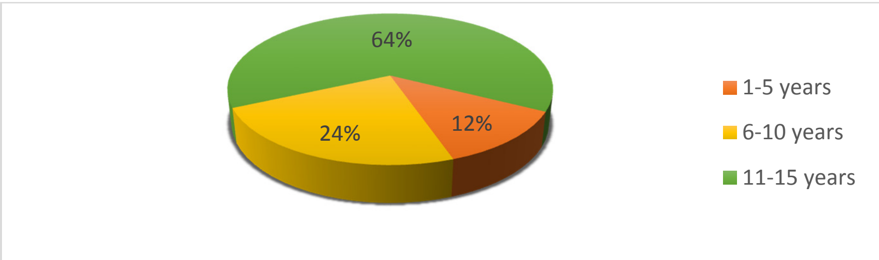

Figure 2. Respondents Years of Experience

4.3. Waste factors Originating stages

Figure 3 shows the Group weighted average mean score (GWA) from where significant waste factors originate in DBLcH project delivery. The three stages include; design, preconstruction and construction.

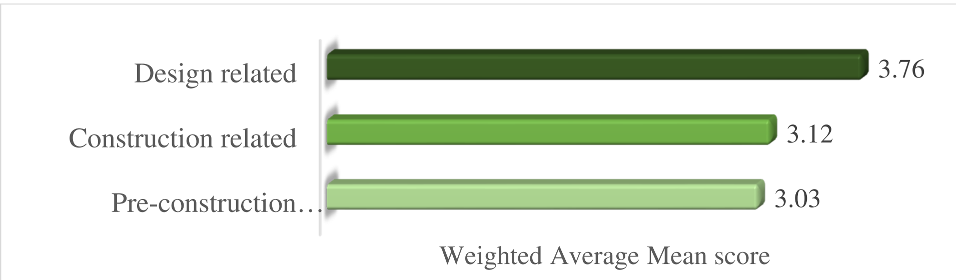

Figure 3. Summary of Survey results on Waste Factors Originating Stages

Assessing the identified waste factors based on these stages, it was discovered that the design stage ranked highest with a group weighted average mean score of 3.76 followed by construction with 3.12 and the Preconstruction ranking least with 3.03.

Within these stages, a total of forty six (46 Nr) waste factors were identified contextual to DB LcH project delivery. Thirteen (13 Nr) waste factors were design-related, eight (8Nr) pre-construction and twenty five (25 Nr) construction-related. Further detailed analysis on individual impact of the various waste factors originating from each stage impacting on the delivery cost performance on such projects are further presented and discussed.

4.4. Design related waste factors

Figure 4 presents the weighted average mean score on the design related waste factors impacting on the delivery cost performance of the projects. The analysis shows that uneconomic designs and specifications ranked highest with weighted average of 4.76 while limited time allowance for design ranked least with weighted average of 2.54.

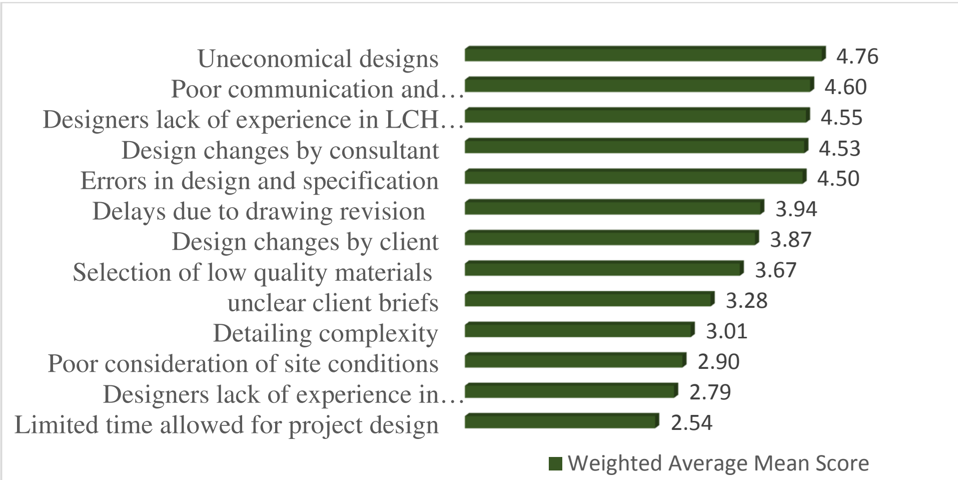

Figure 4. Summary of Survey results on Design-related Waste factors

4.5. Preconstruction-related waste factors

Figure 5 presents the weighted average mean scores by the respondents on the preconstruction-related waste factors impacting on the delivery cost performance of DBLcH projects.

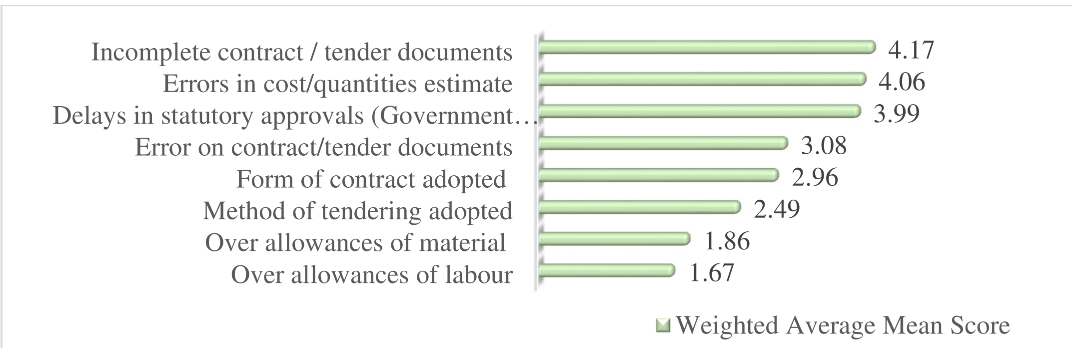

Figure 5. Summary of Survey results on Preconstruction-related waste factors

The analysis shows that incomplete contract / tender documents ranked highest with weighted average of 4.17 while over allowances of Labour quantities in estimates ranked least with weighted average of 1.67

4.6. Construction-related waste factors

Fig 6 presents the weighted average mean scores on the construction-related waste factors impacting on the delivery cost performance of DBLcH projects. The analysis shows that poor supervision ranked highest with a weighted average of 4.65 while inadequate equipment ranked least with weighted average of 1.77

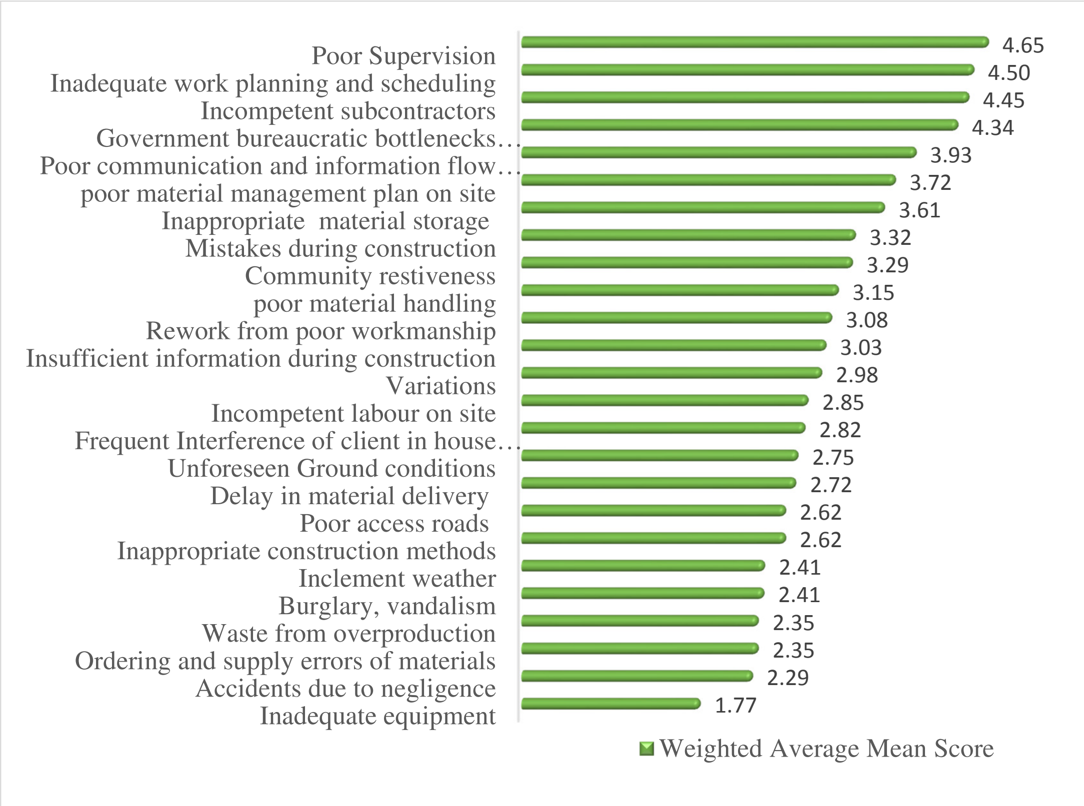

Figure 5. Summary of Survey results on Construction-related waste factors

4.7. Kruskal-Wallis Test on ranking of waste factors by different group respondents

Further analysis using the Kruskal-Wallis Test revealed that most of the waste factors impacting on delivery cost performance on such projects had a p-value > 0.05. Therefore, it can be deduced that there were no significant differences in the ratings (Mean scores) among the three responding groups.

5. Discussion of Findings

The findings of the study emanating from Fig 3 revealed that the design stage was ranked most significant stage generating waste factors affecting the project delivery cost performance. This is in agreement with findings by Osmani et al. (2008) and Gamage (2011) on DB construction projects. Similarly from Figure 4-6, seven (7 Nr) very highly significant waste factors impacting on the delivery cost performance on the projects are highlighted across the three stages. These waste factors are predominantly design and construction related and include; uneconomic design (4.76), poor supervision (4.65), poor communication and coordination amongst the project team members during design (4.60), Government bureaucratic process for design approvals (4.55), designers lack of previous experience in LCH projects(4.53), design changes by Client (4.50) and finally inadequate project planning and scheduling (4.50). This corroborates findings on significant waste factors by Osmani, Glass and Price (2008) and Adewuyi and Otali (2013) in the Nigerian context on design changes and uneconomical designs, Nagpan et al. (2012), Lu et al. (2011) and Wang et al. (2008) on Poor supervision, Alwi et al. (2002) and Nagpan et al. (2012) on inadequate planning and scheduling and Muhwezi et al. (2012) on poor communication and coordination. However, Government bureaucratic process for design approvals and designers lack of previous experience in LCH projects were emerging findings from the study relative to DBLcH projects based on the perception of the client, contracting and consultancy organisations involved.

Therefore it can be deduced based on these findings from the study and previous studies as documented in this paper that without the elimination of such waste factors as identified, it is apparent that improvement of cost performance on such projects may not be achieved.

6. Conclusions and Recommendations

Having identified that construction waste is one challenge also affecting DBLcH project cost performance in Nigeria (Akinde, 2012), this study set out to identify contextualized waste factors significantly impacting on delivery cost performance of DBLcH projects. This is based on the Lean construction concept that waste cannot be eliminated when the causes have not identified. Through an exploratory sequential mixed method design this paper revealed forty-five (45 Nr) waste factors impacting on DBLcH project delivery cost performance. Amongst these factors, Five (5Nr) design related and two (2 Nr) construction related waste factors had very high impact on the project delivery cost performance. The study also highlighted Government bureaucratic process for design approvals and designers lack of previous experience in DBLcH projects as emerging findings from the study with very high significant impact on the project delivery cost.

Based on these findings, it is recommended that effective cost management should be focused primarily at the design stage towards the improvement of the delivery cost performance on such projects. It is expected that the project team effectively collaborate to arrive at cost effective designs as well as the contractor ensuring effective supervision and project planning during construction. Where possible, proactive counter-measures against the origination of waste factors on the project should span from design through construction.

Finally, identification of waste factors cannot be all exhaustive. Given larger sample of respondents across varying zones such peculiarities may further highlight relative factors following contemporary trends. However, this paper has made some significant investigations by identifying waste factors from a generic view point and contextualizing such in DBLcH project delivery in Nigeria. This provides a platform for future research towards developing appropriate contemporary approaches for effective cost management of LCH project delivery within the south east zone and in Nigeria at large.

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Quantitative Impact of Major Modifications to Standard Contractual Forms in Construction Projects- The Middle East

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Abstract

Despite the fact that there exists several construction forms of contract that aimed at standardizing the contractual clauses in relation to the construction industry, the adoption of the same was being subject to major modifications and alteration endangering the overall spirit and consistency of the contractual forms.

Within the construction industry many parties are involved in projects. Those parties do mainly include the Client and the Contractor, in addition to the Project Manager, Project Consultant(s), Subcontractor(s) and Suppliers. Hence, Contracts needs to be customized, agreed, and signed to formalize parties' relationships. Knowing that the Middle East region is, and will be, subject to major construction projects during the upcoming years, it is of major importance to understand the nature of Standard Contractual forms being used and the modifications that are being introduced noting that well configured contractual clauses would play major role in simplifying part of the complexity associated with the construction environment.

The problem is that if the contractual clauses were not drafted responsibly or modifications to Standard forms were introduced without proper reasoning, contracts negotiation and signature would be a time consuming challenge and would take considerable time from the total originally allocated for the project. Furthermore, the project parties would be focusing on the contractual aspects, governing the project, leading to more claims i.e. fertile ground for contractual disputes, rather than technical and execution issues which would eventually flag hindrance in the project original schedule and certainly an escalation to the project original budget notwithstanding the project works atmosphere. The above issues represent a challenge to any responsible project party whose aim is to have his project executed noting the given time frame and allocated budget constraints.

This paper focuses on the major modifications introduced to one of the mostly being used standard contractual form for the past 10 years in the Middle East, the Conditions of Contract for Works of Civil Engineering Construction (Red Book 4th Edition 1987) one of the FIDIC Forms of Contracts, and it shows the impact and effect that the projects are experiencing due to the said major modifications as relayed through major industry practitioners. Of course, semi structured interviews and special tailored questionnaire surveys are the key to reveal how the major modifications would influence projects. The being assessed impact of the major modification to the standard conditions is presented in a quantitative way as they do relate to project duration and project cost.

Keywords:

Contract, Construction, Middle East, FIDIC, Modification

1. Introduction

The contractual relationship is formed by the arrangement of a contract. The contract defines for the construction parties the baseline of understanding of the offer, acceptance, and consideration agreed upon for a project.

The General Conditions of Contract are of major importance since the same do play a main regulatory role at the various project interfaces during project execution. Those general conditions need to be given proper attention in order to be properly tuned during project award through its corresponding Particular Conditions of Contract.

Particular Conditions are introduced, as per FIDIC Fourth Edition reprint 2011, for the following reasons:

1. Where the General Conditions of Contract requires further information to be included in the Particular Conditions without which the conditions are not complete.
2. Where the General Conditions of Contract requires supplementary information to be included in the Particular Conditions without which the conditions would still be complete.
3. Where the locality and circumstances of the scope of works necessitate additional clauses to the General Conditions of Contract.
4. Where the law of the country in which the works to be executed necessitates introducing modifications to the General Conditions of Contract.

If the particular contractual clauses were not drafted responsibly, or falsely tuned, Contracts, even those with Standardized general conditions, negotiation and signature would be a time consuming challenge and would take considerable time from the total originally allocated (Tatarestaghi, 2011).

During project execution, the problem may become worse and modifications if not responsibly introduced would lead to claims that are considered as a fertile ground for contractual disputes (Murdoch and Hughes, 2008).

The aim of this paper is to present the impact of large modifications to one of the mostly being used standard contractual form for the past 10 years in the Middle East, the Conditions of Contract for Works of Civil Engineering Construction (Red Book 4th Edition 1987) one of the FIDIC Forms of Contracts, and it shows the effect that the projects are experiencing due to the said modifications within the Middle East Area.

This paper is structured as follows: firstly, some essential background information that would assist in overviewing the construction industry in the Middle East also would assist in better understanding the Standard General Conditions of Contract. Secondly, the research method used for the paper is explained. Finally the Research findings are presented with the way forward.

2. Background Information

2.1. Overview of the Construction Industry in the Middle East Region

The Middle East region connects the continents of Africa, Asia, and Europe. The definition of the countries forming the Middle East is not well defined to the extent that not everyone agrees as to what countries can be labeled "Middle Eastern”. The countries that are normally referred to being middle Easterns are: Bahrain, Cyprus, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia KSA, Syria, the United Arab Emirates, and Yemen (Gunderson 2003).

Comprising some of the spectacular skyscrapers to artificial floating island homes, state of the art large retail malls, major residential and commercial developments, the construction industry continues to remain at the top of Middle Eastern countries agenda in their quest to create an alternative to the predominantly oil based economy. During the third quarter of 2011, the value of construction contracts awarded reached USD 36.78 billion awarded in the second quarter of the same year (Ventures Middle East, 2011).

To identify the distribution of construction projects by countries, Figure 1 indicates Projects by Country and Status of Construction.

From a different perspective, within the Middle East region, the construction market in Saudi Arabia comprises the largest construction market with multibillion dollar projects under way and many more being still in the planning stage by the private and public sectors, (Mohammed Al-Nagadi, 2011), which is in line with Figure 1.

During 2011, the Saudi Arabia's construction sector indicated a double digit growth of 11.6% in 2011 if compared to 7.8% in 2010, (Bank Audi Saradar, 2012), reflecting a positive increasing trend in the construction market which implies additional use of construction contracts and imposes additional challenges to the contractual forms. A major key driver in Saudi Arabia's construction industry is the shortage of supply and escalating demand in the housing market. In March 2011, King Abdullah released a plan to build 500,000 affordable homes within the Kingdom worth US$ 66.7 billion (Bank Audi Saradar, 2012).

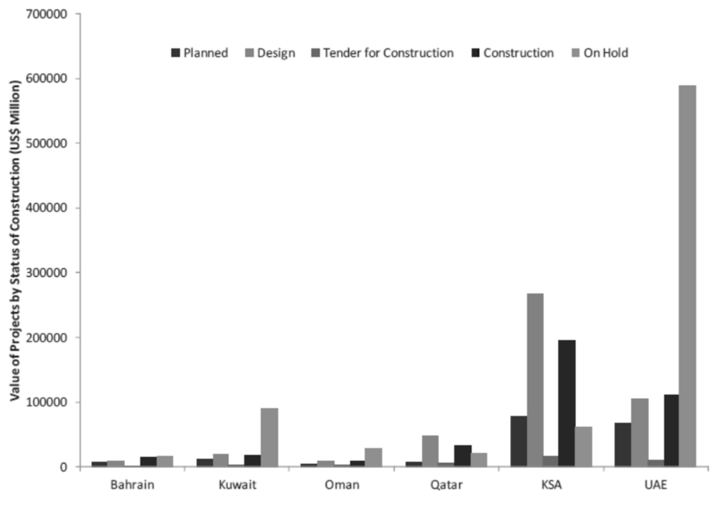

Figure 1: Projects by Country and Status of Construction (US$ Million) September 2012 (Ventures Middle East, 2012)

Another new dimension added to Saudi Arabia construction projects is the concept of economic cities with currently four are being constructed (King Abdullah Economic City, Jazan Economic City, Prince Abdul Aziz Bin Musaed Economic City, Knowledge Economic City being) with a value of around USD 50 Billion, and two More under the design and planning stage (North Economic City, Easter Province Economic City) (Saad Al Adhami, 2011).

2.2. What is “General Conditions of Contract”?

Within the construction industry many parties are involved in projects. Those parties do mainly include the Client and the Contractor, in addition to the Project Manager, Project Consultant(s), Subcontractor(s) and Suppliers. In order to progress the proper project construction delivery on time, budget and quality (Project Management Institute, 2008) those parties need to be working in a certain close regulated manner to ensure the processes, and procedures are adhered to within the construction industry. In this regard, Contracts needs to be customized, agreed, and signed to formalize parties’ relationships.

A Contract is “An agreement between two or more parties creating obligations that are enforceable or otherwise recognizable at Law” (Garner, 1995, p. 215). There are various types of construction contract. The choice of contract type depends on the project procurement methods designed to serve the project objectives and the existing constraints such as different ways of handling risk transfer, pricing, responsibility for performance, complexity, and cost certainty.

A prerequisite requirement for the signature and execution of a contract, amongst other things, is the general conditions that all the parties to the contract need to agree upon (Tataresttaghi, 2011). “The General Conditions of Contract are general terms on which a corporation procures its resources or, contracts with other corporations” (Pathak, 2010, p. 52).

Accordingly, the General Conditions of Contracts are niched in the contracts between the owner and the general contractor, the owner and the designer, the owner and the supervisor, the owner and the professional construction manager, and between the general contractor and the subcontractors depending on the project stakeholders and the situation at hand (Sutt, 2011).

2.3. Why the “Standard General Conditions of Contract” Use Do Worth Investigation?

The General Conditions of Contract are as significant to the management and progress of construction projects and the profitability of the construction industry, as are accurate schedules, reliable equipment, and quality materials. Accordingly, adequately configured contractual clauses would play major role in simplifying part of the complexity associated with the construction environment (Cushman and Cook, 1995) this is one of the reasons behind the effort in establishing Standards General Conditions of Contract.

Standard General Conditions of Contract (Standard Form of Contract) in construction are being introduced with the major advantage of establishing the same understanding of conditions between actors in a project hence reducing valuable time spent on understanding the Conditions during individual negotiations. The advantages Standard Form of Contract are not limited to the above; in fact other advantages do exist (Shnookal, 2010):

1. Since Employers, Engineers and Contractors most probably have used such contractual form, this means that they are familiar with their rights and obligations that are enclosed in the said form of contract. Accordingly, efficiency in contract administration is greatly improved. The importance of the same is highly obvious in international contracting where communication is relatively difficult and there is high probability of misunderstandings.
2. Since the Contractors are familiar with the Standard form in terms of risk allocation, the cost of tendering (on contractors) is normally reduced as Contractors understand that there is no hidden risk which may be the case when exploring terms that they are not

familiar with. The cost of the same shall be reverted back to the Employers once a contract is entered.

3. "Standard forms do present an impartial starting point from which the parties can negotiate from" (Shnookal, 2010); the parties are familiar with the Standard form, the cost of negotiating the contract conditions is reduced since potential areas of disagreements within the terms are reduced keeping the Standard forms as benchmarks.
4. It is likely that the tender price be less for Standard forms since Contractors do not have to add the price of unforeseen risks that they are not familiar with or do not usually need to assume.

In order to shed further lights on the importance of the Standard General Conditions of Contract, it is worth to examine the content of typical Standard General Conditions of Contract to understand the extent of issues regulated by these conditions. For instance, and as per the Conditions of Contract for Construction For Building and Engineering Works designed by the Employer (FIDIC 1999, Red book), one of the Fédération Internationale Des Ingénieurs-Conseils (FIDIC) Conditions of Contract publications, the said conditions do regulate, as example: General Provisions, The Employer's Role, The Engineer's Role, The Contractor's Role, Staff and Labor, Plant, Materials and Workmanship, Commencement, Delays and Suspension, Employer's Taking Over, Defects Liability Period Procedures, Measurement And Evaluation, Variations And Adjustments, Contract Price And Payment Details, Termination By Employer, Suspension And Termination By Contractor, Force Majeure Details, Claims, Disputes And Arbitration Procedures…. Etc. Accordingly, the Standard General Conditions of Contract are of major importance since the same, as proven above; do play a main regulatory role at the various project interfaces during project execution which mandates a particular attention and proper tuning during project award through its corresponding Particular Conditions of Contract.

2.4. **Modifications as "Sources of Disputes"**

It was noted before that if the contractual terms and conditions were not properly considered i.e. any claim may be considered as a fertile ground for contractual disputes (Murdoch and Hughes, 2008). In 2006, Fenn et al Fenn et al developed and published a summary of the studies of the sources of disputes (Fenn et al., 2006) and that his study showed that disputes do relate to contract interpretation, misunderstandings, extension of time, variation to scope, payment, administration, contract terms…. Etc. For instance:

- Lee (1994), noted that unfair contract clauses, vague definition of contract documents in terms of performance period, payment, variations do contribute to disputes arising from contract problem
- Jones (1994), highlighted that inadequate contract drafting is a factor that would contribute to disputes
- Lo (2002), noted that differences in contract interpretation between project parties would lead to construction conflict
- Yan (2002), marked that contractual factors do form one of the sources of dispute.

All four authors did note that the contractual details if not responsibly considered may act as sources of disputes.

2.5. Construction Disputes Observation within the Middle East

According to EC Harris 2013, an International Built Asset Consultancy, the construction disputes in the Middle East are more than double the global average, the same was attributed to the a failure to properly administer the contract, failure to understand and/ or comply with the parties own contractual obligations, its contractual which indicate additional urgency to further investigate the Conditions of Contracts being used (EC Harris, 2013).

3. Research Methodology

Saunders (2009) defined Methodology to be "the theory of how research should be undertaken". Yin (2003) noted that having well designed rigorous methodology "is the logical sequence that connects the empirical data to a study's initial research questions and, ultimately to its conclusions". This paper recognizes that one of the mostly being used standard contractual form, for the past 10 years in the Middle East, is the Conditions of Contract for Works of Civil Engineering Construction (Red Book 4th Edition 1987 reprint 1992) which is one of the FIDIC Forms of Contracts. Consequently, the analysis focuses on the large modification introduced to the Contractual Clauses enclosed within.

Accordingly, the methodology adopted to assess the modifications logic is as follows:

1. Examine and investigate the various particular conditions clauses being introduced and identify the ones that are largely subject to modifications endangering the overall spirit of the original Standard Contract Form. This shall be done through detailed analysis, Content Analysis, aiming at highlighting the contractual clauses that are subject to large modifications through the corresponding particular conditions. The classification is done by considering Modifications Ranking Indicator "MRI" by ranking the contractual clauses modifications on a scale ranging from One to Three;
   - One: being not modified and do not need further analysis.
   - Two: represent minor modification to the Standard Contractual Form: those modifications that do not change the intent of the contractual clause. In fact those modifications that are needed for completeness, clarity, and do reflect project circumstances.
   - Three: represents the contractual clauses that are majorly modified: those modifications that change the contractual clause intent such as full clause deletion, partial clause deletion, modifying responsibilities…etc.
2. Modified Clauses with MRI being 3 are further analyzed through semi structured interviews that are conducted to identify impact the said modifications are creating on per Clause basis. For instance, each of the organizations were asked the following 4 questions:
   - A. Why the specific modification is being introduced?
   - B. What are the implications of such modification?
   - C. What conclusions/ consequences of the modifications can be drawn?
   - D. Any other recommendation concerning the modifications being witnessed

In addition to the above questions, the participants were required to fill two survey questionnaires that would simplify the required input from them at the end of the discussion of every Clause modification within of the semi-structured interview. The two survey questionnaires do relate to project duration and project cost impact. This paper present the average result obtained from the said survey from a Duration and Cost perspectives.

3.1. Data Collection Techniques

This paper considers surveys and semi-structured interviews for data collection. The same addresses key industry players. Surveys and semi-structured interviews were addressed to Contract Administrators, Chief Executive Officers, Lawyers, Quantity Surveyors and Project Mangers. Surveys were used in conjunction with the semi structured interviews at the end of the analysis of every majorly introduced modification.

This paper focuses on the major players in the construction industry within the Middle East region. This is mainly considered because they do represent all points of view within any construction project. Concerning the sample size to be considered, this research covered the three by far largest Middle Eastern contractors, the two by far most spreading engineering consultancy firms, one of the largest project management consultancy services company, and one of the largest dispute and conflict resolution legal firm in the Middle East. The above seven organizations do have a weighing presence within the construction industry in the Middle East and the data obtained from them is expected to be representative and reflects the industry conditions and suits this research objectives.

Table 1: Data Collection Details

	Contract Administrator	Chief Executive Officer	Lawyer	Quantity Surveyor	Project Manager
Organization 1	X				
Organization 2				X	
Organization 3		X			
Organization 4	X				
Organization 5			X		
Organization 6					X
Organization 7	X				

3.2. Data Analysis Techniques

This paper considers ranking the modifications introduced to the Standardized Contractual Conditions into three levels through Modifications Ranking Indicators "MRI", depending on the degree of modifications assessed; One being not modified and three highly modified. Accordingly, each modification was first analyzed from a qualitative point of view and given a certain MRI which would transform qualitative data to quantitative data to be inputted to spread sheets for overall ranking. When the said ranking was set, those with an average MRI being 3 were further analyzed through semi structured interviews that were conducted in order to assess the impact of the said modifications.

4. Research Findings

4.1. Slightly Modified Clauses (Average MRI=2)

As previously discussed, the slightly modified clauses are those clauses whose average MRI were rounded and found equal to 2. Modifications with MRI = 2, indicate that those modifications do not change the intent of the contractual clause, in fact those modifications that are needed for completeness, clarity, and do reflect project circumstances.

4.2. Majorly Modified Clauses (Average MRI=3)

The majorly modified clauses are those clauses whose average MRI was rounded and found equal to 3. The following table, Table 3, indicates the majorly modified Sub-Clauses.

Table 2: Majorly Modified Clauses (MRI=3)

PART I - GENERAL CONDITIONS of CONTRACT	Average MRI
Definitions and Interpretation	
Engineer and Engineer's Representative	
Assignment and Subcontracting	
Contract Documents	
General Obligations	
8.1 Contractor's General Responsibilities	3
10.3 Claims under Performance Security	3
12.1 Sufficiency of Tender	3
14.1 Programme to be Submitted	3
14.3 Cash Flow Estimate to be Submitted	3
Labour	
Materials, Plant and Workmanship	
Suspension	
Commencement and Delays	
47.1 Liquidated Damages for Delay	3
47.2 Reduction of Liquidated Damages	3
Defects Liability	
Alterations, Additions and Omissions	
51.2 Instructions for Variations	3
52.3 Variations Exceeding 15 per cent	3
Procedure for Claims	
Contractor's Equipment, Temporary Works and Materials	
Measurement	
55.1 Quantities	3
56.1 Works to be measured	3

PART I - GENERAL CONDITIONS of CONTRACT	Average MRI
Provisional Sums	
Nominated Subcontractors	
Certificates and Payment	
Remedies	
Special Risks	
Release from Performance	
Settlement of Disputes	
67.1 Engineer's Decision	3
67.2 Amicable Settlement	3
67.3 Arbitration	3
67.4 Failure to Comply with Engineer's Decision	3
Notices	
Default of Employer	
69.1 Default of Employer	3
Changes in Cost and Legislation	
70.1 Increase or Decrease of Cost	3
70.2 Subsequent Legislation	3
Currency and Rates of Exchange	
71.1 Currency Restrictions	3
72.1 Rates of Exchange	3
72.2 Currency Proportions	3
72.3 Currencies of Payment for Provisional Sums	3

4.3. The Impact of the Major modifications on the Project

In order to assess the impact that large modifications have on a given project, Semi Structured interviews were conducted. The impacts that were obtained from the said interviews can be categorized into three groups: time or project duration related impact, cost related impact, and project feasibility impact.

Again, the modifications that were put into discussion within the semi structured interview are those modifications that change the contractual clause intent such as full clause deletion, partial clause deletion, modifying responsibilities, reallocation of risks….etc.

Every major modification was put into discussion through semi-structured interview, then once full understanding of all the said modification circumstances are analyzed, the impact of the same was provided on a per modification per Clause per organization. Tables 3 and 4 represent the average of the same.

The impact being presented in this paper is limited to the Project Duration and Project Cost.

4.3.1. Project Original Duration Related Impact

All seven participants were addressed given the same assumption of typical project duration of three years. Accordingly, the project duration related impact was assessed given the said assumption.

Detailed presentation of the findings in relation to the modification average impact on project duration on a Sub-Clause basis is being presented in Table 3.

As can be seen, the impact of major modifications in relation to project duration cannot be ignored since an additional 14.5 months out of 36 months (being ~40%) of the project original duration is indeed major.

Table 3: Project Duration Related Impact

	Average Project Duration Related Impact
PART I - GENERAL CONDITIONS of CONTRACT	
General Obligations	
8.1 Contractor's General Responsibilities	2 Months
10.3 Claims under Performance Security	0 Months
12.1 Sufficiency of Tender	2 Months
14.1 Programme to be Submitted	4 Months
14.3 Cash Flow Estimate to be Submitted	0 Months
Commencement and Delays	
47.1 Liquidated Damages for Delay	2 Months
47.2 Reduction of Liquidated Damages	
Alterations, Additions and Omissions	
51.2 Instructions for Variations	3 Months
52.3 Variations Exceeding 15 per cent	0 Months
Measurement	
55.1 Quantities	0 Months
56.1 Works to be measured	0 Months
Settlement of Disputes	
67.1 Engineer's Decision	0.5 Months
67.2 Amicable Settlement	0.5 Months
67.3 Arbitration	0.5 Months
67.4 Failure to Comply with Engineer's Decision	0 Months
Default of Employer	
69.1 Default of Employer	0 Months
Changes in Cost and Legislation	
70.1 Increase or Decrease of Cost	0 Months
70.2 Subsequent Legislation	
Currency and Rates of Exchange	
71.1 Currency Restrictions	0 Months
72.1 Rates of Exchange	

72.2 Currency Proportions	
72.3 Currencies of Payment for Provisional Sums	
Total Duration	14.5 Months

4.3.2. Project Cost Related Impact

All seven participants were addressed given the same assumption of typical project cost being 100%. Accordingly, the project cost related impact was assessed given the said assumption.

Table 4: Project Cost Related Impact

	Average Project Cost Related Impact
PART I - GENERAL CONDITIONS of CONTRACT	
General Obligations	
8.1 Contractor's General Responsibilities	2%
10.3 Claims under Performance Security	10%
12.1 Sufficiency of Tender	0%
14.1 Programme to be Submitted	13%
14.3 Cash Flow Estimate to be Submitted	0%
Commencement and Delays	
47.1 Liquidated Damages for Delay	8%
47.2 Reduction of Liquidated Damages	
Alterations, Additions and Omissions	
51.2 Instructions for Variations	4%
52.3 Variations Exceeding 15 per cent	3%
Measurement	
55.1 Quantities	2%
56.1 Works to be measured	0%
Settlement of Disputes	
67.1 Engineer’s Decision	2%
67.2 Amicable Settlement	0%
67.3 Arbitration	1%
67.4 Failure to Comply with Engineer’s Decision	0%
Default of Employer	
69.1 Default of Employer	5%
Changes in Cost and Legislation	
70.1 Increase or Decrease of Cost	2%
70.2 Subsequent Legislation	
Currency and Rates of Exchange	
71.1 Currency Restrictions	3%
72.1 Rates of Exchange	
72.2 Currency Proportions	
72.3 Currencies of Payment for Provisional Sums	
Total Cost	55%

Detailed presentation of the findings in relation to the modifications average impact on project cost on a Sub-Clause basis is being presented in Table 4.

As can be seen, the impact of major modifications in relation to project cost is important and cannot be ignored since such modification would yield 55% increase above the project original targeted cost or budget.

4.3.3. 4Modifications Impact Conclusions

The above two sections showed that the impact of the major modification to sub-clauses is around 40% from a time perspective and another 55% from a cost one. Therefore, and from a cost perspective, project financing and budgeting need to be revisited since such high impact to the project would mandate even full rethink of the project.

From a time perspective, 40% increase in project duration would recommend certainly to revise the construction sequence that would be adopted for the project.

Since the impact of the introduction of the said major modification was proven to be considerable and if the contractors failed in properly assessing the impact of the said modifications, such major modifications would trigger a claiming environment within the project to balance for the improper assessment of the modification which may be aggravated to disputes. This is in line with what was highlighted in sections 2.3 and 2.4 of this paper that disputes do relate to contractual factors such as contract interpretation, misunderstandings, inadequate contract drafting, variation to scope, administration, contract terms….. Etc.

From a different angle, and given the considerable impact (55% + 40%) that the major modifications have on the project, the same may present a sort of validation about what was addressed by EC Harris concerning the fact that the construction disputes in the Middle East are more than double the global average, which was mentioned to be linked to the failure to comply with the parties own contractual obligations.

5. Way Forward

The findings presented in this paper are being further analyzed in a way to understand how to mitigate for the given presented impact; also, the said modifications itself need to be further screened to assess any advantages or positive impact that the same may have. Finally, recommendation in relation to the modifications would be drawn, tested, and formalized.

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The need for Kaizen costing in Indigenous Nigerian construction firms

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Abstract

The application of adequate cost management methods and techniques before and during construction activities is a major determinant of project success. Construction cost management methods such as target costing, life cycle costing, activity based costing and kaizen costing are some of the ways in which a project cost can be effectively managed.

Kaizen is a Japanese word for continuous improvement and it has been used in the Japanese manufacturing sector since the 1960s. This method employs techniques for incremental cost reduction and it is based on Kaizen philosophy and principles. Kaizen costing is a very useful method for post-contract cost control because it is applied during the manufacturing or production stage of a product. This cost control method creates more profit for the manufacturer, provides better quality products and improves customer satisfaction. Kaizen costing is a post-contract cost management method which can be used to increase the competitiveness of a company. This approach can be combined with target costing and other cost management methods for more effectiveness.

This paper focuses on how kaizen costing can be used as a means of overcoming the challenges facing the Nigerian construction firms in terms of cost overrun; project delays and abandonment; inadequate cost control management and improving competitiveness of indigenous construction firms. Based on existing literature, this paper illustrates how kaizen costing can effective contain the challenge of cost and time overrun during construction. The process of using kaizen costing during the construction phase is addressed in detail

Keywords:

Construction, construction firms, Kaizen, Kaizen costing, Nigeria,

1. Introduction

Infrastructural development is an integral part of any economy. Construction industries around the world have a major contribution to the gross domestic product (GDP) and economic growth. In the UK, the construction industry contributed about 6.3 percent and to the GDP in 2014 (Rhodes, 2014). The construction industry in Nigeria only contributes less than 2 percent to the GDP and it was 1.4 percent in 2012 (Odediran, Adeyinka, Opatunji, & Morakinyo, 2012). This may be due to a number of factors emanating from government policy. The construction industry in Nigeria is dominated by foreign construction firms, having a larger share of government construction projects.

At the moment the construction industry in Nigeria is dominated by multinational construction contractors, these companies have huge capital bases, the required equipment, structured equipment, technical expertise and the required network to execute any project (Bala, Bello, Kolo, & Bustani, 2009; Saka & Ajayi, 2010). The Indigenous (local) construction firms in Nigeria are ***small and medium scale*** in structure undertake projects which end up with the problems of cost and time overruns; project abandonment (as a result of litigation and poor construction cost management); poor workmanship; poor project management; poor financial management; poor planning, inadequate mechanization and regular litigation (Odediran et al., 2012). This challenge experienced by indigenous contractors in Nigeria has led to the bankruptcy of many indigenous construction companies. Sanni and Hashim, (2013) & Mansfield, Ugwu and Doran (1994) have identified some lapses in the cost control methods used by indigenous construction companies in Nigeria, which has led to cost overruns and poor project performance in many projects handled by these companies.

This paper focuses on the effect of cost overrun on indigenous construction firms in the Nigerian construction industry, cost management methods and techniques used in managing cost overruns during construction and how it is used in Nigeria. The new methods used in construction cost management in other parts of the world would be highlighted for possible implementation in the Nigerian milieu.

2. Cost management methods and techniques in the construction industry

The construction industry is a very important industry in any nation. The UK construction industry has one of the largest construction industries in the world with varying projects such as tunnelling, highway schemes, civil engineering and building projects, which utilized detailed estimating cost control and planning (Potts, 2008). Within the construction industry in UK, techniques used in post-contract cost control include earned value analysis, cost and schedule performance, cost ratio and fixed budget system (Dikko, 2002; Mansfield, Ugwu, & Doran, 1994; Sanni & Hashim, 2013). Furthermore, multi-discriminant analysis, elemental, approximates and computer aided analysis are also identified as cost control methods and tools in the UK (Kern & Formoso, 2004; Olawale & Sun, 2010). Successful management of the construction industry depends on the cost control techniques, notwithstanding the fact that different methods and techniques are used in different parts of the world.

Cost management in construction begins with preliminary cost estimate, taking off and preparation of bill of quantities. This process is a conventional process which leads to the preparation of a cost analysis during the cost planning process. Cost planning is at the pre-contract phase this may include elemental cost analysis; size related estimating which is based or ground floor area; functional or performance-related estimating (Potts, 2008). The choice of an estimating process depends on the nature of the procurement, construction project and methods of construction. The cost management process at this phase is at the pre-contract stage, however most changes occur during the post-contract phase of construction which may negatively influence project delivery.

3. Post-contract cost control

Post-contract cost control starts from the initial budget which has been planned followed by interim valuation at the construction stage. Contractor or client's cash flow is prepared to monitor the project finances to ensure profitability (Sanni & Hashim, 2013). Other techniques used in monitoring construction cost during execution are earned value analysis (Hunter, Fitzgerald, & Barlow, 2014); new techniques involving intranet-based cost controlling system has also be proposed by Abudayyeh, Temel, Al-Tabtabai, and Hurley (2001); measuring work on site may also involve methods such as cost ratio calculation; incremental milestone; units completed and weighted units (CII, 2000). Managing cost during construction involves making the right decisions at the right time and ensuring the cost of each activity does not go beyond the projected cost.

Cost control of any project starts from the inception and ends at the completion with the issuing of final certificates (Ashworth, 2010). Ashworth, (2010) also noted that the post-contract stage of a project begins from when the contract is signed to the final account and certificate. The process of controlling cost in the post contract stage according to Ashworth (2010) is detailed as being:

a) *"Interim valuations and payment certificate*
b) *Cash flow and forecasts through budgetary control*
c) *Financial statements showing the current and expected final cost for the project*
d) *Final account, the agreement of final certificate and the settlement of claims"*

The choice of a method in controlling the cost of a project during the post-contract stage will depend on the contractor's selection method; price determination method for tender and final account; client or contractor control; and the duties of the Quantity Surveyor in managing the budget and account (Ashworth, 2010). The four main stages highlighted above may vary depending on the type of construction project. Every construction project and the teams involved in any construction project are unique. Therefore the method used in controlling cost during a project will also be exclusive.

In the UK, the cost control practice during construction projects was evaluated by Olawale and Sun (2010). Their findings show that design changes, project complexities and performance of sub-contractors are some of the inhibiting factors leading to cost overrun in projects. Olawale and Sun (2010) also noted that the inaccurate evaluation of project duration, conflict between project parties, errors in contract, risk and uncertainty associated with projects are the main inhibitors of projects success during the post-contract stage. This implies that the available software and tools used in the UK such as Microsoft project professional, earned value analysis calculation, cost record keeping, work programming, material scheduling, variation management, re-measuring of work on site, adjustment of prime cost sums management of inflation, day work accounting and management of claims (Ashworth, 2010; Olawale & Sun, 2010; Potts, 2008), have not been sufficient in managing cost overrun. The available expertise in the construction industry in the UK has not led to better post-contract cost control practices. Therefore, there is a need for innovation in managing post-contract cost. These construction post contract cost control methods and techniques are also used in Nigeria. However, these approaches of managing post-contract construction cost have not improved the competitive advantage of indigenous construction firms in Nigeria. These firms have also been experiencing cost and time overruns. The next section will address the challenges indigenous construction firms face when using the traditional post-contract cost control system.

4. Challenges of post-contract cost control in Nigerian construction firms

The role of Quantity Surveyors in construction organizations in Nigeria have always been related to the financial probity of every project. The quantity Surveyor has the duty to ensure that construction cost stays within budget with an excellent profit margin for the contractor and delivery of the final product to the client at a reasonable cost. According to Sanni and Durodola (2012) some techniques used in Nigeria as being monitoring labour, equipment and material cost; overhead monitoring; taking corrective action; identifying cost overruns; analysing cost reports; keeping and using historical data; analysing cost variance, forecasting cost of completion; summarizing profit and loss. The post-contract cost control process needs to improve with the new trends in construction cost management such as lean construction and other modern methods. Also, the demand for improved infrastructure with varying complexities necessitates new techniques of managing construction cost.

The traditional cost controlling system in the post-contract phase has always been used in Nigeria (Olawale & Sun, 2010; Olusegun & Alabi, 2011; Sanni & Hashim, 2013). However the drawback of the traditional cost controlling system in Nigeria has been affected by inflation, interest rates, import duties and fluctuating exchange rates (Dikko, 2002). These negative factors have led to project abandonment and cost overruns in the construction industry. The inhibiting factors affecting cost control in the UK are also very similar to the Nigerian situation. This calls for a more systematic and comprehensive approach in managing modern complex projects in Nigeria.

New methods now being used for managing post-contract cost include activity-based costing and kaizen costing. These methods are discussed in the subsequent sections and also compared in terms of their strengths and weaknesses.

5. The use of activity based costing in the construction industry

Activity-based costing (ABC) has been in use since after the World War II. However, this system of accounting came into prominence in the 1990s as a technique for making costing decisions in many corporations (Harrison and Sullivan 1995, cited by Lin, Collins, & Su, 2001). Activity-based costing is defined as a system of "*calculating the cost of individual activities and assigning these costs to cost objects such as products and services on the basis of activities undertaken to produce each product or service*" (Horngren et al., 2001 cited by Lin et al. 2001). ABC is very different from the traditional costing system because of the cost tracers used in identifying the cost drivers such as overheads (Jong No & Kleiner, 1997). This process is not only based on costing products and services but it is also integrated with supply chain management.

According to Lin et al. (2001) the cost of the supply chain has to be measured for the supply chain management to attain its goals. Therefore, the cost of the supplier has also been identified as a significant cost in ABC. However many projects have not been able to implement ABC because of lack of identification and implementation of activity based costing (Jaya, 2013). Moreover, ABC cannot be effective alone, it has to adopt some cost management tools in the pot-contract cost control phase (Jong No & Kleiner, 1997). This may involve milestone setting and interim valuations.

This system of managing post-contract cost may be very effective if combined with the traditional method of managing construction cost or with kaizen costing. Kaizen costing is highlighted in the next section.

6. Kaizen and kaizen costing in the construction industry

The word "continuous improvement" has become common in many organizations in the world. Continuous improvement is not only relevant to performance management but also production management in large corporations and also in small and medium enterprises (SMEs). Lean thinking and continuous improvement has becomes a subject which many organizations have harnessed as a tool for improved performances in all divisions. Koskela and Ballard (2012) argued that failure to harness the concept of product in management has led to a lot of challenges in the field of management science for half a century. The use of techniques such as lean production in construction has been a major subject of discuss in the academia. The concept of lean production has greatly improved the cost, quality, client satisfaction and construction project delivery (Sacks, Koskela, Dave, & Owen, 2010). Although most organizations use Kaizen method for business process mapping for improved output, client satisfaction and increased profit without the main use of the word “kaizen”, the costing aspect has been used in many construction and engineering firms around the world.

The application of kaizen costing in the construction industry has not been well documented as there are few articles on this topic. Some of the research and literature review on kaizen costing in the construction industry is based on Granja et al (2005) analysis of target and kaizen costing in the construction industry. Granja et al. (2005) noted that continuous cost improvement is necessary at the construction stage not only to maintain the cost of the project but also to target more profit and eliminate waste.

The case studies conducted in a metal industry, a large construction and concrete company by Savolainen (1999), the paper discussed the understanding and adoption of kaizen processes empirically., The findings reveal that kaizen adoption process is iterative and the speed of implementation differs in these two companies. Kaizen involves continual incremental improvement of the product cost and waste reduction during the execution stage (Kaur & Kaur, 2013). Singh and Singh (2012), documented a comprehensive literature of how and where kaizen has been studied and utilized. The collage comprises of case studies, surveys and key components of kaizen in the manufacturing and construction sectors in various countries. Singh and Singh (2012) also noted that kaizen costing focuses on the profit and value a product will give at the manufacturing stage. This process should be part of the management function aimed at improving the product and service delivery. In this case, kaizen costing process involves the employees and employers inputs in improving their organization’s performance and handling of financial and non-financial aspects of manufacturing. Kaizen costing is aimed at reducing cost and creating greater valuable products with the influence of every stakeholder.

The use of kaizen costing in these organizations studied by Ellram (2006) is not only limited to the manufacturing process but also the supply chain. Cost reduction in the supply chain also reduces unit cost of the product. Therefore, kaizen costing management is not only within the organization but also with other external factors or stakeholders who have to be managed along with the performance of the company in reducing cost. Cheser (1994) stated that Kaizen costing has been implemented in organization where the product cost has been monitored and reduced to improve the companies’ profit. Also the continuous improvement of the number of working hours in an organization along with the budget of the organization has created more profits in organizations. (Budugan, & Georgescu, 2009). This involves elimination of non-productive activities which may increase during the working hours. Employee productivity has been improved using kaizen costing. Utari (2011) studied the use of kaizen costing in Coca-Cola Bottling Indonesia-Central, Sumatera; the findings shows that eliminated rejected products using kaizen costing significantly increased the profit of the company. This process involves identifying what the consumers what and disregarding any component or product which do not add value.

Table 1: The merits of kaizen costing

S/N	Merits of Kaizen costing	References
1	Incremental waste reduction during the construction process	Kaur and Kaur (2013)
2	Cost reduction can be established with sub-contractors and suppliers	Ellram (2006)
3	Incremental cost improvement during construction for higher profit	Singh and Singh (2012)
4	Possible integration with a company's budgeting system and reduce non-productive working hours. Improved employee-employer relationship.	Cheser (1994) and Utari (2011)
5	Improved product quality, client satisfaction and competitive advantage	Budugan, & Georgescu (2009)

Table 1 above enumerates the benefits of kaizen costing. These benefits have been studied by analysts over the years in areas where kaizen costing has been used. This is mostly in the manufacturing sectors. Based on the proven benefits identified by Ellram (2006) and Singh and Singh (2012) in manufacturing industries, there is a need for more adequate research in the application of kaizen costing in construction. This method of cost reduction during manufacturing has also been expressed as a strategy for cost control during the same phase. This can be translated into the construction industry.

Table 2: Strengths and weaknesses of activity based costing and kaizen costing

Post-contract cost management technique	Strength	References	Weakness	References
Activity based costing	Overheads are identified and minimized	Jong No & Kleiner, 1997;	Has to be combined with other methods	Jong No & Kleiner, 1997;
	Units costs are calculated in terms of activity	Lin et al. 2001;	Critical success factors has to be identified before it can be used	Jaya, 2013.
Kaizen costing	Has been combined with target costing and it is flexible for use	Granja et al., 2005;	Can only be used during the post-contract phase	Granja et al., 2005;
	Based on profit, value and improvement	Singh and Singh, 2012.	lengthy implementation process	Savolainen, 1999.

Table 2 above juxtaposes the strength and weaknesses of activity-based costing and kaizen costing. The weaknesses of each method can be complemented by their strengths if activity-based costing and kaizen costing is combined in a framework. Granja et al. (2005) developed a framework which combined target costing with kaizen costing.

Target costing is used during the cost planning phase. Target costing is not only relevant to the manufacturing sector but also the construction industry. Target costing is a Japanese word for *"Genka Kikaku"* (Everaert, Loosveld, Acker, Schollier, & Sarens, 2006). This technique has also been used in the Nigerian construction industry. However, it does not solve the challenged of cost overrun which many indigenous Nigerian construction firms are facing. However, there is a need to investigate the use of continuous improvement or kaizen costing within Nigerian construction firms.

7. How kaizen costing works during the construction phase

Kaizen costing is based on the philosophy of kaizen which is an arm of lean production. According to IFS (2010), Yashihuro Monden categorizes kaizen costing into two:

> *"1. Asset and organization-specific Kaizen Costing activities planned according to the exigencies of each deal.*
>
> *2. Product-model-specific costing activities carried out in special projects with added emphasis on value analysis (Monden has the automotive industry in mind)".*

IFS (2010) further explained that kaizen costing can be divided into *maintenance* and *improvement*. The maintenance aspect involves management function which would be narrowed down further to policy guiding waste reduction in the office, rules and regulations, guidelines and procedures for employee-employer relationship, elimination of waste. This managerial function is essential as a culture within the organization before the site activities. Reduction of waste which is also known as *Muda* in Japanese involves all non-value adding activities (IFS, 2010), therefore managing value during production is essential to the realisation of waste reduction during production.

Cost estimates must be established in a standardized calculating framework. This framework or system must be established within the organization for product cost monitoring for a lower cost than the normal cost and ensure products are within the budget or target cost. This process is subsequently repeated (IFS, 2010).

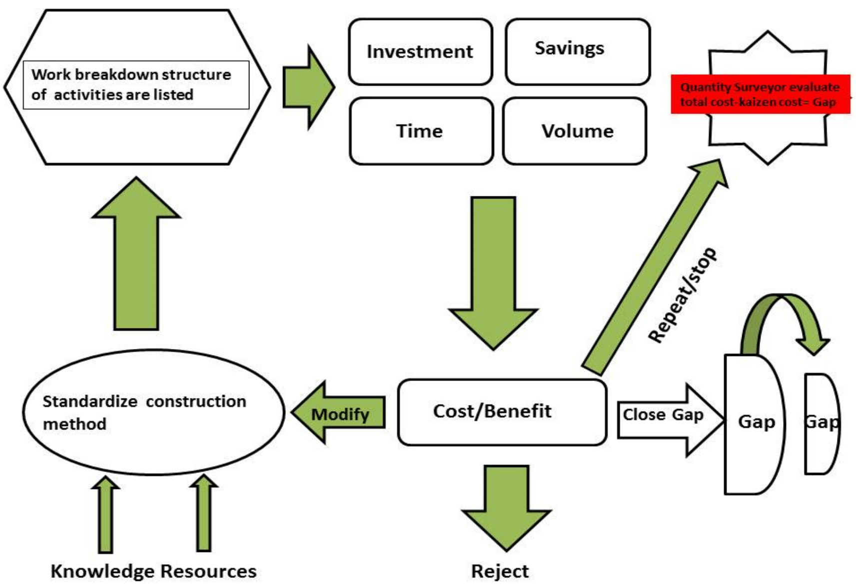

Figure 1: Kaizen costing process during construction (Modified from IFC? white paper, 2010)

Figure 1 above is an illustration showing how kaizen costing can be used in the construction industry. This is modified from IFS white paper on the development of an application for kaizen costing. This framework acknowledges the existence of a budget for construction work which has to be prepared before the constriction phase. A standard construction method has to be established in addition to the program of works in form of a work breakdown structure (WBS). The work breakdown structure would allow the project manager and Quantity Surveyor to allocate finance, time, labour resources. The Quantity Surveyor would seek alternatives to these resources and cost saving mechanisms. This evaluation compares the current cost of construction to the target cost in the budget, therefore eliminating more waste. The wastes identified are reduced further and further to create more value and profit. This process involves closing the gap created by waste. The circle is repeated until the best quality is attained.

8. Kaizen costing in the Nigerian construction industry

Kaizen costing has been used in construction waste reduction, improved quality of the final product, improved profitability and competitiveness of a company (Kaur & Kaur, 2013). These key benefits have not been studied by analysts in Nigeria. The focus has only been on target costing and improved estimating techniques for reducing cost overrun and project abandonment (Frimpong, Oluwoye, & Crawford, 2003; Sanni & Hashim, 2013). More f attention has been given to procurement and contract management in construction without considering new innovations in the corporate governance of indigenous small and medium construction companies in Nigeria.

9. Conclusion

The present challenges facing indigenous construction firms in Nigeria may not be totally resolved by adopting kaizen costing. Nonetheless, the proven benefits in the manufacturing sectors can be transferred to the construction industry via these firms. Although, there may be very little literature on the utilization of kaizen costing in the construction industry, some construction firms may term it to be continuous improvement during interim valuation. More studies are required to fully investigate the use of kaizen costing in the construction industry. The incremental reduction of waste during construction can create more profit for the construction firm and improve their competitive advantage in the Nigerian construction industry. Since most indigenous construction firms are small and medium scale in nature, the need for maintenance and improvement of construction cost is vital. This also depends on the management function of creating more guidelines for activity waste reduction. Further studies about kaizen costing combined with activity based costing and the supply chain in a unified framework would create a robust approach for post-contract cost control. Nonetheless, the framework designed in this paper has the potential to drive the profitability of indigenous contracting firm to the peak and deliver excellent products.

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Exploring the Role of Leadership on Total Quality Management

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Abstract

The leadership of large and complex organizations in today's environment of shrinking resources requires a strong commitment by the leader. Total Quality Management when combined with good leadership and management skills yields increased productivity. Therefore, building on recent attempts in the leadership and total quality management literatures, this paper develops a basic literature of leadership for quality, focusing on leader traits, values, and behaviours based on underlying TQM principle and the role of leadership when implementing TQM. This paper will be deducted from a literature in synthesis from an ongoing research. It will examine also two examples of successful TQM implementation in construction industry will be reviewed with a focus on leader actions which contributed to organizational improvements. Finally, the paper will suggest actions and techniques which may prove helpful to leaders when implementing TQM.

Keywords:

Total Quality Management, Leadership, Implementation, Organisation.

1. Introduction

Regardless of their implications for the management of quality in establishments, leadership theories may not have specifically focused entirely on quality and on the role of leaders as managers in the construction sector. Construction in recent times initiates some leadership and total quality management literatures; this research enhances a theory of leadership for quality, focusing on leader traits, values, and behaviours as determined by underlying TQM principles. Contributions of the TQM literature to the leadership literature are ascertained as well as discussed. A set of leader traits, values, and behaviours are extracted from the TQM philosophy and integrated into an articulation of a theory of leadership dependent on these constructs. The philosophy formulated here tends to make incremental technological contributions by examining these hitherto unexamined behaviours in the leadership literature. The framework contributes value to the literature by embedding key leadership constructs in organizational procedures. Contributions to the TQM and leadership literature, limitations of the approach, and implications for research and practice are discussed.

Total quality management (TQM) is a management philosophy that is designed to guide the operation of the entire organization. It basically requires each individual in the company to be focused on the services or products that the customer receives. Consequently, total quality management is predominantly integrated into all elements of the company and demands total support from management and staff to achieve success. The responsibility of managing quality is necessary in today’s environment, as demonstrated by the popularity of the TQM movement and the achievements it possesses brought to several organizations (Easton & Jarrell, 1998; Douglas & Judge, 2001; Hendricks & Singhal, 1997).

Nevertheless, the role of leadership in managing quality is comparatively unaddressed in the leadership literature. Irrespective of the acknowledgement of the construct validity of the Total Quality Management philosophy by organizational behaviour researchers (Hackman & Wageman, 1995) and its significance to the field of management theory (e .g. Anderson et al., 1994 ; Dean & Bowen, 1994 ; Spencer, 1994), research on quality management as a legitimate responsibility of leaders has not acquired much consideration (Waldman, 1993) in any of the approaches to leadership research (House & Aditya, 1997).

The purpose of this paper is to build on the leadership and quality management literatures and develop a theory of leadership, focusing explicitly on the role of leaders as quality managers at multiple levels in an organisation.

2. Total quality management

The growing literature on total quality management stresses the importance of TQM to organizational performance and has repeatedly stressed the lack of leadership support for the failure of many TQM initiatives. Several investigators have examined the implementation of total quality management and its impact on organizational performance (e .g. Douglas & Judge, 2001; Jayaram et al., 1999), with both sets of researchers identifying effective positive relationships between the implementation of total quality management and performance (Hendricks & Singhal, 1997). Several researchers in the total quality and management literatures have pointed to the importance of the role of leadership in managing quality (e .g. Anderson et al ., 1994 ; Dean & Bowen, 1994 ; Repenning & Sterman, 2002). Hackman & Wageman's (1995) analysis concluded that the founders of the movement view quality as the final and necessary responsibility of top management. There is apparently a substantial consensus among the founders of the quality movement as far as the importance of leadership to managing quality is concerned, as evidenced by their writings (Crosby, 1979 ; Deming, 1986 ; Feigenbaum, 1983 ; Juran, 1994), with all of these founders viewing quality as a leadership responsibility and viewing TQM principles in the same way as principles of leadership. Deming's (1986) argument that his views are in fact statements of good principles of leadership suggests that the behaviours associated with total quality management are themselves appropriate leadership behaviours, i.e. the 'what' of the theory (Whetten, 1989) developed here. Consequently, it is possible to extract from the total quality management philosophy, a set of traits, values, and behaviours that can lead to positive outcomes for organizations, along the lines of Anderson et al.'s (1994) articulation of a theory underlying the Deming management method.

This paper will first of all identify the contributions of the TQM philosophy to the leadership literature. The role of leadership in quality management as suggested by the TQM literature is then briefly reviewed. The literature which has focused on possibly the impact of leaders or the effect of top management orientations on quality programs is then integrated with the quality and leadership literatures to aid in the development of a theory of leadership for quality. Initial theory is then presented by building on the three core principles of TQM and framing propositions around each of these principles, considering relevant literatures in the leadership area. In conclusion, the contributions made here to the TQM and leadership literature and a discussion of the implications for future research and practice. TQM contributions to the Leadership continue to be a key subject matter of research and practical interest for a number of decades. Research on leadership has taken a number of different perspectives such as the trait approach, the behavioural approach, the contingency approach, and the charismatic approach (House & Aditya, 1997; Yukl, 2002). Based on the aforementioned discussions, despite their implications for the management of quality in organizations, these theories have not explicitly focused on quality and on the role of leaders as managers of quality. Much of the theory and research frameworks developed focus on leadership as a key managerial role. Within this framework of viewing leadership as a key managerial role, leaders have been seen as people managers, task managers, communicators, inspirers, and information processors, but not as managers of quality. This paper contributes to the literature by examining both the traits and behaviours of leaders as quality managers.

3. Leadership at Multiple Levels

Kotter (1990) is one of the few researchers who have specifically addressed the issue of the difference between leadership and management. Much of the leadership literature treats the two concepts as synonymous and there is a lack of agreement and a strong debate in the literature on this issue (e .g. Hunt et al., 1982). Kotter (1990) surveyed a large number of executives and asked them to provide ratings of people in their managerial hierarchies on both leadership and management, based on their own definitions of the dimensions. The results suggest three essential ideas that can be used to generate a distinction between the two levels. First, not many people are perceived as having both strong leadership and management skills (House & Aditya 1997). Second, very few people are seen as having strong leadership skills but weak managerial skills. Third, a large number of people have strong management skills but weak leadership skills. This leads to the conclusion that good managers are not necessarily good leaders and are thus not able to provide good leadership. Strong leaders however, are not weak managers. The perspective taken in this paper, with respect to this distinction, is that leadership is conceptually broader than management and that leaders provide much more to their organizations as compared to managers. This opinion is consistent with the writings of a number of other researchers (Bennis, 1989; Zaleznik, 1977).

Conceptually, leadership can be seen as that combination of traits, values, attitudes, and behaviours that result in the effective long-term performance of establishments. This description draws on the trait, behavioural, contingency and other macro approaches to the study of leadership. Whereas Kotter (1990) separates the concepts of leadership and management, the perspective taken here is that leaders are first and foremost managers and thus have the responsibilities of both management and of leadership. The similarity with Kotter's view is that not all people in positions of leadership actually provide leadership. More specifically, all leaders need to be managers but not all managers are necessarily leaders. Thus, both (seemingly) routine behaviours, such as team design have both structuring behaviours and ultimate leadership behaviours (Kotter, 1990). Institutionalizing a culture of quality and continuous improvement and customer focus behaviours, are included in the realm of leadership behaviours in the theory developed in this paper.

A consideration of the total quality management philosophy and its component principles can help identify a number of broad organizational factors embedded within the principles of TQM that have not been considered in the traditional literature on leadership. Numerous researchers (Anderson *et al.*, 1994; Dean & Bowen, 1994) suggest that the core ideas of TQM within the context of management of process quality are that organizations are sets of interlinked processes, and that improvement of these processes is the foundation of performance improvement. Many of the theories of leadership take a behavioural and psychological approach, focusing on dyadic techniques as opposed to organizational processes such as quality, leading to calls in the literature for examination of leadership without the exclusion of the organizational processes in which it is embedded (House & Aditya, 1997). Further, there are also calls for the examination of specific leader behaviours, such as the total quality oriented behaviours, as opposed to the generic leader behaviour dimensions identified by the behavioural approach to the study of leadership (House & Aditya, 1997). This study answers these calls.

The TQM point of view suggests that the involvement and participation of managers and employees at all levels is important to the successful management of quality in organizations. From this perspective, the leadership literature concentrates on leadership at all levels in the organization. Organizational behaviour theorists have generally confined leadership and its effects to the individual, dyadic, or small group levels of analysis (Waldman & Yammarino, 1999). Much of the leadership literature, with the exception of the charismatic and transformational approaches, focuses on the study of leadership at the supervisory level and thus leader behaviours of supervisors or lower level managers.

4. The Role of Leadership in Quality Management

Many quality experts believe that the key to successful management of quality begins at the top of the organization. The TQM literature argues that because senior managers create the organizational systems that determine how products and services are designed and produced, the quality improvement process must begin with management's own commitment to total quality. Thus, creating and designing systems that have an impact on how products and services are produced, and fostering organizational culture (Waldman, 1993) is the responsibility of leadership at the top of the organization. Leadership at other levels in the organization is in the form of team design and coaching (Wageman, 2001) and in the use of appropriate 'control' and 'exploration' structuring behaviours (Douglas & Judge, 2001). These and other aspects such as systematic experimentation and implementing participation system behaviours are articulated in the theory developed here as key attributes of middle and lower level leaders, thereby extending the literature's attention to these specific behaviours at different levels. A number of commonalities between transformational leadership and the leadership views of the total quality management philosophy have been discussed (Dean&Bowen, 1994) from the point of view of (a) communication and reinforcement of values and (b) articulation and implementation of vision, and visionary leadership in the form of defining, communicating, and motivating continuous improvement (Anderson et al ., 1994) .

A facet of TQM that views organizations as interlinked processes (Dean&Bowen, 1994), suggests that those processes need to be managed from the point of view of continuous improvement and enhancing customer focus, a set of behaviours that have not been investigated. Thus, the principles of TQM implicitly contain relevant roles for leadership, in addition to those identified in the leadership literature, that need to be articulated. This paper builds on and extends this prior work by identifying the core principles identified by both these researchers and the founders of the quality movement and then generating propositions around those leadership behaviours. Waldman's (1993) theoretical consideration of leadership, in the context of managing quality, linked variables such as organizational culture, leadership, total quality oriented behaviours and policies, and outcomes of total quality efforts in a preliminary attempt at deriving the theoretical linkages among these constructs, which stopped short of developing testable propositions. Most of the other work in the literature on leadership in the context of quality initiatives is in the form of inductive approaches and case studies. Waldman (1993) presented a reciprocal link between leadership and organizational culture but argued for a more effective unidirectional link from leadership to organizational culture in a later inductive study (Waldman et al., 1998). This paper extends and builds on Waldman's work, by arguing for a stronger impact of leadership on organizational culture that then subsequently impacts values, attitudes, and behaviours of individuals in organizations attempting to manage for quality. By focusing directly on the total quality oriented behaviours and policies and pinpointing suitable leadership behaviours, in addition to values and attitudes, based on consistency with the philosophy of total quality management. This paper articulates more specific behaviours organized around the broad principles of Total Quality Management. For example, focus on teams and group processes (e .g. Cohen & Bailey, 1997; Wageman, 2001) are used here to focus on and develop functional leadership behaviours in the context of teams.

The responsibility of leadership at the top management levels in successfully managing quality has been addressed by many case studies, examining issues such as the attitudes of top managers that are necessary for effectively managing quality (e .g. Choi & Behling, 1997), the struggles faced by organizations in implementing total quality management (e.g.Rago, 1996), leadership styles that are used in implementing TQM in organizations (e.g. Savolainen, 2000), the impact of leadership roles on quality initiatives and the interrelationship between organizational culture and leadership (Waldman et al., 1998). The general consensus of the authors of these case studies is that organizations that successfully manage quality tend to have leaders that can effectively involve people at multiple levels in the organization and motivate them to participate in, and as, teams in the management of quality. This consensus among the various case studies relates to the value of the three core principles of the TQM philosophy and its utility in providing the basis for a theoretical framework that can make significant contributions to the leadership and TQM literatures. Values related to the three core principles of customer focus, continuous improvement, and teamwork are suggested to be imperative for leaders to successfully lead organizations through total quality transformations (Youngdahl et al., 1998).

5. A Theory of Leadership for Quality

The theoretical framework of leadership for quality developed here builds on the three core principles of total quality management and develops propositions around each of the principles. The three generally accepted core principles of total quality management namely customer focus, participation and teamwork, and continuous improvement provide the building blocks of the theory of leadership for quality, with the associated values and behaviours of leaders forming the key constructs of the theory. Based on the theoretical and case study evidence, values closely aligned to the three principles of total quality management are theorized to enhance the outcomes such as quality performance and other outcomes, through their influence on leader behaviours. Specifically, the extent to which leaders value focusing on customers (both internal and external), the extent to which they value teamwork and participatory processes, and the extent to which they value systematic experimentation for continuous improvement purposes are identified as the values held by leaders in organizations that pertain to the effective management of quality. These are expanded upon and described in the following sections.

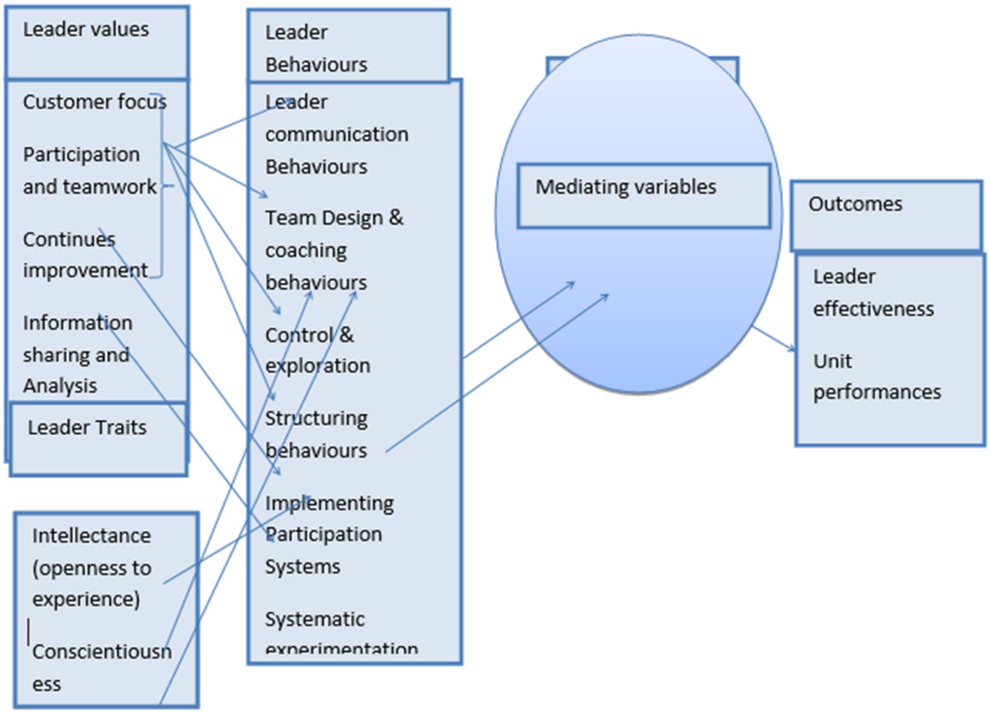

Figure 1: Theoretical framework of leadership for quality adopted from Lakshman (2006)

This theoretical framework identifies leader values as the driving force that influences both leader behaviours and eventual outcomes. The view that firmly held human values drive human behaviours has been an established fact in the organizational behaviour literature for a long time and in the leadership realm for some time now (e.g., Conger & Kanungo, 1987; England & Lee, 1974). Firmly held leader values affect leader behaviour by affecting their perceptions of situations and problems, the solutions they generate, their interpersonal relationships, and their acceptance or rejection of organizational pressures and goals (England & Lee, 1974). Leader values are also likely to form the basis for the vision they develop and the cultures they foster in organizations (e.g. Waldman & Yammarino, 1999). Participation and teamwork values of leaders are to be related to team design behaviours, structuring behaviours, and implementing participation system behaviours. Continuous improvement values of leaders and the leader trait of 'intellectuals' (e.g. Barrick & Mount, 1991) are proposed to be related to systematic experimentation behaviours. Leadership high intellectuals tend to be imaginative, curious, and experiment with new ways, rather than doing things the tried-and-true way (e.g. Hughes et al., 2002). In addition, a number of specific leader behaviours, as opposed to the traditional generic behavioural dimensions, are discussed as components of the theoretical framework developed here. Leadership behaviours such as the implementation and facilitation of participation systems, and the implementation of several processes related to teams (e.g. team design, careful hiring, scheduling, training etc.) focus on the achievement of teamwork and participation. Leader behaviours aligned with the principle of continuous improvement such as the design and implementation of systematic trials of experimentation to separate signal and noise variables in terms of their impact on processes and outcomes are also identified and discussed. Several mediating variables in the form of participation effectiveness, and teamwork effectiveness are seen to result from the leader behaviours that then lead to the outcomes. The major outcomes in the theoretical framework identified above are leader effectiveness, quality, and unit performance. Leader effectiveness, consistent with the literature, is defined both in terms of objective outcomes such as quality performance, and effectiveness of continuous improvement efforts, and through subjective outcomes such as the satisfaction and commitment of subordinates in the unit and leadership ratings.

6. Teamwork and Participation

Participation and teamwork are one of the core principles of the TQM philosophy that has not been addressed completely in the leadership literature, within the context of organization wide quality management. The Vroom & Yetton (1973) theory of leader participation, dominant in the leadership literature, is focused on decision making and does not address organization wide participation in managing quality. Moreover, participatory decision making is only one of the options in this theory whereas the TQM literature sees teamwork and participation (in the operation and ongoing improvement of processes) as the default. Participation and teamwork from the point of view of quality management needs to be organization wide and not limited to specific decisions. Thus, a theory of leadership for quality needs to address the role of leaders as enhancing organization wide participation and teamwork.

7. Customer Focus and Continuous Improvement

From the point of view of the TQM literature, the leadership literature is also wanting in terms of specifically addressing the role of leadership in emphasizing customer focus and continuous improvement (the other core principles of TQM) for enhancing organizational effectiveness. For example, the 'Big-five' personality trait of 'openness to experience' may potentially be related to leadership effectiveness in terms of continuous improvement efforts of a total quality initiative. Alternately, customer-focus behaviours and continuous improvement behaviours, such as change-oriented behaviours in Yukl's (2002) three-actor taxonomy of leader behaviours may be related to leadership effectiveness. These have been relatively unaddressed theoretically and empirically in the leadership literature.

The importance of continuous improvement of processes and outcomes on a number of performance parameters to the competitive success of organizations has been highlighted by the examples of Japanese companies (Imai, 1986). This principle of total quality management suggests that the long-term health of an organization depends on treating quality improvement as a never-ending quest. Opportunities to develop better methods for carrying out work always exist, and a commitment to continuous improvement ensures that people will never stop learning about the work they do (Juran, 1969, Deming, 1986, Ishikawa, 1985). Dean & Bowen (1994) identified a number of techniques that are used in organizations implementing total quality initiatives, including flowcharts, Pareto analyses, statistical process control, and fishbone diagrams. From a leadership point of view, it can be argued that a culture of quality is more easily instituted when the leaders themselves hold values of continuous improvement dear to their heart. More importantly, when these values are translated into actual behaviours that reinforce and emphasize the importance of continuous improvements on both processes and outcomes, the results are likely to be much more positive. Along with values, leaders with high intellectuals are more likely to experiment with new ideas and be open to creative means of obtaining improvement. The effectiveness of quality leaders will vary as a direct function of the degree to which they effectively communicate the importance of continuous improvement of both processes and outcomes to the members of their unit.

8. Conclusion

This paper makes contributions to both the leadership and TQM literatures. The contribution to the TQM literature is in terms of developing a theory that specifically incorporates the role of leaders in the TQM initiative and therefore identifying potential leader actions that can facilitate the implementation of TQM in organizations, which has generally been considered in many case studies as challenging to say the least. In addition to the theoretical contributions that can be derived from such a perspective, a number of managerial implications can also be drawn from this approach. The managerial implications arise from the identification of the necessity to communicate their core values related to customer focus, teamwork, and continuous improvement to all organizational members. The leadership theory developed here focuses on leader values and behaviours Vis-a`-Vis organizational processes, as the underlying principles of TQM, on which it is based, thereby embedding the situational context. Moreover, the theory developed here also includes an analysis of leadership at multiple levels, including leadership of teams. Although some in the literature have focused on visionary and transformational leadership (Anderson et al., 1994; Waldman, 1993), this theoretical framework focuses on the behaviours and values suggested by the underlying TQM principles, some of which have an overlap with the transformational approaches discussed in the literature, especially with respect to the communication of values consistent with a TQM culture. Beyer (1999) has suggested that leadership theories need to include both innovative and maintenance leadership, whereas the literature tends to be dominated by the former with an under-emphasis of the latter. More importantly, the TQM principles suggest a number of other leadership behaviours that are crucial in a quality context, and have not been addressed in prior work. Thus, the leadership behaviours and values suggested by the underlying TQM principles, as identified here, provide an important complement to other leadership approaches.

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The extent that chartered project management surveying practices and clients avail themselves of professional project management practice standards

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Abstract

The importance of project management is recognised within the UK construction industry. Various project management organisations promote and promulgate the use of their practice standards. The concepts and definitions of projects and project management, the "iron triangle" and making projects "critical" are evaluated. This literature review assesses project-based organisations and embedding new project management knowledge. The concept of projects as learning tools and the emergence of the project management office are considered. The different views on the issues that may arise from standardised project management practice are contemplated. The advantages and challenges of the codifying professional services are highlighted. The value of this research is to provide a greater understanding of the potential barriers that practitioners may encounter in knowledge transfer and learning from projects. The significant finding from the literature review is that there are challenges for practitioners in transferring knowledge, tacit or otherwise, and ironically this seems to be compounded by the characteristics of project-based working in project-based organisations. The outcome of this literature review will influence the ongoing professional doctorate research i.e. the extent that chartered project management surveying practices and clients avail themselves of professional project management practice standards.

Keywords

Iron triangle, Knowledge, Project-based organisations, Professional project management practice standards,

1. Introduction

1.1. Focus and structure of Paper

The focus of this paper is to provide an understanding of the potential barriers that project managers may encounter in knowledge transfer and learning from projects. The first part of this paper clarifies the research method and considers the significance of project management within the UK construction industry. An overview of the growth of the project management associations and their practice standards are provided. This paper critically evaluates the definitions of projects and project management, the concepts of the iron triangle and making projects "critical". Project-based organisations and their relevance to UK construction industry are appraised. The emergence and role of the project management based office is assessed and the penultimate section of this paper highlights the different views on standardised project management. This paper concludes with recommendations for employers and project management associations.

1.2. **Research method**

This paper is based on a literature review that comprised theories and concepts from different subject areas: project management theory, organisational theory, concept of workplace learning and tacit knowledge. The purpose of this literature review is to evaluate significant ideas and research that would explain how project managers acquire and transfer their knowledge. The materials for this literature review have come from peer reviewed journals, industry reports, textbooks, conference proceedings, newspaper articles and websites. The literature review has an international flavour as the research materials have been drawn from USA, France, Sweden and the UK.

1.3. **The UK construction industry**

The construction industry is estimated to contribute 7% of the UK gross domestic product and was valued at £90bn in 2011 (HM Government, 2013). The industry is an important one: it employs 2.93m people, comprises more than 280,000 businesses and is one of the biggest sectors in the UK economy (Department for Buisness, Innvoation and skills, 2013). However, the construction industry has some long-term problems and arguably should improve its performance. A highly fragmented industry and inefficient procurement practices are cited as some of the reasons for its underperformance (Cabinet Office, 2011). From 1944 to 1998, the Government has procured 11 significant reviews of the construction industry (Murray & Langford, 2003). It was assessed that

> *the industry has become less attractive … demands on the industry cannot be met … cannot attract staff to deliver buildings on time (Murray & Langford, 2003, p. 7).*

In 2001, more than 70% of capital projects in the public sector exceeded their original contract date and budget (National Audit Office, 2001). In 2012, only 33% of projects were delivered on time and within budget (House of Commons, 2012). Demonstrably, the industry has a significant challenge in managing the delivery of capital projects on time and within budget.

1.4. **Project management in the UK**

The importance of project management is recognised within the UK construction industry, which has had some high profile projects that were regarded as poorly delivered, e.g. Wembley Football Stadium, the Scottish Parliament and the Millennium Dome. The Chief Executive and Chairman of the Olympic Delivery Authority considered that effective project management was key to the successful delivery of the London 2012 Olympic Games (APM, 2012). The UK Government has accepted that project management should be improved and has undertaken various initiatives to this effect. These include: plans to improve governance and internal client skills in accordance with the remit of the Major Projects Authority (Cabinet Office, 2012, p. 24 & 25) an acceptance that civil servants lack expertise on project management (Neville, 2014b) and sending senior civil servants for further education and training on the delivery of major projects (Neville, 2014a). The concept that project management is a successful tool for delivering projects may be undermined if not implemented consistently across Government departments. Browne (2013) cautioned that the ad hoc and piecemeal implementation of standards and the failure of Government departments to adhere to due diligence checks are a problem when delivering projects.

1.5. **Growth of professional project management associations**

Project management is a growing profession and this is partly evidenced by the growth of professional project management associations (PPMAs) and the development of project management as a subject in academia.

For the purpose of this paper, the group of the PPMA are considered to be the Project Management Institute (PMI), the Association for Project Management (APM) and the Royal Institution of Chartered Surveyors (RICS) Professional Project Management Group (PMPG). The PMI is the largest of the group, it was established in 1969 in the USA and has more than 500,000 members worldwide (PMI, 2015b). The APM was established in 1972 in the UK and has more than 21,150 members (APM, 2015). The RICS introduced the qualification of "Chartered Project Management Surveyor" (CPMS) in 2001 (McCann, 2013). There are more than 30,000 CPMSs worldwide (McCann, 2014).

The PPMA promote the use of their professional project management practice standards (PPMPS). Berg, Horstman, Plass, and Van Heusden (2000, p. 787) highlighted that there is often confusion as to difference between practice standards, guidelines, protocols, or codes of practice "these terms are used interchangeably and there is no general agreement on the relevance or clarity of the claimed differences". This paper will focus on three key PPMPS: the PMI's and APM's Bodies of Knowledge (BoKs) and the RICS PMPG's Guidance Notes and Information Papers. The PPMPS are regarded as a form of codified knowledge. Egbu & Robinson (2005, p. 46) argued that the construction industry is highly knowledge-intensive sector and that knowledge "is critical for effective action in the economy of the future and can bring critical competitive advantage".

1.6. **Limitations of the Bodies of Knowledge**

The limitations of, and concerns with, the BoKs within the subject of project management practices have been reviewed in different ways for more than a decade (Bredillet, 2010; Cicmil & Hodgson, 2006; Dalcher, 2014; Hatfield, 2014; Kozak-Holland, 2013; Maylor, 2001).

Bredillet (2010, p. 5) proposed that the development of project management was led by the professional associations in the 1980's but contested that the knowledge was flawed as it continued to be "very user-oriented, and did not always adhere to recognised standards of academic rigour". Morris, Crawford, Hodgson, Sheperd, and Thomas (2006) considered that the BoK have become "de facto standards" for practitioners. It is suggested that this view was accurate for example, the PMI promotes their BoK "as the globally recognised standard and guide for the project management profession" (PMI, 2013, p. 1).

Morris et al. (2006) warned academics that they should not rely on the PPMA to set standards for education of project managers. Notable contributions from various academics have challenged traditional project management ideology. Some examples include: defining the differences between project success and project management (Munns & Bjeirmi, 1996), the concept of the "iron triangle" (Atkinson, 1999) and making projects "critical" (Hodgson & Cicmil, 2006). It is suggested that these examples provide a greater understanding of the limitations of the PPMPS. In addition they provide a basis for further exploration of other less obvious factors that may contribute to the limitations of the PPMPS including organisational theory, the concept of projects as separate learning entities and the role of practitioners in knowledge sharing.

2. Different perspectives on project management

2.1. Projects and project management

It is suggested it is relevant to distinguish between project and project management. De Wit (1988, p. 169) proposed that it was not straightforward to assess whether or not a project was successful

> *The measurement of success seems invariably to concern itself with either completed projects or at least a completed project phase. A project may be perceived a success one day and a failure the next. Therefore, to think that one can objectively measure the success of a project is an illusion.*

De Wit (1988) distinguished between project success and project management success. Project management success was judged on cost, time and quality. Munns and Bjeirmi (1996) considered the differences between project and project management and asserted that project management is a short-term activity in comparison to a project that has a longer life span and therefore has different objectives or required outcomes. Munns and Bjeirmi (1996, p. 82) argued that "project management and its techniques are only a subset of wider context of the project". Maylor (2001, p. 96) did not share this view and argued that defining project management as a one off activity, "infers a degree of novelty that is often misplaced" and that project management has a "much wider range of durations and complexity". It is suggested that the differences between projects and project management are relevant in the context of the construction industry. The differences include time frame and the contractual role of project managers.

Capital projects have a longer life cycle when compared to the period allocated for project management period; for example, it may take two years of project management services to provide some new houses but these are likely to have a minimum life span of 60 years.

It is also pertinent to consider the role of those delivering project management services and projects. Munns and Bjeirmi (1996) argued that the project team focus on the project management tools and techniques to deliver the project. It is suggested that this analysis is correct as the various standard forms of project management consultancy services in the UK include contract conditions that consider how the project management services will be delivered. (See section 2.2 on the "iron triangle" below). These contracts do not contain legal clauses that oblige project managers to ensure the aims of the project are achieved. Project management services will normally be almost complete when the project is handed over to the client except for some later services that may be required to resolve building defects. Cooke-Davies (2002) advocated that while delivering project success was more difficult than project management success, project managers should collaborate those with line management responsibility to optimise the benefits of the project. The PMI explicitly embraced this idea via the "PMI Talent Triangle" that practitioners must have a skills encompassing "strategic and business management insight" (PMI, 2015a).

2.2. The concept of the iron triangle

Atkinson (1999) continued the theme of questioning what constituted success for project management. He criticised the emphasis on using the standard criteria of delivering budgets on time, on cost and to the specified quality, hence his use of the term "iron triangle". He suggested that the measurement of project success should take in to consideration other factors and questioned the implications for trying to define project management. Atkinson (1999) did not suggest any mechanism for the implementation of his proposed new criteria "The Square

Route". There has been no analysis as to how providers of professional indemnity insurance would perceive the additional potential risks to project managers from having long-term liability for projects as opposed to providing project management services during a project.

2.3. The iron triangle and its influence on practitioners knowledge sharing

The concept of the "iron triangle" is relevant. Previous studies have suggested that this long standing concept of delivering projects on time and on budget to a specified quality has influenced practitioners' approach to long-term learning and transfer of knowledge (Foos, Schum, & Rothenberg, 2006; Pemsel & Wiewiora, 2013; Von Krogh, Ichijo, & Nonaka, 2000). Pathirage, Amaratunga, and Haigh (2008, p. 214) concluded that in an organisational context tacit knowledge constitutes understanding, capabilities, skills and the experiences of individuals; often expressed in human action in the form of thoughts, points of view, evaluations and advice; generated and acquired through past experiences, individuals, and repositories; utilised for the benefit of individual and organisational development.

Foos et al. (2006, p. 15) concluded that project managers were not interested in the long-term transfer of tacit knowledge as they perceive they are rewarded on delivering the project's "iron triangle" requirements also known as the project manager's "execution realm". Their findings revealed senior managers viewed the transfer of tacit knowledge as strategically important. Their research focused on the development of external technology integration from various sectors but excluded the construction industry. Egbu and Robinson (2005) highlighted intra- and inter-organisational knowledge sharing within the construction industry and that there is unease regarding the latter type of knowledge sharing. Some of these concerns include copyright and confidentiality. It is suggested that the aforementioned concerns including an individual's perception of commercial advantage may contribute to practitioners reluctance to share or transfer tacit knowledge.

Von Krogh et al. (2000, p. 14) considered that tacit knowledge was likely to emerge in micro-communities over time rather than during project work. The rationale being that there is more time for members to get to know each other, their personalities and rituals etc. and establish the micro-communities as a stable group rather than being disbanded as soon as the project is finished.

Pemsel and Wiewiora (2013) concluded that the nature of projects as temporary organisations can impede knowledge sharing among practitioners as there focus is on delivering their current project with little time for reflection before the next one. Bordass and Leaman (2013, p. 1) presented a view that "designers and builders are trained to ... hand over the keys, not to look in to what happens afterwards".

The nature of the construction industry with its emphasis on competitive tendering especially in the public sector for design services and works does not encourage the design team and contractors to remain in teams that get the opportunity to create long-term and sustainable relationships. However it is suggested that there are also specific challenges for practitioners embedding new project management knowledge within project-based organisations which are discussed in section 3.3.

2.4. The concept of making projects "critical"

Cicmil and Hodgson (2006, p. 1) highlighted that various individuals have questioned the traditional approach to project management and its body of knowledge since 1994. Their overarching concern was that while universal principles may be of some use for managing projects, this approach does not consider that project managers operate in an ever-changing and competitive environment. They challenged the long-held conventional view that project managers have purely rational and technical skills, e.g. planning, commanding, controlling etc. Cicmil and Hodgson (2006, p. 11) summarise the conundrum by asserting "project management is perceived as social, context-bound practice which cannot be reduced to a set of theories, tools and techniques". Blomquist and Packendorff (1998) concurred with the view that projects must not be perceived as operating as a distinct system impervious to outside political or economic pressures. The perspective of looking at projects and project management in this way allows research to consider other theories e.g. organisational theory that may have been regarded as traditionally outside the project management domain.

3. Project-based organisations

3.1. The projectified society

Lundin and Soderholm (1998, p. 16) asserted that use of projects by organisations to remain competitive is likely to continue and introduced the term "projectified society". However they suggested that a society organised or dominated by projects would face uncertain and complex problems including the temporary and unpredictable nature of the labour market and the difficulty of maintaining a stable knowledge reservoir. They suggest that the projectified society is partly in existence as projects will continue to fulfil an important economic role in society. The issue of a growing projectified society would appear to present long-term challenges for project managers when passing on knowledge to others.

3.2. Project-based organisations and the construction industry

Bresnen, Goussevskaia, and Swan (2004) argued that the construction industry is a good example of where project-based organisations are located due to its extensive range of activity. The nature of construction encourages project-based working as clients requires project-specific and unique requirements, multiple inter-professional contractual arrangements and heterogeneous project teams. However project-based organisations may have potential problems when they are implementing new management ideas or procedures that may be regarded for general application and therefore perceived as context free and open to interpretation by project managers in different ways. Bresnen et al. (2004) highlighted that implementing new management initiatives should be done so with an awareness of the social context in which they occur. They concluded that the development of new project management practice is a two-way process and depends on the organisation's system of guidelines and the individual practitioners' actual use and interpretation of them in practice.

3.3. Project-based organisations and embedding new project management knowledge

Bresnen et al. (2004) judged that the introduction of new measures or knowledge by companies was complex within project-based organisations that had embedded project management practices. Their research clarified that it was not that the working on projects that prevented new knowledge from being embedded, but that the ongoing interactions and praxis were changing on the basis of practitioners' experience of projects. They considered the use of structuration theory to comprehend that diversity of practice is acceptable.

Goussevskaia, Scarbrough, Swan, and Bresnen (2006) considered that due to the characteristics of project-based learning, careful consideration was required before introducing new organisational practices. Their research focussed on the implementation of new project management practices in four UK construction companies. They drew attention to the features of project-based organisations, the transitory nature of projects, the short term emphasis on performance and decentralised work locations. Their research showed that some new project management practices were not accepted and this was partly due to the perceived validity of the new procedures and politics within the organisation. These findings are consistent with other research. Hatfield (2014, p. 205) undertook some scenario planning and predicted "managers continuing to do what they do regardless of what professional institutes and standard writers say they ought to". Garcia (2005) highlighted the issue of adopting project management standards and cautioned against the introduction of more unnecessary standards. Her view was that organisations must comply with various standards to remain competitive in the market place but cautioned against imposing a new standard that conflicted with an existing one or was incompatible with the organisation's culture.

4. Project learning

4.1. **Project learning tools**

Ayas (1998, p. 90) argued that "professional" project management" is "building long term capability for learning and continuous improvement with every project undertaken". Ayas (1998) added to the debate that project managers are focussed on short-term performance and this was not conducive to the investment required for "professional" project management. She proposed that the following mechanisms or tools could be useful for learning from projects: a project audit, a generic work breakdown and a demonstration project. The ability to undertake a project audit is recognised by the RICS's PMPG Board as a CPMS competency. It is suggested that a generic work breakdown structure may exist in professional companies as part of their in-house project management procedures. Some PPMPS already include checklists and aide-memoirs; for example, the RICS's Project Monitoring Guidance Note includes Appendix A that sets out an extensive generic check list for project managers' use in compiling an Initial Audit report.

It is suggested that demonstration projects for a capital project are rare in the construction industry. Several factors may contribute to this: a perceived unwillingness of clients to invest in a capital project that could be expensive to monitor over a long period of time, the public sectors obligation to competitively tender works and, more widely, the industry's reluctance to invest in research and development. The construction industry has not demonstrated a high level of investment in research and development; for example, it has a turnover of £65bn but spent only £270m on research and development in 1999 to 2000 (National Audit Office, 2001, p. 9). Arguably the UK Government's own commitment to research has diminished as it has committed only £150m to the construction industry from 2013 to 2018 (Department for Buisness, Innovation and Skills, 2015).

Ayas (1998) did not directly refer to the potential of other project learning concepts i.e. the PPMPS or the project management office (PMO) that may be of value to practitioners. The rationale for this anomaly may be that the emergence of the PMO was a relatively new idea in 1998 (Hobbs, Aubry, & Thuillier, 2008).

4.2. **The project management office**

Hobbs et al. (2008) proposed that the emergence of the PMO was another response by organisations to remain competitive in a global market. It is suggested that one of the reasons for the emergence of the PMO was to counteract the potential lack of knowledge sharing as part of the growing projectified society. See section 3.1 above.

Boud and Garrick (1999b) asserted that work and learning are no longer separate. Workplace learning is defined as that which is concerned with immediate and future competencies ... too important to be left to educational institutions and in-house training departments ... (Boud & Garrick, 1999a, p. 5)

It is suggested that the emergence of the PMO may be seen as result of changes to workplace learning and employers have a vested interest in the long-term development of practitioners.

The PMI has promoted and favoured the use of the PMO as an important aspect of knowledge transfer (PMI, 2015a). Pemsel and Wiewiora (2013, p. 31) defined the PMO as "a formal layer of control between top management and project management". The PMO's function will vary but its role can be regarded as an organisational unit facilitating coordination of knowledge and other resources between the PBO [project-based organisation] and its projects, and can therefore act a bridge over organisational and knowledge boundaries (Pemsel & Wiewiora, 2013, p. 32).

Pemsel and Wiewiora (2013) provided for a pessimistic view there was a significant mismatch in practitioners' expectations of the PMO's role and project managers' knowledge sharing behaviours. There was a consistent finding that practitioners preferred to seek colleagues' advice than read PMO's guidelines as these were considered laborious. One significant weakness of the PMO is that they focus on past performance of projects rather than providing guidance to practitioners on how they can mitigate problems on future projects. Their research comprised interviews with 64 practitioners within seven organisations, including one in the construction sector.

Arguably, the PMO could have a useful role in capturing and disseminating knowledge from projects and incorporating this information in to the long-term development of practitioners and improving organisational knowledge. In this way, practitioners may consider that projects could be considered as learning entities. The issue is whether project managers can or want to transfer tacit knowledge from undertaking projects. Foos et al. (2006, p. 15) highlighted "that very few mangers differentiate between technology transfer and tacit knowledge". Kreiner (2002) argued that while there was substantial material on knowledge management, he contended that this is not an easy task to manage tacit knowledge. It is suggested that the success of the PMO will depend on its understanding of organisational politics and its support from practitioners.

4.3. **Standardised project management practice**

The issue of standardised project management has been considered by various researches with mixed and contrasting results. Papke-Shields, Besie, and Quan (2010) concluded there was evidence that the adoption of project management practices did lead to increased project success. Their research in the USA indicated that project management practices for time, cost and quality were implemented more than others. It is suggested this finding reflects the tradition of measuring projects in accordance with the "iron triangle". Approximately 54% of responses came from organisations with sales volumes between \$50m to \$1bn. 50% of the organisations employed between 1,000-25,000 employees and their research was pan-sector. Arguably, given organisations of this magnitude, there would be some project management procedures in place in contrast to a client who may commission a capital project once in a life time. Their study was cross-sectional not longitudinal. It is suggested that a longitudinal study would have proven more interesting for example, would the same levels of project management service be maintained during a period of recession? Papke-Shields et al. (2010, p. 651) commented "that we do not have a complete picture of which PM practices are being used and the relative use of these practices".

Other research on standardised project management within the computer and electronics industry concluded that

> *It is wrong to assume that standardizing PM factors will automatically enhance project success … and that increasing standardization further beyond this point – which we referred to as an inflection point may actually stifle project success (Milosevic & Patanakul, 2005, p. 191).*

Conventional wisdom suggests that having standardised project management practice based on the PPMPS would help improve project management services. The standardisation of professional services could reduce scope for negligence which forms part of the corporate risk management process (Connaughton & Meikle, 2013, p. 106).

However, there are concerns about codifying professional services or practice standards. It is suggested, there is a potential risk of inexperienced practitioners falling in to the trap of "box ticking". Hodgson and Cicmil (2006, p. 48) questioned that the "black boxing" of project management procedures and knowledge maybe detrimental, i.e. removing ethical and political dimensions of projects.

5. Concluding remarks and recommendations

5.1. Concluding remarks

The literature review considered some long-standing beliefs that appear to be rarely challenged in main stream project management practice. Considering the differences between projects and project management, the concept of the "iron triangle" and the idea of making projects "critical" has provided an alternative perspective on some of the barriers practitioners may encounter in knowledge transfer or learning from projects. The review of project-based organisations analysed some project management learning tools including the project management office. This paper highlighted some different views on the merits of standardised project management procedures and the codification of professional services and this is an area that should be explored in further research.

The significant finding from the literature review is that there are challenges for practitioners in transferring knowledge, tacit or otherwise, and ironically this seems to be compounded by the characteristics of project-based working in project-based organisations. This new knowledge leads to the suggestion that projects can be perceived as a learning entities in their own right and complemented by other project learning tools such as codified project management knowledge.

The aim of the research paper was to undertake a literature review that will influence the professional doctorate research. The title of the professional doctorate is "the extent that chartered project management surveying practices and clients avail themselves of professional project management practice standards". One of the research objectives is to investigate how professional services firms and clients use professional project management practice standards in the workplace when providing training and development for their employees. The future research will provide an opportunity to explore if the professional project practice management standards can be seen as a source of consistent and lasting knowledge to practitioners and clients.

5.2. Recommendations

It is proposed that employers have an important role to play in the long-term development of practitioners due to changes in workplace learning. It is recommended that by allocating project managers' specific time for reflection *between projects,* they can learn lessons that will be useful for future projects. In addition, it is recommended that the professional project management associations review their professional development requirements, so that there is an emphasis on incorporating lessons learnt from previous projects and knowledge sharing.

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Importance of Leadership in Effective Implementation of TQM in the Nigeria Construction Industry

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Abstract

Total Quality Management is a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback. Within the construction industry, architects, quantity surveyors, engineers, contractors and various other specialists all have, in addition to their special technical skills, their own trade or professional customs and practices. These may have an effect on the building process either individually or collectively. TQM is concerned with moving the focus of control from the outside to the inside of individuals, so that everyone is accountable for his/her own performance. The vehicle for achieving excellence in leadership is TQM. Effective leadership starts with the chief executive's vision and develops into a strategy for deployment. It goes on to embrace all the beliefs and values held, the decisions taken and the plans made by anyone anywhere in the organisation, and the focusing of them into effective, value-adding action. Together, effective leadership and TQM result in a company or organisation culture in which everyone is constantly trying to do the right things, right first time. This paper, practically, possesses the concept of discovering the ways to fix the challenges confronting poor leadership in Nigeria.

Keywords:

TQM, Leadership, Nigeria, Organisation, construction.

1. Introduction

The major problem faced by most construction company in Nigeria is on how to adopt a strategy for high quality building that will satisfy the needs of the owner at a reduced and effective price and still ensure that they remain in business without any involvement in debt. Solving such a problem can be frustrating Most times, because various goals often seem to be inconsistent with one another such as low quality building resulting in the owner's dissatisfaction. These problems are multifaceted due to the fact that the owner wants to spend the least amount possible for the highest quality end product. The challenge now arises on how the company will meet the demand of the clients by providing high quality building at the lowest cost particularly in a time of extensive competition from various bidders (Okuntade 2015).

In many years, the economic well-being of Nigeria as a country has encountered numerous problems ranging from decline in currency and wealth, inadequate investments development, to at least 2% of foreign direct investment. From reviewing various journals, articles, and textbooks, the problems of Nigeria has been attributed to the following factors:

- Need for appropriate leadership skills within the Nigeria construction industry
- Need for appropriate management style
- Need for proper governance
- Need for adequate communication skills
- Need for team spirit
- Need for adequate planning
- Need for adequate Entrepreneurial skills
- Need for conflict management skills
- Need for cross-cultural skills

Great efforts have been taken in finding solutions to improve poor leadership, poor sustainable programs and operational problems of Nigeria and the importance of Total Quality Management (TQM) in the Nigeria construction industry, since all the research effort on the importance of TQM had been centred on developed nations. Little had been done on TQM implementation in the Nigeria construction industry. It is a problem that this paper had to address, and the recommended solutions in this paper had to be based on strong probabilities. Some of the problems faced by Nigeria were caused by lack of adequate strategic and development planning and leadership by its employees, managers, leaders, and governmental agencies.

This paper aims to highlight the importance of leadership role on effective TQM implementation in the Nigeria construction industry, the cultural issues, insufficient leadership competencies, lack of proper management activities, and inadequate business competitive benefit. With the opinion of proposing a TQM concept for implementing highly effective leadership competencies that includes potential value added to the general population, the paper presents Nigeria leaders with dependable resources for management system. This paper is based on a thorough literature review. The paper recommends the use of total quality management on leadership and reorganization of operational managements in the Nigeria construction industry.

2. Introduction to Total Quality Management

Total quality management (TQM) was initially developed in Japan, and its origins can be traced in the work of the well-known quality gurus, Deming, Juran, Feigenbaum, Ishikawa and Crosby and on the rise and dominance of the Japanese automobile industry in the world markets. During the 1980s and 1990s, TQM began to influence national business systems and was widely seen as a "revolution" in management. It is widely accepted that TQM emphasizes self-control, autonomy, and creativity among employees and requires active co-operation rather than mere compliance. In addition, TQM theory supports that internal and external information should be equally shared among all employees in order to encourage them to become responsible for quality improvement. However, although many articles have been written about the "basic principles and tools" of TQM and the various approaches taken to assure a successful implementation of TQM according to Dayton (2003) continue to the role of managing quality is essential in today's environment, as evidenced by the popularity of the TQM movement and the success it has brought to a number of organizations (Easton & Jarrell, 1998; Douglas &

Judge, 2010; Hendricks & Singhal, 2007) remain complex and somewhat clouded. Therefore, quality management plays a crucial role in the actualisation of high quality construction projects that can stand the test of time, satisfy its stakeholders and put Nigeria in the forefront of high quality infrastructural map. A quality management system that can ascertain that all the parties involved in construction projects provides high quality results could be essential in Nigeria. Invariably, the independent implementation of Total Quality Management by the Nigerian construction industry could result in provision of overall high quality standard of projects at the final stage of construction.

2.1. **Total Quality Management in the Nigeria Construction Industry**

Total Quality is a holistic concept which requires quality motivation of all people in an organization towards a common goal. Whatever the structure and management process of the organization the necessary links must be built up between people. We must learn to accept that employees are not only our greatest and most expensive asset but that they alone are the creators of quality, i.e. ‘People make Quality’ (Kanji and Asher, 1993).

The belief is that when people are well motivated then they can overcome any difficulties they experience in solving their problems. Further, whatever work we are associated with, we must motivate ourselves in order to achieve our work objective. Quality motivation is all about people because it is people who make quality. We have a common saying that ‘an organization is as good as its people’. It is well-known that the majority of quality-related problems within our organizations are not within the control of the individual employee. As many as 80% of these problems are caused by the way the people are organized and managed.

Some examples of this bad management can be seen as follows:

- When people are not given the right training to do the job and have to learn the job of others.
- When the job itself is not properly defined and those doing it have to ‘make it up’ as they go along.
- When paperwork is out of date or otherwise inaccurate.
- When systems do not reflect the work that actually takes place or rare not designed to help to do the job.

The role of managers within the organization is to ensure that everything necessary is in place to allow people to make quality. Organizations are run by various systems and procedures in order to manage their activities smoothly and in an orderly fashion. However, in recent years the business world has changed rapidly and business processes have accordingly changed with it. The major activities of managers these days are therefore to manage these organizational changes. Most of them are due to the modern quality revolution which, in turn, has created the customers’ higher quality expectation of products and services.

For the adaption of these changes many organizations have followed a streamline route, i.e. a method to eliminate unnecessary work processes, duplication of workloads and extra cross-functional cooperation. Although streamline routes are desirable for many organizations, nevertheless, our human system organized in this way could easily create some negative and undesirable activities, e.g. loss of enthusiasm, lack of creativity and motivation. It is therefore the leadership of the organization that must play an active role in preserving the positive aspects of the human system and stimulate the individual in its real desire to work. Leadership is the beginning of the quality improvement process which starts with vision, mission, values, policy and strategy, systems etc. And further continues with other principles and concepts of TQM. According to the European Model for TQM, leadership is the driving force behind policy and strategy, people management, resources and processes, leading ultimately to excellence in business results.

As the definition of total quality management suggests, present day leaders and managers are involved in the management of systems and processes rather than in the supervision and control of people as they formerly were. Processes are groups of activities that take an input, add value to it, and provide an output to an internal or external entity.

Frank and Ronald (2006) in their words regarded total quality management, as procedure guided by senior administration to acquire the engagement of every member of staff in the constant transformation of the proficiency of all the exercises, with regard to the regular business, in order to fulfil the requirements and gratification of the client, regardless of whether internal or external.

According to Vetiva construction industry report on Nigeria 2011, Nigeria's home construction industry makes up about 1.4% of their GDP (Q3'10 est.) Most significant, is that regardless of the development observed in the development market of construction, its participation to overall GDP continues to be at minimal levels. In 1981, the construction market accounted for 5.8% of Nigeria's GDP - as well as in the past two to three decades, Nigeria's entire GDP has got risen to an estimated 495 times its actual capacity in 1981. Particularly, the drivers of Nigeria's GDP during the last 3 years' have been the same- Agriculture (crop efficiency), crude oil production as well as wholesale & retail transaction. The construction industry is still to realise its potential opportunities regardless of Nigeria's large deficiency in national infrastructure development.

During the last several generations, crop production, crude oil production and wholesale & retail market have documented a 27 years CAGR of 28%, 29% and 26% respectively, whilst the development industry GDP developed at a CAgr 21% over the exact same interval. This illustrates that Nigeria is way below knowing its actual potential with regards to the construction industry. Nigeria continues to be developing at average of 7.4%, over these past 2years, because of strong agriculture production in spite of the persistent commercial infrastructure difficulties affecting production. Nigeria may accomplish a greater development rate when fundamental infrastructural bottlenecks, particularly electrical power are eradicated. Additionally, when the recurring reforms of the business banking industry as well as interest apex bank (Central Bank of Nigeria) occurs to motivate financing to smaller and medium scaled sectors.

The culture of an organisation is formed by the beliefs, behaviours, norms, dominant values, rules and climate in the organisation. Any organisation needs a vision framework, comprising its guiding philosophy, core values and beliefs and purpose. The effectiveness of an organisation depends on the extent to which people perform their roles and move towards the common goals and objectives. TQM is concerned with moving the focus of control from the outside to the inside of individuals, so that everyone is accountable for his/her own performance. Effective leadership starts with the chief executive's vision and develops into a strategy for deployment.

Therefore, the inability of corporate managers and many leaders in Nigeria to effectively discharge concrete roles and the resultant failure of businesses and programs in today's corporate world have been linked together by analysts that one can easily regard them as cause and effect. In addition, the desire to avoid failure has dominated the minds of experts in various construction sectors, and researchers constantly seek ways of improving the quality of the programs, products, services, and leadership skills of leaders available to individuals in many of the African countries. This, of course, constitutes the major objective of having effective leaders in Nigeria who can apply and practice the total quality management process.

2.2. Roles of total quality management

At this point the purposes of TQM with regards to the construction industry as indicated in this facet, TQM is a procedure accustomed to acquire consistent transformation of the activities of all the routines to render gratification for clients, whether internal or external, and this results in variations in the ways of thinking and the operating atmosphere and offers specific tools strategies and systems for frequent transformation. The system moreover produces a suitable first experience perception of delight customers, and attempts to acknowledge cost quality as an essential tool, and offers evaluation for continuous improvement. TQM on the contrary aspires to get rid of waste materials and it as well allures exposure and the company perhaps utilized as role model for quality.

Transformation in the total quality management is accomplished by the cultural modification dependent on measurement of capabilities, and removal of cause and limitations. Total quality management produces a culture in the company that aims to consistently enhance in all pursuits; it concentrates on an entire knowledge of the numerous business procedure by the usual daily participation of all involved. Total quality management thus employs quality data for measurement and continuous improvement, in spite of this, it rigors the significance of products and services brought to the customer, whether internal or external, attaining specifications whether specified or not Ugboro& Obeng (2010).

3. Challenges in the Nigerian Construction industry

The characteristics of Construction procedures in a developing nation like Nigeria vary considerably from the strategies used in industrialized or developed nations. In Nigeria, the best difficulties confronting construction a professional arises from the fact that the exercise of construction is not consistent. It differs with the client, capacity or perhaps intricacy of the task from the point of view of the proprietors. In order terms, the construction technique is the method of managing the entire project from conception to completion. Construction often does not late to development but to design, authorization and also preparation which we make reference to as “Pre Contract” Subsequently the physical aspect of construction together with Facilities Management, which we describe as “Post Contract” (Osuagwu 2002).

The above assertion could be justifiable considering incessant collapse of building structures around Nigeria and the concern for quality of construction projects across the country (Okuntade 2015). Between 1974 and 2006, 61 cases of buildings collapse were reported across the country (LSPDA 2010). Out of this figure, 13% was directly attributed to faulty designs. Moreover, the report revealed that out of 233 associated cases of lost lives - 53% was traced to incidences due to faulty designs. However, Kado *et al.,* (2010) conducted a study on application of TQM principles by the Design consultancy firms in North-western part of Nigeria. The study indicated that whether by design or coincidence, design consultancy were actually using the aspects of TQM in their operations. A particular firm attained the highest status of 'Recognised TQ Company.' Conversely, the result of the study revealed that, on the overall, the firms recorded a status of 'Realisation of improvement needed.'

3.1. Importance of Total Quality Management Implementation in the Nigeria construction

TQM is an absolute must for any business organization and leaders who are in the 21st century competition. Inherent to the paper is an understanding of the principles of TQM, the management leadership, and how they are related. To obtain this understanding, related literature synthesis was reviewed with the emphasis on understanding the concepts and the developments of TQM, application of TQM, quality improvement processes, management leadership and commitment, leadership effectiveness, continuous improvement, support, and involvement processes, and other actions which an effective leader and manager must do in order to achieve Total Quality Management objective. The organizational structure and operation of a nation or organization must be at par for success to be the result. It enables all of the disparate elements of a company or nation to fit together, work efficiently, and maximize profit or wealth. Transformation is the force behind differentiation and change. It enables a company or nation to set itself apart from its competitors or other nations and creates new growth engines. Corporate success, however, is also a function of the effectiveness of the personal platform of its leader.

In the literature, Total Quality Management has been defined in many ways. Total Quality Management as a systems approach to management that aims to continuously increase value to customers by designing and continuously improving organizational processes and systems. In this regard, TQM is viewed as a means of setting value for the customers, programs, and other entities, an integration of activities and processes across functions and departments, collaboration, and teamwork in an effort to achieve organizational goals. However, it could be explained as the product of the work of such American quality experts as Deming, Juran, Crosby, and the work of an important Japanese expert Ishikawa.

In the literature, many people credit Deming and Juran with teaching Japanese firms the quality control skills that have made Japanese firms such successful competitors with United States and European firms. Although both Deming and Juran offered advice to United States firms in the 1950s, they were disregarded because at that time, United States manufacturing firms‟ capabilities were the best in the world. By the 1980s, however, United States manufacturing practices had taken second place to those of the Japanese, and Deming and Juran were warmly embraced as champions of quality management. Much of Deming‟s philosophy for improving quality is captured in his fourteen points. In the 1980s, Phil Crosby also became a leading proponent of quality management. The idea of “zero defects” means exactly that there will be no defects.

3.2. TQM implementation process

The philosophies and techniques must be integrated into a coherent implementation plan. TQM is a top-down commitment. Leaders and top management must become enlightened and then pass the lamp of wisdom onward. The implementation process consists of five steps, which are:

3.3. Develop a Compelling Vision

Nigerian leaders must have a compelling reason that will sustain them and their countries for years to come. Total quality management is not another program. Total quality management is a way of life that the Nigerian leaders must put their people and their customers first, eliminate barriers, and over-come whatever stands in the way of fulfilling the people interests and customer needs.

3.4. Start Small

It is unrealistic for Nigeria government and businesses to implement a nationwide quality management plan all at once. A single city, state, or region must first serve as a test site. In this stage, vision leadership is articulated and implemented. It is good to try to transform the test site completely before transporting the plan nation-wide or company-wide. TQM will have to work on all employees of the government or organization, not just the best or the worst.

Nigerian construction leaders and management must use the elements of the Deming cycle which are the Plan-Do-Check-Act (PDCA) cycle, in proving a systematic way to view continuous improvement (please refer to Figure 1). Nigerian leaders and top management must have constant communication with citizens and be willing to provide feedback in a timely. The cycle of the PDCA Leadership Model begins with the Check phase, because the development of the plan for quality improvements requires an understanding of the present situation.

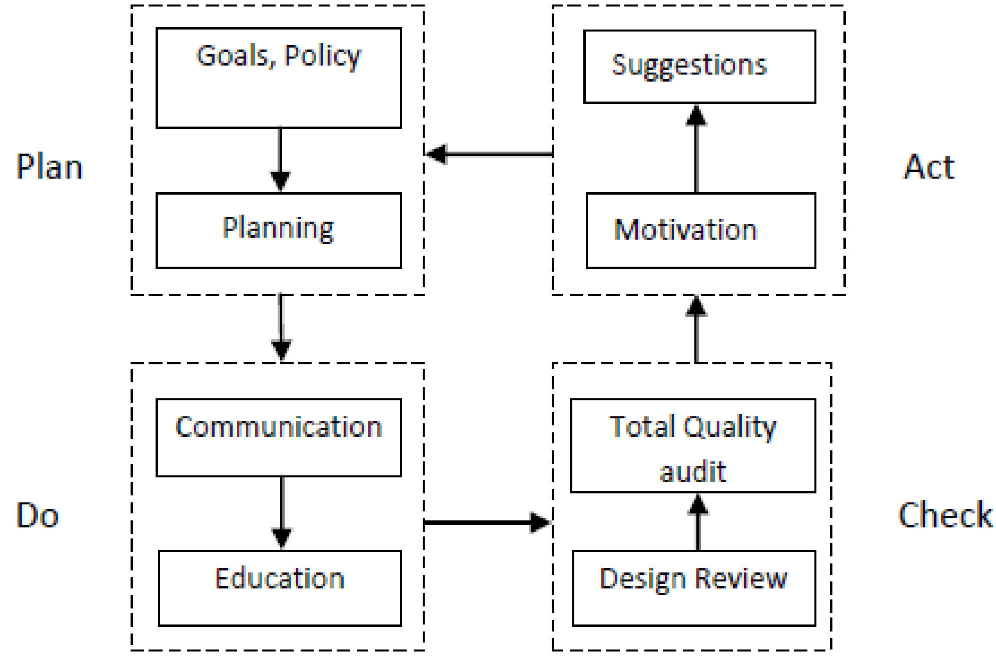

Figure 1: Total Quality Management. Adopted from Laurea (2011)

The TQM leadership model is to consist of two key elements based on Deming's well-known points 1 and 5: continuous improvement of products and services and continuous improvements of processes. Hence, the model will consist of the following two elements: design review and total quality audit. The process of design review consists of checking the product and service development at various important stages–a preliminary stage, on or more intermediate stages and a final stage.

Total quality audit consists of checking the concordance between quality plans and quality results in order to identify future opportunities for improvements. In short, total quality audit is checking the quality of the processes of the company including the product development process.

In other words the causes behind the measurements should be understood. In this context a thorough analysis and evaluation of measurements are a must. That means building up a coherent measurement system is a prerequisite for an effective quality audit. When checking the product development process it is important to integrate results from design review. These results should be evaluated in exactly the same way as results from other business processes in order to identify future opportunities for improvements. Before the revolution of TQM top management participation in design review and quality audit was not common. These activities were usually considered to be the responsibility of the quality department. Today it is widely realized that these two activities cannot be delegated. Both are key elements of leadership and policy deployment.

The next phase of the leadership model is the Act phase, which consists of two elements namely: motivation and suggestions.

If top management participates wholeheartedly in the check phase an important signal has been sent out to the whole organization that quality and quality improvements are top priority. The effect will be people who are motivated for quality improvements. For each key process suggestions for quality improvements will be generated as input to the next phase of the PDCA Leadership Model. The last phase of the PDCA Leadership Model is the Do phase. Here we also have two elements. The final quality plan has to be communicated to everyone concerned and the necessary education has to be achieved. Besides the need to educate the employees (including management) in the use of quality tools there is also a need to educate and train all the employees in human motivation – theory and practice

3.5. **Become Obsessed**

Nigeria leaders and management must plan strategically and also become obsessed with implementing the vision and sweating out the details because these are what the people and customer sees, not wondrous corporate platitudes. Nigeria leaders and management should ensure abundantly clear that its people and customers are welcome and that they are the core value of the nation. This ranges from stable security, encouraging foreign businesses to established well economical business, creating a friendly environment and well healthful society to produce a service and product of world class quality that the customer will be proud to own and find a pleasure to use the service and consume the product. Obsession to accomplish quality must be a top down approach. Employees must know who the top leaders and managers are personally. They cannot remain faceless.

4. Theoretical application of TQM in Nigeria leadership

Clear leadership and vision are considered to be the most important critical success factors of TQM. If TQM is adopted as a positive business strategy a substantial upfront investment of management time must be made before a return is seen. The model I presented in Figure 1 is an attempt to point out and to systematize some of the key tasks for leaders committed to the TQM process.

The PDCA cycle is an obvious choice as a frame of reference. The Plan phase and the existence of well-developed communication reflect the degree of deployment in the firm while education and training reflect the degree of empowerment. When TQM has been incorporated into the firm's strategic and operational plans, communicated to all employees and delegation of responsibility has been undertaken as a consequence of education and training, then a need to measure the correspondence between plans and results is the next managerial step on the quality journey.

The Plan, Do and Check phases in this model reflect top-down leadership but to modify existing quality plans or establish new quality objectives, participation of the workforce is crucial. The Act phase reflects the bottom-up principle. It is a very important managerial task to create a motivational environment to ensure that the employees perform according to quality goals and make suggestions about quality improvements. As stressed by many authors motivation is increased and commitment is shown if management takes immediate action on good ideas from the workforce.

This paper outlines the key elements and other variables that describe an effective leader and TQM principles. The variables are:

- Leadership effectiveness
- Leadership and management commitment
- Employee and individual involvement
- General public input and
- Continuous improvement and effectiveness of a nation

The theoretical application of TQM explains the rationale behind the recommended TQM implementation in Nigeria leadership process.

4.1. **Leadership Effectiveness**

The leadership effectiveness generally concentrates on two important dimensions - the human element and the operation element. The most fundamental human goal of a leader's effectiveness is the changing of beliefs and attitudes of individuals in the nation. Before these changes can occur however, it is important that people learn to trust each other. To achieve trust certain procedures should exist, for example, open-communication, and empowerment should be used. The outcome of these activities can be an increased awareness of trust in others; this allows individuals in Nigeria to devote more time to goal accomplishment and less to corruptions. Improvement in these areas increases the likelihood that Nigeria can contribute more to the society at large and will also be able to obtain and utilize the scarce resources needed to ensure its future growth and existence.

4.2. **Leadership and Management Commitment**

Leadership and Management commitment are the active ingredients of TQM program implementation, which is necessary to demonstrate the level of leadership and management commitment to the country (Nigeria). A strong level of leadership commitment is required to overcome individual resistance.

4.3. **Employee and Individual Involvement**

TQM programs are based upon the involvement of local employees and individuals to be an active element in the improvement process of the country (Nigeria). Typically, TQM programs are developed to encourage participative leadership, to reduce the number of bureaucracy levels, to increase accountability, and to transfer some of the leadership responsibilities to the non-management individuals. Emphasis is placed on training important individuals in the Total Quality Management processes and in increasing their individual skill levels.

4.4. **General Public Input**

The government typically designs and produces policies that affect the public, without involving or communicating the policy with the public. TQM programs emphasize the need to communicates and involve important community leaders, institutional leaders, and religious leaders in the policy making. In TQM programs, customer needs are identified, and the organization, products, services, and processes are upgraded to achieve customer satisfaction, therefore, Nigeria leaders should follow the philosophy of TQM.

4.5. **Continuous Improvement**

After a TQM program is in place, it is important that the improvement of open communication, responsibility, accountability, caring attitude, teamwork, and positive decision making processes continue until it's becomes a culture. Performance standards are constantly raised to new levels to promote the continuance of improvement. Nigerian leaders are expected to continue to improve in their decision making process and activities with proper TQM training.

5. Recommendations

Prior to the enumeration of the recommendations in this paper, it is important to point out some crucial facts:

This paper seeks to provide a solution for effective Total Quality Management implementation in the Nigeria construction industry. The people and the governments wish to see a positive change in the operation of the country. The wish of the people is necessary because regardless of how good the plan to implement effective leadership in Nigeria, many of the programs and operations of the country will not be effective, if the rulers are not willing to implement the changes.

Secondly, the suggested changes are not an end in themselves; they are means to an end of the problems. If the suggested changes are followed, it is strongly hoped that success will be achieved in terms of improving the Nigeria's image and relationship with other nations in leadership and performance, which will eventually position the country to be one of the top ten successful countries in using TQM.

The principal fact towards the workability of the recommendations is that the government must render one hundred percentage supports in implementing TQM in the construction industry. Government should be willing to set up a climate whereby skilled or CEOs with excellent track records will be selected and will be allowed to perform their managerial duties and be evaluated based on their performance with TQM. In the light of these, the following recommendations are made:

- There must be an encouragement of leadership from everyone, senior and lower officers in government, senior management to lower ranked employees, especially when these ideas are very necessary to the country, institutions, and organizations. Inadequate communication leads to poor performance, less acceptable service, a loss of revenue, and lack of patronage from the foreign businesses, foreign organizations, and customers worldwide. The government, CEOs, and other leaders must relay to all employees including the people of non-salary relationships, the philosophy of TQM, why it should be implemented, how it will help to reach their vision and the benefit it will bring over time to the country. Adequate communication on the advantages and disadvantages of TQM will help the leaders, employees, and customers overcome some fears of change.
- As soon TQM is underway, attendance of improvement training by leaders, management, and non-management employees will be an excellent motivator. Other motivational factors must be included as incentive package. However such motivational designs must be scrutinized to ensure that they do not defeat their objectives. Evaluation mechanism must be provided so that Nigeria leaders, managers, and other employees will always test or find out if TQM principles are being used as top priorities. Series of meetings with

training opportunities should be in place. Excellent employees must be rewarded so as to induce all employees and citizens to strive for excellent performance.

- The construction industries should be deeply involved in the training of other leaders, managers, principals, students, supervisors, and other levels of employees. Method of evaluation should be designed to show that the entities being trained are serious with the training and will incorporate ideas from the training into their different aspects of job performance.
- The introduction of implementation of TQM plan is in no way seen in Nigeria's past actions in transactions with other nations. For the country to be successful, top management break-through planning should be encouraged. The break-through plan helps in the processes, and in focusing quality improvement efforts on processes that can really make a difference. This might improve the position of Nigeria in a global competition which tends to reduce the negative perception of foreign businesses and foreign countries. TQM experts such as Deming, Juran, and Cosby recognize that TQM principles sometimes, or in many instances, are void of break through plans, and such have been observed to hurt their efforts. Efforts should guide against this outcome.
- The absence of teamwork which started from the government bureaucracy is a detrimental factor to Nigeria's performance. If people get together as a team and design policies and appoint who should implement the policies, all they need to do is devise an evaluation mechanism that will be used to assess the policy implementer's performance. In this aspect, the team should have a strong focus on continuous improvement processes and quality improvement. Team leaders and facilitators should be people with training on total quality tools and effects. The team should focus on problem-solving skills and the enhancement of morale.
- The initial approach of TQM, without doubt costs money, time, and needs dedication. The construction industry in this present situation should help to provide the team planners with financial backing and commit the leaders to devoting quality time with a built in reward in the plan. Nigeria's leaders in this case should be champions to the implementation of TQM principles. The application should be centred on solving problems of the country's operation. Results or outcome from any applied policy must be communicated to all community, institution, and religious leaders and feedback required from them. If complete success is not achieved, comments or feedback from general public, regardless of their level, may be very important weapons in arriving at the solutions.
- Quality culture is very important in any country and organization's utilization of TQM establishment. If the country is to achieve a quality leader servant, it is necessary that all involved in the policy making play a major part. In order for the nationwide effort to be achieved, leaders in the construction industries must provide quality culture. That is, leaders and management must provide the setting that stimulates quality. The setting consists of motivation, direction, and resources that each individual needs to achieve his/her quality goals. This culture requires that Nigeria's leaders and management take two steps.

6. Conclusion

Effective leadership and total quality management demands readiness of the Nigerian people. The willingness and pride in the country and the government's willingness to provide the resources necessary to serve and satisfy the general public needs must be emphasized. However, this paper suggests that based on past leadership, a TQM program will be more effective in increasing the capabilities and performance of government, businesses, and the general public in Nigeria. The leaders in Nigeria should be willing to emphasize on the people-oriented elements of management commitment and people's involvement, which will increase or change the process elements of continuous improvement and the people of Nigeria's satisfaction in improving the effectiveness of performance must be highlighted. It is imperative that Nigeria's leaders are not totally myopic to TQM concepts, but the major problem lies in implementation. This paper has unveiled the reasons for non-implementation and has concretely illustrated that the recommended TQM model might remedy the problems of Nigeria if properly implemented. Many authors agree with the writings of TQM experts such as Deming, Juran, and Crosby, which emphasized that the four key components of TQM program are essential for any nation planning to implement a TQM program. Deming strongly emphasized the importance of management leadership in his writings. Feigenbaum (1960) also indicated that the people in any nation are the most important participants in a TQM program, while Crosby (1985) agreed and concluded that leaders must emphasize that responsibility and accountability are the key elements to success. This, of course, is indicative of the lack of TQM implementation in sustainability of programs, organizational structure and operation of Nigeria. The paper also found that there were political, geographical, social, economic, and tribal constraints which negatively affected and still affect the performance of Nigeria.

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Land Tenure Security According to Land Registration Systems in Iraq

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Abstract

Land Tenure Security (LTS) is a significant way in which the land user's rights are protected. It can be safeguarded under different forms that are included in various concepts, practices and influences which can be registered and protected officially. In Iraq, land tenure administrations have deep historical foundations reaching back to different periods related to land tenure, however, the current land systems such as registration and recording systems are greatly influenced by conflicting policies and ideologies that control its programs and reforms, and this indicates a real need for more research within this area.

Therefore, this paper aims to investigate this gap by studying the link between land tenure security and the Iraqi land administration regulations and its management which have previously been, and may currently be, linked institutionally. Focusing on the Iraqi land institutional frameworks, this research considers the land registration process, the buy–sell process, and the registration process for obtaining approval for land tenure security. The paper will deal with both the Iraqi Land Institutional Structure (ILIS) and LTS within different periods related to LTS. It also focuses on tenure security aspects in the current conflict period in Iraq after the fall of Ba'athist regime in 2003.

The data collection is built on reviewing the available data and documents and then performing analysis in order to produce results contributing to the final findings. Accordingly, the paper concludes that the history and development of the LTS in Iraq were identified via its social, political and religious settings. It stresses that land registration systems in Iraq were linked directly with the main domination of feudalism and tribalism systems relating to the landlords in rural and semi-urban areas. There is an interconnected matrix of legal, social, religious and economic factors which are linked directly with the ILIS aspects, particularly in the context of the LTS.

Keywords:

Land, Tenure, Security, Land registration, Urban, Iraq.

1. Background

Land and property ownership rights are an essential human right. Tenure is a matter of awareness, and can be safeguarded under various forms, securing the rights of land users. The UN-Habitat report (2008, p5) defines tenure as "the way land is held or owned by individuals and groups, or the set of relationships legally or customarily defined amongst people with respect to land". In other words, tenure reflects relationships between people and land directly, and between policies in their dealings in land. It is worth noting here that tenure has been defined as the relationship among people with respect to land resources (Payne, 2001; UN-Habitat, 2003a; Franzén, 2009; FAO, 2012).

As a result, land tenure can mean the ways in which a society allocates the titles by which land rights are held. The UN-Habitat (2005) showed that land tenure is an issue of varying elements created to manage land rights by the registry titles within the institutional states. Thus, land tenure should primarily be viewed as a complex set of rules that govern land use and rights to land ownership.

In practice, the management of land tenure and tenure security may engage in a wide range of issues related to land users and policies that control users' rights. The literature stresses that tenure policies need to be related to the capacity of institutions, communities and other stakeholders associated with land management and administration (Abelson, 1996; UNCHS, 1996; Davis, 2004; Tebbal and Ray, 2001; UN-Habitat, 2006b; Gulyani and Bassett, 2007). This is a theme echoed by the UN-Habitat report (2012) and the United Nation Millennium Development Goals report (2013) which clarified the role of documented tenure term, as the protection of ownership rights that should be issued through a legal institution's framework.

The general picture of the literature has focused on how to help governments implement the process of Urban Land Tenure (ULT) securing access to land rights for their people. It concluded that documented forms of tenure are important to save ownership rights and avoid forced eviction (Abelson, 1996; UNCHS, 1996; Davis, 2004; UN-Habitat, 2006b; UN-Habitat, 2012). In addition, it states that tenure security is linked with the right to adequate housing which is relevant to a State's ability to protect rights through legal declarations and plans of action (UN-Habitat, 2012). Iraqi land management and administration has been well-documented since 1955 (Al-Nahi, 1955; Al Rashid, 2005; UN-Habitat, 2010b; Shaikley, 2013). It is now widely recognised that the Iraqi land tenure administration, in both the rural and urban sectors, were under massive influence from conflicting policies and ideologies of the Iraqi state and even religious rule that controlled its programs and reforms (Al Rashid, 2005; UN-Habitat, 2010b). These same factors (weak governance) eventually caused social legitimacy and legally insecurity for land tenure administrations (UN-Habitat report, 2012; Shaikley, 2013).

In fact, consequences of state insecurity and inter-communal violence can contribute to land tenure insecurity. For instance, after the fall of the Ba'athist regime in 2003, there was a period of great influence from conflicting state policies. In addition, many reports indicate that an estimated 4 million Iraqis have fled their homes and 57% of the urban population currently lives in slum-like conditions (Al Rashid, 2005; UNICEF, 2007; UNRWA, 2012; Shaikley, 2013). Recently, the chaos of looting, multiple ownership claims and destruction of public records (in Iraq) have increased (UN-Habitat report, 2012; Shaikley, 2013), causing more influence on land tenure security.

With this in mind, the literature has focused on the sustainable institutional aspects of the administration as the principal mechanism through which tenure security can be sought. As a result, the absence of an ability to address the more fundamental supply rights of land, inappropriate regulatory frameworks and weak financial mechanisms; all lead to a lack of Iraqi tenure security.

2. The Iraqi land tenure indicators

The paper focuses on examining the Iraqi land tenure policies, practices, and the land legal structures, presenting the issues involved in tenure security. It also describes the related systems in order to improve tenure security and identify the main indicators, as discussed below:

2.1. The Iraqi Social and Political Influence

Iraq is a multi-cultural society and post war country; it currently suffers many abnormal situations. Iraqi livelihoods, living standards and basic infrastructure services have been deeply damaged (UN-Habitat, 2007; UNRWA, 2012; Shaikley, 2013). Iraqi social and political conflicts have an important influence on land tenure security. Many reports indicate that an estimated four million Iraqis, nearly 15% of the total population, have fled their homes (Williams, 2007; UNICEF, 2007; Razokhi, 2006; UNRWA, 2012; Shaikley, 2013). Furthermore, the majority of the urban population is still suffering from a lack of access to safe drinking water, sanitation, and basic health services, in addition to the lack of electricity (UN-Habitat, 2010; Shaikley, 2013).

In addition, the Iraqi political situation had a significant influence on the migration inside and outside the Iraqi cities. For example, approximately 1.9 million people have sought refuge inside Iraq (UNRWA, 2012), in addition to the 2.2 million which have crossed the Iraqi border into neighbouring countries, and the 57% of the urban population which currently lives in slum-like conditions (UNRWA, 2012; UN-Habitat report, 2012; Shaikley, 2013).

Therefore, state insecurity and inter-communal violence plays a significant role in activating the dislocated millions of people outside the Iraqi cities, which in turn has established one of the more serious relocation problems both during and after the 2003 war. That leads to a significant problem for millions of householders to save their land tenure rights and also for authorities to control such migration within such political situations.

2.2. The Influence of the Ethno-Genesis

Up until the end of the nineteenth century, as pastoral nomads, the tribes in the southern region of Iraq have influenced local frameworks for a ruling dynasty and tribal state. For example, Yitzhak (1994, p.443) stated that "…in 1867, 50 percent of the population in southern Iraq were nomads and 41 percent were cultivators, by 1905 this had changed to 19 and 72 percent, respectively". However, that percentage was halved throughout the twentieth century (Franzén, 2009; Shaikley, 2013) where the Iraqi urban dwellers increased their numbers much faster.

According to the vast influence of pastoral nomadic tribes in southern regions of Iraq, Yitzhak (1994) stated that these tribes were gradually forced to establish primitive settlements under the form of tribe unity. In the beginning the tribes were displaced pastoral nomads living a rural life and then they were organized within primitive neighbourhoods. The Al-Nasiriyah territory, for example, was established as a tribal city ruled by the clan dynasty of the sheikh (Yitzhak, 1994). Thus, land ended up registered in the name of the tribe sheikh, Naser Basha, and even the city took its name (Yitzhak, 1994; Franzén, 2009).

However, the tribal background was a working political alliance of clans based on social and religious conceptions. According to tribal rules, the tribal lands are private property and owned in the name of the tribal sheikh, who was thereby presenting his tribe's men (Yitzhak, 1994; Shaikley, 2013). In addition, the land ownership according to tribal rules is converted between men only (Yitzhak, 1994), that means the tribal lands are the ownership of tribe's members under the name of the sheikh. According to Shaikley (2013) land ownership under the rural and tribal background, is a right of men.

That means that land tenure rights are influenced by gender regulations according to tribal rules of ownership, since the land is registered in the name of the family men while women do not have that right.

2.3. **Religious Tenure Systems**

The UN-Habitat (2008) stated that within religious tenure systems, a number of tenure security categories exist. In a given authority, these include various types of shared ownership. For example, in an Islamic land tenure system there are four main categories within the Islamic law (*Shari'a*): the term '*Waqf*' is land 'held for endowment'; `*Mulk*', or private ownership lands; and `*Miri*' term as the state controlled land which carries `*Tassruf*' or the government rights to use land, and the `*Musha*', or communal lands, (UN-Habitat, 2008; Shaikley, 2013). It is important to recognize the essential characteristics and applications of religious tenure systems that could work as an impediment to urban renewal and efficient land management. These include, for example, the *Waqf* lands within the Islamic tenure system which hold substantial areas of land allocated for charitable or religious endowment. The ownership of this land and the *Waqf* lands cannot be repossessed (UN-Habitat, 2008).

Therefore, these types and applications of land tenure show the effective role of the religious systems in Islamic countries and how these systems can work as major factors against the registry requirement of land ownership. In summary, it should be acknowledged that Islamic land laws (*Shari'a*) have a vital and deep dynamic existence within the active systematic evolution of Islamic Ownership concepts (figure 1).

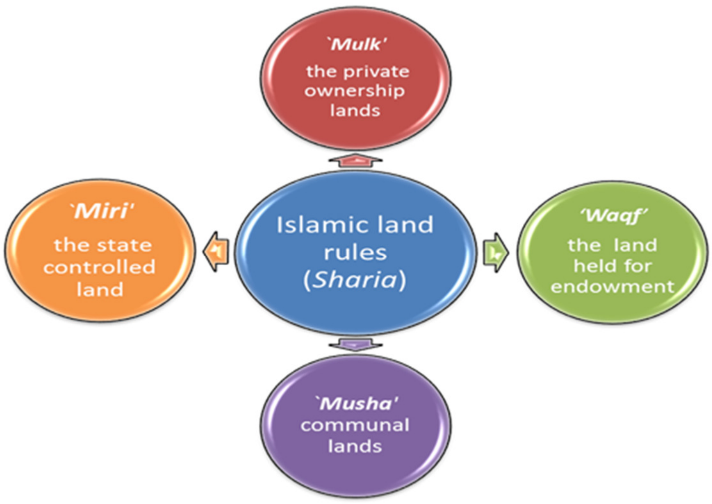

Figure 1: The legitimate characteristics of land tenure under Islamic laws (*Shari'a*).

3. The Iraqi Historical Background of Land Registration

Iraqi land administration can be classified within four main periods according to the main administration forms of a land register and ownership title deeds:

3.1. The Ottoman Land Ownership Period

This period started by the Ottoman occupation of Iraq in 1534 (Shaikley, 2013). During the Ottoman period, most of the lands were owned in a feudal system, by the powerful families of tribal lords (Sleglet and Peter,1983; USAID, 2005; Sheikh, 2013). In Iraq, according to Batatu (1978), land was held by socio-economic and political factors which combined to inhibit the development of individual landholding. In fact, the land was held by the tribal landowners, many of whom were tribal sheikhs. Land tenure was classified into several categories with legal sources of transfer. Sheikh (2013) included a category, such as the TAPU, that provides individual rights while most of the land ownership was owned by legal sources of ownership title deeds.

However, further TAPU grants were banned after 1881, and the Ottomans made numerous attempts over the next thirty years to repossess the lands (Sleglet and Peter, 1983). Thus, during the era of the British occupation in 1914 some 80 percent of the land was *Miri* and a small fraction was TAPU (Sleglet and Peter,1983; Batatu,1978; Sheikh,2013).

In practice, Iraqi land administration was established during the Ottoman period. The main land reform within this period can be identified into the main categories of land owned by the state and public land use, land held individually, and finally, land held by religious rules (Table 1).

Table 1 : The Ottoman Main Land Ownership Regulations in Iraq.

Land Type	System Name	Regulations
• Privately held Land	TAPU	Ottoman land rights law
• Owned by Ottoman State	Ameriya (Miri)	Ottoman Land Rights law
• Endowed Lands	Waqf	Ottoman land rights law
• Public Land for general use	Mewat	Ottoman land rights law

3.2. The British Mandate Period

Under British control, the form of land Ownership title deeds named 'TAPU' was ordered to be examined by registry institutions. That ownership examination led to the establishment of the Real Estate Registration (RER) which was issued under Declaration No. 24 (1920) (Sleglet and Peter, 1983; USAID, 2005; Franze´n, 2009). The British realised the importance of tribal Sheiks. Franze´n (2009) states that they gave them vast legal and taxation powers that effectively transformed them into feudal landlords.

However, during the British Mandate period, types of land regulations were achieved through new rights of land use and benefit. Sheikh (2013), for example, has listed a wide range of land rights use for a fixed term. However, land distribution within the old policy of feudalism was encouraged by British policy (Franze´n, 2009; Shaikley, 2013), while the religious forms of land ownerships such as the *Wagf* were kept from the Ottoman period (Franze´n, 2009). After 1920, the Kingdom of Iraq began for the first time to play a role in the land registration process. For example, Sleglet and Peter (1983) and Franze´n (2009) stated that with the old document known as the TAPU was issued an Arabic translation of the law (No. 727) dated (January 28, 1929).

In practice, within this short period, the Iraqi land system was slightly changed while most of the land regulations are still influenced by the old policy of feudalism and tribalism (Table 2).

Table 2 : Land Rights Categories and Practices in Iraq during the British Mandate.

Land type	System	Regulations
• Privately held land.	Rights gained through TAPU Authorization/allocation.	Real Estate Registration RER; Declaration No. 24 (given 1920).
• Ameriya lands	Ameriya (Miri) lands (State land).	Declaration No. 15 (given December 18, 1918). Alezma 10 Land Rights Law (an old Ottoman land system established about 1890)
• Endowed lands.	Waqf	Ottomans Land Rights Law

3.3. **The Iraqi Independence Period**

The Iraqi land administration system in an independent Iraq can be divided into two main periods; the period of the land socialism reform and the Arab nationalism of the Arab Socialist Baath Party (ASBP). *Qasim*'s reign, the stage of social land reform, was a short era (1958-1963). Built on socialism, the old feudalist and tribalism systems were demolished (Al Rashid, 2005; Franze´n, 2009; Shaikley, 2013).

Although the era was short and with political problems, *Qasim*'s policy also played a significant role in land ownership reforms; for example, Al Rashid (2005) and Shaikley (2013) stressed that the first Iraqi modern land polices were linked directly to the demolition of feudalism and tribalism which both related to the landlords in Iraqi rural and semi-urban areas.

In context, the Arab Socialist Ba'ath Party's (ASBP) political development went on to argue for Arab Nationalism. Iraqi land administration under the ASBP ideological policy was concerned with the centralized system (ASBP Article No. 49 of 1972) (Franze´n, 2009; Shaikley, 2013). In line with socialist ideology, Al Rashid (2005) and USAID (2005) showed that by 1974 the task of state ownership of the land, targeted by the land reform act of 1958, had been completed. Additionally, Al Rashid (2005) stated that by the end of the 1970s, the old Ottoman land administration system, the basic TAPU land system of registration, was replaced finally by the Real Estate Registration Departments (RERD), which created an improved title issuance system and established the RERDs throughout the country.

In summary, during the previous periods of the Socialist and Ba'athist policies, the basic system and the legal body policies relating to Iraqi land were identified. Also the land ownership document was recorded and validated and held the title deed document as the national legal proof of ownership.

3.4. **The Iraqi Conflict Period (2003-to date)**

After the fall of the Ba'athist regime in 2003, there was a period of great influence caused by conflicting social and state policies. For example, the new Iraqi government was faced with a huge legal problem regarding the transfer of lands and properties ownership which had been removed by Ba'ath from thousands of families (Al Rashid, 2005; United Nation report, 2009; UN-Habitat report, 2010; Shaikley, 2013). Also, the Iraqi refugee crisis still presents a national humanity problem. Thus, by returning to Iraq, refugees could presently have more influence and use this as an indicator of tenure insecurity in vulnerable Iraqi communities with legal challenges to urban land tenure problems. In order to solve this problem and with the aim of encouraging the Iraqi refugees to return, the Iraqi administration established the national legal committee to resolve property disputes (Al Rashid, 2005).

Many reports indicate that current social and political conflicts are important explanatory factors with potentially grave consequences. For example, the UN-Habitat report (2010) declared that in Iraq as a result of conflicts, urban residents living in slum conditions rose from 2.9 million in 2000 to approximately 10.7 million in 2010. Recently the chaos of looting and destruction of public records have also increased (UN-Habitat report, 2010).

In summary, the legitimate characteristics of land tenure established its own land laws based essentially on religious regulations of ownership in specific arrangements and administrations and across the Muslim majority.

In practice, the Iraqi basic land tenure categories and practices of the previous periods are listed in Table (3), and the Iraqi factors influencing the security of land tenure are illustrated in figure (2).

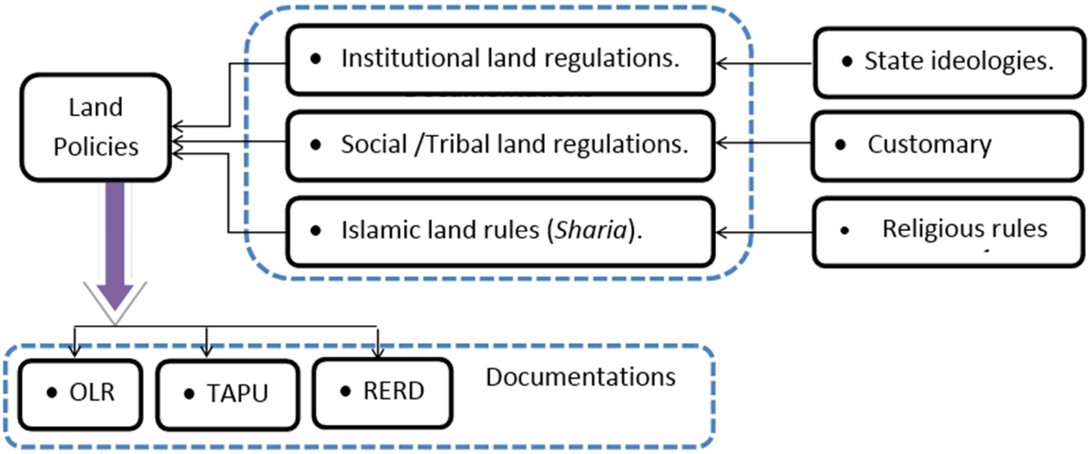

Figure 2 : The Iraqi main Factors influencing the local Systems of Land Tenure.

Table 3 : Iraqi basic Land Tenure Categories and Practices.

Land Type	Contributing	Practices	Legal source
Ameriya (Miri)	State land, owned by governorate.	The Ottoman era and still exists under state regulations.	• Ottoman Land Rights. • State regulations of ownership.
Mulk	Rights gained through TAPU title, allowing various degrees of freedom in the use of the property.	Private ownership and governed by land rights laws, still exists.	• Ottoman Land Rights. • State regulations of ownership.
Waqf	Mainly religious endowments, translation of private ownership within an endowed land governed and regulated by Islamic law.	The Ottoman era, still exists.	• Ottoman land rights • The British Mandate land rights. • The recent State regulations laws.
Empty land	The dead land (Mewat) is undeveloped land at a distance from any town or village.	The Ottoman era.	• Ottoman land rights • The British Mandate land rights. • The recent State regulations laws.
Land rights use for a fixed term	Rights of use and benefit land.	The Ottoman era, still exists.	• Ottoman Land Rights. • State regulations of ownership.
	Rights of use and benefit for a fixed term of years during which the land and property is still owned to grantor.	The Ottoman era, still exists.	
Communal lands	The term was used at village level to denote either common undivided land or communal grazing land.	The Ottoman era, still exists.	• State regulations of ownership laws: • Civic Code Art 68 (1958). • Civic Code Bk. 1 (1929).
Unit/plot	User residence ownership rights.	Still exists under the new state regulations.	• Ottoman land rights. • Pastoral lands, as opposed to cultivated land.
Leases	Rights of use and benefit for specific amount and period.	Still exists under the state renting regulations.	• Ottoman land rights. • State regulations of ownership such as: Law 87/ 1979 .
Sell-Buy Process	Long complex transaction procedures that takes place at the RERD.	Still exists under the state renting regulations.	• Issuing the Title Deed to be examined accurately at the RERD.

4. Summary and Conclusions

In this paper, the interconnection between the Iraqi land administrations and land tenure security were investigated. The paper suggests that Iraqi land tenure security is associated with a wide range of relationships related to social, ideologist and religious aspects. There is an interconnected matrix of legal, social, and economic factors linked with the land aspects. The history and development of the LTS in Iraq were identified via its social, political and religious settings.

These motivation indicators will help to increase the efficiency and accuracy of the local urban sectors and to adopt a certain ULT application in Iraqi cities. It can pose the problem of how the Iraqi institutional framework and legislation technologies promote tenure security working between land users and land policies to ensure that individual and community rights are documented and protected.

As argued in the introduction, the issue of Iraqi land tenure legality / illegality and insecure tenure with the current consequences can be dependent on the ability to define legal requirements regarding access to land and property. And the Iraqi land arrangements can help to illustrate misconceptions about the critical local factors influencing the LTS.

A review of land policy in Iraq should be placed high on the government's agenda. What is required is a rather more active attitude from the matrix of legal, social, and economic factors linked with the land aspects, and to reduce political conflicts and provide support in the form of an urban planning scheme to enhance urban development.

With this paper, it is expected that more research on this issue will be useful to drive and increase the effectiveness and accuracy of the LTS applications in Iraqi cities.

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Accelerating Construction Works: Pitfalls and Perils in Reducing Delay

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Abstract

This paper aimed to uncover some of the challenges associated with agreements to accelerate under construction contracts. The paper adopts a doctrinal review of literature and case law dealing with acceleration claims and disputes. The study found that acceleration measures result in lowered work efficiency and increased construction costs for the contractor, and identified several legal and contractual difficulties that may arise when the parties agree to accelerate, particularly in circumstances of shared responsibility for delay. The study then set out recommendations to overcome some of these challenges, which may if implemented may reduce the likelihood of disputes. The findings of this study are valuable to practitioner-researchers looking to draft acceleration agreements that minimise the likelihood of a dispute, and may act as a basis for further research exploring some of the practical challenges associated with negotiating acceleration agreements.

Keywords

Acceleration, construction, contracts, delay, claims.

1. Introduction

Project delays are a common and often unavoidable risk in construction projects. Delays can arise from "excusable" events such as restricted access or additional work, which entitle the contractor to an extension of the completion date; or from "non-excusable" events such as slow contractor progress, which may result in contractor liability to liquidated damages for delay under the contract (Davidson, 2008). In either case, overrunning the planned completion date can increase outturn costs and reduce profits for both contractor and employer. This means the prospect of "acceleration", or speeding up the remaining work to reduce delays, may be an attractive option to the party with most to lose.

Acceleration is normally achieved by working extra hours, changing working methods or revising the planned sequence of work (Riad, Arditi, & Mohammadi, 1994). These methods can result in a significant decrease in contractor efficiency and an increase in project cost (Keane & Caletka, 2008). However, standard form contracts often lack mechanisms to value and agree acceleration, leaving it to the parties to reach acceptable terms. This is made difficult because acceleration agreements introduce additional risk and uncertainty into the contract, and acceleration costs are difficult to ascertain.

The circumstances in which acceleration might be required are diverse. Where delays are excusable, the employer may require the contractor to accelerate to reach completion earlier than would otherwise be the case under the contractual extension of time machinery. The parties might agree lump sum, conditional or cost based payments for achieving completion earlier than would be required by the contract. On the other hand, contractors might prefer to pursue contractual avenues to recover an extension of time and loss and expense, rather than incur additional acceleration costs for which full recovery may be uncertain. Even in situations of non-excusable delay, the contractor might prefer to incur liquidated damages than accelerating to complete on time, potentially requiring the employer to incentivise timely completion.

Despite this complexity, discussion of the legal principles underlying acceleration appear relatively infrequently in reported case law. This may be largely because acceleration disputes tend to be settled through negotiation, or adjudication. Furthermore, surprisingly little literature has focused on agreements to accelerate, and the potential legal difficulties surrounding them.

This paper addresses acceleration agreements on a more in depth basis. Acceleration in the construction industry is defined, and the consequences and costs of acceleration are exposed (Section 2). The contractor may have existing obligations to accelerate under the contract. Examples of these obligations in standard form contracts are interpreted in the context of the common-law (Section 3). After addressing the need to deal with delays before acceleration measures (Section 4), three contractual mechanisms by which to compensate acceleration efforts are identified, and the potential risks and opportunities associated with each are examined (Section 5). Finally, complicating factors associated with delays experienced after the acceleration agreement are explored, and some possible solutions to mitigate these problems are proposed (Section 6).

2. What is acceleration?

In common use, acceleration describes an "increase in speed or rate" (*Oxford Dictionary of English*, 2013, p. 9). In physics, acceleration (mathematical symbol: 'a') is the rate at which the velocity of an object (Δv) changes over time (Δt), thus expressed as the formula $a = \Delta v / \Delta t$ (Avison, 1984). However construction practitioners relate acceleration to an increase in the rate or speed of the *performance of work* (E. Baker, Mellors, Chalmers, & Lavers, 2013; Creyke & Bixler, 1964).

Acceleration in construction is effectively "doing something faster than anticipated." (Barry Bramble & Callahan, 2011, p. 6.01). This may be a single activity in the programme, or as is normally the case, the remainder of the whole works to achieve an earlier completion date (Arditi & Patel, 1989). Acceleration is a comparative measure between the original plan and the reality of work performed at site (Livengood & Bryant, 2004; Pickavance, 2013). For example in *Amec Process & Energy Ltd v Stork Engineers & Contractors BV,* Hicks LJ found that, "In the context of this contract [acceleration] would entail finishing, or possibly reaching some intermediate stage, before the contract date"[4]. Pickavance takes this view to define acceleration as "the completion of work in a shorter time than… anticipated by the contract." (2000, p. 73). Similarly Chern (2010) explains that this time may be the original contractual completion date, or a later date after determining any extension of time entitlement. In either case, the contractor undertakes to complete the works earlier than he would otherwise be required to under the contract.

Contractors achieve acceleration by increasing overall work output each day. Work output can be increased by resequencing activities, increasing resources, increasing working time, and introducing temporary works (Riad et al., 1994). However, the assumption is that a sophisticated contractor plans its works in order to maximise resource efficiency and avoid defects and rework, rather than to minimise the overall project duration (Atkins, 2007). The optimum method of work uses the minimum resources to complete the construction works in

[4] (1999) 68 Con LR 17 (QB) [101].

the allocated time (Cooke & Williams, 2013). Therefore, the revised working methods necessary to achieve acceleration can attract significant additional costs. Based on a review of the literature, Table 1 summarises the possible consequences of these measures on the contractor's work.

Table 1: Consequences of acceleration measures

Method	Consequence	References
Re-sequencing activities	Increased works-inspections	Dieterle and Gaines (2012)
	Increased management time	Dieterle and Gaines (2012)
	Increased defects	Atkins (2007), Dieterle and Gaines (2012)
	Reduced labour efficiency	Mohan (2008), Frendt (2000), Livengood and Bryant (2004)
Increasing resources	Disruption of smooth trade interfaces	Horner and Takhouni (1996), Livengood and Bryant (2004)
	Learning curve for new workers	Barry Bramble and Callahan (2011)
	Additional equipment/supervision	Livengood and Bryant (2004), Tweeddale (2004)
	Use of uncompetitive suppliers	Barry Bramble and Callahan (2011)
	Reduced labour efficiency	Smith (1987), H. Thomas and Jansma (1985)
Increased working time	Enhanced/overtime payments	Horner and Takhouni (1996), M. Baker (2012)
	Reduced labour efficiency	Mohan (2008)
	Material delivery premiums	Barry Bramble and Callahan (2011)
Temporary works	Additional equipment at site	Davidson (2008)
	Defects and re-work	The Royal Institution of Chartered Surveyors (2011)

A contractor is normally entitled to complete earlier should it choose to do so[5], although the employer has no obligation to improve its performance in order to facilitate this choice.[6] A contractor may also accelerate voluntarily to overcome non-excusable delays to avoid late completion damages (E. Baker et al., 2013; Mohan, 2008). However as noted by Hulburt (2001) and Bailey (2011), an employer cannot become liable for costs associated with a voluntary acceleration. This principle was illustrated in *Ascon Contracting Ltd v Alfred McAlpine*

[5] *Glenlion Construction Limited v Guiness Trust* (1987) 39 BLR 89 (QB) pp. 98-99.
[6] *F Finnegan Ltd v Sheffield City Council* (1988) 43 BLR 130 (QB).

Construction Isle of Man Ltd[7], where the court found it essential to establish by whom the decision to accelerate was taken, in order to decide on liability for the acceleration costs.

The above demonstrates the particularly complicated nature of acceleration under construction contracts. However, these complexities are compounded by various contractual challenges associated with implementing acceleration. Questions relating to a contractor's subsisting obligation to accelerate, terms of payment for acceleration, and the management of shared liability for delay all have the propensity to lead to disputes. The remainder of this paper examines these challenges in closer detail.

3. Contractual obligations to accelerate

A contractor has no general common law duty to "mitigate" or reduce employer delays, which might potentially generate additional cost (Bailey, 2015). This should be distinguished from the expectation in common-law that a claimant mitigates its loss otherwise arising from a breach of contract[8], which might result in increased delays if slowing down work is the most economical option. However, construction contracts often place obligations on the contractor to mitigate delay, however caused. It might be argued that the contractor is required to accelerate under such obligations, without the need for an agreement to accelerate.

For instance the JCT/SBC contract makes extensions of time conditional upon the contractor using 'best endeavours' to prevent the delay, irrespective of the cause (JCT, 2009 Cl. 2.18.6.1). The case law suggests that a best endeavours obligation does not require any possible action[9], but it is a duty to do whatever is reasonable within the circumstances[10]. The obligation requires a party to do what is commercially practicable as construed in the context of its capability[11] – but this does not extend to risking financial ruin[12].

In *John Mowlem & Co Plc v Eagle Star Insurance Co Ltd (No 2)*[13] the construction contract included an equivalent provision to the JCT/SBC. The Court of Appeal found that in the event of excusable delay, the contractor would be expected to undertake mitigation measures including constructing a canopy to protect the work from bad weather, an action that amounts to a potentially costly acceleration measure. That being said, clause 4.23 of the JCT/SBC entitles loss and expense payments where a Relevant Event materially affects progress, and the contractor would not be reimbursed by another provision in the contract for taking such mitigation measures. Consequently, there appears to be nothing in this clause that would prevent the contractor recovering acceleration costs implemented to fulfil its obligation to use "best endeavours" in the event of delay, providing the event leading to the delay entitles additional payment.

In contrast, under the ECC3 contract, the Project Manager assumes when assessing compensation events that the contractor reacts "competently and promptly" to the event, and that any cost and time due to the event are "reasonably incurred" (NEC3, 2013 Cl. 63.6). In other words, the contractor is only entitled to the amount of additional time or payment for a compensation event that would arise after reasonable steps to mitigate the delay. The obligation

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[7] [1999] 66 Con LR 119 (QB).

[8] *British Westinghouse Electric and Manufacturing Co Ltd v Underground Electric Railways Co of London Ltd* [1912] AC 673 (HL) [689] (HL).

[9] *Midland Land Reclamation Ltd and Leicestershire County Council v Warren Energy Ltd* (1997, Judge Bowsher QC, unreported) (QB).

[10] *IBM United Kingdom Ltd v Rockware Glass Ltd* (1980) FSR 335 (CA).

[11] *Terrell vs Mabie Todd & Co Ltd.* (1952, 69 RPC 234) (QB).

[12] Ibid.

[13] 44 Con LR 134; [1995] NPC 64.

is effectively to use reasonable endeavours to prevent delay. A reasonable endeavours obligation is "appreciably less than best endeavours"[14], and does not extend to sacrificing commercial interests,[15] and may not require more than one action to avoid an outcome that is not favourable to the other party[16]. Under this obligation, a contractor cannot sit by and watch a delay unfold – some positive action is required. However, unlike the JCT/SBC obligation, it is unlikely that "reasonable" steps would include incurring substantial acceleration costs to overcome an employer delay.

Consequently, whilst no general obligation exists in common law to overcome employer caused delay, there are potentially contractual terms that must be taken into account when determining the amount of reimbursement that a contractor may be entitled to when acceleration is required. The two standard form contracts reviewed here place markedly different obligations on the contractor to reduce delay, potentially through acceleration measures. Whereas the JCT/SBC may require the contractor to incur additional cost as a contractual obligation, the ECC3 appears to set a far less stringent requirement to take reasonable steps to reduce delay, which might preclude incurring any substantial cost. In either case however, the obligation does not extend to improving on the contractual completion date once set, should the employer wish to do so.

4. Dealing Pre-existing delays

The need to accelerate is normally triggered by forecast delays to completion. Where the delay is accepted as wholly the employer's responsibility, the entirety of the acceleration cost would normally be recoverable from the employer. However, things become more complicated where the parties share responsibility for the delay.

To form the basis for apportionment of the acceleration costs, the certifier under the contract must determine any extension of time and additional payment for delay otherwise entitled under the contract at the date of the acceleration agreement. Performing an assessment of liability for delay can be complicated and is beyond the scope of this paper. For instance Ndekugri, Braimah, and Gameson (2008) identify at least seven methods available to determine responsibility for delay, which are suitable at different times within the project cycle, and which have varying degrees of accuracy and complexity.

However acceleration may require allocation of responsibility for delays before completion of the work, and in these situations, the UK The Society of Construction Law (2002) advocates the use of the "Time Impact Analysis". This method utilises critical path modelling and can identify the effects of both excusable and non-excusable delay events incrementally on the forecast for the remaining works, to form the basis of any payment for acceleration costs.

Whatever the method implemented, the objective is to break down the delay at the effective date of the acceleration agreement, and reach a conclusion on overall responsibility for the delay, expressed in number of days. With this information available, the parties can progress to negotiate the terms of any acceleration agreement on a more objective basis.

The risks associated with failing to properly apportion responsibility for delay before proceeding with acceleration were demonstrated in *Mirant Asia-Pacific Construction Ltd v Ove Arup and Partners International Ltd*[17]. In this case, the claimant contractor was unable to establish a right to payment for acceleration costs caused by an engineer's defaults, due to the

[14] *UBH (Mechanical Services) Ltd. v Standard Life Assurance Co.* The Times 13th November 1986 (QB).
[15] *P&O Property Holdings Ltd v Norwich Union Life Insurance Society* [1993] EGCS 69 (QB).
[16] *Rhodia International Holdings v Huntsman International LLC* [2007] EWHC 292 (QB).
[17] [2007] EWHC 918 (TCC).

lack of any assessment of delay at the time of entering into the agreement. The failure to link the acceleration to the delay claimed led to a substantial dispute, which could have otherwise been avoided.

Nardin (2014) suggests the employer is generally only liable to pay for the part of the acceleration measures that cover the excusable delay. However, in some cases, the contractor may prefer to incur late completion damages where those costs are less than what would be incurred through accelerating to overcome his portion of the delay, or the contractor may be incapable of implementing the acceleration measures due to financial constraints. This means that the employer may be forced to pay the contractor to accelerate and overcome its own delays. For instance in *Williams v Roffey Bros & Nicholls (Contractors) Ltd*[18], the High Court found that a contractor's agreement to pay additional sums to its subcontractor to complete the works by the original completion date – despite that the delays were the subcontractor's responsibility – was enforceable.

5. Payment for acceleration

The process of initiating acceleration is normally governed by the construction contract. However, few construction contracts give the certifier power to instruct acceleration unilaterally (JCT, 2009; NEC3, 2013). Unlike certifier instructions relating to changes in the quantity and scope of work, the parties must normally reach an agreement as to the terms of any acceleration before its implementation.

For instance the JCT/SBC permits the architect/contract administrator to instruct the contractor to provide "Variation Quotations" (JCT, 2009 Sch. 2), but this power does not extend to requiring the contractor to commence acceleration without agreement on payment for the resultant costs. Similarly in the NEC3, the Project Manager may invite the Contractor to submit a quotation for acceleration, but implementation of acceleration measures does not commence until the quotation is accepted (NEC3, 2013 Cl. 36.1).

There are several potential ways by which a contractor can be compensated for acceleration. There may be a fixed lump sum payment agreed for the acceleration alongside a revised completion date. This payment may be conditional on completing all or part of the work by the prescribed dates. Alternatively, the parties might agree the right to compensation for acceleration in principle, to enable acceleration to commence, but the terms of valuing the acceleration effort may be left undetermined. These approaches are each associated with particular risks and opportunities that warrant some further examination. Three scenarios are investigated below.

6. Lump sum payments

An acceleration agreement that fixes a new completion period (which is less than what would otherwise be available under the contract), and provides the contractor a lump sum payment[19], is arguably the most *balanced* approached in terms of risk between the parties. The employer retains the right to deduct late completion damages should the contractor fail to achieve the revised completion date, but the contractor receives the benefit of an unconditional payment for the acceleration efforts.

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[18] [1990] 1 All ER 512 (QB).

[19] E.g. *Mirant Asia-Pacific Construction (Hong Kong) Ltd v Ove Arup and Partners International Ltd & Anor* (n 14).

However, the terms of this kind of agreement must be carefully negotiated. Except in the most simple of cases, the extent of delay reduction that the desired acceleration might achieve could be difficult to determine before the measures are implemented. The contractor therefore risks incurring liquidated damages that might offset the payment obtained for acceleration if the acceleration fails. Equally, the benefit that the employer would have otherwise obtained by the acceleration might also be lost if the effort is unsuccessful.

To address these risks, R. Thomas and Wright (2011) suggest that the employer might offset the potential additional losses in the event that the contractor fails to achieve the required date, by setting a revised rate of liquidated damages. This may include some of the cost of the lump sum payment should the contractor fail to achieve completion within the revised period, or the additional benefit that would have been gained had the acceleration been implemented.

Adjusting the rate of damages in the agreement is particularly important, because liquidated damages are recognised as an exhaustive remedy for delay.[20] This means that the employer may face a significant challenge in recovering any additional damages arising from the contractor's failure to fulfil his acceleration obligations that are not included with the rate of damages per day otherwise stated in the contract, as amended by the acceleration agreement.

Conversely, the contractor might also wish to include within its lump sum payment an allowance for risk to cover the additional costs or liquidated damages that might be incurred in the event of a failure to achieve the amount of acceleration required in the agreement. Reaching an equitable agreement on the terms of payment might therefore require careful negotiation.

Whilst establishing payment terms at the outset might be challenging in the context of pressure from the ongoing delays, the parties do at least obtain commercial certainty of the consequences of failing to meet the intended completion date, potentially reducing the likelihood of a dispute.

7. Payment of reasonable costs

The approach presenting the least risk from the *contractor's* perspective might occur when the acceleration agreement anticipates payment based on a reasonable sum for costs incurred. This may be applicable where the revised completion date is not fixed, but the acceleration agreement places an obligation for the contractor to use best endeavours to reach an earlier completion date.

As has been explored above, the contractor would be obliged to do all that he can do to achieve the earlier date if best endeavours are required[21]. However, under this scenario, the extent of acceleration effort required might be uncertain at the date of the agreement, rendering the amount of payment entitled difficult to forecast.

To provide a degree of certainty, the parties may elect to agree fixed rates for valuing the acceleration. That was the approach taken by the Court of Appeal in *Cleveland Bridge UK Ltd v Severfield Rowen Structures Ltd*[22], where part of an award for acceleration measures was calculated based on a cost per additional shift introduced to mitigate the delay.

If on the other hand the parties agree that the acceleration should be undertaken but fail to stipulate the method of valuation, then the contractor would normally be entitled to a *quantum meruit* for the work performed.[23] Gibson (2015) outlines various methods by which to value

[20] *Temloc Ltd v Errill Properties Ltd* (1987) 39 BLR 30 (QB).
[21] *IBM United Kingdom Ltd v Rockware Glass Ltd.*
[22] *Cleveland Bridge UK Ltd v Severfield Rowenv Structures Ltd* [2012] EWHC 3652 (TCC).
[23] *Clarke & Sons v ACT Construction* Court of Appeal ([2002] EWCA Civ 972) (CA).

acceleration on a cost incurred basis, including the measured mile approach, the total cost approach, and the use of formulae.

A formulae approach was adopted in *Amec Civil Engineering Ltd v Cheshire County Council*.[24] The acceleration agreement required the contractor to use best endeavours to achieve completion by the date of 25 October 1995, on the understanding that the employer would make fair and reasonable recompense for the costs incurred.[25] The court endorsed the parties approach to valuing the acceleration based on the amount that the accelerated work actually cost ("X") less the amount that the works should have cost without acceleration ("Y"). Further deductions were then made for contractor culpable issues ("A") and the cost of variations undertaken during the acceleration ("B"). Thus, the method of valuation was expressed simply as X-Y-(A+B).

Arditi and Patel (1989) describe two approaches to determining the amount of payment owed from acceleration. The first is simply to apportion the total of the acceleration costs in terms of the number of days of the pre-acceleration delay allocated to each party. The second assumes that the contractor elects to implement different acceleration measures in the order of their consequential cost. On this basis, Arditi and Patel (1989) suggest that the increasing costs for the different methods can be allocated to the delay events in order of occurrence. In practice, such precise apportionment of cost may be challenging.

There are also inherent difficulties in relying on a retrospective approach to value acceleration costs. Whilst the basis of such a claim is conceptually simple, an extensive examination of the contract cost records will be necessary to establish the costs associated with the acceleration measures. Even where records are available, some subjectivity is inevitable in determining what the situation would have been but-for the acceleration, which may act as a catalyst for disputes. It might be preferable, therefore, to express the method of valuation within the agreement *before* acceleration measures are begun.

8. Conditional payments

Possibly more favourable to the *employer* are acceleration agreements that fix a new completion period, but make payment conditional on the contractor meeting a revised completion date. On these terms, the contractor faces a double-edged sword, with risk of liquidated damages for failing to complete by the revised date, coupled with loss of the conditional payment for any acceleration efforts implemented. A contractor entering into this kind of agreement would be wise to negotiate an allowance for the additional risk.

However, if the contractor is prevented from meeting the revised completion date and obtaining the additional payment due to circumstances under the employer's responsibility, it seems that a contractor may be entitled to payment for some of the additional amounts that would have been paid had the acceleration measures succeeded. In *John Barker Construction Ltd v London Portman Hotel Ltd,*[26] the High Court found that an agreement to accelerate that included for payments conditional on achieving the original completion date despite prior delays was payable at 50% of the agreed amount, on the basis that the contractor lost its chance to recover the additional payment.

[24] [1999] BLR 303 (QB).
[25] Ibid 303.
[26] (1996) 83 BLR3 (QB).

9. Dealing with subsequent delays

Davidson (2008) stresses that the most important aspect to consider in the agreement of acceleration are methods to manage situations in which the acceleration measures are not wholly, or only partially, successful. In the case of subsequent excusable delays, the court in *John Barker*[27] resorted to an arbitrary, rather than a technical solution to determining the amount of payment for acceleration costs due where intervening events rendered the acceleration impossible to achieve. To reduce this uncertainty, it may be prudent for parties to incorporate mechanisms for dealing with post agreement delays within the acceleration agreement.

Where the agreement is based on reaching a specific completion date, these could be mechanisms that simply duplicate the existing extension of time machinery in the contract. Continuing to operate the contractual machinery may be the simplest solution, where both parties remain clear on the circumstances that entitle extension of time but preclude recovery of additional payment (e.g. JCT, 2009 Cl. 2.29.9). If the parties attached an amount of liquidated damages to the revised completion date, then dealing with contractor liability for intervening delays may be simply a matter of applying the liquidated damages to each day of the delay.

However, the contractor's acceleration efforts may need to be factored into any assessment of extension of time or additional payment arising from the excusable or compensable event. The agreement may therefore require provisions to follow in the event that the revised completion date is unachievable. For instance, should the contractor abandon the acceleration, or continue at the accelerated pace?

10. Conclusion

The case law and literature reviewed in this study has demonstrated that implementing acceleration measures is a potentially complicated decision that is associated with substantial risk. The acceleration measures can lead to an increase in construction costs that must be reimbursed through additional payment, requiring the parties to enter into an agreement that sets out the terms of the acceleration.

However, the case law in this area has also demonstrated that disputes can arise over the amount of additional payment entitled after implementing the acceleration measures, unless careful consideration is given to allocating responsibility for delays at the time of the agreement, and provision is made to deal with subsequent delays whether under the responsibility of the employer or contractor.

Based on the findings of this study, the following are five key recommendations that parties should consider when setting out to negotiate an agreement to accelerate:

1) Before the contractor commences acceleration, the certifier should determine any existing entitlement to extension of time and payment for delay related costs entitled under the contract, to form the basis of the acceleration agreement and its payment terms. This decision should take account of any subsisting obligations on the contractor to mitigate delays.
2) The acceleration agreement should include an appropriate adjustment to the amount of liquidated damages in the contract, to provide for the potential increase in loss that the

[27] Ibid.

employer might experience in the event that the contractor fails in his obligation to achieve the revised completion date.

3) The acceleration agreement should also make provision for subsequent events or circumstances that would entitle the contractor to extension of time and additional payment. This may be achieved by retaining the existing extension of time and loss and expense machinery in the contract, with suitable expansion to determine the extent the acceleration measures should continue if the desired completion date is rendered impossible to achieve.
4) Wherever possible, the parties should seek to agree a lump sum payment for the acceleration within the agreement, before the acceleration measures commence. Adopting this approach may minimise the risk of disputes arising over the value of payments due later on.
5) Where a lump sum payment cannot be agreed, the parties should agree within the acceleration agreement: the method of valuation, fixed rates for valuing the acceleration, and the types of records that should be kept during the acceleration to form the basis of the valuation. Expressly setting out these requirements might avoid the need to rely on a third party determination of the payment due later on.

The practical implications of the findings of this study are therefore twofold. First, practitioners looking to implement acceleration measures can identify from this study the key factors that might need to be considered when drafting the terms of any acceleration agreement. Second, by drafting the acceleration agreement to take account of the recommendations set out above, the risks of disputes arising over payment for the acceleration measures might be reduced. In an industry plagued by disagreements and disputes, making real attempts to address some of the challenges articulated in this study may have significant benefits to parties looking to avoid some of the of the pitfalls and perils in reducing delays.

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The Importance of Integrating Cost Management with Building Information Modeling (BIM)

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Abstract:

The UK construction industry has been branded as an inefficient, fragmented and non-value delivering industry by prominent critics such as Michael Latham and Sir. John Egan; both have insisted on the need to change the way the industry delivers and manages assets through integrated project processes. Sir. John Egan specifically highlighted the need for significant reduction in project time and cost. As a result, for the last few years the main emphasis within the construction industry is on integrating various project processes by using the integrated approach and enabling technologies that bring all the stakeholders in a close relationship for achieving greater success. One of the most critical project processes is the cost management that involves cost estimating, control of expenditure and cost advice on cash flow and payments. Furthermore, Building Information Modeling (BIM) has emerged as a very powerful approach and set of information technologies that allows the project stakeholders to work collaboratively on highly technical and comprehensive models using parametric design components and visualize design in 3D. The UK government has made the delivery of public procured projects through BIM mandatory from 2016. Thus, it has become critical to investigate the prospects of cost management practice in this context and determination of how BIM can help in its improvement.

The aim of this paper is to examine the importance of BIM in the UK construction sector with a specific focus on cost management through a state-of-the-art review of literature in order to highlight the significance of BIM for potential improvements in area of cost management.

Keywords:

Building Information Modeling, Cost Estimating, Cost Management

1. Introduction

The UK construction industry is largely guided by recommendations made by government industry initiatives that identified the need for reducing waste and adding value to the project through streamlining the design and production processes (Egan, 1998, 2002; Latham, 1994). Taking inspiration from their work, this study focuses on the identification of issues and challenges in current cost management practice in the UK construction industry because it is one of the most critical process in construction projects as mentioned by Hanid, Siriwardena, & Koskela (2011) and seeks the possibility of improvement by streamlining the cost management with other project processes through integration with BIM.

BIM is making significant impact on the UK construction industry (Eastman, Teicholz, Sacks, & Liston, 2011) and this technological push is driven by the UK government being the major public construction client (Office, 2011; Withers, 2011). However, while the designers and constructors have been embracing BIM, cost consultants on the other hand are showing resistance (NBS, 2014; Wu, Wood, Ginige, & Jong, 2014). That is one of the reasons why the cost management practice and the adoption of BIM stand far apart.

This paper is focused on determining the importance of integrating cost management and BIM to highlight the benefits and identify potential challenges. The research method adopted for this research is a comprehensive literature review of cost management in construction and BIM. The first part comprises the literature review of cost management and the second part contains a brief introduction of BIM and its principles proceeding to the third part that focuses on applicability of BIM in area of construction cost management.

2. Cost Management in Construction

Ashworth (2010, p. 434) has defined cost management in the construction industry as "a process of planning, estimating, co-ordination, control and reporting of all cost-related aspects from project initiation up to the time of an asset's eventual disposal". It has to account all types of costs that are incurred by the facility over its lifetime as suggested by Ballard (2008).

There are a number of cost accounting concepts that guide cost managers such as Full Absorption, Activity-Based Accounting, Constraint-Based Accounting, Throughput Accounting, Target Accounting, Lean Cost Accounting, Inter-Organisation Cost Management, Whole-Life Costing, Value Management, Risk Management (Agndal & Nilsson, 2009; Burtonshaw-Gunn, 2009; Cartlidge, 2009; Dallas, 2006; Hanid, Koskela, & Siriwardena, 2010a; Kelly, Male, & Graham, 2004; Kishk et al., 2003; Potts, 2008; Wübbenhorst, 1986). While, all of these approaches focus on reducing and controlling project costs but the traditional concepts and practice ignore the notion of value and process improvement as discussed by Fine (1974) and Hanid et al. (2010a). Therefore, the current practice has failed in achieving these targets. Literature reveals a number of issues and challenges faced by cost managers and they are discussed in succeeding section.

3. Challenges in Construction Cost Management

The issues and challenges faced by the cost managers include disruptions in the process, design liability, duration of project, lack of collaboration and inadequate design reviewing, isolated decision making, use of traditional cost accounting methods and lack of automated processes (Ashworth, 2010; Hastak, 1998; Kern & Formoso, 2004). Along with these there is lack of knowledge, limited and wrong understanding and practice of cost management techniques (Dallas, 2006; Hanid et al., 2011). In addition, these issues are mainly related to the state of technology, knowledge, quality of data, communication, collaboration of project participants and coordination of activities.

3.1. **Technology Issues**

IT has made limited impact on the construction cost management (Cartlidge, 2006; Fazenda, 2011; Smith & Tardif, 2009). Computer-Aided Design (CAD) has been mainly used for drafting, modeling and measurement purposes (Olatunji et al., 2010) and 2D drawings only provide the geometric data (Eastman et al., 2011) that has no visualization and limits the project understanding. Due to non-interoperable isolated software and lack of automated processes, there is a large proportion of manual, labour and time intensive work involved such as measurements, data entry, cost calculations and documentation. The resulting physical and mental overload has a negative impact on the cost manager's performance (Akintoye & Fitzgerald, 2000; Eastman et al., 2011).

Akintoye & Fitzgerald (2000) identified inability to respond to the variations, lack of cost data review and use of basic isolated systems are major reasons for low reliability of estimates. According to Eastman et al. (2011), system incompatibility issues and loss of data has cost implications. Also, the current computer programs are inadequate, e.g. they calculate even more risk cost than the traditional allowance of 5% (Potts, 2008).

3.2. **Knowledge and Understanding**

The knowledge and experience of the cost manager plays a vital role in the determination of project cost, understanding project specific needs, making assumptions and choice of appropriate costing technique to be deployed (Akintoye & Fitzgerald, 2000; Eastman et al., 2011; Hastak, 1998). Cost managers aim to make cost estimating and monitoring and control processes accurate but their knowledge and understanding acts as a barrier by limiting their opportunities that can be availed by using alternatives techniques and methods.

Furthermore, detailed costing techniques are not used because of the unfamiliarity and unavailability of required detail of design information, instead cost managers rely upon their experience by making assumptions and adopting the solutions that makes more sense to themselves without consulting rest of the project team that can adversely effects the value and performance (Akintoye & Fitzgerald, 2000). Deliberate production of wrong estimates is also common due to fierce competition and lowest bid contract awards (Akintoye & Fitzgerald, 2000; Hanid, Koskela, & Siriwardena, 2010b). Another bad practice is "production of socially acceptable estimates" because detailed and pricier estimates drive the clients away as stated by Skitmore & Wilcock (1994). Other factors that affect how cost manager use their knowledge include insufficient time allowed and physical and mental work overload (Eastman et al., 2011; Jackson, 2002).

3.3. **Use of Traditional Techniques**

The main focus of the traditional cost accounting techniques is on the initial cost that is viewed in relation to product instead of the function which adversely effects the project value proposition (Ashworth & Hogg, 2007; Burtonshaw-Gunn, 2009; Cartlidge, 2009; Dallas, 2006; Hanid et al., 2010a). Akintoye & Fitzgerald (2000) state that these methods bring inaccuracy and uncertainty in the cost estimates.

Four estimating methods are commonly used in construction, namely functional, size related, elemental costs analysis and the unit rates method (Potts, 2008). These methods focus on costing the finished elements and establish budgets. The use of pre-defined budgets as a cost control mechanism limits the opportunities for cost reduction or value enhancing and results in cost dictating the design (Hanid et al., 2011). Wrong interpretation of costing techniques also has a negative impact on the overall cost management process, e.g. Dallas (2006) states that value management is practiced as a cost cutting tool and the value perspective is completely ignored.

While modern clients prefer better value (Kashiwagi & Savicky, 2003), their value perspective is mostly ignored (McNair, Polutnik, & Silvi, 2001) because the conventional methods cannot serve that purpose. The detailed methods that tend to deliver value are not deployed because of unfamiliarity and lack of technological support (Akintoye & Fitzgerald, 2000).

3.4. **Quality of Data**

The project scope often has missing information issues causing cost uncertainty (Akintoye & Fitzgerald, 2000). Estimates are produced using historical data of a similar project obtained from a cost database like BCIS that is adjusted to the current market rates (Doloi, 2011; Potts, 2008). Missing design information and elements are filled in by the assumptions made by the cost manager that leads to cost miscalculation. The historical data has inherent issues such as reliability, incomplete information, design faults and is generally aimed at achieving the expected cost (Elfving, Tommelein, & Ballard, 2005; Hanid et al., 2011). Moreover, during construction there is limited project progress data is available, therefore manual processing is required for cost monitoring and control. The lack of standardized mechanism for documentation transmission and recording is a critical reason for data loss resulting in increased cost as stated by Eastman et al. (2011). Therefore the quality of data and its management is a vital to successful cost management of construction project.

3.5. **Communication**

Poor communication and feedback systems have been identified in the current cost management practice (Akintoye & Fitzgerald, 2000). The lack of communication and data sharing is result of fierce competition, lack of trust, selfishness, short term relationship and use of isolated systems by the firms, ultimately resulting in the increased project cost as discussed by Eastman et al. (2011). The lack of the availability of required information can lead to ineffective decision making. Cost managers obtain up to date data by information requests and going through extensive paperwork. This leads to inefficient and delayed cost accounting that does not correspond to actual project progress. Information and Communication Technology (ICT) enables the project team to share and disseminate project information (Cartlidge, 2006) but the low level of collaboration amongst participants indicates the lack of interest in developing communication and information sharing.

3.6. **Collaboration of Participants**

Lack of coordination and collaboration among the construction project participants has been highlighted by Latham (1994) and Potts (2008). It has a negative impact on the project cost and cost management practice because each organisation is focused on making their own profit instead of overall project benefit that ultimately leads to value loss as discussed by Hanid et al. (2011). The collaborative working has a lot of potential for cost reduction. Each organisation has an impact on project cost and the sum of these is called Inter-Organisational Cost (IOC) (Kulmala, Paranko, & Uusi-Rauva, 2002). In order to effectively control project cost, it is vital to minimize IOC and the mechanism is called Inter-Organizational Cost Management (IOCM) (Agndal & Nilsson, 2009). IOCM is a joint process focused on cost reduction through formal collaborative relationship between project participant organisations (Cooper & Slagmulder, 2004). IOCM requires mutual trust, information sharing, long term partnering, open booking accounting and profit sharing (Kulmala et al., 2002; Zaghloul & Hartman, 2003). The firms need to proactively extend the best practice across the supply chain for collective cost reduction. Hanid et al. (2011) have highlighted the need for deployment of collaborative approaches such as Just-in-Time (JIT), Total Quality Management (TQM) and open book accounting for improving IOCM. However, they also indicate that the negative behaviour of clients and contractors are a major obstacle that prevent the collaboration and these behaviours are linked to the nature of the construction industry and bad practices focused on winning the workload and securing their profit/ saving.

3.7. **Coordination**

The lack of coordination between project processes such as cost management, design and construction cause difficulty in cost estimating and monitoring and controlling. Furthermore, the lack of coordination between cost management and production process results in value loss and inconsistent cost accounting (Hanid et al., 2011). As a result, construction projects go over budget and payment disputes arise (Doloi, 2011; Kashiwagi & Savicky, 2003). This is partly due to isolated location of information from schedule of payments, production plans and feedback from cost control process (Kern & Formoso, 2004). The lack of coordinated cost management causes delays, conflicts, ambiguities and inaccuracies in cash flow management. Other problems resulting from isolation include delays and disruption in the process or plan, facility defects and lack of continuation of payments, project duration, inaccurate measurement of works, variations in work or material and cost discrepancies (Hwee & Tiong, 2002; Thompson, 1976). Therefore, improvement in coordination is vital for successful cost management.

The above discussion on the issues that are currently being experienced by the cost management practice provide an insight and highlight the need for immediate action. The next section contains discussion on BIM and its applicability in the area of cost management.

4. Building Information Modeling (BIM)

With growing BIM has emerged as a highly advance and integrated approach coupled with very sophisticated technology to tackle the chronic problems of the construction industry such as isolated operations of stakeholders, incompatibility among systems, limited use of ICT and overwhelmingly manual processes that are responsible for waste, cost overruns and loss of value (Eastman et al., 2011; Olatunji, Sher, & Ogunsemi, 2010). The UK construction industry is going through a major transition towards adopting BIM (Office, 2011; Wu et al., 2014). There are high expectations associated with BIM adoption such as increased productivity and collaboration (Miettinen & Paavola, 2014).

BIM is essentially an approach and a set of processes and ICT that allows the project stakeholders to collaborate using 3D design and information models that contain parametric objects and associated geometric and non-geometric information (Eastman et al., 2011; London, Singh, Taylor, Gu, & Brankovic, 2008; NBIMS, 2011; Succar, 2009). Miettinen & Paavola (2014) it also acts as a tool and a repository for handling and storing building design data and all the related information that can be used throughout the building's life-cycle.

4.1. Basic Principles of BIM

BIM has a great potential for influencing the people, process, technology and information in the construction industry through its primary principles that are Interoperability, Parametric Objects and 3D Modeling complemented by highly advanced Information Management System enabling multi-disciplinary collaboration (Eastman et al., 2011; London et al., 2008; NBIMS, 2011; Popov, Juocevicius, Migilinskas, Ustinovichius, & Mikalauskas, 2010; Succar, 2009; Wu et al., 2014).

4.1.1. Interoperability

Interoperability has been defined as the "ability to exchange data between applications, which smoothes workflows and sometimes facilitates their automation" (Eastman et al., 2011, p. 99). BIM provides an interoperable platform that allows stakeholders from various trade backgrounds to collaborate and exchange data (Steel & Drogemuller, 2009).

4.1.2. Parametric Objects

Parametric objects are design components that feature the geometric & non-geometric information and rules for creating relationships between these intelligent objects within the building's model (Eastman et al., 2011; NBS, 2011). These intelligent objects can be attributed cost and scheduling information that can be used by the cost managers, they also enable constructors to manipulate building design to assess functionality and behaviour of the facility (Sacks, Koskela, Dave, & Owen, 2010).

4.1.3. 3D Modeling

BIM enables representation and creation of building design in 3D modeling format that is the digital representation of physical and functional features of the facility (Eastman et al., 2011; NBS, 2011). Moreover, stakeholders can view the virtual model of the building and components for making assessments such as design verification (Eastman et al., 2011).

4.2. Information Management in BIM

BIM has the capability to store geometric and non-geometric project data that can be shared and modified (Eastman et al., 2011; Sacks et al., 2010). BIM provides the constructors with the ability to effectively communicate and share information with the project team including professional, operatives and the client (Eadie, Odeyinka, Browne, McKeown, & Yohanis, 2013; Eastman et al., 2011; Miettinen & Paavola, 2014). The work of various disciplines such as designers, engineers, builders and cost etc. is brought together to by a centralized BIM model (Thurairajah & Goucher, 2013). It also acts as an information repository and all the project development information from all disciplines can be stored and accessed at any time (Meadati, 2009; Shafiq, Matthews, & Lockley, 2013). Shafiq et al. (2013) suggests that the information management feature of BIM is an important feature for promoting inter-disciplinary collaboration. The information in the model can be accessed by the project team to obtain relevant data. There are two modes of data handling in BIM; exchange (*importing or exporting of unstructured and incomputable data*) and interchange (*importing or exporting of structured and computable data*) as stated by Succar (2009). The introduction of IFC (Industry Foundation Classes) file format have helped in overcoming compatibility between different BIM software packages (Eastman et al., 2011; Steel & Drogemuller, 2009).

5. Implementation of BIM in the UK Construction Industry

The UK construction industry is following a global trend of implementing BIM and the government as a major construction client has made a commitment to reduce the whole life cost of construction projects by up to 20%, through the Government Construction Strategy launched in 2011, by calling for more integration, standardisation and lean working. A key part of this strategy is the use of collaborative BIM, which has been mandated on all centrally procured public projects by 2016 (Office, 2011; Thurairajah & Goucher, 2013; Wu et al., 2014). This is acting as a major driver for implementing BIM and transforming the UK construction industry (Eadie et al., 2013). The government's demand is currently limited to implementing Level 2 BIM with no obligation to include 4D scheduling and 5D cost data in the model (Thurairajah & Goucher, 2013).

BIM has received a warm welcome in the UK construction industry and academia and there are high hopes for its potential in transforming the traditional practices in the industry. However, NBS (2013, 2014) has reported that designers and constructors have made progress with BIM adoption while on the other hand cost managers are still resisting it. If this reluctance continues, it is feared that the cost management practice may fall behind other trades in adopting BIM (Wu et al., 2014). Therefore, it is critical to highlight the potential benefits and improvements that BIM can bring to cost management and to identify the barriers that prevent the cost managers from adopting BIM.

6. Benefits of Integrating BIM and Cost Management

The basic principles of BIM; 3D modeling, interoperability, parametric objects and advance information management features, hold a lot of potential for improving the state of cost management practice by resolving problems identified in the traditional practice, as presented previously. The following discussion proceeds to establish importance of integrating cost management with BIM in relation to addressing the issues identified with the traditional practice of cost management.

6.1. Technological Support

BIM offers highly sophisticated technological platform that includes 3D models consisting elements that have both geometric and non-geometric information associated with it (Eastman et al., 2011). Another key benefit is that the model has the ability to integrate various information and design models corresponding to various trades that can be simultaneously operated and the information exchange between the models supports quick access and updating. Any changes in the model are recorded and immediately updated. Cost managers can benefit from these features for improved processes.

BIM-based cost estimation can improve overall cost reliability and that is one of the main drivers for its adoption (Eastman et al., 2011). They further state that the process is not 100% automatic as there is still need for professional analysis and input to go into the model first. Cost estimating feature is built into the BIM system, information can be extracted at any required stage and updated automatically if any change is made to the model (Azhar, Hein, & Sketo, 2008). The cost schedules such as Bill of Quantities (BOQ) and the cost plans can be automatically and speedily generated according to measurement rules and cost can be associated like cost to buy, tender, replace or life-cycle cost (Aouad, Lee, & Wu, 2007).

Accuracy of estimates is a serious issue, hence built-in estimation features in BIM software can significantly improve the accuracy of cost the estimates (Nassar, 2010). Projects can be modelled from the concept stage using the parametric objects from the library of previously completed projects (Eadie et al., 2013). This in-turn will enables BIM-based estimation (Wu et al., 2014). Also, new elements can be added to the model with progress in design development thus interim estimates can be easily extracted for function and cost evaluation (Eastman et al., 2011).

Quantities for BOQ can be readily extracted at any stage for producing estimate at that stage as stated by Davidson (2009). Automatic quantity take offs feature of BIM can improve the state of accuracy and time consumption that can be directed towards value enhancing activities (Barker, 2011; Davidson, 2009; Eastman, Teicholz, Sacks, & Liston, 2008; Popov et al., 2010). Detailed cost plans can also be generated far quicker than the traditionally manual methods. 4D project scheduling and 5D Cost libraries can be linked to the BIM model for generating detail cost plan (Thurairajah & Goucher, 2013).

As the estimating information is available, any subsequent process like cost and financial reporting and monitoring processes that rely on this information can also be improved in terms of speed and accurate. The speedy, accurate and detailed information access BIM enables cost managers to compare alternative design solutions for determining better value for the client. However, although BIM makes a lot of time and labour intensive tasks automated, there is still the need for professional input required for making assumptions and assessments.

6.2. Support for Enhanced Knowledge and Understanding of Project and Estimating Techniques

Due to lack of semantic information and visualization in 2D drawings the project understanding is limited; therefore cost managers have to make excessive assumptions. Automation of complex costing tasks through BIM based estimation, enables the cost managers to generate and compare alternative plans quickly and invest their time and energy in risk management and capital allowances that have more impact on the value (Thurairajah & Goucher, 2013). Availability of the required semantic data helps in shifting cost focus from the traditional finished product to functional perspective (Dallas, 2006). With BIM visualization support cost managers can develop much better understanding of the project design that will help in avoiding misinterpretation (Meadati, 2009) and are required to make fewer assumptions (Thurairajah & Goucher, 2013).

Similarly, given these benefits and integration of 4D construction schedules and 5D cost data in the BIM, cost management can be implemented in-line with lean principles (Sacks et al., 2010). They further suggest that there are interactions between BIM and Lean as both of them aim for the reduction of waste and adding value to the project.

Life-cycle Cost Estimating can also be improved because BIM automates complex analysis and calculation to support cost managers as previously the detailed estimating methods were avoided (Eastman et al., 2011; Thurairajah & Goucher, 2013). Therefore, BIM can help to eleviate the knowledge and understanding related barriers currently effecting the cost management.

6.3. Support for Enhancing Data Quality

The quality of data used by the traditional cost management methods is one of the major issues. BIM deployment "earlier in the design process will have greater influence on cost" (Eastman et al., 2011, p. 163), which can help to improve the data quality as the project design will be based on the parametric objects that can be linked to the current cost libraries (Eastman et al., 2011; Thurairajah & Goucher, 2013). Additional components can be added to the BIM model as the design develops (Eastman et al., 2011). BIM models contain more detailed information and 3D visualization help cost managers to make fewer assumptions (Meadati, 2009), which that reduces the uncertainty from estimates. The detailed estimates are considered accurate that can be prepared at any project stage due to BIM data support for integration of cost data and data export and interchange.

Although BIM principally attempts to address the data quality issues but it will take some time before the full benefits are achieved, also there have been attempts to address object definition standards that required to identify particular component i.e. IFCs but still the problems exist as various BIM vendors use different standards (Lawrence, Pottinger, Staub-French, & Nepal, 2014).

6.4. Support for Coordination and Integration of Processes

The studies on cost management indicate isolation and lack of coordination in the process (Jackson, 2002; Thurairajah & Goucher, 2013). BIM provides an integrated and interoperable platform that can help in resolving these issues. The coordination of 3D design, 4D schedule, and cost integrated 5D BIM can bring the coordination required for the cost management decisions as impact of changes to the design can be simulated (Lawrence et al., 2014; Meadati, 2009). This can remove lack of coordination between contractors and sub-contractors as highlighted by Perera, Davis, & Marosszeky (2009) and Ranns & Ranns (2005).

The re-work and unprecedented cost increment that can result from structural or program clashes can be reduced with BIM scenario simulation, improving the coordination of scheduling and material supplies etc. In addition it also encourages the use of whole-life costing as the facility use, maintenance and decommissioning can be analysed (Eadie et al., 2013). They also found that clash detection feature of BIM is one of the main driver for its acceptance in the UK construction industry. Another key benefit of the improved coordination and integrated systems is significant time saving as reported by Azhar et al. (2008).

BIM provides opportunity to the cost managers to adopt appropriate production plans, undertake value engineer, forecast cost layout and financial commitments by integration of project process and better coordinated activities. Therefore BIM approach cost managers are in a much better position to forecast, monitor and control project costs.

6.5. **Collaboration for Cost Management**

Latham and Egan emphasised on the collaborative working and building trust among the stakeholders for streamlining the processes and eliminating waste (Egan, 1998, 2002; Latham, 1994). Thurairajah & Goucher (2013) has stated that collaborative working is one of the most popular advantage of BIM in construction projects. BIM provides a centralised medium for sharing and storing project information (Eastman et al., 2011). As there is a number of organisations involved in a project, all the supply chain members need to become involved for streamlining the processes (Aouad et al., 2007; Eastman et al., 2011). Eastman et al. (2011) further argues that Lean can be rigorously implemented through collaborative working resulting in better time and cost performance. There is significant potential that waste from the whole supply chain can be removed. The inaccuracies that are caused by the isolated working can be eliminated as well (Thurairajah & Goucher, 2013).

Collaboration can encourage participants to help each other to improve the product and processes for reducing the inter-organisational costs. Through BIM support, project participants can perform their role in a much better way and promote collaboration. Cost managers can take advantage of this collaboration and advise on cost impact and improvement opportunities and undertake IOCM for cost reduction. Therefore, BIM-based collaboration has the potential for supporting cost management process and cost reduction/accuracy.

7. Challenges Preventing BIM and Cost Management Integration

There is a great potential for improving the cost management practice by integrating it with BIM, but there are certain challenges and barriers that prevent this integration to take place. Cost of BIM implementation, training and legal system creates doubt for the sub-contractors to be involved with BIM (Bingham, 2011). This can potentially leave a large number of project participants outside BIM-based cost management and the full benefit of coordination and collaboration will be difficult to achieve such as IOCM for reducing cost across the supply chain. Similar, training and implementation cost problem has been reported to have limited BIM adoption by the cost management practices (NBS, 2014). In addition, Wu et al. (2014) found that this limited BIM adoption is also due to the substandard models, inconsistencies in design information and data exchange tools and formats that are being used in the practice.

Moreover, there is a gap in BIM measurement process and UK measurement standard rules e.g. New Rules of Measurement (NRM) that present a major challenge for UK cost management practice to bridge the UK measurement standards to BIM model (Wu et al., 2014).

There is a lack of availability of comprehensive software solution that can fully perform cost estimating process that is an integral part of cost management which creates a major barrier for integration with BIM (Wu et al., 2014). Literature also indicates that interoperability issues between different BIM vendor's software (Lawrence et al., 2014; Meadati, 2009; Thurairajah & Goucher, 2013). These interoperability issues causes loss of data that can lead to cost implication and effect the accuracy and consistency of estimates as discussed before. IFCs standards are considered a universal standard, BIM cost estimating tools e.g. CostX does not effectively support IFC format that effects in quantification process (Wu et al., 2014). This can be improved with development and acceptance of IFCs and wider implementation of BIM (Lawrence et al., 2014).

Meadati (2009) has identified that BIM use is limited to design and early construction stages that means that cost monitoring and control in construction and post-construction phase presents a substantial challenge without proper BIM support. In this scenario the pre-construction cost data will be located in BIM, whereas it is ambiguous that how and where the cost data from later project phases will be stored, and located and also how easy it will be to perform the cost assessments using the information from BIM and other yet un-identified sources.

The lack of knowledge and understanding of BIM among cost managers that is preventing BIM adoption and expanded usability in cost management process (Thurairajah & Goucher, 2013; Wu et al., 2014). There is a significant need for investment by the cost management practices in UK to invest in staff training to alleviate this barrier (NBS, 2014).

There is eminent need to alleviate the barriers identified in the practice, people, technology and information for a smooth transition of the semi-automatic and fragmented cost management practice in the UK construction industry to be fully integrated with BIM and completely become BIM-based.

8. Conclusion

This paper has focused on the determination of integrating cost management with BIM for improvement in practice. The literature suggests that although the aim of various techniques both traditional and modern aim towards achieving better value for the client and eliminating waste from the costing process in-line with the broader industry targets set by Latham and Egan. However, the current practice has failed to deliver that.

BIM is seen as a very promising development that holds the potential for improving the practice and achieving the industry targets. BIM provides a comprehensive interoperable platform that enables integration of design, schedules and cost data. The project member can access and operate simultaneously and information within the models can be updated. BIM also effectively adjusts the model in response to any change that provides cost managers with a clear picture for making cost adjustments.

Traditionally cost managers had a limited role and functionality due to confined knowledge, techniques, technology, data and information provisions. Due to these limitations the estimates produced were inaccurate and uncertain. BIM provides support in automation of the key tasks such as measurements and quantification, access to comprehensive and current project information, ability to track changes and clashes, single medium for communication with ability to record and store all information produced. The study finds a lot of potential in eradicating waste from the cost management process like re-works and adding value to the practice by undertaking detailed methods of cost estimation enabled through BIM. Also, in line with the government's commitment, BIM will eventually become an integral part of the construction industry and the delivery and management of built environment assets.

Therefore, the paper confirms that the integration of cost management with BIM is inevitable. However, the barriers of investment, knowledge, process, standards and interoperability are required to be addressed. Furthermore, the paper also indicates that BIM use should be extended to the construction and post construction phases to realise full benefits of BIM and cost management. There is need for detailed research into the challenges and technological implementation in later project stages. This will also help in establishing concurrent cost monitoring and control that could then be able to manage the wider spectrum of project cost defined by Glenn Ballard (2008) as the relative project costs, which will enable realization of full benefits of BIM and cost management.

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Leveraging Facilities Management Best Practices in Managing The effect of Climate Change on Older Buildings Within The Low Carbon Economy

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Abstract

This paper reviews the impact of climate change on older buildings and makes comparisons between established and new developments in the way older buildings are managed in the commercial sector. The study is looking into the emerging roles of Facilities Managers (FM) and will attempt to produce a set of generic procedures and processes for FM practitioners to be able to manage buildings within the low carbon economy, especially older buildings. Older buildings are regarded as buildings that were built over 50years ago. Generally speaking, this means that a property must be at least 50 years old, although this is just a general rule of thumb (GDNR. 2010). The building stock also includes Heritage, Historical and Listed buildings.

For the purpose of this study, commercial buildings were focused on exclusively. The findings of a pilot survey and peer-discussions on the challenges facing the facilities management profession within the low carbon economy, as a direct result of climate change, show that there is a strong need for a new approach to facilities management, especially the maintenance aspects of older buildings. The industry needs to develop methodologies and techniques to address the impact of climate change on buildings, especially old and historic buildings

Keywords:

Building Maintenance, Old Buildings, Low Carbon Economy, Facilities Management, Emerging Roles, Climate Change, Framework.

1. Introduction

As a part of a global phenomenon, the UK climate is changing (UKCIP, 2009). Summer months tend to get hotter with more days requiring active cooling of buildings. Peak rainfall becomes more intensive, leading to short term flooding and disruption to business activities. These changes have provided the current focus on sustainability issues in many aspects of the built environment, including facilities management. In parallel, the role of Facilities Managers in an organisation has been widely expanded to an extent that Facilities Managers are now involved in many aspects of their organisations' operations. Some of these responsibilities that may be relevant to sustainability issues ranges from energy management to green procurement, from corporate social responsibility to managing sustainability and reducing related carbon emission of buildings. The burdens of regulations affecting sustainability are likely to continue to increase.

1.1. **Aim**

The principal aim of this study was to produce a framework for facilities managers (FM) to enable them to manage the effects of climate change on existing commercial buildings within the low carbon economy.

In light of the on-going discussions, this study has set out to develop a framework for Facilities Managers based on consensual best practices, particularly as it is considered expensive to run older buildings with contemporary methods. Accordingly, the study is developed with the following overall objectives, in response to the key research questions:

1.2. **Objectives**

1. To discover what problematic situations stem from the approaches and methods currently used by FM practitioners
2. To identify the features of best practice approaches for the maintenance and management of older buildings.
3. To explore constructive 'improvements' that can be proposed in order to deal with such problematic situations.

2. The built environment

The primary function of a building is to mediate between the external and internal climatic condition and to provide comfortable functional space for various activities such as living, carrying out business and other activities. Buildings are designed to provide the essential elements of an enclosed workspace, which affords physical security (Warren 2010). This functional purpose of buildings differs in different building stock – residential, recreational, industrial and commercial, etc. For commercial organisations, this mediation includes the ability of buildings to serve core needs of the end-users and to give an optimum performance such that the building is not an expensive liability to the organisation.

For any building, there exists a life cycle which starts at the design stage, onto construction, then refurbishment, and the maintenance and decommissioning at a later stage. The maintenance activities are undertaken at set points throughout the operational phase of the building's life. The design and construction phase of a building's life cycle has a short span, but the operational phase can last for decades, and it is this phase that is on the receiving end of the impacts of climate change.

The focus of this study is on the maintenance of older commercial buildings in response to the need to tackle the impact of climate change by mitigation and possible adaptation agenda in order to ensure that the commercial building sector continues to be viable in supporting required core business needs.

It is important for organisations to carry out Building Life Cycle Energy Assessments (LCEA) on their buildings. The assessment will address environmental impacts due to climate change. Figure 1 below shows the life cycle assessment of a commercial building which will detail the environmental impact on building, energy consumption and costs.

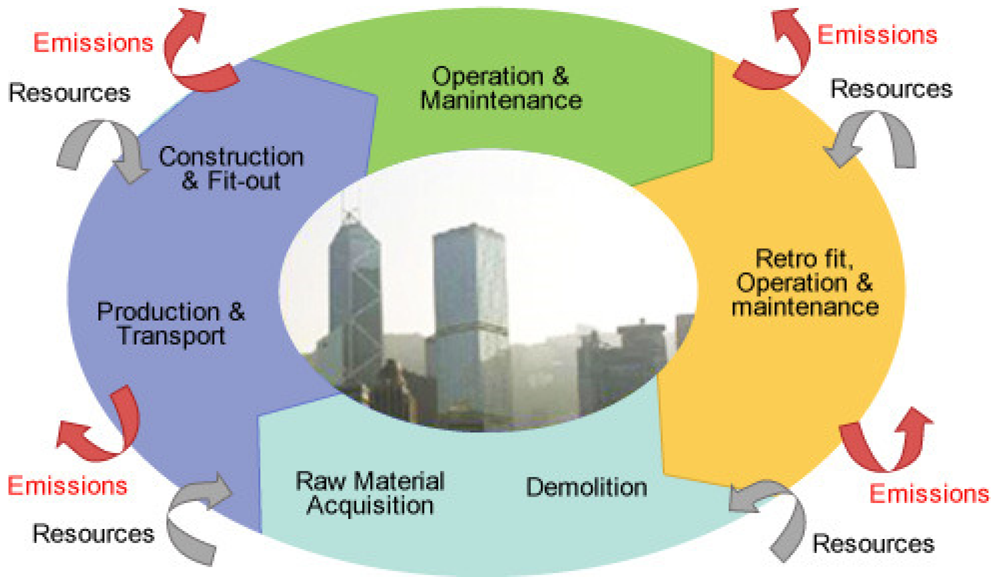


Figure 1. Building Life Cycle Energy Assessment. (www.energyland.emsd.gov.hk)

Built-asset performance in commercial properties is ensured through maintenance and refurbishment, which forms part of the building life cycle (Finch. E, as cited in Alexander (1998).

Building maintenance as defined by The British Standard BS 3811: 1964 is *"a combination of any actions carried out to retain an item in, or restore it to, an acceptable condition"*. The Chartered Institute of Building (CIOB) defines maintenance as the work undertaken in order to keep, restore or improve every facility, to an agreed standard, determined by the balance between need and available resources (CIOB 1990).

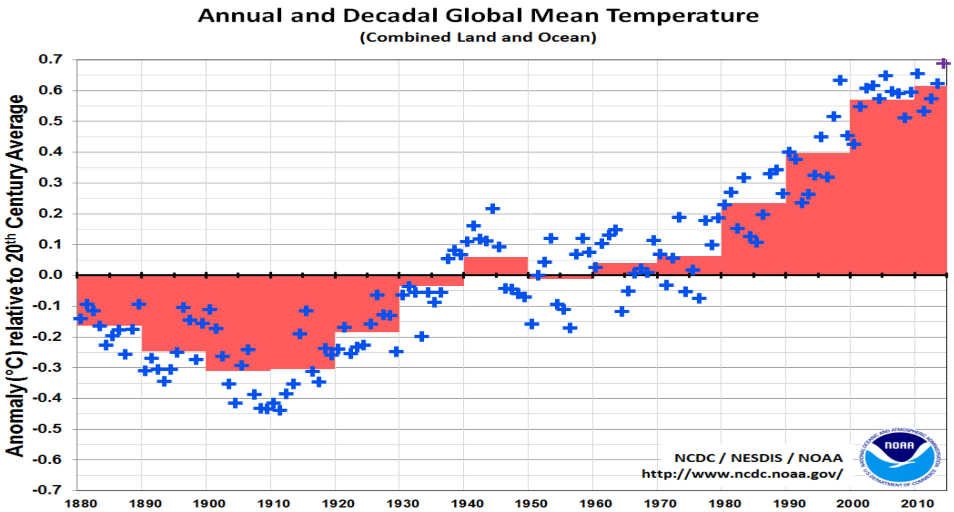
These definitions argue that maintenance is a critical task to provide an appropriate level of building performance. However, in reality most built-asset owners take the view of 'if it's not broken, why fix it' because asset fabric maintenance is perceived as a technical activity which continues to be highly resource-consuming (Atkin and Brooks 2005; Barrett and Baldry (2003).

3. Impacts of climate change on buildings and business

There is an overwhelming volume of information available on climate change and its impact on buildings. This information is available in printed journals by research and professional institutes, electronic format from government departments, and also manufacturers of building related materials, systems and equipment. Some of the information is frequently updated, so it is almost impossible to obtain an accurate quick snap-shot of developments without carrying out an extensive study.

Research in environmental quality improvements has spawned more than 20 years of academic inquiry Burgess, R (2014). Early research in climate change has described this as the most significant global threat of the 21st century and it is likely to affect the lifestyle and health of people worldwide. The threat posed by the change in climate may include changing patterns of infectious diseases, flooding, heat waves and rising sea-levels. In the UK, the weather is changing significantly (UKCIP (2009) as summer months are becoming hotter for longer, thereby requiring remedial actions to cool the buildings. The sustainability challenge has been considered potentially the greatest long-term challenge facing the human race (Blair, 2006).

The following images in Figs. 2, 3 & 4 are updates to various analyses that the National Oceanic and Atmospheric Association (NOAA) has provided in the past. These are all based upon the Merged Land and Ocean Surface Temperature data sets processing for December 2014, and represent the same data, presented in slightly different ways. These graphics will not be updated until the next annual analysis released in January 2016.



<u>Fig 2. Global Analysis (</u>www.noaa.com) <u>viewed 23/2/15</u>

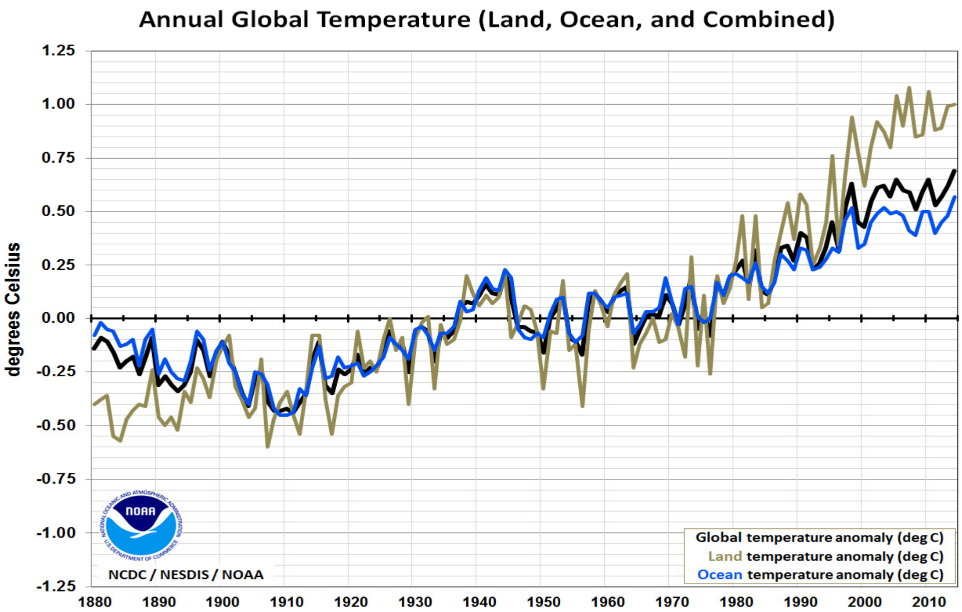


Figure 3 Temp.Time-Series for land-only, ocean-only, and combined land-and-ocean (oceans make up roughly two-thirds of the Earth's surface) (www.noaa.com)

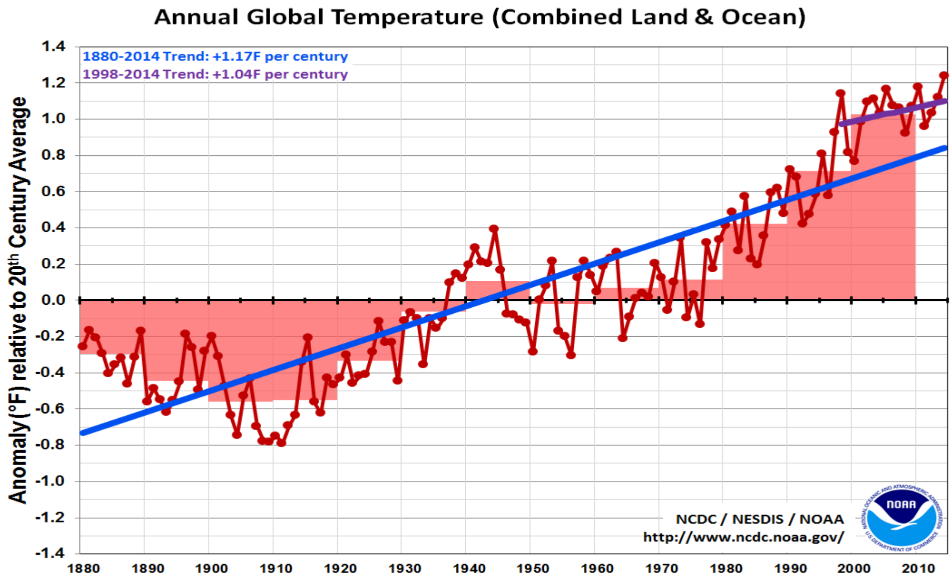


Figure 4. Global Surface Temperature: long-term trend . (www.noaa.com)

Climate change is a significant factor that will affect the way people live and work in the future. The Intergovernmental Panel on Climate Change (IPCC 2001), in its Third Assessment Report (TAR) established that most of the observed warming over the last 50 years is likely to have been as a direct result of the increase in greenhouse gas concentrations and the atmospheric concentration of carbon dioxide CO2 increase by 31% since 1750, with the rate of increase of atmospheric CO2 concentration being about 1.5 ppm (0.4%) per year over the past two decades (IPCC 2001).

Fig 5 shows observed and projected changes in global average temperature under three no-policy emissions scenarios. The shaded areas show the likely ranges while the lines show the central projections from a set of climate models. A wider range of model types shows outcomes from 2 to 11.5°F.

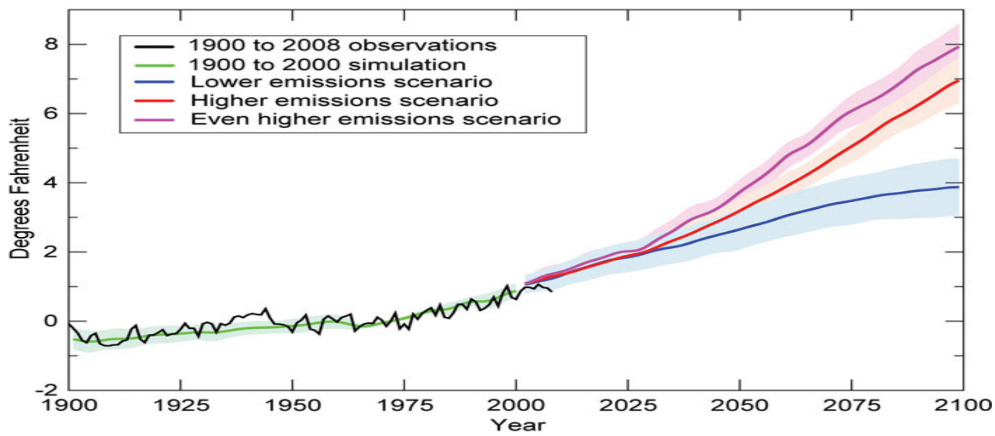


Fig 5. Future Climate change: projected changes in average temperature (www.epa.gov)

The IPCC in its report, identified two pathways for dealing with future climate change, namely adaptation and mitigation. Mitigation of climate change impact deals with a reduction in Green House Gases (GHG) in the atmosphere, while adaptation deals with taking corrective action to reduce the impacts due to climate change and to generate benefits from the opportunities offered.

The IPCC TAR (2001) defines 'mitigation' as "an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases" and 'adaptation' as "an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities".

In the context of building management, mitigation would be seen as an intervention that reduces future GHG emissions associated with a building whilst adaptation could be regarded as changing the operational elements of a building.

4. Scope of study

The scope of this study is limited to the commercial sector in the UK. Thus, a study restricted to the selected sector would allow the researcher to form definite conclusions which may be more amenable to clear interpretations and create a pedestal for further research that can be extended to other parts of the industry.

It would have been ideal to address the application of facilities management to all sectors of the economy. However, this is unrealistic for the same reasons mentioned earlier and also the issues around access to restricted government buildings.

A study of the application of facilities management to sectors as varied as oil and gas, museums, education etc with their differing problems and standards would merely result in less justifiable and generalised conclusions which may lead to varied implications of inadequate understanding. A study devoted to a selected sector of the industry, would afford a more concentrated study within the low carbon economy.

Facilities management practices and procedures have generic principles that can be adopted by all sectors as reflected in the literature review. This study is particularly an exploratory survey seeking to establish the receptivity of facilities management principles in asset management within the low carbon economy.

The sustainability agenda has moved on from lip-service to becoming a critical topic in the boardroom. Key points in managing older buildings under the current climate is the reduction of the environmental impact such as high energy consumption, water usage, greenhouse emission and waste management. Sustainability is about overlapping social, environmental and economic requirements and the need to bring them all into harmony. All of these requirements are relevant to older buildings.

Besides adding to the existing body of knowledge in this area, the study is significant in the sense that it will seek to demystify the existing doubts as to the practicality of sustainable methods of managing older buildings with Total Quality Management (TQM) principles in solving problems as regards building maintenance, training of personnel, technological resources, compliance with legislation etc. This study would then enable those principles in application in building maintenance, as well as those that are not yet in application, to be determined. This would help to proffer solutions to other problems that would surface in building maintenance operations and how to address them.

As with the mitigation agenda, managing the existing stock is the real challenge, much of which performs poorly or responds poorly to the effect of today's climate. Strategies are needed to be developed for adaptation measures but may also need to identify critical thresholds where practicalities and costs of adaptation would become critical issues.

Prominent effects of climate change on older buildings are;

- Fabric deterioration due to changing weather conditions
- Duration of time taken to heat up buildings in the winter
- Duration of time taken to cool buildings in the summer
- Damage to facades due to heavy rainfall
- Overall cost of energy consumption
- Disaster preparedness

5. Significance of study and rationale for adaptation for commercial buildings.

In the light of the literature on approaches to mitigation and adaptation of climate change, it is noted that both these approaches are of equal importance to businesses and their existing and future buildings. Existing commercial built assets will have to respond to the increasing mitigation initiatives for emission reductions from building operations and also to the physical impact of a changing climate and extreme events.

This is emphasised by Camilleri et al (2001), Camilleri and Jacques (2001), Liso (2001), Liso et al (2003) and Salagnac (2007), each of whom have noted the impacts of climate changes specifically in the building industry which have arisen as a result of recurring extreme-event damage repairs and insurance costs, carbon taxation, expenses for replacing less-efficient equipment with more energy efficient ones, and increased outgoings due to higher energy bills.

They further suggest that addressing these issues would require policy formation for reducing GHG emissions from buildings and also preparing them for future climate changes through site-specific and regional impact research.

The failure to address the above would possibly render the existing property portfolios obsolete as they would no longer be able to serve their organisation's business needs (Jones and Desai 2006).

6. Building Maintenance: present practices and the challenges

In order to address climate change mitigation and adaptation approaches for existing commercial buildings, it is necessary to understand the present maintenance practices. This section presents common maintenance models and facilities management practices. In doing so it points towards the required responsive maintenance method which needs to be addressed in order to accommodate present and future climate-change mitigation and adaptation options. It does so by outlining the research proposal and its aims and objectives.

Nowadays, businesses are not restricted by geographic boundaries and their corporate identity cannot be fully defined by only core activities. The maintenance and management of the noncore services, which includes their property portfolio, is also a high priority and, if ignored, this could affect an organisation's overall corporate image and could result in reputational and financial loss.

In today's scenario of increased environmental legislation, especially with regard to climate change mitigation and energy efficiency, there are increasing demands placed on buildings for reducing emissions in accordance with maintaining the required standards. This demand will also be coupled with the need for making buildings habitable and resilient to the extreme events and future climate changes as projected by climate change science, which will need to be responded to by the maintenance personnel within all commercial organisations.

Maintenance models and related issues

Maintenance schedules in building management are required in order to keep property functioning to a required standard and to serve the organisation's business core objectives.

British Standard BS 3811:1993 defines maintenance as *"a combination of any actions carried out to retain an item in, or restore it to, an acceptable condition"*. The actions here are those of initiation, organisation and implementation. Maintenance also seeks an improved performance compared with what previously existed at reasonable budget level. In order to emphasise this aspect of improvement and budget, the Chartered Institute of Building (1990) defines maintenance as *"work undertaken in order to keep, restore or improve every facility, i.e. every part of the building, its services and surrounds, to an agreed standard and legislation determined by the balance between need and available resources"*.

In light of these definitions it could be said that maintenance programmes are important in order to achieve the necessary standards of building performance, yet in reality such maintenance continues to be a high resource-consuming activity (Alexander 1998; Barrett and Baldry 2003). In accordance with these perspectives, the present maintenance models exist in two major prevailing maintenance approaches, namely as planned preventive maintenance and as reactive (corrective) maintenance. BS 3811 defines 'planned maintenance' as *"maintenance organised and carried out with forethought, control and the use of records to a predetermined plan"* and 'preventive maintenance' as *"maintenance carried out at predetermined intervals or other prescribed criteria and intended to reduce the likelihood of an item not meeting acceptable conditions"*.

Thus preventive maintenance which is normally planned is defined as 'planned preventive maintenance' (Wordsworth 2001). Planned preventive maintenance is divided into schedule based and condition-based maintenance programmes.

From the very simple 'only fix it when it's broken' techniques (~1950) through to the preventive maintenance (from early 1950s), various optimized versions of maintenance programs have been evolved. The various maintenance types and their characteristics are shown in Fig 6.

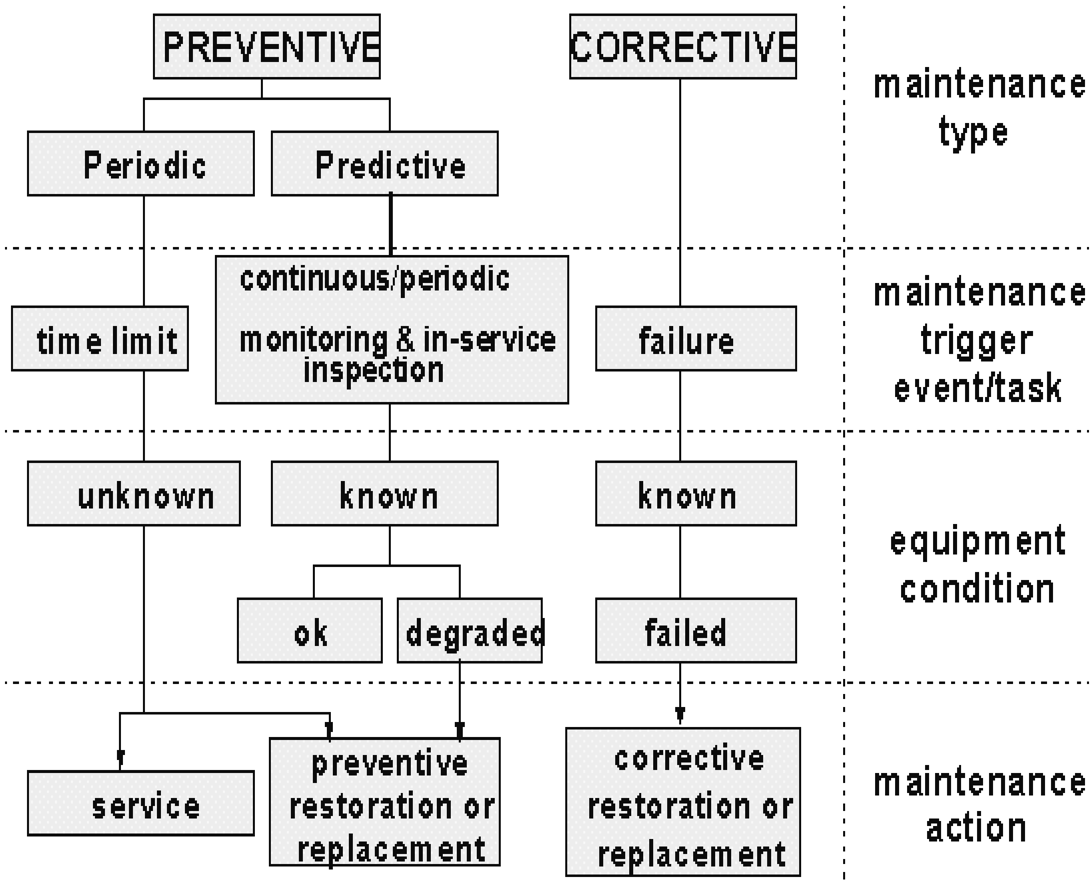


Figure 6. Condition based maintenance program

It is believed that government legislation and other measures are highly necessary to move forward the pace of change. The government is facing challenges in striking the right balance between 'carrot' and 'stick' in order to achieve its sustainability objectives, whilst the industry also must engage as much as possible and attempt to meet targets. The study will further engage in survey and action research methods to capture the various contributions of Facilities Managers including technologies invested in by corporate bodies and how these technologies are helping to improve the environment. The findings of this study when completed are expected to help innovators, building designers and other built environment consultants to monitor the successes of their designs and technologies and to improve on good practices.

7. Facilities Management (FM)

Facilities management is the process by which organisations ensures that their buildings, and other systems and support services can achieve the objectives of the organisation in changing weather conditions (Atkin and Brooks 2005). Facilities Management focuses on risk reduction of an organisation's response to changing environment control and protection.

Barrett and Baldry (2003) define Facilities Management as an integral approach to operating, maintaining, improving and adapting the buildings to support the primary objectives of that organisation.

The facilities or maintenance manager is the person tasked in an organisation with maintaining the property in a habitable condition such that the building can fulfil its basic function in line with relevant legislative compliances, and to address the constantly increasing gap in present property condition and the future demands in response to constant technological advancement, user demands and market forces.

8. Role of Facilities Managers

The role of Facilities Managers in an organisation has been widely expanded to such an extent that Facilities Managers are now involved in many aspects of their organisations' operations. Some of these responsibilities may be relevant to sustainability issues ranging from energy management to green procurement, from corporate social responsibility to managing sustainability and reducing buildings related carbon emissions.

In order to comply with statutory and corporate demands for environmentally friendly policies and practices, Facilities Managers are expected to take the lead in organisation-wide environmental management system programmes geared to reducing and managing buildings related CO_2 emissions, improving transport (company fleet), waste management and recycling, and maintenance of tools and machinery. Thus new roles and skills are emerging for Facilities Managers to assume environmental stewardships that allows them to manage buildings efficiently, as well as to contribute to value for money and the meeting of efficiency targets (Sutrisna, 2009).

To meet the requirements of the emerging roles, the existing training and competences of the Facilities Managers may be insufficient. Each organisation's Human Resources function will need to ensure that the skills and competences of the contemporary practicing Facilities Managers are attained in meeting the demands of tackling the new challenges they are faced with. These matters are usually within the scope of what is known as Human Resource Development (HRD). Figure 7 illustrates the range of roles and responsibilities of the Facilities Manager.

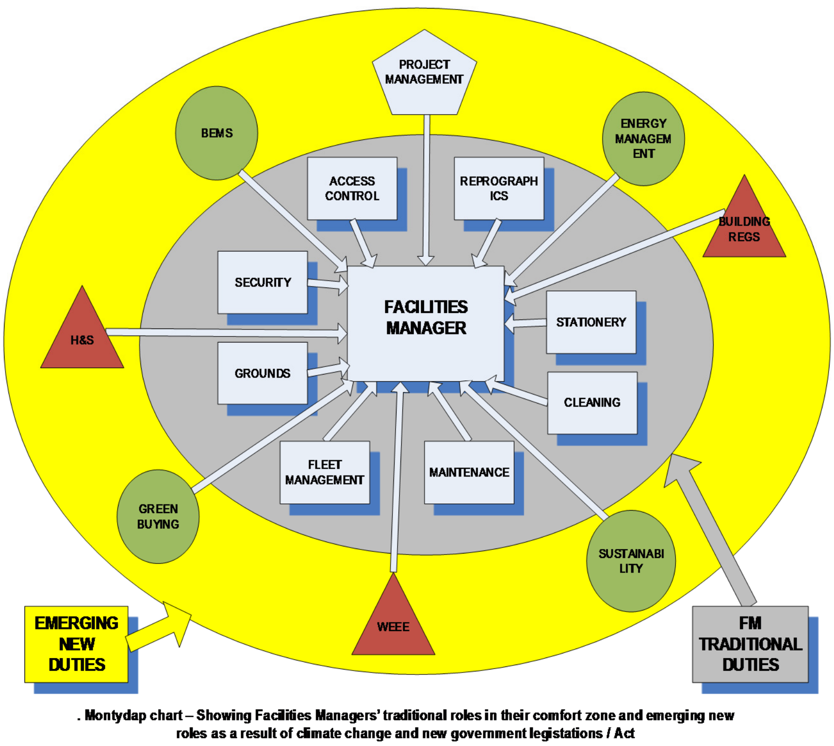


Figure 7. Traditional and emerging roles of facilities managers (FM)

This study attempts to focus on the key issues regarding this potential gap affecting Facilities Managers in recent years and their potential training and retraining needs in fulfilling these emerging roles. It is expected that Facilities Managers will play a significant role in addressing the effects of Climate Change especially on older buildings.

Globally, the facilities management profession continues to mature and evolve. Facilities Managers today are expected to understand their company's core businesses and are expected to be able to contribute to the bottom line — not only by reducing facilities capital costs, but also by improving and reducing corporate carbon footprints whilst improving the revenue generating capacity and image of their organizations. To help prepare its members and the FM profession for the future, International Facility Management Association (IFMA) periodically conducts a trend forecasting exercise with a panel of industry experts to identify the emerging trends, challenges and issues that are likely to influence facility management profession in the coming years.

9. Findings so far

At this stage of the study, it is evident that climate change is an issue over which there is little control. Organisations need to be pro-active in dealing with climate change by investing in new technologies and creating a new cultural change organization-wide as well as having a dedicated professional responsible for their sustainability and building related carbon reduction agenda. There is subjective evidence of inconsistencies in the UK industry sector in the role of professionals in this matter, particularly of Facilities Managers. The role of the Facilities Manager is viewed as the conductor or executor of boardroom decisions.

The duty of Facilities Managers varies in the industry depending on the structure and size of the organisation. The roles of some Facilities Managers (FMs) are often driven by building related regulations and Health and Safety legislation as set out by regulatory bodies and the UK Government. Prominent legislation binding building management is the introduction of the International Standards Organisation series (i.e. ISO 14000) which states that buildings must be seen to comply with environmental legislation in their management by using renewable energy, recycling of office waste and so on. The government has introduced a procurement innovation known as Office for Government Commerce (OGC). This initiative sets out rules and regulations for companies doing business to comply with various standards i.e. IIP, CHAS, ISO 14000, and ISO 27000 before they can participate in tendering for government projects or services.

To meet some of these requirements, Facilities Managers are the responsible officers in the organisation to action compliance with statutory demands. There is a growing concern that Facilities Managers are being put under pressure and facing ever growing challenges to cope with demanding changes to building management by corporate bodies owing to government legislation.

10. Summary of key findings from Survey

The primary research carried out for this study used a survey questionnaire which revealed that there is much more to be done in term of managing and maintaining older buildings within a low carbon economy.

A pilot survey was initially carried out in order to investigate and inform the need for carrying out this study, and then an in-depth questionnaire was used in the whole survey process. A further survey to establish the ability and validity of a proposed framework was carried out. The pilot survey was carried out at an early stage prior to sending out the in-depth questionnaires for feedback on aspects such as layout of questions, clarity and appropriateness, wording and adequacy of the questions in conveying the desired meaning, and time needed to complete.

200 potential respondents were targeted from various professional networks such as LinkedIn, BIFM membership forum, and other professional groups across the industry in the UK. Over 40 e-mails were returned undelivered, reducing the potential responses to about 160. Of these 44 responded, providing a response rate around 27%.

Following this, face to face and telephone interviews were conducted as a follow-up, with similar type of questions used in the questionnaire-survey as part of the mixed methods research and as a means to validate findings from the in-depth questionnaire as suggested by Bryman, A (2006). These interviewees, a total of 12, were selected mainly using the snowballing technique and in line with the Purposive Sampling Strategy. The collected data was manually collated on a spread sheet for analysis using a prepared codebook.

The major findings were as follows:

- Unlike many other building types, Summer is the peak time for commercial buildings as ventilation and air conditioning systems are used extensively, and inefficient and outdated systems compounds the level of energy efficiency.
- Facilities managers finds it difficult to cope with effects of climate change. As such, they use technical solutions available to them just to maintain ambient temperature for the end users of their buildings.
- Breakdowns during summer months and huge bills in the autumn could finally grab attention. Meanwhile, regulations in respect of energy labelling, climate change taxes and public pressure over global warming could finally bring home to organisations that little will be achieved without the help of facilities managers who have to channel all this debate into practical solutions. Figure 8 below shows a sample of what a majority of organisations invest in (window-mounted aircon units) to cool down their offices. This is probably not an efficient way of tackling the effect of climate change. The fabric of the building needs thorough energy assessment that will determine a better and efficient solution.

Figure 8. Is the installation of air-con units the solutions to climate change?
Source: Journal of sustainability education, (www.jsedimensions.org.11/2/14)

Identifying the key issues, trends and challenges in the industry can help FM practitioners to succeed by identifying the industry patterns to look for such as the core skill sets to work on and the places to allocate their resources.

11. Conclusions

Some of the trends that will be focused on in this this study are:

- Sustainability continues to grow in importance and prominence worldwide. Organizations have begun to incorporate consideration of the impact of this into business goals, procedures and corporate culture. Within the profession, it has moved from an emphasis primarily for new construction to influencing existing building operations.
- There is a growing recognition that facilities management can contribute to the health and wellbeing of building occupants, thereby benefiting efficiency, productivity, profitability and occupant welfare.
- There is a growing desire to elevate facilities management to improve the recognition and perceived value of the profession within the corporate hierarchy. Many have achieved success in this arena through careful alignment with their organization's mission and by emphasizing the facilities professional's role as the manager of significant assets and enablers of the organization's mission, vision and values.
- Complex building systems and controls increasingly offer opportunities and challenges for the profession. The industry can leverage new technologies to better manage facilities, but it also needs to ensure adequate training is in place to educate practitioners on new systems

- Facilities management faces problems stemming from the aging building stock — difficulties compounded by the global recession. As facilities and mechanical systems reach and exceed their expected operating lives, significant issues of "repair or replace" must be addressed.
- The increasing quantity and complexity of data available to facilities Managers through new reporting protocols poses challenges and opportunities for the profession. More facilities departments have added the ability to convert raw data into usable and meaningful information that fosters informed decision making.
- Facilities management increasingly faces challenges posed by open work plan arrangements, differing hours of operation, and varying occupancy rates and densities — all of which impact on power use and other considerations.

A standardized approach to the maintenance of older buildings within the low carbon economy is achievable if a robust strategy is in place to manage the buildings given that the following are in place;

- Strategy for managing older premises including retrofits.
- Embracing of new technologies in managing older premises.
- Support from senior management/board members in tackling effects of climate change on buildings.

12. Further Literature Review and framework of improvements

Having completed a substantial literature review to establish the problems associated with the effects of climate change in buildings, this will continue in order to be able to develop a theoretical framework incorporating the existing body of knowledge and emerging issues related to tackling the effects of changing weather conditions on buildings**.**

The intended Framework of improvements will be prepared in order to propose some solutions to the 'arising problem' situations identified from the data analysis.

Future publishing of the research and functional value of the proposed framework through an academic forum (Journal or conference paper) is also planned.

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Lean Construction as an innovative approach for minimising risks in Mega-Construction projects in developing countries

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Abstract:

The past two decades have witnessed a rapid increase in construction activities in developing countries in the Middle Eastern Gulf region. This coincides with the governments' announcements regarding substantial spending on the improvement of infrastructure. Despite the increase in activities, construction companies still currently face many challenges, including completing projects on time and within budgets; the issue of delay has promoted a negative image for the industry in that region.

Basing the research on data collected from documents concerning finished construction projects in which the researcher has been professionally involved, his experience in the field of construction project management in the Middle East and risk management in particular, followed by an extensive study of the literature, the researcher identified some of the most common problems associated with construction projects in one of the Gulf Area countries, the Kingdom of Saudi Arabia (KSA).

The researcher then identified and assessed the implemented strategies, commonly used by contractor teams, to overcome each of those problems, studied the Lean Construction method as the "new" strategy introduced recently to the field, and will go on to compare them in an attempt to investigate whether the Lean Construction method could lead to better results in solving the problems faced by construction projects. The problems identified were categorised into three individual risk types: construction waste; being behind schedule; and project over budget.

One of the main obstacles facing the research is the lack of awareness among different parties in the construction field in the KSA of Lean Construction principles and the added value that may be gained if it is applied throughout the project life cycle.

The main objective of this research is to develop an innovative framework for the application of Lean principles in the construction industry (Lean Construction) and to show the extent to which this approach will minimise the risks involved in Mega-Construction projects in developing countries and in the KSA in particular. The main findings so far are that the main issues in the KSA regarding the implementation of a "new" construction method are: (1) the lack of awareness of workers in the KSA of Lean Construction principles; and (2) The lack of a future strategic plan for the construction industry in the KSA in terms of managing waste and risks in general.

Keywords:

Developing countries, Lean Construction, Mega-Construction projects, and Risk Management

1. Introduction

Construction companies in the KSA currently face many challenges, including that of completing projects on time and within estimated budgets. The KSA construction market is considered the largest in the Middle East, both by the value of contracts awarded in general and in terms of future projects in the pipeline industry in particular (Ventures Middle East, 2011). The main drivers of the market continue to be oil prices, the need to diversify the economy, job creation and demographic growth (Bannan and Elmualim, 2014). Infrastructure projects in the KSA are vital because of the substantial investment in airports, roads, ports and railways, which are being developed by the government in an effort to increase capacity to cope with the rising population (The McGraw-Hill Companies, Inc., 2007).

Currently, more than 1,300 KSA Mega-projects worth over $732 billion in the oil, gas, construction, transport, power and water sectors are being implemented (Deloitte, 2013). This huge figure indicates how vital it is to use advanced techniques to minimise the projects' cost and maximise their value by controlling all possible risks in order to avert the failure of projects, which in turn may result in a severe negative impact on the growth of the economy in the whole area.

In 2014, one of the multi-national companies, Architecture, Engineering, Construction, Operations and Management (AECOM), conducted an industry survey, revealing that the Middle East construction industry still has some way to go before it can have real confidence in its ability to manage risks (AECOM, 2014). Construction companies in the Middle East are influenced by many factors that could lead to project failure or negatively affect their performance. These factors include, but are not limited to, material waste, time loss, poor quality, reworking and unexpected risk (AECOM, 2014). The issue becomes even more complicated when each project party argues that the cause of failure is not "their responsibility". From the researcher's work experience in the KSA and the data collected from previous construction projects, it is clear that the main goal of any construction company is to increase profit, and thus it always seeks to propose alternatives that may reduce a project's cost.

The researcher analysed the current methods and techniques contractors commonly use to eliminate or mitigate construction problems in order to find more efficient solutions. It was found that contractors in the Middle East are mainly concerned with the problems that directly affect the project's cost, notwithstanding that all issues affect the cost, including material waste and failure to finish the project on time. Moreover, contractors commonly do not consider risk as an issue; they handle it upon occurrence by using corrective actions instead of taking proactive actions (Al-Kharashi and Skitmore, 2009). Based on the researcher's work experience of completed projects and the literature reviewed, the following are the main factors that negatively affect construction projects in the KSA, categorised into three main risk types: waste, project delay and over budget.

Firstly, the traditional methods for managing construction projects and evaluating their performance in the KSA are implemented only when profit is felt to be affected. In general, contractors do not have any input during the design phase, but are more commonly involved in the construction phase, where the contractor implements a value engineering techniques to reduce the waste by selecting the best construction method (Alalshikh and Male, 2010). Construction waste, and ways of minimising it, is the first issue to be discussed in this paper.

Secondly, project delay is one of the main problems facing the construction industry globally as well in the Middle East (Al-Kharashi and Skitmore, 2009). Studies by several researchers in the Middle East have reported that 70% of all public sector construction projects fail to complete on time (Albogamy et al., 2013). At an early stage of the project, the consultant usually requests that the contractor submit a baseline schedule for a specific time-frame and present a bi-weekly report during the construction phase in order to ensure that the project is on the right track (Albogamy et al., 2013). The big question thus becomes: how do contractors deal with the submitted schedule? Further investigation has shed light on what led to this second problem: delay in construction projects or, in other words, being "behind schedule".

Another problem in the KSA construction industry, and in that of the region in general, is that contractors suffer from projects being over-budget (Albogamy et al., 2013). Numerous problems may have a significant impact on the budget; therefore, managing associated issues early may help to control the project's budget. One of the traditional methods used to control the budget is to create a reasonable cost baseline for the associated project, then assign a cost-control engineer to monitor and report by using Earned Value Analysis (AACE, 2008). However, none of the commonly known risk management techniques have actually been applied in construction projects in the KSA (Alrashed et al., 2014).

From the literature review, any associated issues, either minor or major, must be considered as risks and should be eliminated or mitigated at an early stage of the project (Washington State Department of Transportation WSDOT, 2010). The environment in the Middle East is highly resistant to change, yet the increase in the number of Mega projects makes the search for a more successful project management technique necessary. Judging from the reviewed literature, the application of Lean principles in other industries has indeed resulted in a more efficient, successful project delivery.

The application of Lean principles in the construction industry, referred to as "Lean Construction", will result in minimising the risks associated with Mega-construction projects in developing countries, particularly in the Middle Eastern region. Through an extensive study of the literature and investigation of an ongoing Mega-Construction project in the KSA, this research aims at developing an innovative framework for the application of Lean principles in the construction industry, showing the extent to which this approach will minimise those associated risks in the KSA in particular.

2. Synthesised literature review

2.1. Construction issues and implemented methods

This section provides an overview of some associated construction issues and the methods commonly used to deal with them.

2.1.1. Construction waste

The construction industry in general suffers from generated construction waste, which directly affects the project budget (AbdelHamid, 2007). Kozlovská and Spišáková (2013, p.687) state that construction and demolition waste (CDW) accounted for 33% of the total waste stream in the European Union in the year 2010 (Eurostat 2010).

One of the main methods applied to manage construction waste is Value Engineering (VE). According to Elayache (2010), "VE is a thorough problem-solving technique, combining several disciplines, that is primarily concerned with increasing the value of the steps required to attain the goal of any product, process, service, or organization" (Elayache, 2010). Al-Yousefi (2010) states that VE is a known and accepted method that has had an impressive history in the improvement of value through customising Quality and optimising Life Cycle Cost (LCC). As it is known as an organised process, a wide range of companies and establishments have applied VE to achieve their goals. The VE process achieved success due to its ability to identify available opportunities for the removal of unnecessary costs while assuring quality, reliability, performance and other critical factors in order to meet or exceed customers' expectations.

In the Middle East, contractors are not concerned with the possible methods of reusing produced waste, but with reducing it in order to maximise the project’s value. In the KSA, most contractors do not apply VE during the whole project life cycle because of the applied delivery method (type of contract), which is a unit price contract (Al-Dubaisi, 2000). According to AECOM (2013), the unit price contract is most commonly used in the Middle East, especially in the Gulf Area, but the VE method does not comply with it because the contractor does not have any input during the design phase. Therefore, this method is not applied properly; contractors apply it only during the construction phase, leading the consultant to issue a Design Change Notice (DCN) (Al-Kharashi and Skitmore, 2009).

It was found that the type of delivery method is affected by the use of VE in a way that controls the generated construction material waste (Al-Yousefi, 2010). The Design-Build Institute of America (DBIA) claimed in 2010 that in the standard design-bid-build scenario, the study of VE can be carried out during the project delivery phase, from the stage of planning until the completion of the design phase. The VE study generally concentrates on major project components, because it indicates the best value (DBIA, 2010).

2.1.2. Behind schedule

According to AACE (2008), the input data for creating a master schedule include all the works under the contract, as well as identification of external effects and milestones and of authorisations needed to launch works or access roads. The following phase is where detailed activities for each work package and a master schedule showing interfaces between disciplines, which requires approval by all parties, are created. Then comes the resource loading phase, where a master resource loaded schedule is created from the integration of all individual detailed schedules, followed by creating and analysing resource and cash profiles to start the updating and reporting process (AACE, 2008).

Typically, the consultant requests the bid-winning contractor to submit the baseline schedule, which includes the project end date. The contractor then creates a time schedule using planning and scheduling software such as Primavera and follows the typical steps, from splitting the project into work activities to marking critical paths of activities (Hildreth and Munoz, 2005). The contractor submits a bi-weekly report, based on the approved baseline schedule, to monitor and control the project’s progress and compare the baseline to the actual performance; in this way an updated schedule is created. This scheduling method is commonly used in the construction industry worldwide and is thus adopted in the KSA. However, normally contractors in the Middle East work on a large number of activities in order to claim money in the early project phases, i.e. they do not follow the work sequence provided in the approved baseline schedule. Consequently, most construction projects in the Middle East fail to finish within the approved time frame (Al-Kharashi and Skitmore, 2009).

The Critical Path method is implemented for this issue which is an essential technique to construct a model of the project that includes a list of all activities required to complete the project and time/duration that each activity will take to complete the project (Lu and Li, 2003). It is used to determine start times, finish times and float calculations of activities, marking critical path, and developing bar charts.

The problem of being behind schedule does not occur because of the selected project management method, but because of the manner in which it is applied, as well as the setting of unrealistic time schedules. The construction team should follow the approved baseline and should not report an incorrect status of the project to avoid presenting delays. Moreover, the construction team should prepare a realistic constructability plan and discuss it with the project planner so that it is reflected in the project schedule (Al-Kharashi and Skitmore, 2009).

2.1.3. Project over budget

According to AECOM (2014), delivering large-scale projects on time and on budget in the Middle East remains a major challenge. 78% of responding participants of a survey performed by AECOM reported that project over-budgeting was mainly a result of changes in project scope and unrealistic timeframes, and thus delays and unclear project objectives (AECOM, 2014, p.46).

Many contractors in the Middle East lose their project profit due to their failure to control the approved project budget. In the KSA, contractors mainly use a cost management method to control project cost including such processes as resource planning, cost estimating, cost budgeting and cost control.

The resource planning process involves i) the determination of physical resources (manpower, equipment, materials) and the quantities that should be used to perform project activities according to the resource requirements; ii) description of the types of resources required and the quantities for each element of the work breakdown structure (AACE, 2008).

The cost estimating process develops estimates of the costs of the resources needed to complete project activities, including identifying and considering various costing alternatives resulting in cost estimates, including details such as scope of work, assumptions made, possible range of results and a cost management plan describing how cost variances will be managed (AACE, 2008).

Cost budgeting, which involves allocation of overall cost, estimates the cost of the individual work items in order to establish a cost baseline for measuring project performance after considering the contingency percentage. The output of the cost budgeting process is cost baseline, which is a time-phased budget that will be used to measure and monitor the cost performance of the project. It is developed by summing estimated costs by period and is usually displayed in the form of an S-curve (Hildreth and Munoz, 2005).

The last process is cost control, which is concerned with: (i) influencing the factors that make changes to the cost baseline so as to ensure that changes are beneficial, (ii) managing the actual changes when and as they occur. Cost Control includes: monitoring cost performances to detect deviation from the plan, ensuring that all appropriate changes are recorded accurately in the cost baseline, preventing incorrect, inappropriate, or unauthorised changes from being included in the cost baseline, and informing the authorised party of any changes (Hildreth and Munoz, 2005).

Moreover, the contractor uses the earned value technique during the cost controlling process, developed by project management practitioners, to measure project performance and progress based on a combination of schedule, costs, quality and work performed, with a focus on early warning of trends in any of these areas (Bhosekar and Vyas, 2012).

The Earned Value Analysis (EVA), a project performance evaluation technique originating from industrial engineering, highlights the need for eventual corrective actions through providing early indications of project performance (Subramani et al., 2014). Bhosekar and Vyas (2012) also define the concept of Earned Value Analysis as "a programme management technique that uses "work in progress" to indicate what will happen to work in the future". EVA uses cost as the common measure of project cost and performance schedule. It provides the cost measurement in currency, hours, worker-days or any other similar quantity that can be used as a common measure of the values associated with project work.

Despite the use of the above-mentioned cost management processes, KSA contractors are still failing to control the approved project budget, and not due to the inefficiency of the method adopted, but to the manner in which it was applied (Mitra and Tan, 2012).

3. The Lean Construction Method

In the late 1950s and early 1960s, the Toyota Motor Company of Japan explored the concept of Lean Production, developed by Engineer Ohno, whose philosophy is the continuous reduction of waste in all its forms (Womack et al, 1991 cited in Howell, 1999). Seven types of waste were noted in the Toyota production system: overproduction, waiting, transportation, inventory, motion, defectives and over-processing (Cullen et al, 2005). Womack et al (1990) summed up the definition of Lean principles as follows: (1) define the value from the customer's point of view; (2) provide a value stream map; (3) execute the work flow; (4) manage continuous improvement (Womack et al, 1991 cited in Cullen et al, 2005)

Recently, Lean Production has been implemented in the construction industry (Howell, 1999, p.1). The construction industry has resisted many ideas from manufacturing industries because of the philosophy that construction is different; therefore, it was a challenge to apply Lean Production techniques to it (Howell, 1999, p.4). Lean Construction accepts Ohno's ideas concerning the required level of improvement in the design of the production system. But the question here is: how would the Toyota system and Lean Production apply to the construction industry? (Howell, 1999, p4).

The vision of the International Group of Lean Construction (IGLC) is "to better meet customer demands and dramatically improve the Architectural, Engineering and Construction (AEC) processes as well as product" (International Group of Lean Construction [IGLC], 2015). The main issues that usually face the construction industry are waste, risk, difficulties in attaining the required value and meeting customer needs.

One of the Lean Construction tools, the Last Planner System (LPS) is a production control system for projects management. It substitutes for or replaces both a typical management system based on activities and a defined schedule produced by a project manager (Engineers Australia, 2012, p.19). The LPS has helped contractors in the reduction of project delivery time and at the same time allowed specialty contractors to improve utilisation of their resources (Engineers Australia, 2012, p.19). Ballard (2000) indicates that Last Planner System (LPS) is a technique that provides workflow and responds to construction project Variables (cited in Salem et al., 2005, p.3).

4. Problem statement and research methodology

Based on the researcher involvement in some of the mega construction projects in the KSA and based upon this participation, was able to collect, study and analyse data derived from documents of completed construction projects. The researcher has examined the drivers and barriers that could negatively affect projects' performance from the perspective of key contractors in the field. It transpired that delivering Mega-projects on time and on budget remains a major challenge in the region.

The problems that the research may face are:

1. In developing countries like KSA, questioning may be misinterpreted as a means of monitoring the activities of workers for purposes of fiscal assessment. This presents two problems: firstly, for cultural reasons, many informal workers do not want to be seen performing high-reward activities; secondly, it may be understood as a way of forcing workers to pay more tax on their income.
2. While case studies are a more comprehensive research method, they are limited to the project being studied and results cannot be generalised.

The researcher chose a specific, on-going Mega construction project in the KSA, and during his participation with the project, the resercher used it as a case study in order to investigate the matter deeply and consider the implementation of the Lean Construction techniques. This will show the extent to which applying Lean Construction techniques will improve the success of delivery of the project as opposed to other traditional methods that have been used before and those being presented throughout this research.

A quick survey has been performed to gather first-hand information from workers involved in the on-going construction project in the KSA, to get a preliminary view of the awareness level of Lean Construction techniques in the area. The results of the survey will be used in the analysis of the research topic and as a basis for a more successful Lean implementation in the KSA. An interview method will be employed to collect data, interviewing a large number of people (20 to 30 individuals) in order to extract as much data as possible, allowing a wide range of opinions and points of view to be gathered (Yin, 1994). The results of findings from the literature review and the empirical data collection methods will be chosen and examined accordingly.

The researcher chose a mega-project in the KSA as a case study. The project is the "Site Development of the Industrial City of RAS AL-KHAIR" (Figure 1). This project has played an important role in the development of the huge industrial city of RAS AL-KHAIR, which has had a significant effect on the economy of the country. The contract value is SAR 750 million, (around £120 million). Considering the Saudi Arabian currency in relation to the budgets of construction projects in the Middle East, the author assumed this project qualified as a Mega-project and chose it to implement the selected method of Lean Construction. The researcher critically analyses the traditional methods of solving construction problems and compares them to the selected technique of Lean Construction in order to achieve the main objective of the research. His findings so far are that the Mega-project must be carefully planned and managed, all projects parties should be involved in the big picture from an early stage in the project and that lessons must be learned from similar attempts that were applied previously in other countries.

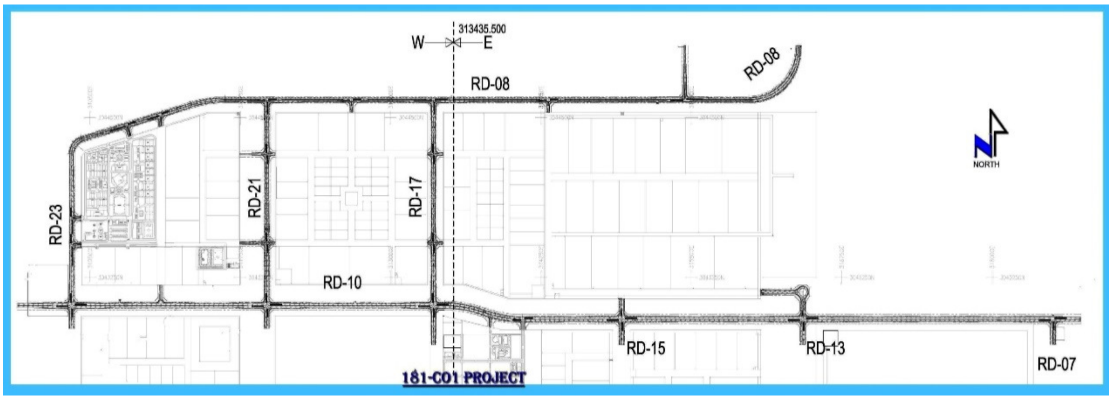

Figure 1: The Site Layout of Site Development Project: 'Selected Mega-project in the KSA' (Royal Commission, 2013).

The Scope of Work of the project is to construct and develop approximately 1,427 hectares of industrial land. It is part of the ongoing development of Ras Al Khair Industrial City (RIC). The main objective is to procure, supply and construct the facility within 30 Months from Notice To Proceed (NTP).

The theoretical project execution plan, at early stage of the project, provided a framework for assisting top management, the architect and the project management team to identify the project's objectives. It also determined the roles and responsibilities of each party, as well as the details and scope of the information to be shared. Value for money and fast delivery of the project are the major objectives that need to be achieved throughout the project's life cycle.

The survey has been carried out by the researcher to construct a preliminary point of view to such extent that the application of Lean Construction techniques would add value to construction companies. It also aimed at investigating the extent of the awareness of the Toyota Production System's philosophy and the implementation of the associated management systems among construction workers.

It is important to examine the traditional methods that are usually implemented in infrastructure projects and compare them to Lean Construction. The KSA Government requested that the project be completed in 30 months, as scheduled. New challenges are likely to appear, and following Lean Construction techniques throughout the project phases will require a high level of awareness from the project team. A final predicted challenge is to ensure and demonstrate that the selected method encourages a positive approach on the part of the contractor.

5. Conclusion, findings and future work

There has been much research conducted on the issues associated with construction projects in the KSA. Some have focused on the principles of Lean Construction and others on the procedures of current implemented methods. This research approaches the Lean Construction technique as a new method that, based on the literature review, the analysis of data collected and the investigation so far into the ongoing mega construction project chosen as a case study, will maximise project value in comparison to other traditional management methods. At this stage of the research, based upon the conducted survey and literature review, the researcher has found that the main issues in the KSA regarding the implementation of a "new" construction method are:

1. The lack of awareness of workers in the KSA of principles, including Lean Construction principles, other than the traditionally used ones,
2. The lack of a future strategy plan for the construction industry in the KSA in terms of managing waste and risks in general.

The researcher proposes applying the Lean Construction method to Mega-construction projects in the Middle East to provide an appropriate strategy for those issues. It is believed that the traditional implemented strategies can manage the associated construction issues; however, they are not ideal for Mega Projects. Those strategies could benefit from an integrated system to increase efficiency. Based on the research performed thus far, the researcher was able to acquire a first impression of how the application of Lean Construction may affect the construction process and this is based on a case study on the application of Lean Construction; to a chosen, ongoing construction Mega-project in the KSA in which he is professionally involved. The researcher will compare it in the further research to the current implemented methods to determine whether Lean Construction will add value to the construction industry, supporting his research with figures and cost savings.

After studying the literature and gathering the relevant information, the researcher summarised the main findings of this research as follows:

1. For construction waste issue, the applied method, which is Value Engineering, should be enhanced and applied at an early stage of the project. In order to do that, the delivery method should theoretically be changed to allow VE to work well. The researcher assumes that, practically, the type of contract will not change, as shown in the case study. Thus, the VE should be applied throughout the construction phase, as it currently is by most contractors, but with the integration of Lean Construction to increase the efficiency of managing waste.
2. For the behind schedule issue, the current implemented method is the Critical Path Method (CPM), which is mostly about controlling what is already happening, i.e. “reactive action”. But integrating Last Planner (LP) with CPM will allow a more reliable way of planning works, provide a smoother workflow and a more prompt response to construction project variables i.e. “proactive action”.
3. The researcher views the Lean Construction method as an integrated system that enables a view of most common construction issues all at the same time, despite the separate action taken for solving each of the issue. In the construction industry, any single issue will most likely lead to another. For example, if waste is increased or the project is not finished on time, then the project cost will be affected.

Further research will be conducted to compare the current traditional methods for dealing with construction waste, behind schedule, project over budget with the Lean Construction techniques. In relation to this, a framework will be developed and recommendations will be driven of how the Lean Construction would be useful to governmental agencies.

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Concept of Project Finance in Infrastructure Development and Delivery in Nigeria

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Abstract

The development and provision of infrastructure facilities in some developing and developed countries in the world has primarily been through the traditional forms of procurement strategies by the public sector through budgetary allocations. Recently, with the demand for more infrastructure arising from the population explosion coupled with the financial constraint experienced by the government, the public sector have sought to involve the private sectors in the development of infrastructure facilities through joint ventures inform of Public-Private Partnership (PPP). However, the success of the infrastructure project delivery and performance lies in an enabling environment for both the public and the private sectors which are involved in the development and provision of the infrastructure facilities. This paper is aimed at examining the concept of project finance in road infrastructure development and delivery via Public-Private Partnership (PPP) strategies in Nigeria. An in-depth literature review was conducted on road infrastructure project development in Nigeria in order to assess the key challenges impacting on the effectiveness and efficiency of project finance initiative in Nigeria. The findings of the study shows that the development, delivery and maintenance of road infrastructure facilities has been on joint venture arrangement between the public and the private sectors inform of Public-Private Partnerships, the findings further revealed that the key challenges affecting the effectiveness and efficiency of the Public-Private Partnerships in road infrastructure project development and delivery in Nigeria are the institutional and regulatory framework in the implementation of the procurement strategies employed. The study therefore concluded that the effectiveness and efficiency of the procurement strategies is contingent upon addressing these challenges as soon as possible in order to meet the demand for road infrastructure facility in Nigeria.

Keywords:

Effective, Efficient, Framework, Procurement, Project Finance, Public-Private Partnerships, Strategy.

1. Introduction

The development and delivery of road infrastructure in Nigeria has been through the traditional procurement strategy financed by the public sector. According to Akinyosoye (2011), the huge cost associated with the road infrastructure development and delivery under the traditional procurement strategy in the Nigeria had been overwhelming. In order to address this, a procurement strategy different from the traditional approach seems a more optimal route to go. This therefore necessitated the adoption of different procurement strategies such as joint ventures or partnering inform of Public-Private Partnerships (PPPs) for the development and delivery of road infrastructure facility in Nigeria. This procurement strategy involves public bodies (government) and private companies. The procurement strategy is aimed at accelerating the road infrastructure project development, delivery and operation by tapping the private sector's financial resources as well as its skill in designing, constructing and operating road infrastructure project effectively and efficiently on a whole life-cycle cost basis (World Economic Forum, 2013).

The adoption of this procurement strategy in Nigeria has become very popular for both new development and the management of old road infrastructural facilities. However, many road infrastructure projects that had been developed through PPPs have failed as a result of the ineffectiveness and inefficiency of the PPPs framework (Sanusi, 2012). In recognition of these challenges, the Nigerian government has made great effort by establishing mechanisms and frameworks for PPPs. These include the adoption of the Infrastructure Concession Regulatory Commission (ICRC) Act in 2005 and the subsequent creation of the ICRC office, the enactment of National Policy on PPPs in the year 2009 and the formulation of Public-Private Partnership Regulations in the year 2011. These are geared towards dealing with the current and the impending challenges facing the development and management of road infrastructure projects through PPP procurement strategies in Nigeria (Sanusi, 2012).

2. Background

Infrastructure is one of the drivers of a sustained economic growth and the development of any country; it also acts as an enabler for a country's competitiveness. However, WEF (2012) opined that infrastructure development will not drive economic growth unless it is fully aligned with the country's economic, industrial, social and environmental priority, and being delivered effectively and efficiently, hence the development of road infrastructure facilities by the public sector has often turned out to be slow and/or inefficient in many countries of the world, because the most pressing problems and challenges impacting the development and delivery of the road infrastructural facilities is the working capital and liquidity required. In view of this, Ibrahim *et al.* (2006) opined that many countries are therefore facing significant road infrastructure needs, owing to the rapid growth in population, economic growth and rapidly progressing in urbanization. According to WEF (2013), the strong demand for road infrastructure and its insufficient provision imply a global investment gap of at least US$ I.0 trillion per year. As many governments do not have the financial resources and skills to provide the required road infrastructure facilities, the governments are therefore increasingly looking at the private sector in closing the road infrastructure deficiency gap, because the global road infrastructure requirement are huge and governments' fiscal budgets are increasingly constrained. As a result of this, WEF (2013) opined that Joint Venture or Partnering inform of Project Finance Initiative (PFI) this form of procurement arrangement will accelerate road infrastructure development by tapping the private sector's financial resources and its skills in delivering road infrastructure effectively and efficiently on a whole life-cycle cost basis. Figure 1.1 shows the broad and narrow definitions of project finance for infrastructure development and delivery involving Public-Private Partnerships (PPPs).

3. Project-Finance Initiative (PFI)

Private Finance Initiative is a non-recourse type of project procurement, asset based financing of an economically separable capital investment in project, where the lender look primarily into the cash flow in the project as the source of fund to service the loans obtained for the project and provide a return on the equity being invested in the infrastructure project (Nesan, 2007).

The major reason for the adoption of Project-Finance Initiative for road infrastructure procurement according to Flybjerg *et al.* (2003) cited in WEF (2013) is that the traditional public delivery of road infrastructure projects has often proved to be disappointing in many countries of the world because many infrastructure projects procured under the traditional models regularly experience cost and time overruns, as well as disregarding the resulting life-cycle costs of the infrastructure project. Examples of such challenges of the traditional delivery model was shown in a survey of major rail and road projects in Europe and North-America in the year between 1927-1998 where an average overruns of 28% of the contract sum was experienced. The distinguishing feature of project financing from the conventional financing according to Nesan (2007) is that the lender do not have recourse to the entire portfolio of assets of the project sponsor, instead rely only upon the cash flow of the infrastructure project. As a result of this, the lender takes on the highest risk in the project financing which also incorporate the appropriate risk assessment and risk transfer associated with the project development.

Gatti (2008) listed the following five points as the distinctive features of Private Finance Initiative (PFI) to include;

i. A deal where the debtor is regarded as a project company set up on an ad hoc basis that is financially and legally independent from the sponsors;
ii. Where lenders have only limited resources;
iii. Where project risks are allocated equitably between all parties involved in the procurement transaction, with the objective of allocating risks to the contractual counterparties best able to control and manage the risks;
iv. Where cash flows generated by the Special Purpose Vehicle (SPV) must be sufficient to cover the payments for the operating costs and to as well service the debts in terms of capital repayment and interest in the procurement deal; and
v. Where collateral is given by the sponsor to the lenders as security inform of receipts and assets tied up in the development, delivery and management of the project.

Furthermore, Gatti (2008) opined that in Private Finance Initiative arrangement, a sponsor can choose to finance a project through two alternative means which include;

i. Where the new initiative is being financed on a balance sheet arrangement also referred to as Corporate Financing under this arrangement, where the project is not successful, all the remaining assets and cash flows will serve as a source of repayment for the creditors in the procurement.
ii. Where new project is incorporated into a newly created economic entity, the SPV, and financed off balance sheet also known as Project Financing. In this form of arrangement, if the project is not successful, project creditors will have no claim on the sponsoring firms' assets and the cash flows, instead, the existing shareholders will then benefit from the separate incorporation of the new project into an SPV arrangement.

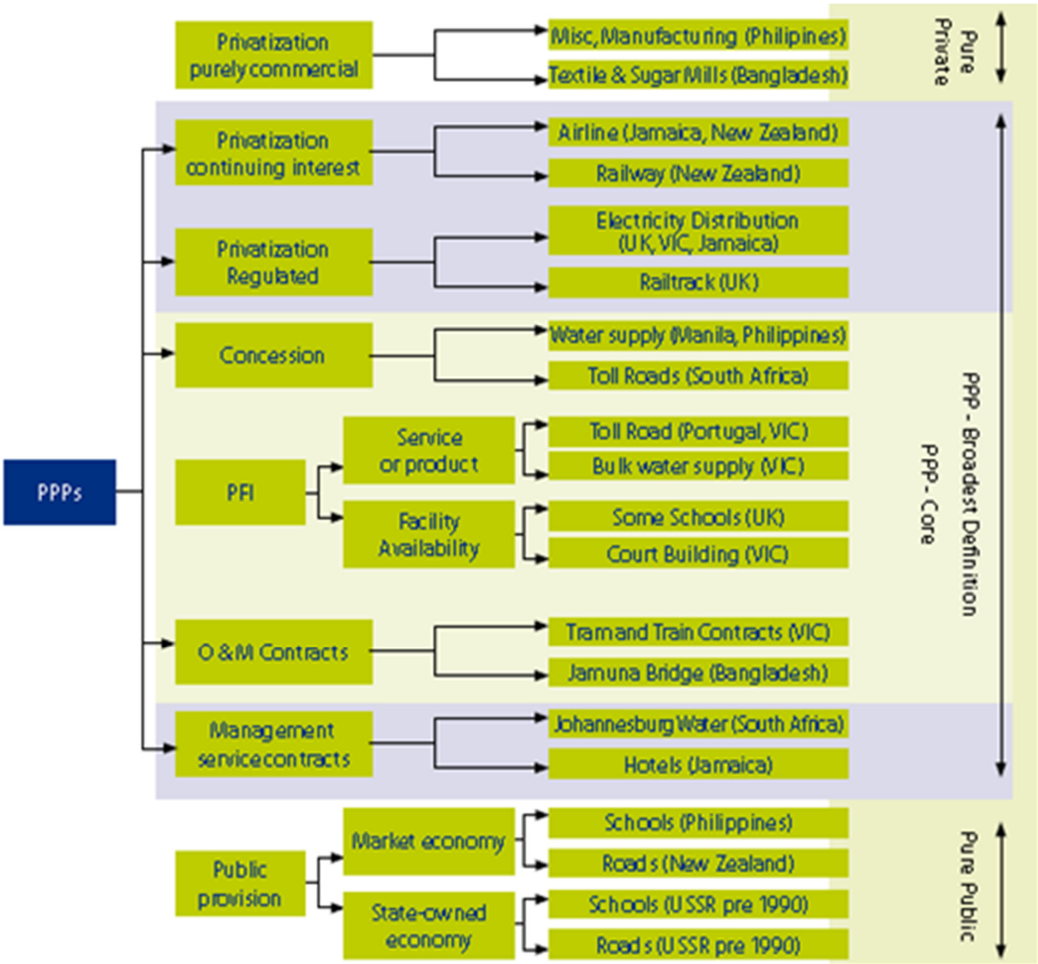

Figure 1.1: Broad and Narrow Definitions of Project Finance

4. Public-Private Partnerships in Infrastructure Development and Delivery

Globally, partnership approach to infrastructure development and delivery has continued to grow tremendously as a result of the financial constraint being experienced by the public sectors in the provision of require infrastructure (Dada & Oladokun 2012). In practice, most governments adopt PPP principles as a matter of ideological persuasion by utilizing private sector expertise to lever greater efficiency and change management by using private companies for an effective approach in enhancing project productivity, then boost economic growth, by way of transferring the greater part of the risk involve in project development to the private sector. Because according to WEF (2013), Public-Private Partnerships provides an opportunity for private sector participation in financing, designing, construction, operating and maintenance of public sector programmes and infrastructure projects. The World Bank (2012) & Dada (2013) also gave a broad definition of PPP as a procurement strategy covering management and operating contracts, lease/affermage, concessions and joint ventures as well as partial. Public-Private Partnerships for infrastructure service development and delivery has four key characteristics which includes;

i. Involvement in an efficacious sharing of risks between public and private sector;

ii. Providing public services;

iii. Offering value for money; and

iv. Long term partnership over many years.

The PPP procurement strategies involve competitive tendering and the successful bidder (or franchisee) is selected on the basis of the value for money (VfM) outcome for the government. VfM is determined using both quantitative and qualitative criteria while tenders for road infrastructure development are generally conducted on the following basis;

i. The private provision of an asset for government use on a take-or-pay basis (for example, the provision of a serviced hospital bed or a primary school building);
ii. The private delivery of services to or on behalf of government (for example, a convention centre or public transport system); and
iii. Private provision of an asset on a market-risk user-pays basis (for example, a toll road).

The payment method in PPPs according to Regan & Smith (2011), has two components: a base fee calculated by reference to quantitative service provision under the contract and an incentive fee calculated by reference to service delivery that exceeds key performance indicators, while projects in PPPs are generally bid on the basis of the fee to the government or the user-pays tariffs. However, bid criteria and nonconforming bids may also include up-front payments to the government. Service delivery failure can result in an abatement of fees or the imposition of financial penalties. At the end of the contract period as contained in the contract agreement, the asset reverts to the government.

Okeke (2010) listed the goals of Public-Private Partnership to include; (i) obtaining more value for money; (ii) better risk allocation; (iii) faster implementation; (iv) improve service quality; (v) achieving additional revenue streams; (vi) reducing life-cycle costs; and (vii) reducing waste and blocking avenue for corruption. However in Nigeria, the ambition of the public sector in the provision of road infrastructure through PPPs was impacted by many challenges such as (i) problem of transparency in the selection of concessionaire, (ii) poor project preparation and lack of bankable studies, financial models and business plans, (iii) lack of knowledge of PPP legislation, (iv) ill experienced PPP institutions at Federal level in ensuring quality, and (v) lack of experience in concession agreement (African Development Bank, 2010).

The choice of PPP procurement strategy for road infrastructure projects according to ICRC (2012) depends on the objectives of the stakeholders involved and allocations of risks between the private and public partners in improving service efficiency, transferring investment risks and maintaining service control. In order to exploit the benefits of PPPs according to WEF (2013), the planners and the stakeholders need to choose an appropriate procurement strategy; the choice may differ from project to project. In making the choice and customizing the procurement strategy, the stakeholders will have to strike a balance between two considerations: ensuring attractiveness of the project for the private sector; and safeguarding public interests and keeping the overall infrastructure project economic costs down.

Table 1.1 shows the major project finance strategies for infrastructure project development and delivery in Nigeria.

Table 1.1: Typical Project Finance Strategies for Infrastructure Development.

S/N	Project Finance Model	Description
1	**Design-Build (DB) or Turnkey Contract**	The private sector designs and builds infrastructure to meet public sector performance specifications, often for a Fixed price. The cost of overruns is transferred to the private sector.
2	**Service Provision Contract**	A private operator, under contract, operates a publicly owned asset for a specified period. Ownership of the asset remains with the public entity.
3	**Management Contract:**	A private entity contracts to manage a Government owned entity and manages the marketing and provision of a service.
4	**Lease and Operate Contract:**	A private operator contracts to lease and assume all management and operation of Government owned facility and associated services, and may invest further in developing the service and provide the service for a fixed term.
5	**Design-Build-Operate-**	The private sector designs finance and constructs a new facility under a long term lease and operates the facility during the term of the lease. The private partner transfers the new facility to the public sector at the end of the lease term.
6	**Design-Build-Operate-Finance (DBFO):**	A private entity receives a franchise to finance, design, build and operate a facility (and to charge user fees) for a specified period, after which ownership is transferred back to the public sector.
7	**Buy-Build-Operate (BBO):**	The transfer of a public asset to private or quasi-public entity usually under contract that the assets are to be upgraded and operated for a specified period of time. Public control is exercised through the contract at the time of transfer.
8	**Build-Own-Operate (BOO):**	The private sector finances, builds, owns and operates a facility or service in perpetuity. The public constraints are stated in the original agreement and through on-going regulatory obligations.
9	**Build-Own-Operate-Transfer (BOOT)**	This is an extended version of the BOT model where the private sector builds, owns and operates a facility for a specified period as agreed in the contract and then transfers to the public.
10	**Operating License**	A private sector receives a license or rights to build and operate a public service, usually for a specified period. Similar to BBO arrangement.
11	**Finance Only**	A private entity, usually a financial services company, funds a project directly or uses a mechanism such as long term lease or bond issue.

5. PPP Road Infrastructure Project Life-Cycle in Nigeria

Successful PPP procurement strategies depend on the quality of information served at the project preparation stage which will determine the success of the project life-cycle. But ICRC (2012) opined that the success or failure of PPPs in road project development and delivery can often be traced back to the initial design of the PPP policies, legislation, and guidance in the conception and development of the road infrastructure project. Figure 1.2 shows the PPP road infrastructure project development tasks in Nigeria.

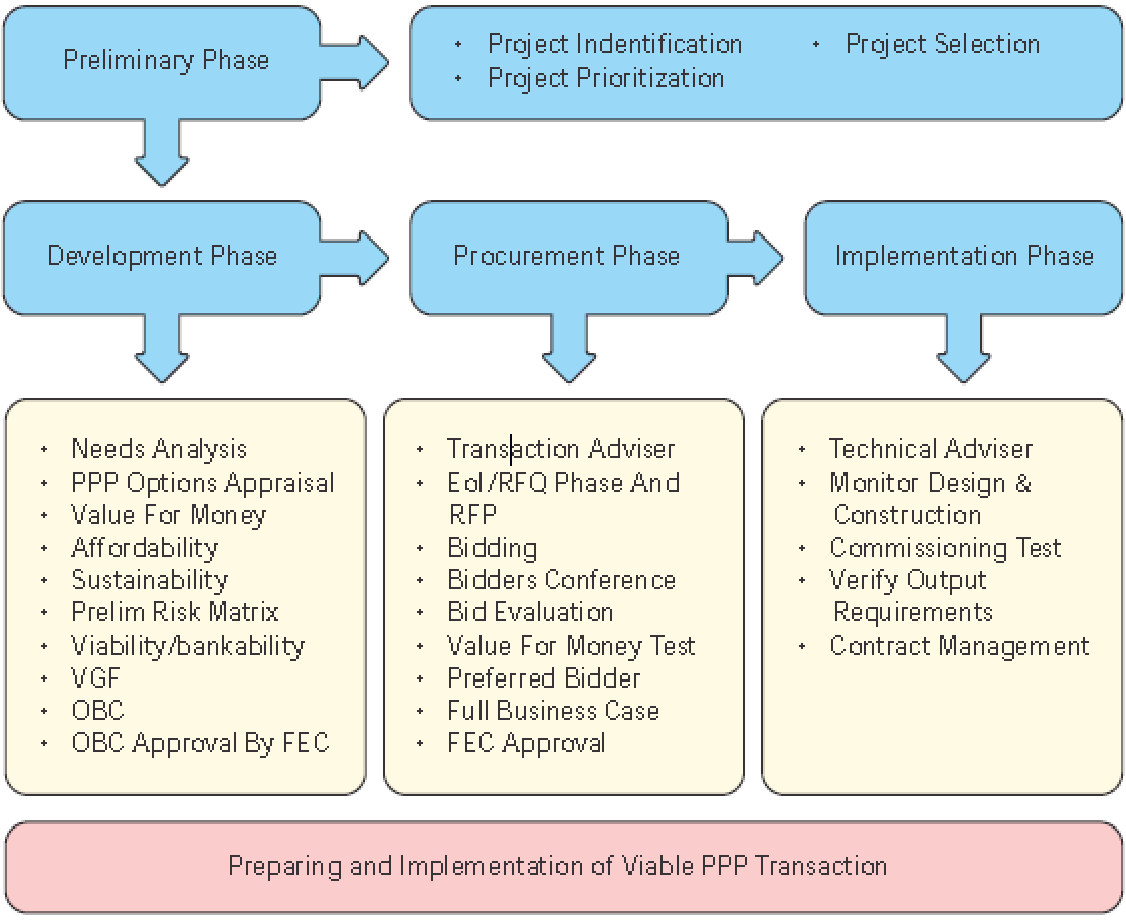

Figure 1.2: PPP Road Project Development Tasks in Nigeria

(Key Definitions: VGF- Viability Gap Funding; EoI- Expression of Interest; RFP- Request for Proposal; OBC- Outline Business Case; FEC- Federal Executive Council)

According to FMW (2013), at the project development stage, the infrastructure projects are initiated by various Ministry, Department, and Agencies (MDAs) of the public sector. ICRC (2012) and FMW (2013) further stated that the road infrastructure projects could also be initiated by the private partners in the procurement strategy as an Unsolicited Proposal (UP) under a transparent, competitive process which will also be managed by the MDAs. This stage will involve, project planning, preparation and approval of outline business case for the proposed road infrastructure project development.

At the project procurement stage, ICRC (2012) observed that the road infrastructure projects will be advertised in the press and through other media inviting potential bidders to submit their Expressions of Interest (EOI). The project procurement stage involves the following processes;

preparation of bid documents, selection of preferred bidder and negotiations, preparation of full business case and contract award. At the implementation stage, the oversight of the road infrastructure projects will shift from the project team to the MDA's project board and/or the management board linked at this stage for the road infrastructure project. ICRC (2012) stated that the commencement of the road infrastructure projects begins at this stage while the MDA appoints the independent engineers jointly with the developers in reviewing and auditing the construction activities for the road infrastructure projects. At this same stage, after the completion of the construction work on the road infrastructure facilities, and begins operations, the MDA, in conjunction with the Contract Monitoring Unit (CMU) within the Infrastructure Concession Regulatory Commission (ICRC) for the public partners monitors the performance of the PPP companies throughout the concession period in ensuring the performance evaluation of the road infrastructure facilities. At the project maturity stage, ICRC (2012) and FMW (2013) observed that this phase marks the completion of the road contract period and leads to the natural termination of the procurement agreement. This also involves the exit from the road infrastructure facility by the PPP companies. Figure 1.3 shows the PPP road infrastructure project life-cycle in line with the National Policy on Public-Private Partnership Ventures.

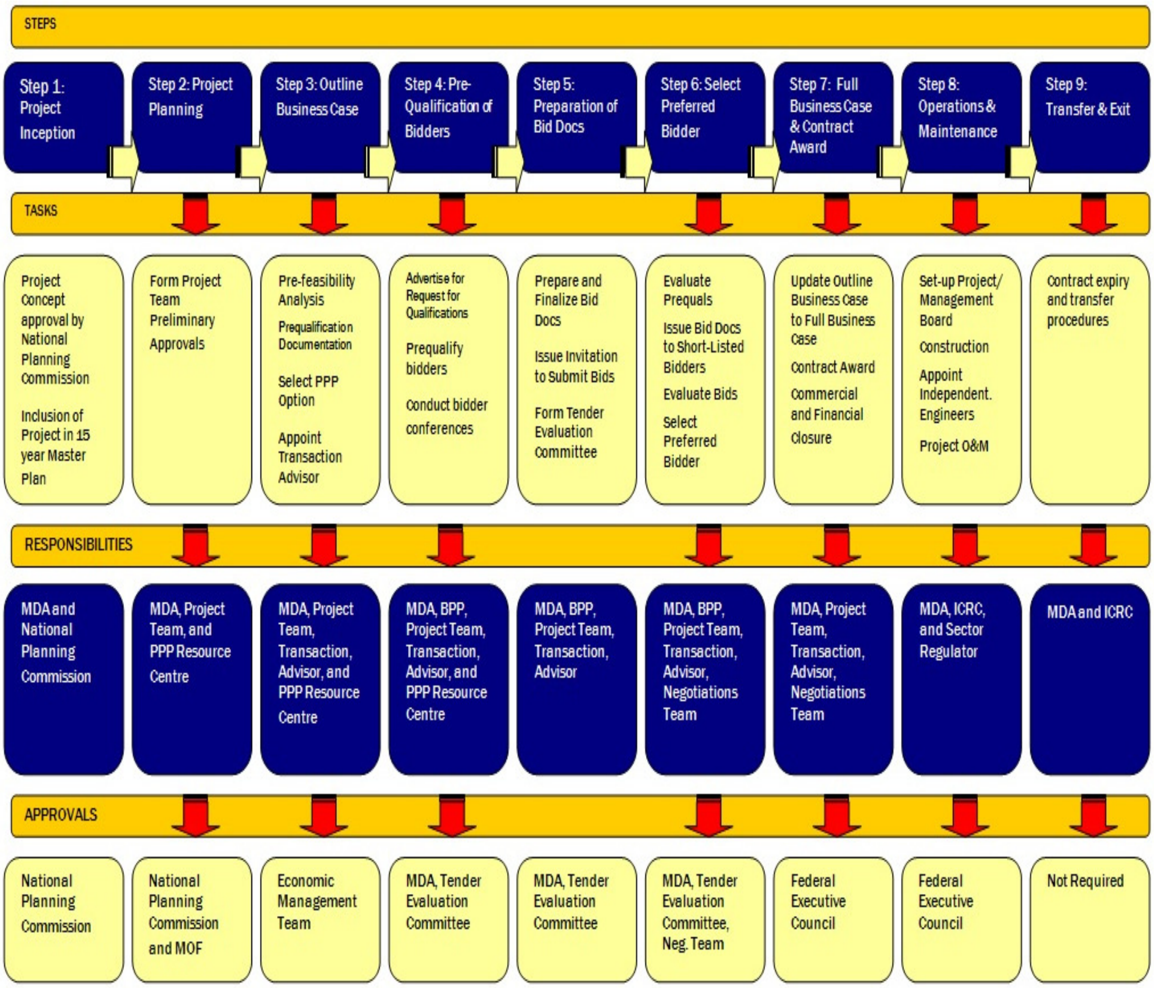

Figure 1.3 PPP Road Infrastructure Project Life-cycle

However according to FMW (2013), the impact of PPPs procurement strategies in road infrastructure development in Nigeria has been somewhat limited as the capacity and political will to enforce the existing governance framework for PPPs procurement strategy for the road infrastructure development and delivery is missing in the procurement arrangement.

6. Major Challenges of PPP Road Infrastructure Project Development in Nigeria

The challenges impacting on the effectiveness and efficiency of PPP road infrastructure project development in Nigeria according to Ameh *et al*., (2010), Sampath (2013) and WEF (2013) have been attributed to the institutional and regulatory framework of the Public-Private Partnership procurement strategies employed in the road infrastructure development. These challenges include:

i. procurement procedures and processes, in securing competitive bids, negotiation and award,
ii. allocation of risks,
iii. management of the inherent risks and the inhibiting risk factors, associated with road infrastructure projects,
iv. Preparing an enabling PPP environment,
v. Internalising PPP process within the public sector,
vi. Project identification and project development,
vii. Preparing the business case, and
viii. Supporting implementation and operations.

In the same vein, Okonjo-Iweala (2014) opined that with the current PPP framework in Nigeria, there is a tendency to make legal requirements too complicated whereby pushing every risk on the public sector to the benefit of the private investors who will invariably walk away with rewards at virtually no risk because the rate of return expected by the private investor from the road infrastructure is so high, while Omisore (2014) noted that insufficient private development funding, limited number of bankable deals and poor project planning and management are the major challenges of the current PPP framework for road project development and delivery in Nigeria.

Omisore (2014) in a study on bankable PPP infrastructure projects further enumerated some of the major factors affecting the bankability of road infrastructure projects in Nigeria to include; (i) legal framework; (ii) political risk; (iii) macro-economic factors; (iv) tariff sustainability; (v) size and location of the road projects; and (vi) fiscal space, see figure 1.4.

Ndubisi (2012) reviewed some of the road infrastructure facilities procured under PPPs and identified the issues and challenges of the PPP procurement strategy in the road infrastructure project development, delivery and performance to include;

i. lack of national infrastructure blueprint,
ii. unclear political direction and support,
iii. weak regulatory and enforcement powers of ICRC,
iv. inadequate financial modelling to enable proper affordability and value for money assessments,
v. technical capacity gaps,
vi. lack of institutional framework for PPP project preparation,
vii. inconsistency in the PPP project pipelines, and
viii. Lack of standardisation, hindering replication, etc.

In a related development, ICRC (2013) also reported that the early PPP experiences in road infrastructure project development and delivery in Nigeria have been both promising and sobering where some of the road infrastructure projects have proven to be financially viable with social and economic benefits, while other road infrastructure projects have been plagued by delays, cost overruns or renegotiations.

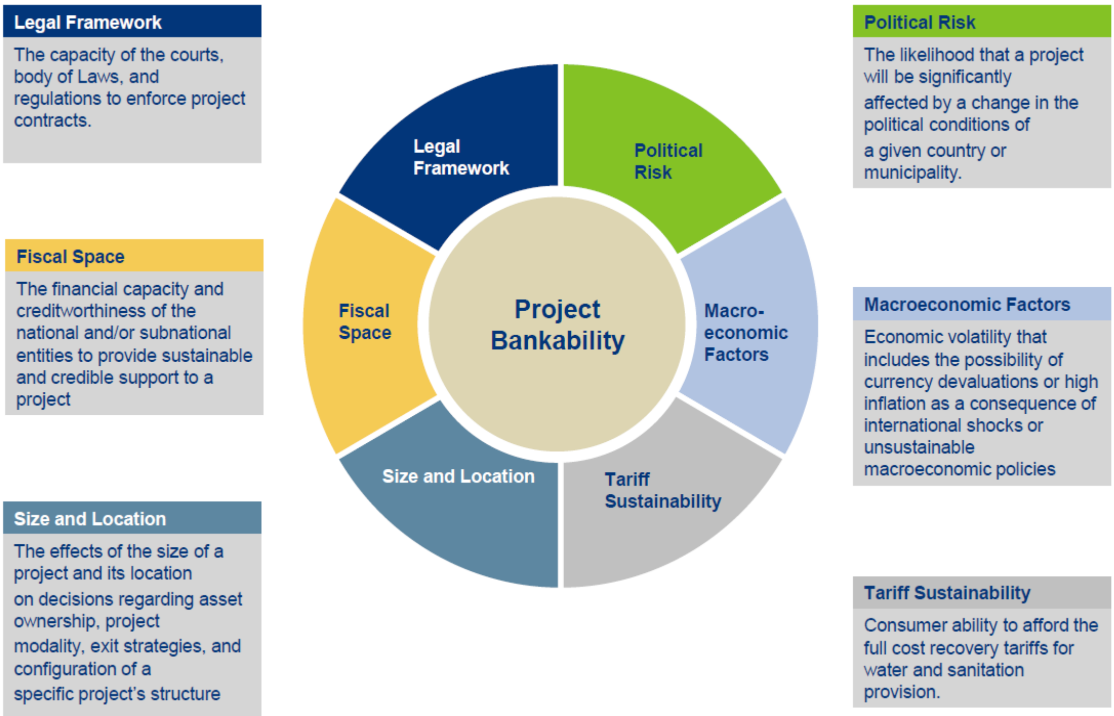

Figure 1.4: Factors Affecting Bankability of PPP Projects in Nigeria

Similarly, Amobi (2013) also reiterated that the most pressing development and delivery challenges of road infrastructure project procured under PPP procurement strategy in Nigeria was the lack of effective PPP project preparation and acceleration towards bankability. Because according to Amobi (2013), the institutional investors held substantial assets under their management, for which they are seeking attractive long-term infrastructure investment opportunities. As a result of this attitude on the part of the institutional investors, many road infrastructure projects became stalled in the pipeline and have failed to get off the ground the reasons according to Federal Ministry of Works (2013) was the road infrastructure project preparation gap which include;

i. the shortage of well-prepared bankable PPP road projects where investors are sufficiently reassured by the commercial and technical feasibility,
ii. the inadequate risk allocation,
iii. the public sector's contractual commitment and capacity, and
iv. poor demand forecasts

According to WEF (2013) and Omisore (2014), the foremost reason for most of these challenges impacting on the effectiveness and efficiency of PPPs institutional and regulatory framework for road infrastructure development and delivery in Nigeria is inadequate project preparation and management process in terms of poor demand forecasts, delayed land acquisition and approvals, inadequate or balanced risks allocation, and regulatory framework although this may varies as the projects themselves, the environment and the stakeholders.

7. Conclusion

This paper examined the concept of Project Financing through Public-Private Partnership for road infrastructure development and delivery in Nigeria in response to the increase demand for more road infrastructure facilities which have been hampered by the ineffectiveness and inefficiency of the existing PPPs institutional and regulatory framework.

Although the adoption of PPPs procurement strategy has been instrumental to reducing the financial burden on the public sector in the provision of road infrastructural facilities, by allowing the public sector to be the facilitator and framework regulator. The private sector are involved in the funding, construction and management of the road infrastructural facilities which have been affected by the inefficient and ineffective PPPs institutional and regulatory framework in the development and delivery of road infrastructure facilities in Nigeria. This paper examined the concept of project finance in road infrastructure development and delivery via Public-Private Partnership (PPP) strategies in Nigeria. This study also examined the general principles and characteristics of road infrastructure project development through PPPs in Nigeria in order to identify the key challenges impacting on the effectiveness and efficiency of the institutional and regulatory framework of the procurement arrangement employed. The findings of the study shows that the development, delivery and maintenance of road infrastructure facilities has been on joint venture arrangement between the public and the private sectors inform of Public-Private Partnerships, the findings further revealed that the key challenges affecting the effectiveness and efficiency of the Public-Private Partnerships in road infrastructure project development and delivery in Nigeria are the institutional and regulatory framework in the areas of ; (i) project preparation management process, (ii) project bankable feasibility study, (iii) balance risk allocation and regulation, and (iv) enabling project environment.

The study further revealed that the efficiency and effectiveness of PPP procurement strategy will depend upon the ability of the public sector in addressing the key challenges of the institutional and regulatory framework. The study therefore concluded that the current PPP framework for road infrastructure project development in Nigeria needs to be reviewed so as to enhance the effectiveness and efficiency of the framework in the development, delivery and performance of road infrastructure facility in Nigeria.

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Potentials for Added Value in Highway Investments Predicated on Ground Condition in the Niger Delta

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Abstract

The Niger Delta is a typical tropical delta crisscrossed by a myriad of streams, rivers and inland water channels. It is a heterogeneous terrain associated with varying geological formations with a significant proportion having difficult expansive clayey sub-soils. This implies that any form of construction work in the region will come with its technical and financial implications, clearly underscoring the need to manage and analyze uncertainties associated with the difficult terrain. The high element of financial risk associated with construction work in the region has been noted and emphasized by a wide range of scholars in related studies on Niger delta soils.

The problem of ineffective investments on road construction in the Niger Delta has become a subject of grave concern to government. Delays and abandonment of projects are endemic in the region despite the present budgetary allocation for road infrastructure in the region, which ranges between 60 - 70% of annual capital expenditure. Extensive areas of the Niger delta basin are not traversed by roads due to construction difficulties and the costs associated with road construction in the region. Recurring themes in the present scenario of road project planning, design and estimation, to which this has been attributed, are that of poor value management and risk perceptions in relation to ground conditions.

Against this backdrop, the study seeks to identify various potential value adding/cost saving avenues revolving around ground conditions, for investment in road development in the Niger Delta. A survey of technical literature on the financial implications of ground risks and what it portends for investment in highway development in the Niger Delta is carried out. The literature reveals that increased value for money expended on road projects can be achieved at the Feasibility, Planning, Design and Contractual phases of highway development based on an adequate understanding of the terrain. However, there are evident gaps in the literature that critically addresses the potential for added value for investments, predicated on improving the accuracy of conceptual and tender estimates for highway projects. The development of a costing prototype using engineering geological mapping, and guidelines relevant for improving the accuracy of estimates predicated on ground conditions is thus proposed. This will in effect serve as a risk minimization /value adding measure for investment in highway development in the region.

Keywords:

Ground Conditions, Highway Investment, Niger Delta, Risk, Value.

1. Introduction

The nature of construction works involves a high level of uncertainty and a wide range of risk factors have been established as fundamentally affecting time and cost (Creedy, 2006; Smith *et* *al.*, 2006). Risk in projects can lead to financial/economic loss as a result of uncertainty thus curtailing the realization of project cost objective (Young, 1996; Chapman and Ward, 1997). Equally poor risk management in projects have often led to lengthy delays which in extreme cases have led to project abandonment (Ihuah and Benebo, 2014).

A typical limiting risk factor is ground conditions, which in the context of the Niger delta region has been shown in the literature to have a tremendous impact on development (Oguara, 2002; Teme, 2002; Youdoewei, 2013, David-West, 2014). This has consequently affected the ability of past governments to develop an adequate road network necessary to satisfy the needs of rapid economic development in the region (Oguara, 2002). The central problem that has been identified as contributing to this problem has been related to the problematic terrain as shown in figure 1 (Emujakporue, 2012; Ngerebara, 2013*)*.

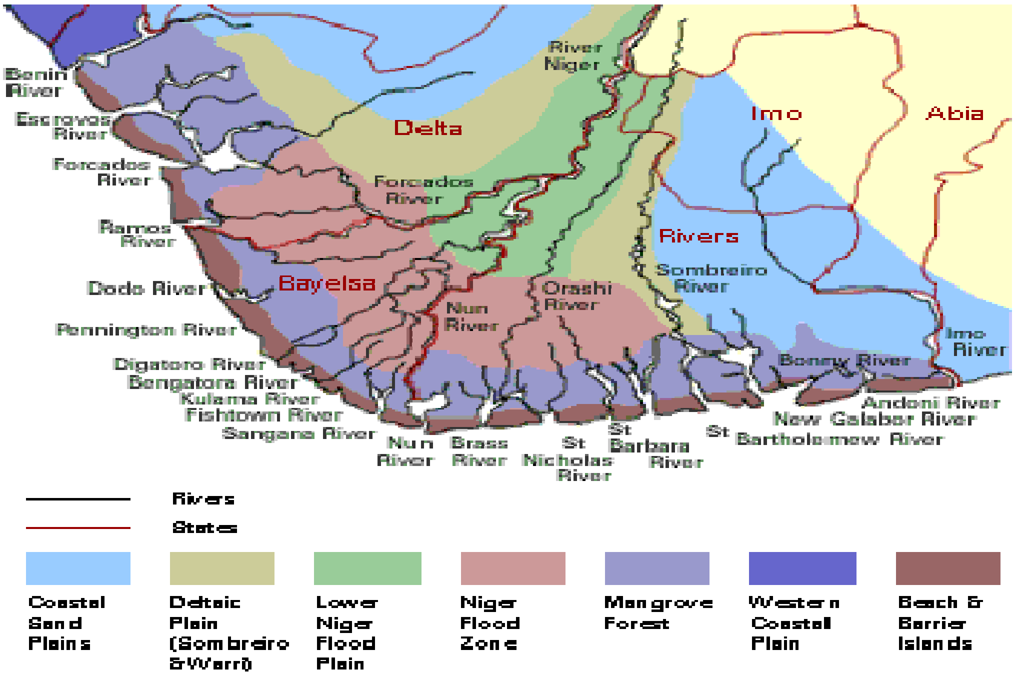

Figure 1: Map of Niger Delta showing varying geologic zones Source: http://www.**waado.org**

The mode of transportation in communities situated in the most remote riverine sections of the region, often crisscrossed by a myriad of waterways, is predominantly by canoes as depicted in figure 2.

Figure 2: Typical transportation mode in the meander belts of the Niger Delta (Source: http://www.dailymail.co.uk, 2014)

However, despite the environmental handicap of the region, in recent times there has being a renewed drive to open up the region by linking these areas of the region by roads. Oguara, (2002) stressed that road development in these areas in the region would require: expensive specification; designs; and specialized construction methods; to account for this environmental handicap. Considering the enormous impact that the terrain has on construction, in terms of the escalated associated costs, Ngerebara *et al.*, (2014) stressed that emphasis should be placed on ground conditions.

2. Literature Review

2.1. Value for Money and Risk in Construction

Value for Money in general economic parlance has been defined by the Business dictionary as:

> *"A utility derived from every purchase or every sum of money spent. Value for money is based not only on the minimum purchase price (economy) but also on the maximum efficiency and effectiveness of the purchase.*

Key themes in this definition can be extracted as being:

- Utility
- Economy
- Efficiency
- Effectiveness

A definition of the concept of 'Value for Money' in the context of construction by the National Audit Office (NAO, 2004) is equally applied to these themes:

> *"Value for Money in construction involves completing a project to **time, cost and a level of quality** that meet **user needs** throughout its lifetime, and contribute to the environment in which it is located with a wide range of social and economic benefits"(p. 4).*

An early investment and appropriate level of human and capital investment in construction projects was advocated as necessary to achieve these benefits. Michael, (2006) emphasized that projects are not all about construction but about the effective achievement of the long term goals of clients who expect tangible benefits delivered in the most economic mode.

Risk and Uncertainty have been widely noted as underlying variables with the propensity for eroding the potential for achieving value in construction, if not adequately managed. Michael, (2006) thus added, that if value for funds expended on projects is to be achieved, an effective risk management system must therefore be in place, so that avoidable risks and uncertainties do not erode the potential for maximizing value in investment. Smith *et al.*, (2006) asserted that in construction works, the output performance indices of time, cost and quality are subject to risk and uncertainty.

Highway projects are by their very nature, subject to high levels of risk and uncertainty (ICE, 1999). The U.S Department of Transport,(USDOT, 2006) in one of its technical notes used the maxim '*All transportation projects are carried out on earth, in the earth or under the earth*' to describe the level of ground related risk associated with road projects. This coupled with the highly variable and predominantly difficult soft soils of the Niger Delta terrain as shown in figure 1, underscores the high element of financial risk associated with construction work in the region. Venmans, (2006) explored the concept of road building with due cognizance of subsurface conditions for optimizing constructions to profit from subsurface conditions. Thus he illustrated the concept of value engineering using construction on soft soil to demonstrate that the variability in the construction cost of road ranges between ±10% and ±30%, depending on the geotechnical parameters of the subgrades soils as indices of subsoil uncertainty.

This has been emphasized in earlier works (Arumala and Akpokodje, 1987; Oguara, 2002) and in other more recent related studies on Niger Delta soils such as Agbola and Olurin, (2003); Unoanwanaile, (2009); Youdoewei, (2013) and Ngerebara *et al.*, (2014). The implications of this for road development by highway agencies in the region would mean a corresponding reflection of this ground factors in routing, pavement designs and cost estimates (TRRL, 1978**;** ICE, 1999; Youdoewei, 2013; David-West, (2014). The predominantly adverse nature of ground conditions in the region, therefore dictates the need for exploiting every avenue to maximize value for money invested in road construction.

2.2. **Potential value adding and risk minimization measures in the Niger Delta**

From the literature, various potential value adding/cost saving practices revolving around ground conditions, for investment on road development in the Niger delta, can be logically identified. Numerous publications on the potentials for increased value for money expended on road projects achievable at the planning and design phases of highway development based on an adequate understanding of the terrain are evident. These studies (technical and scholarly articles) in local and international literature, have repeatedly emphasized the need for ground investigation at the planning phase (in terms of route selection) and at the design stage (in terms of appropriateness of designs). These studies which convergently advocate for proper ground investigations for highway projects, commencing from desk studies to detailed site specific investigations, have often emphasized the technical and financial of consequences inadequate ground investigations.

However, there are very limited number of studies that have logically identified the potential for added value in highway investments that can be achieved via the increased accuracy of estimates predicated on adequate geotechnical input at the:

- At the preliminary estimating/budgetary phase (more accurate conceptual estimates leading to less cost overruns and delays);

- At the tendering and contracting phase/procurement (in terms of better risk containment which leads to lower bid values and less claims).

Most of these related studies still tend to dwell more on the technical implications, and do not adequately and systematically analyze the cost implications of varying geotechnical inputs in estimates. However, Romero and Stolz (2009), in a technical article pegged most conceptual estimates for transportation projects, in which the nature of ground conditions have a dominant influence on cost, "*No more than a Guestimate*". He noted the huge difference in cost between initial budgetary estimates and final costs for most projects, arising from the very high level of uncertainty from ground conditions. He thus advocated more a detailed deterministic approach to generating conceptual estimates.

2.2.1. Budgeting

Inaccurate conceptual estimates have being established in the literature to be a major source of cost overruns for highway projects which can lead to delays and even total project abandonment (Duverlie and Castelain, 1999; Asmar *et al.*, 2011; Halwatura and Ranasinghe, 2013). These authors convergently stated that developing reliable and accurate total project estimates at the budgetary phase of project development is a major challenge for most highway agencies. This collective assertion by these authors had in an earlier research by Flyvbjerg et al (2002), being empirically established to be a global phenomenon. Emphasising this phenomenon and the need for improved estimating accuracy at the conceptual phase, Duverlie and Castelain, (1999) stated thus:

> *"Although only 5–10% of the total project cost is spent early on, 70–80% of the cost is committed during the initiation phase when design drawings and specifications are not readily available and existing information could possibly lead to project cost underestimation"(p. 7).*

Consequently, Chou (2009) expressed the opinion that slow and grossly inaccurate cost estimates resulting from un-updated project information has become a problem. Winters *et al* (1998) rightly emphasized that successful projects are often those which have been able to accurately forecast the final cost of a construction contract. Therefore generating cost projections at the conceptual phase of highway development should logically reflect subsoil conditions. Geotechnical variations in subsoil profile along routes need to be adequately accounted for in conceptual estimating and in the mechanism of risk containment in contract award. The ICE, (1999) in their technical reports advocated that an ability to quantify the financial impact of unforeseen ground would act as a catalyst to clients and their professional advisers in making better informed decisions based on more realistic estimates.

Similarly, Flyvbjerg *et al.,* (2002) in a study of estimation practices on a global basis equally stated that:

> *"ignoring or underplaying geological risk may be helpful in getting projects approved, but no other risk factor is more likely to boomerang back and haunt projects during construction" (p. 281).*

Therefore in estimating the potential funds to be allocated for an outlined scheme, the need for representative estimates that closely reflect the likely costs of construction cannot be overemphasized (Asmar *et al.*, 2011; Halwatura and Ranasinghe, 2013). This is because if differing ground conditions are encountered along any chosen route, the corresponding profiling of standard civil engineering designs would vary accordingly. It would thus be unrealistic to estimate cost uniformly throughout the proposed length of the road way. Most roads projects traverse various soil types and this would ideally mean that the basis for cost estimation of any route cannot be uniform throughout its length due to variations in the ground conditions. An understanding of subsoil condition and their engineering implication in estimating via was advocated as requisite to generating conceptual estimates that can closely approximate final costs (ICE, 1999).

However, at the planning phase of road works, literature shows that highway agencies typically use average cost per kilometer of the road length as a basis for generating initial estimates which are used as a basis for planning budgetary estimates (Chou, 2005). This has meant that the variations in soil types along routes and consequently the changes in pavement specification and design that ought to be reflected in these initial estimates are not. There is an evidenced need to reflect subsoil variations in conceptual estimates to generate early stage estimates that can better approximate final costs.

In the context of the Niger Delta, such practices lead to a huge disparity between initial budgeted cost and final cost due to the typically heterogeneous and highly variable soil profile inherent in the region. Figure 1 shows 7 distinct geological zones evident in the Niger Delta region. As such these varied geological formations as depicted would imply a corresponding differentiated costing profile for segments of road length whose subgrades fall within their spatial limit.

2.2.2. Procurement

Whether ground investigations are carried out as a basis for designs before contract award and commencement of road works in the Niger delta remains in doubt. This is logically linked to the robust body of literature centered on investigating the high incidence of premature road failures in the region (Abam, 2005; Aigbedion, 2007; Emujakporue, 2012). These studies often point to inadequate designs with respect to the existing subgrade soils as being one major factor compromising road quality in the region.

The Transportation and Road Research Laboratory (TRRL, 1993) Road Overseas Road Note 31, is the stipulated highway standard recommended by the Federal Government for the construction of highways in Nigeria. This standard sets out a catalogue of design configurations suitable for the various subgrade soils inherent in the tropical setting of Nigeria. However the level of adherence to this design standard by the state highway agencies in the Niger Delta Region is not known.

Sunjka and Jacob, (2013) in investigating the causes of project delays in the Niger delta, revealed that changes in specifications and designs which were not considered originally, have impeded the time effective delivery of highway contracts in the region. It was stated thus

> *"Improper design stalls project execution because of the time it takes for such design to be reviewed, amended and accepted for construction works" (Sunjka and Jacob, 2013, p. 641).*

Consequently, claims, variations, delays and project abandonment for road works have been mostly linked to ground conditions, which has retarded the economic development of the local communities to be serviced by such roads (Dlakwa and Culpin, 1990; Sunjka and Jacob, 2013; Ossai, 2012).

Isaksson, (2002) opined that from the contractors' perspective, an inadequate awareness of the cost implications of the terrain and associated technicalities of design would lead to poor tender estimating. Within the context of the Niger Delta this may lead to not adequately capturing the financial implications of requisite road designs. Inconsistencies in the estimating context on the part of the client and the contractor would therefore occur in this scenario, if ground conditions are not being investigated and duly accounted for in contracts as a mechanism of risk containment (Ashton, and Gidado, 2002).

Manfield *et al.*, (1994) revealed in an empirical study that unclear definitions of contract terms by the client is one of the factors causing significant cost overruns in the Nigerian construction sector for highway projects and specifically noted insufficient geotechnical information details in contracts awarded. The high level of financial risk exposure to the clients (highway agencies) in contracts awarded on this rather arbitrary basis is thus evident. Consequently the basis of contract award by highway agencies in the Niger Delta has being criticized by Sunjka and Jacob, (2013) as being poorly packaged with contractors standing to benefit from this shortcoming.

The mechanism for managing ground related risk in contracts would therefore constitute as a value adding measure. As such, on this basis, it was stated that both parties to a contract (the highway agencies and road contractors) would have an informed basis of contracting, reducing the propensity for costly delays and claims. (Odeck, 2004; Kaliba, *et al*, 2008). Romero and Stolz, (2009) thus opined that clients for construction projects ought to recognize the need for appropriate risk allocation to the contractual party best suited to manage that risk.

The literature reveals that for transportation projects different formalised measures have been deployed for this purpose (O'Toole, 2006*).* Risk allocation measures such as Inclusion of Geotechnical Investigation Reports in contract documentation, and the use of 'Differing Site Conditions' clauses are often used. The contractual setting in relation to whether ground investigation report was included by the client as part of the contract documentation is the key feature of contracts around which hinges the magnitude of the risks borne by both parties to a contract. O'Toole (2006) identified two common arguments often raised by contractors when faced with the unforeseen ground conditions during the progress of works as:

- Whether a ground investigation report was included as part of the contract documentation
- Whether the report is representative of the site conditions, where reports are provided.

In the event where a ground investigation report is not included as part of the contract or where reports are not representative of the ground conditions is a sufficient basis for claims and variations to arise in a contract. The literature equally established that the inclusion of adequate and representative geotechnical investigation reports elicits lower bids values which are tendered on the platform of adequate information, with less room for costly variations leading to better financial performance of contracts (O'Toole, 2006; Romero and Stolz, 2009). As such the inclusion or exclusion of ground investigation reports, will largely determine the level of contingency included in bids and the basis of variations and dispute containment.

3. Findings of the Study

Against the preceding backdrop of the issues presupposed as being basic underlying factors in the current state of highway project delivery in the Niger delta, the researcher has identified the following gaps in knowledge, suspected as existing, in the practice of highway agencies that need to be addressed.

Table 1: Identified Potentials for Added Value in Highway Investment

Project Phase	Suspected Gaps in Knowledge	Potential for Added Value
Preliminary Budgetary Estimating Phase	Use of uniform average cost per kilometre of road length that is not reflective of the typically heterogeneous ground profile	Improved Accuracy of Conceptual Estimates
Design Phase	Non-Adherence of pavement designs to the adopted National Highway Standard (TRRL, 1993) in relation to sub-soils	Appropriate Designs
Tendering and Contracting Phase	Adequacy of Ground Investigations and non-inclusion of reports in contract documentation	Risk Containment in Tender Estimates

These gaps in the knowledge principally revolving around the terrain and subsoil conditions of the Niger Delta region, have given impetus to the study. Based on the perceived theoretical and practical discrepancies in the approach to estimating and containment of associated ground related risks in contracts, the potential for significant savings and added value in highway investments has been identified, and thus constitutes the rationale of the study which is carried out as part of a PhD research.

4. Conclusion

The study has highlighted various avenues of increased levels of geotechnical input in highway projects in the Niger Delta, as avenues for added value in investment estimates and designs. The need for increasing levels of geotechnical input as projects progress through feasibility to procurement will thus warrant reduced levels of ground related financial risks, based on higher levels of certainty in project and contract definition. Summatively figure 3 diagrammatically captures the major thrusts of the study, in advocating for investment in highway development in the Niger delta, to be predicated on ground conditions via geotechnical input. This conceptual background sets the structure of the study.

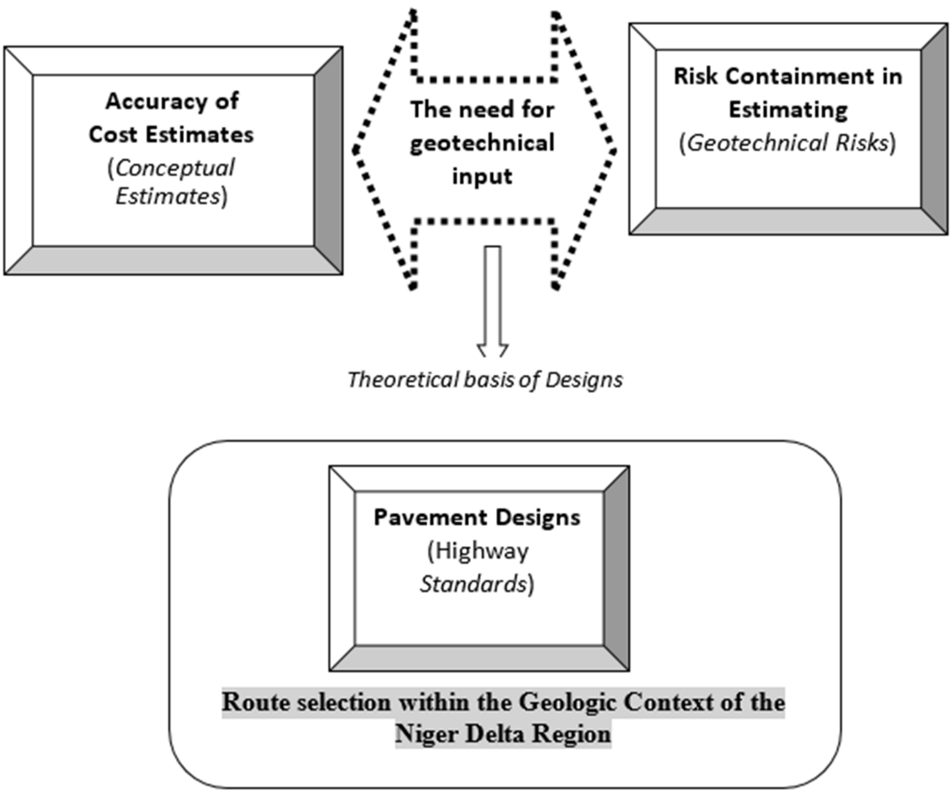

Figure 3: Conceptual Approach of the Study

It is thus obvious that the Niger Delta region of Nigeria by virtue of its terrain is an embodiment of a geologic setting which stands to benefit from the a thorough understanding of the intricacies of subsoil conditions and what it portends for the financial management of highway projects. The ultimate cost efficiency of highway project delivery in this region can thus be said to be highly predicated on the approach adapted to managing the financial undertone of the inherent deltaic ground conditions.

On the basis of findings from this phase of the study, the study advocates for a more detailed approach to producing estimates for highway development in the Niger delta, based on an understanding of the geotechnical requirements. using a methodology which lies between the borderline of several fields of knowledge. This is as opposed to conceptual estimating methodologies evident in the literatures which generate cost estimates on a uniform cost per kilometer basis or rely on subjective judgment to extrapolate cost. the researcher proposes the following as a follow-up to the study which will be addressed in the subsequent phase of the study:

- To identify the appropriate pavement structural design sections corresponding to various soil types evident in the Niger Delta as reflected in the Nigerian highway specification and design standards, as compared to the design/cost estimation practice of highway agencies in the Niger Delta;
- To develop a costing prototype and guidelines reflective of the heterogeneous ground conditions inherent in the Niger delta, which can be deployed as a value adding measure in the pre-tender cost estimation of road projects.

The proposed costing prototype to be developed via the deployment of engineering geological mapping relevant to the Niger delta region, can serve as a useful input in more elaborate conceptual estimating methodologies as a 'Cost Estimating Relationship' (CER) which can be used to create differentiated costing profile along heterogeneous highway routes in the region. The proposed methodology can equally be applicable to other geographic areas with similar highly variable terrain in the dual capacity of both a risk management tool and as a predictive basis for cost estimation.

This research work will thus create an awareness of the need for the establishment of differentiated costing platforms at the preliminary phase of highway development for addressing and accounting for the vagaries of varying subsoil profiles along route ways in deltaic environments. High way agencies can thus base their initial estimates and investment decisions on a more sound and scientific basis than those based on subjective assessment. This would thus inform policy measures in the management of road infrastructure investment budget.

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Managing innovation projects: Conceptual framework and two case studies from Dubai Police

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Abstract

Innovation has becoming the life style of this generation. Innovation and technological advancement had significantly revolutionized our society, while non-stop reforms on innovation endlessly influencing most of our daily life. Companies are under a huge pressure and each one is competing toward delivering innovative and faster ideas than others to capture the customer's attention. In this context innovation is about the process of translating an idea into a good or service with the intention to create value focusing on customers. Sustaining the company's brand image and reputation cannot be over emphasized with regards to high market risk involved. Obviously, there has been an intensified competition in barely all industries across the globe. Even in situations where an organization does not choose to compete with others, there is a need for an effective or proper utilization of the scarce resources. In either case, these organizations are challenged to be in the forefront towards developing and testing new ideas. However, new ideas or practices are very susceptible to rejection by global consumers' discriminating tastes. Innovations in an organization may not be accepted positively by every stakeholder, and that can largely impact on the success of the organization's productivity. Accordingly, the strategy that an organization lays to implement innovation projects and the nature of the innovations are of inordinate significance. This paper is sought to tackle the research problem which is to seek answers on whether or, not, suitable framework is relevant for selected organization in the United Arab Emirates, given the critical success factors for innovation diffusion practices. In this respect, two case studies in Dubai were used to argue the innovation diffusion success elements showed that the main diffusion factors are communication, availabilities of resources especially talent employees, strategies and leadership style.

Keywords:

Diffusion, Dubai, Innovation, project management, Talent management.

1. Introduction

Innovation is a key factor to economic growth and better life standards (Ozorhon 2012). Innovation has been considered by many as a principle that relate to governance, competitiveness, sustainability, and efficiency in production to provide value to the customers (Korkmaz, Miller, & Sun, 2012). It is worth to mention that project management is an adapted concept in current organizations for achieving their goals. Projects set as a temporary organization where resources like money, people and time have been utilized carefully for delivering the required outcome. Innovation projects can be done through products or process. It's essential to say that process innovation has more impact on return than the products innovation because it considers as transferable. It's important for organizations to understand the type of innovation it is embarking on and what is involved in order to manage their projects successfully. There are many critical factors affecting the success or failure of a project. In most recent time, UAE has been trying to be an innovative country by looking for ways to delivering creative and unique projects. A recent announcement by HRH Shaikh Mohammed bin Rashid (ruler of Dubai) that 2015 will be the year of innovation shows a political support for innovation in UAE. Dubai is considered one of the main cities in UAE attracting investors as it has the most features and specialties for that. The aim of this paper is to tackle the issue of managing innovation projects, through review of conceptual frameworks and models which are related to innovation. In consistent with the aim of this paper two innovation projects are presented. The cases described critical innovation processes through which critical success factors where identified.

2. Literature Review

2.1. Innovation distinguished from Invention.

Innovation is different from invention (Robertson, 1967). Invention is creating something that has never been in existent before, while innovation is creating new or developing something that already exists. Morton & Burns (2008 pg 3070), categorised the practice of innovation into threefold: 1) the process of bringing new and improved products and processes to joining the vast sea of market-business arena; 2) developing, adopting and, 3) adapting manufacturing processes to enhancing productivity and product quality; and developing, adopting and adapting business practices to enhance the performance of the firm'. It is also defined as the creation of new idea and knowledge in order to improve the performance of the organization. However, innovation appeared not to have been discussed a lot in the literature (Keegan & Turner 2002) and there is nothing mentioned in the project management and international project management literature on the importance of innovation as a topic (Keegan & tunner 2002). The important of innovation is to maintain the company's competitive advantage in the marketplace and for improvement purposes. Innovation is discontinues events where it has many stages (Robertson 1967). Innovation starts in the organization when it begins to affect its past events and resulted in the ability to adapt new ideas and practices and this is called path dependency stage (David 1985, Liebowitz and Margolis 1995, Coombs and Hull 1998). It is said in the literature that project based organization consider innovative because project always have something new in their process or products (Keegan & turner 2002). Human resource management is the base for innovation as they are the idea creators (Zeleny 2012). Here, it is the emerging top level management vision which is very important to accept change and provide all the support needed for this adaptation and creativity such as human and financial resources.

There are three forms of innovation which are; idea, practice and purpose (Roger, 1995). It is essential that an organization understands the type of innovation it is embarking upon and what that potentially may involve, in order that it can plan and manage the initiative successfully. Furthermore, the level of innovation is based on the effect they make: radical, architectural, modular and incremental (Henderson and clark, 1990). Each level has different effect on the organization. Especially when comparing radical and incremental programmes. The most popular is incremental innovation which is "doing what we do, but in a better way" (Tidd 2006 pg.3072). Alexender, (2014) stated that incremental innovation causes small jump in the process with more learning progression. For a radical innovation which occurs both at micro and macro levels, it is essential that all stages are achieved, whereas for incremental innovation every step is a success in itself, which may explain why Wagner et. al. (2011) found that incremental innovations are more often successful. On the other hand, Plessis (2007) has stated that using both radical and incremental innovations result in being successful. It is therefore important to further understand innovation development processes in relation to the declaration made by the Ruler of Dubai.

2.2. **Dubai as innovation city**

Innovation has become the core of the development of cities and this since the industrial revolution (Shearmur, 2007). There are many case studies of innovation in cities discussed in the literature (Shearmur 2012). In the United States, New York is considered the most innovative city in 1982 Feldman & Audretsch (1999) comparing to other states around. Glaeser and Saiz (2003) have done a study which concluded that cities are adapting more to innovation if it's educated and have faster wages increase and population growth. To explain, if the people are educated and the city is assigning high wages to them, it will affect directly technological improvement and innovation and this result in rewarding and appreciation of talented people. Furthermore, Berman, Bound, and Griliches (1994) and Autor, Katz, and Krueger (1998) recommend that graduate workers are more suitable for technology adaption. In the 1990's, innovation initiatives started around the world is the smart cities in many areas like health, environment and business (Schaffers et. al. 2012). One example of these cities is the French city called Saint Etienne which focuses on designing. Dubai city is a second largest emirate in the United Arab Emirates which has 1.2 million population 75% of them were expatriates as at 2006. It has a high growth rate of $305 billion in 2006 (Bagaeen, 2007) due to oil and gas exploitation and production. Dubai is considered the third busiest export center in the world coming after Singapore and Hong Kong. In recent time Dubai has initiated the process adapting many innovation strategies toward creating its image and reputation. Some of its projects are The palm (artificial island in the ocean shaped as palm), biggest shopping mall in the middle east, an airport of 120 million passenger capacity per year, very organized transportation network, the tallest building in the world (Burj Khalifa) and the new innovative project called (musbar al amal) a trip to discover the moon.

2.3. **Talent Management**

Literature has defined talent management in different ways and until now there is no agreed definition for the concept. Some has defined it as the person's abilities, skills, experience, knowledge and growth (beechler & woodward, 2009). Talent management became the focus of HR professional and studies for the past few years and its consider as a source for competitive advantages .A study shows that talent management in attracting and retaining practices are the main concern of senior business executives and set as one of the organisation's challenges and factor toward its success (Ingham, 2006) and competitive advantages (Taylor, 2004. Calo, 2008).

2.4. **Innovation Diffusion Adapted in Project Management**

Managing project efficiency is very important toward achieving the projects goal and innovation success (Chamberlin, 2010). Therefore, innovation projects have a pressure of reaching the end with effective outcome. Innovative projects have the nature of uncertainty and vagueness and it always require collecting and sharing knowledge and information toward solving problems. The caring atmosphere of innovation initiatives provided from the management sets an essential element for innovation to be implemented smoothly. Furthermore, project management used to be as operational effectiveness but now the view has changed to strategic positioning. Literature doesn't discuss the innovation in the service organizations adequately. Managing innovation in services firm’s processes is about idea gathering, transformation, development and implementation. Managing innovation project team effectively and especially their communication contribute to its success (Hoegl & Gemuenden 2001). Main success factor associated with innovation project is the teamwork (Gemuenden,& Hoegl, and Glendale, 2001).

2.5. **The Theory and Practice of Innovation**

Early practices of company innovation efforts, specifically refers to product development (Porter, 1988). Meanwhile, innovation diffusion means the process of communication and transferring ideas (Wagner et al., 2011). The first procedure is when the idea is being adapted as a decision to change. Innovation diffusion has been described as the development of new ideas and implementing this idea over time involves connections with others within an organizational setting (Van De Ven 1986). It is how the idea has been communicated and processed in the social system which considers the base of diffusion and therefore implemented in the organization (Zeleny, 2012). It is the attitude change of the employees and how the decisions are made (Roman, 2004). Since 1960s the innovation diffusion started to be the area of interest (Munray 2009). Big organizations tend for innovation diffusion more than small firms (Freitas 2008). According to Battisti and Iona (2009) while size of the firm has depth impact for diffusion the process of innovation diffusion consist of initiation, adoption and implementation which is shown in Figure 1 describing innovation in marketing (Rogers 1982; Thompson 1965; Pierce and Delbecq 1977) considering the main model of diffusion modified in the 1970s (Islam, 2006). The graph is a normal curve of innovation diffusion with time suggested by Roger (1967) and Meade & Islam (2006).

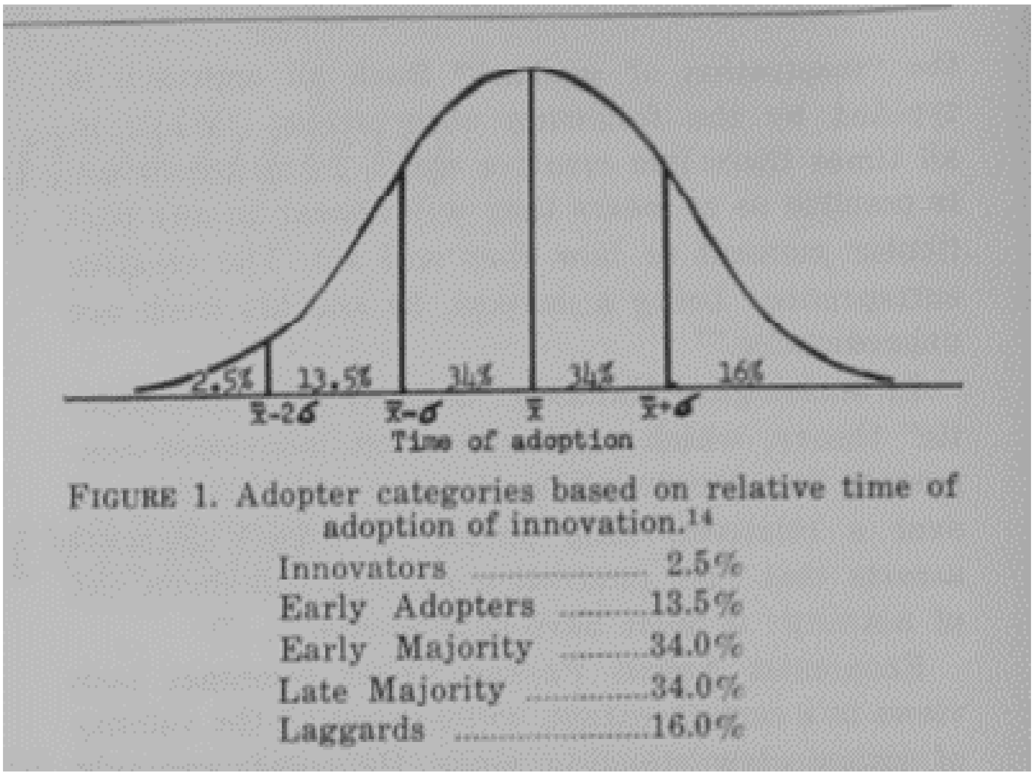

Figure (1): The process of diffusion of innovation. Robertson, T. S. (1967)

2.6. **Opportunities and drivers of Innovation Diffusion**

This paper enumerated some of the most important success factors of innovation. The main drivers for innovation, stated in the literature is culture & process Schlegelmilch, Diamantopoulos, Kreuz & bodo, (2003) and R & D, (Sundbo, 1997, Frances, Fortuin, Omta (2009). Further to the above, availability of resources, communication, collaboration, customer focus and ability to choose right idea (Bodo, 2003Fortuin et. al. 2007). What is more relevant is, management support fits with company vision, staff – motivated workforce, customer-focused. Additional, managers are considered as strong innovation drivers for the company's success. On the other hand, the main barrier for innovation success is the organisation's environment Conceicao (2006). To explain, environment of the work means the culture, the financial ability and risk, the ability level for change, cooperation between team members (Oaorhon 2013). Further, barriers include receptivity of customers and organizational inflexibility are known barriers to innovation (Conceicao, 2006). The main enabler for innovation success is people through applying new technology (Zeleny 2012). Figure 2 explains how the drivers, barriers, enables and opportunities processes impact innovation in the project.

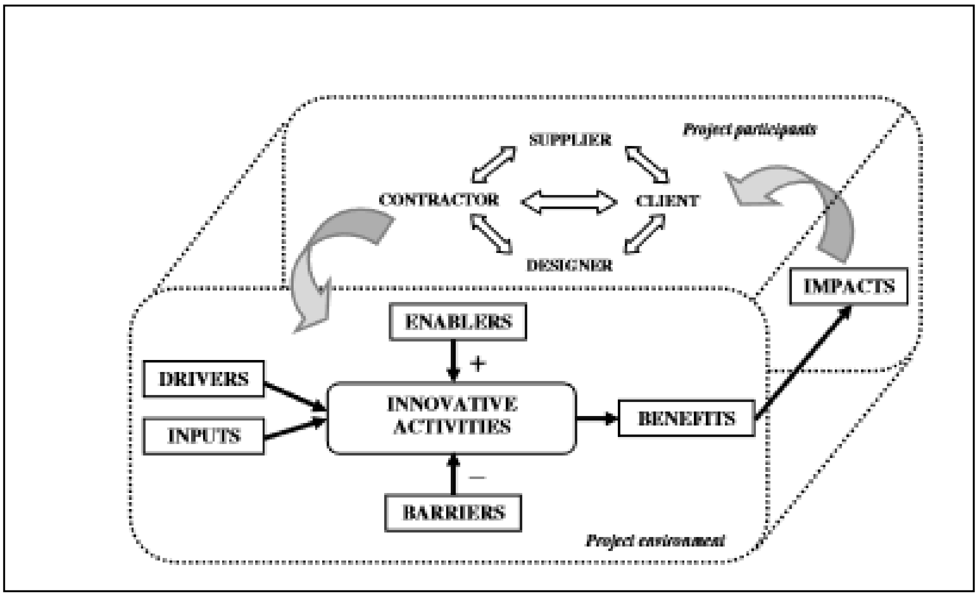

Figure (2): Why sustainability is now the key driver of innovation. Nidumolu et. al. (2009).

3. Critical Factors Success Relevant to Innovation Projects

It has been illustrated in the literature that the basic project management successes are by meeting time, budget and quality (Atkinso, 1999). On the other hand, there are other critical success factors associated with project success. Critical success factor is defined as the capability of project management to achieve both strategic (planning phase) and tactical aspects (action phase) (Slevin and Pinto 1989). It is also the internal and external factors assisting in gaining competitive advantage. To explain, the organization should be aware of some elements in order to achieve the project success.

3.1. **Two types of critical success factors for diffusion of innovation**

There are two types of critical success factors which are internal and external factors. External factors address the opportunities and threats in the market while the internal factors address the abilities in the organization. Furthermore, main success factor in production line like food process is R & D (Fortuin & Omta, 2009). It is worth to mention that applying new technology in the organisation enables people to be more innovative (Zeleny 2012). Furthermore, organizational structure, relationship between supervisors and staff (Evan & black 1967), Leadership (Guimaraes2010), culture and change management is significant elements for innovation project success (Wagner et al. 2010). Guimaraes (2010) has clarified that technology management; competitive intelligence and leadership style are the fundamentals successful factor for innovation projects.

3.2. The importance of Knowledge Management in the Diffusion of Innovation

What is more important is, knowledge management through sharing knowledge, do benchmarking and using intranet for innovation success (Plessis 2007) and process (Tarafdar & Gordon, 2007). Studies show that knowledge management contribute to better organisation's performance (Grant, 2013). 70% of UK companies placed KM strategies by the end of 2002 (Robinson et. al., 2001). Knowledge management support continuous improvement, sharing important knowledge through communication, applies best practices, respond quickly to clients and develop new products and services.

4. Understanding internal CSF of innovation diffusion

Organizational support and resources have a positive effect on the process of diffusion. In addition to that, differences in sources and channels affects the stages of diffusion as well (nilakanta & scamell 1990). Human resources plays a vital role in innovation diffusion (chamberlin et. al. 2010). In addition to that, training is considered as an important factor for innovation diffusion when technical complexity and task interdependence are high (Sharma and Yetton 2007). For example, the internal success factors for quality of conducting market research, development speed and technology (van Riel, Lemmink, and Ouwersloot 2004). Moreover, organisation's climate and communication inside the organization is the heart for diffusion of innovation (Talay et. al. 2013). As well as managing information through collection, transfer and usage, last but not least, tangible and intangible resources are considered an internal success factors for diffusion (Barney, 1991). R & D is considered as the most crucial factor for innovation to be success especially in production area like food (Frances, Fortuin & Omta, 2009) because it is looking at satisfying customer's needs. Organizational culture is a significant factor for project success (Wagner et al. 2011). Moreover, process innovation has also many factors associated to its success like centralization degree, organization’s size, relationship between managers and staff and the degree of change acceptance (Evan & black 1967). It's stated from the literatures that choosing a good project manager and the team are critical for achieving the objectives of projects and therefore being successful (Shenhar & Dvir 2007). Last but not least, it's not easy to manage innovation project especially products innovation as it's proved from the literature that only one out of four innovation products is successful (Evanschitzky et. al. 2010).

4.1. External and Internal Drivers and Opportunities for Innovation at Project Level in the Organization.

The environment of the business is the main external factor for innovation diffusion (Roman, 2004). Network competency is also considered as external factor (Ritter & Cemenden, 2004). Internally, the factors of success will be the productivity and competencies of human resources in-placed in the company. Recruiting talented employees consider as an internal factor of innovation (Roa and drazin, 2002).

5. Conceptual models

Conceptual Models Relevant to Innovation Diffusion

Literature has indicated many modules to explain the factors which affect the critical success factors of innovation. Also, many hypotheses were drawn to link between CSF and innovation diffusion. Gemenden & Ritter (2004) designed a framework (see Figure 3) which explained that setting business strategy and implementing them correctly will affect the technological factor and result positively toward innovation success. It is worth to mention that technological factor consists of technological competence and network competence.

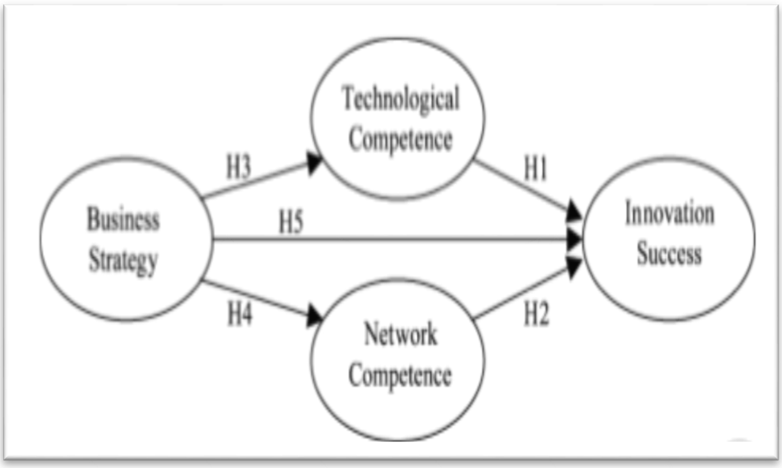

Figure (3): The impact of a company's business strategy on its technological competence, network competence and innovation success. Ritter, T., & Gemünden, H. G. (2004).

Recent studies showed that, technological factor is an internal factor whilst network competences are the external factor for innovation success. As noted above, that applying new technology results positively toward innovation. In essence, setting business strategy in the organization and implement those in the correct way affect technological competences (internal factor) and network competences (external factor) toward successful implementation of innovation project. Technology is not the only effective factor contributing to innovation success. Also human resource management is the base for implementing technology and without trained the organization cannot be successful. Technology consider as a mediating factor for innovation success.

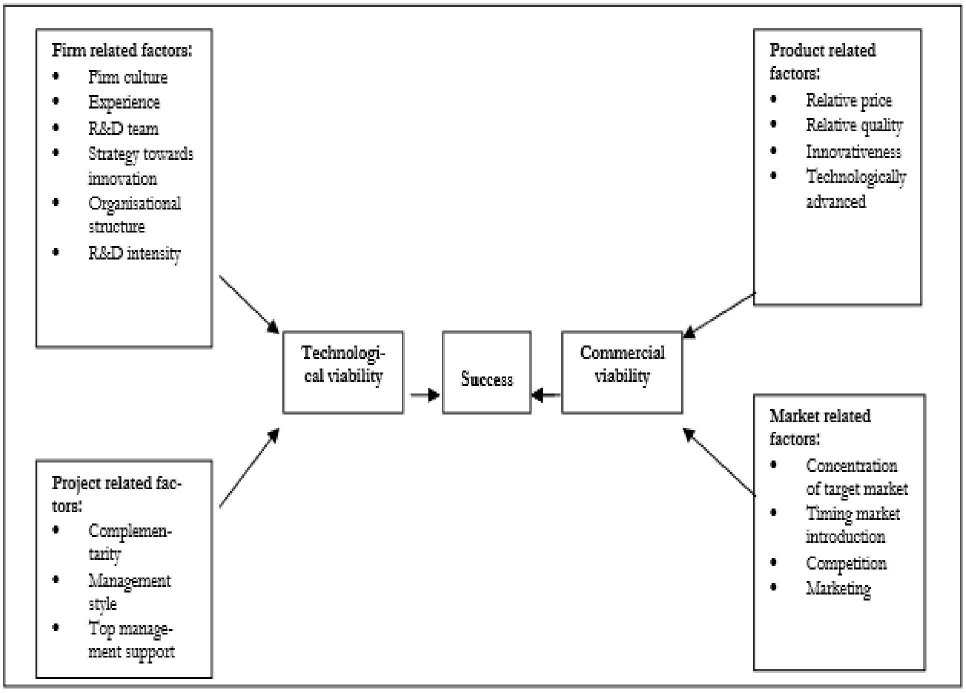

Figure (4): Panne, Beers and Kleinknech (2003). Two (2) main types of capabilities affecting the innovation project success: technological and commercial viability.

The above framework (see Figure 4) explains that there are two main types of capabilities affecting innovation project success, which are technological and commercial viability. Under technological viability there are two critical success factors which are firm related factors and project related factors. On the other hand, commercial viability has product and market related factors and those considered as an external factors affecting the innovation project success.

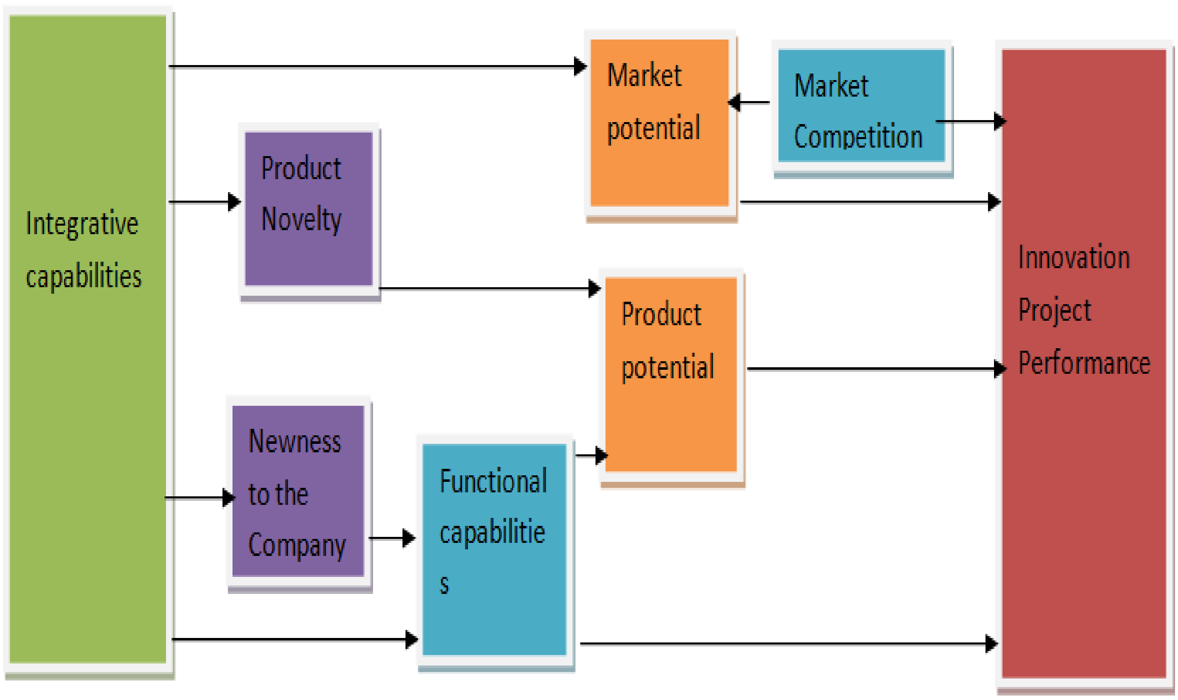

Figure (5): A conceptual model for innovation project, Adopted from Liu Z et al. (2004), p.182

A conceptual model that illustrates how different critical success factors interact to influence the success or failure of an innovation project was developed by Liu et al. (2014). The model (see Figure 5) was developed to illustrate the effect of key success factors on the success of innovation projects by vegetable breeding companies in China. In particular, the model illustrates the interaction between integrative capabilities and functional capabilities of an organization, as well as other market factors that influence the ultimate performance of an innovative project.

Integrative capabilities help in identification of new opportunities for innovation by checking external sources of information. Communication, team interaction, and knowledge sharing constitute important aspects of a firm's integrative capabilities. The success of an innovation project largely lies on the quality of communication, interaction among the innovation project team members, and the level of knowledge sharing (Liu et al., 2014). Communication occurs between the members of the team, as well as between the project team and other units in the organization to help diffuse the innovation. Functional capabilities further help in changing the innovative ideas into new and unusual products or services that appeal more to the customers. The resources available to support functions such as R&D and the willingness of the management to utilize such resources will also determine the success of an innovation. The model further illustrates that an innovation project becomes successful when some good business performance is realized and not just with the completion of the project.

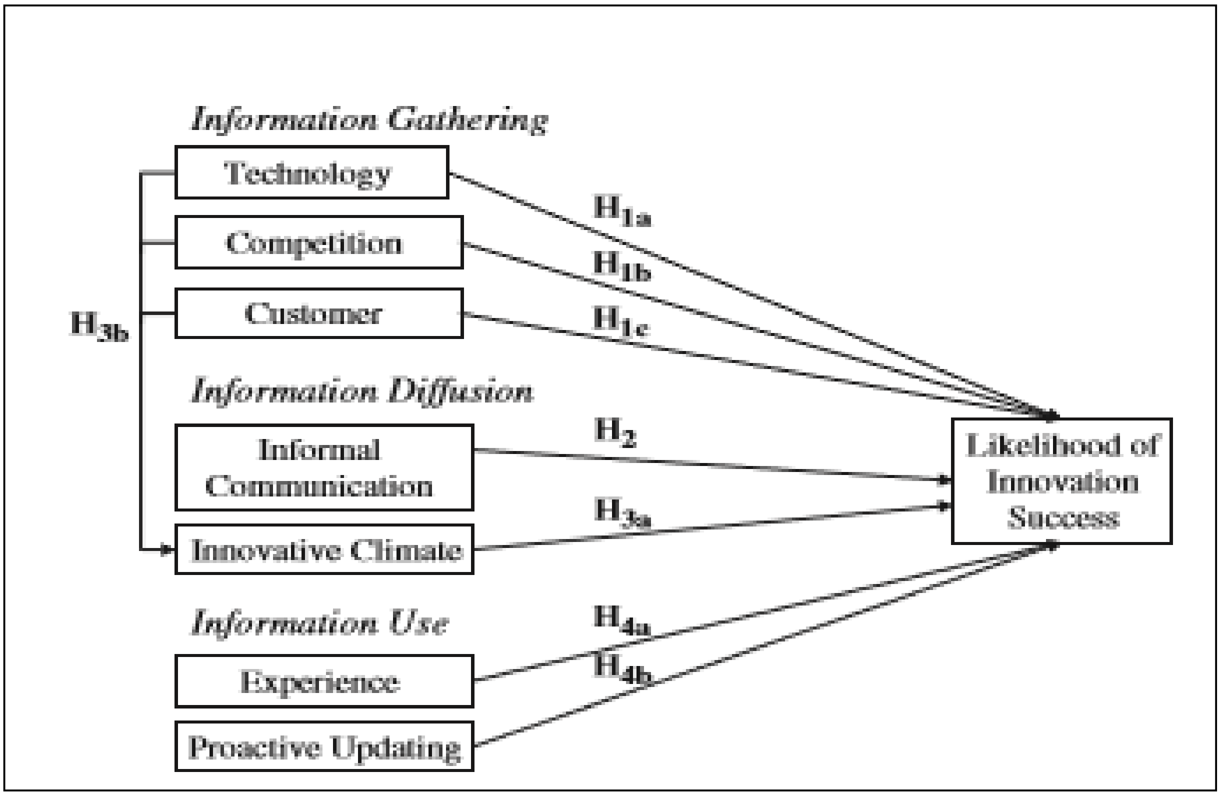

Figure (6): Coevolutionary Dynamics of Automotive Competition: Product Innovation, Change, and Marketplace Survival to innovation diffusion. Talay, M., Calantone, R. and Voorhees, C. (2013).

An emerging but very practical framework addressed in the literature about the relationship between information gathering, diffusion and use to innovation success. It is shows that there are different factors affecting the innovation success and the diffusion of information through communication and climate. To explain, high technology organisation is being successful through managing knowledge through gathering, diffusion and usage of information (van riel, lemmink and ouwersloot, 2004).

Another model of innovation diffusion suggested by (wejnert, 2002) stated that there are 3 things help in diffusion which is characteristics of the innovation, and characteristics of the environment.

6. Methodology & Data Collection

The researcher had chosen two (2) Approaches:

1) *Negotiation* of critical success factors of innovation projects and its relationship. Company strategies will include negotiation of critical success factors of innovation projects and its relationship to innovation diffusion that would be observed in one of the service organization in the UAE. Conceptual frameworks will be critiqued from the review of literature. Although there are many frameworks and models existing in the literature, from international companies, this paper will add to the literature by entailing two different case studies in which innovation projects were introduced and implemented in one of UAE's emirate. More emphasis is given to the approach that was

used to enable the stakeholders buy in the idea of innovation and how the approach impacted on the success of the innovation project.

2) The *Case study approach* was used in this paper. It refers to the qualitative method which will be used for conducting this research as it's used to study complex social phenomena (Yin 2003). Notably, case studies provide examples supported the findings of other cases in the literature. It's the way of explaining the behaviors and practices in the work reality. It can be focus groups, interview or observation. Interview was organized with the project team managers or their team members as it helped to understand the perception, feeling of the people and the factors of innovation diffusion and realize the full picture of the situation.

6.1. Case 1. SOS System.

One innovative project which has been successful at the organizational level is SOS system. In the framework provides reassurance and security to the various segments of society, the idea of the project pursuant to the vision of organization's head. This initiative is to develop a service-oriented intended for older people called ***dutiful to your parents***. Through the development of an integrated system old people can call for help through a device that is connected in their homes. The call signal goes directly to the control room.

This service contributed to the improvement and development of the response rate reducing turnaround time from as low as 4 to 8 minutes. It does not need to contact the applicant for the direction to the location; it is enough to press the SOS button to access by defining its geographical mapping system (GIS).

Interviewing Mr. Tariq who relieved that the organization has high IT capabilities helped toward being successful project. There were security assurance features like indoor wall firearm (Firewall) intruder alarm to prevent the entry of any unauthorized persons and thieves. The innovation diffusion to the department is just a Touch of a button your security service has become an integral part of the daily work in the system of command and control 24 hours. And won a share deal of attention from the staff of the Centre and are subject to follow-up and update and review on an ongoing basis. It also reviewing and evaluating the results of the initiative on a regular basis in order to ensure effectiveness of meetings under the direct supervision.

This project launch require concerted efforts and integration roles between the relevant authorities and stakeholders such as Dubai Police Force, the development of community service, the ambulance service, the Dubai Women Association and the diabetic patients, to reach the desired goals of the launch of this smart service.

The team consisted of 20 talent people in different work role and their responsibilities were Providing the older devices, the development and modernization of connecting electronic devices program (older device) incident management system operations room, Linking the personal data of the beneficiaries operating room system, Provide communications cards and programming, the formation of a working group to visit the target group, identify places of residence installation device and to submit periodic reports on the project. Mr, Tariq said "we have to get off the field and visit the installation of a number (96) in the presence of their families and their loved ones and their assistants, which gave it a great media echo and we received a lot of thanks and gratitude and appreciation to the initiative messages from all segments of society most of societal communication channels both in forums or news sites and newspapers in addition to community communication channels such as Twitter and Face book".

Regarding the implementation process, the department had smoothly implemented the new service. The top management's vision of the organization toward satisfying their customers only but make them happy. The employees are talented and have been trained as how to work with this new service. There was no resistance as all the resources were available and this didn't add any pressure to work. Figure (7) explains the important of exiting the factors of strategy, IT development, talented HR and leadership in order to reach the success of innovation diffusion.

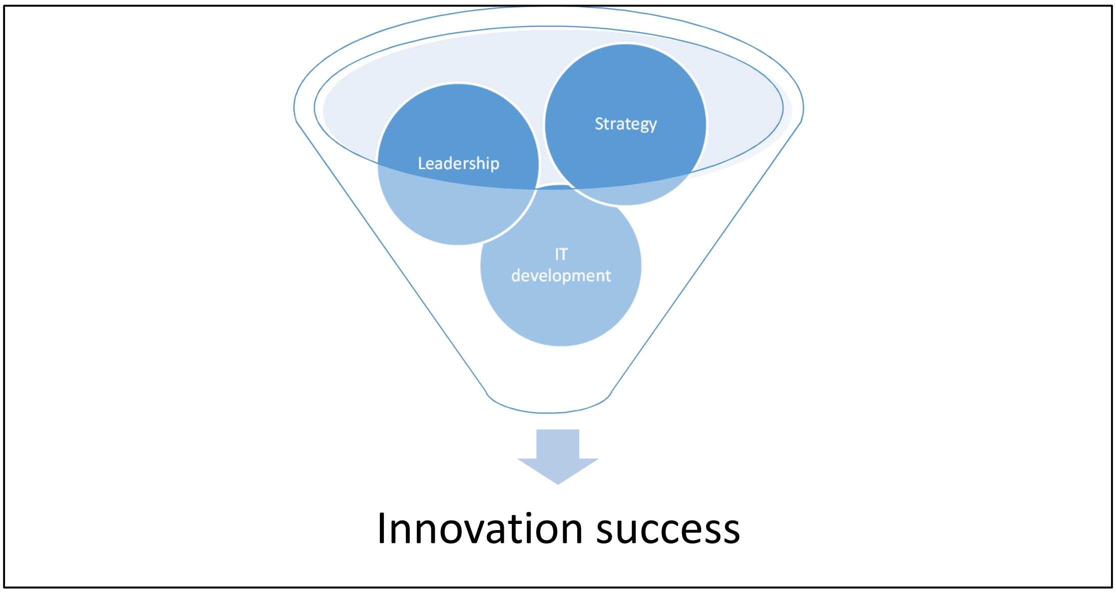

Figure (7) : Model of innovation successful factor toward diffusion of innovation.

6.2. Case 2. Web Marketing and Free-service, No charge Promotions

By interviewing the team leader Mr., Hisham and one of team member Mr., Ammer, second case study about a service called "security housing" which is a free service for people who are travelling outside the country for holiday and they want to make sure that their homes are safe from thieves. There are three ways to have this service which are online through website and app or visit nearest service center to fill the 5 minutes form.

The innovation in this service is by providing security and peace of mind for who are traveling outside the country for holiday and leaving their homes. Also, people can register for this service whilst outside the country.

The environment of work plays a vital role to encourage innovation diffusion. Talented employees are encourage to come out with innovative ideas, management are reward any new ideas from employees.

The implementation of this service only required good communication and cooperation between other departments in the same organization. The employees were motivated to provide this service for people and all the thanks letters from the customers were given to the team by SMS or phone calls. Figure (8) shows the importance of internal critical success factors in order to get innovation diffusion success.

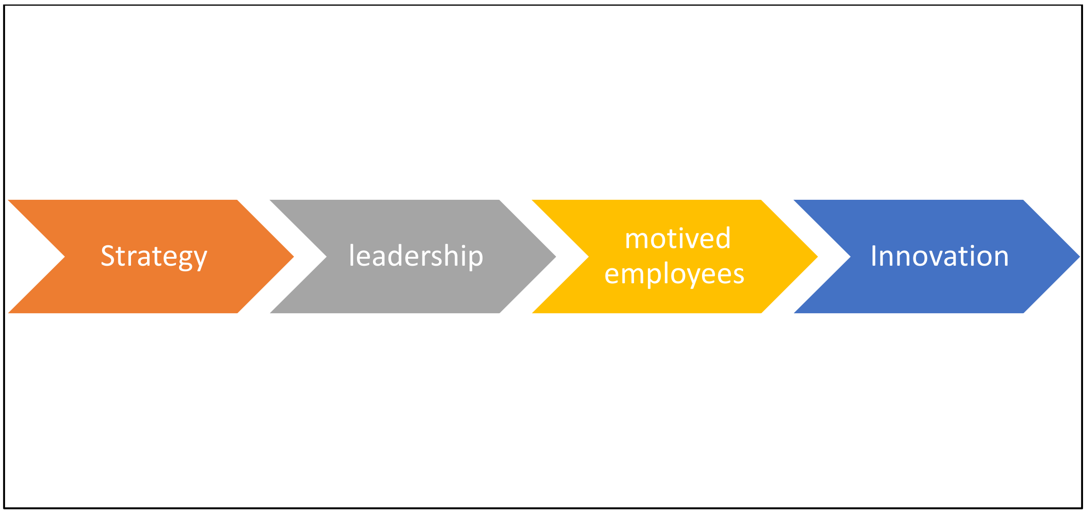

Figure (8): Model showing levels of innovation diffusion

7. Decision Strategy: The Researcher's Evaluation

The two cases above illustrate how an organization can be innovative. The key success factors here include the alignment of the innovation to the organization's overall goals and how they suit customer needs. Moreover, the organisation's caring of their talented employees by training them, motivating, encouraging and rewarding. Innovation principally entails generation of a new idea and putting it into practice (Blayse & Manley, 2004). The success of the innovation project will in turn be influenced by an interaction of different factors.

Essentially, there are three distinct steps or phases involved in the dissemination of an innovative idea into an organization: initiation, adoption, and implementation (Korkmaz et al., 2012). The initial step in innovation is initiation or recognition of the opportunity. This entails an understanding of the need for some innovation. Initiation is achieved by brainstorming the kinds of innovations to be tried out given the goals and objectives of the organization (Blayse & Manley, 2004). One has to develop an idea of the innovations that are available and that can be tested. In both cases, the management of the organizations saw the opportunity to try out new ideas or practices to provide more value to the clients and satisfying their needs.

The next step is adoption that refers to settling on one of the ideas generated during the initiation phase (Korkmaz et al., 2012). After settling on the appropriate innovation, the management then has to communicate the idea to the concerned stakeholders such as the Board or shareholders to approve resource allocation. The idea should also be communicated to the other stakeholders such as employees. Since they will be the key implementers of the changes, they have to be involved in good time. The employees must have good understanding of why there is need for such innovation projects in their department. The final step is implementation that refers to how the organization puts the innovation into effective use (Korkmaz et al., 2012).

7.1. **Differentiation of the two (2) case studies conducted by the researcher.**

Undoubtedly, there are some elements assisted the diffusion of innovation summarized in Table (1)for both projects:

Table (1): innovation diffusion drivers, enablers, barriers, benefits and impact.

Project name	Drivers	Input resources	Enablers	Barriers	Benefits	Impact
SOS system	Availability of resources lit Technological developments and talented HR. Communication Customer focus Choosing right ideas Leadership style	Trained HR IT management	Strategies Top management vision and support	NO	Decrees in costs and duration Improve of service quality	Better organization image Better service and therefore performance Less cost Better organization image Customer satisfaction
Housing security				NO	Providing security High quality service	

8. Further Analysis

Dubai is providing an innovation environment toward sustainable progress (Schaffers et. al. 2012). It has educated employees due to the international universities it has therefore, affecting the innovation in the workplace. Comparing its size to the nearer cities or other cities internationally, it has high economic growth. As it is stated in the literature that the human resources are the idea creators, the two case studies supporting this argument as the organization is persuading their talented employees toward suggesting ideas for customer's satisfaction and therefore better organization's performance. Furthermore, the top management sets as an important elements for implementing innovation and this is what the Dubai leader and the police top management is adapting in their organization where they are accepting change and innovative ideas. Managing project team and especially their communication is a main factor for innovation diffusion success as mentioned in the literature. Dubai police supporting this statement as they are focusing on smart city initiative where the leadership style adopted and the employees are always motivating toward innovation. In addition the atmosphere of sharing knowledge and information between the project team through regular meeting, control and review seems to support innovative initiatives.

The two case studies are supporting the literature as it has almost the same internal critical success factors for innovation diffusion which are applying a good strategy of providing security which is providing many factors in the organization for innovation diffusion. These factors are:

1- Available of tangible resources (IT, finance and talented HR resources) and intangible resource (skills, experience and knowledge).
2- Communication skills between the project team and member. Also, the communication with the stakeholders.
3- Knowledge management through sharing knowledge, benchmarking with global companies and this what the organization implemented.
4- Leadership style the organization implemented. The top management always listens to their employees and accepts new ideas for continuous improvement.
5- Focus on customer toward satisfaction and happy.

Figure (9) is a framework designed for both cases to explain the success factors for innovation diffusion in the Dubai police in Dubai city illustrated below:

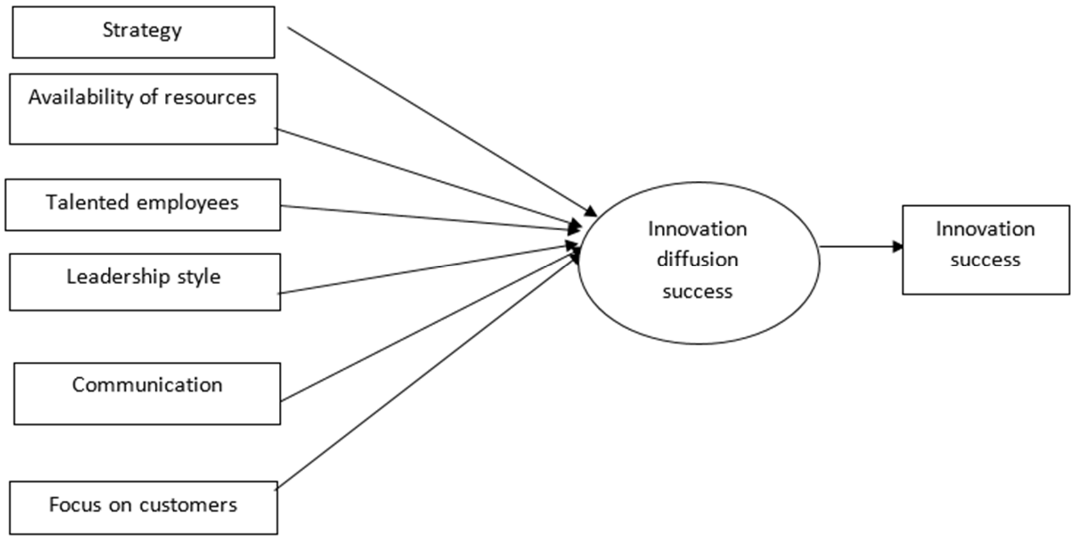

Figure (9): innovation diffusion factors in Dubai police

9. Summary and Conclusion

As the literature didn't reflect on the innovation in service organisation, this paper is contributing to the existing literature on managing project team in innovation project and its main success factors for innovation diffusion in service organisation. The two case studies presented in this paper showed how the strategy, talented employees, leadership and availability of resources contribute toward to innovation. Also, explain the main success factors for innovation diffusion and how the communication and knowledge sharing between managers and the project team being the innovation diffusion success factors. As the organization is seeking for improving their performance and therefore sustainability, innovation and innovation diffusion are very important elements to consider toward implementing that and gaining customer satisfaction. Dubai police is a main public organization in the city of Dubai which their services have effect on the security level in the city, so the two case studies presented in this paper showed how the government is trying its best toward spreading the security and reaching customer not for only satisfaction but also their happiness. The two case studies tell that there are no barriers toward innovation diffusion as it is reflected from the people interviewed and top management support for the innovation and its implementation.

10. Limitation and Recomendation

Case study research has distinct advantages in the depth of knowledge that can be gained on a specific issue within an organization; however, the findings are case specific, there should be comparison studies of organizations undertaking innovation with same organization nature and economic conditions because it is difficult to compare it to the literature which has different conditions and factors. Another things, there are limitation of theories supporting the model. Last but not least, the framework should be test using quantitative method of developing hypothesis and distributing questioner.

Innovation should be aligned with the strategy to avoid being out of control. The main driver for innovation is the management, talented employees and the leadership style in the organization. It is worth to say that the decision making transfer from the manager to all team member was by conducting meetings. If decision making made from top management and affecting the outside demand, it will have less effect inside the team and no knowledge contribution will be made to the process of resolving problem. Furthermore, availability of resources set as an important element for innovation diffusion success.

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Public Private Partnerships: An Alternative to Student Housing Development at State Universities in Zimbabwe

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Abstract

The aim of the paper is to determine how private public partnerships (PPP) can be used as a viable alternative to traditional methods of student housing developments. There is a serious shortage of student accommodation at state universities in Zimbabwe, caused by lack of funding and the rapid increase in enrolments.

The methodology used to conduct the study was to target one state university in Zimbabwe to be the target population. Survey questionnaires were used to gather information among a number of students at this university, as well as property developers in Harare. An interview was also conducted with the dean of students at the particular university.

The findings of the study reveal that there is sufficient demand and need for student housing development through PPP in Zimbabwe. In order for PPP to succeed, however, there is need for PPP legislation to be enacted as an act of Parliament, which will cover student housing partnerships between universities and private developers.

Keywords:

Property development, public private partnerships, student housing.

1. Introduction

There has been a proliferation of state universities in Zimbabwe since 1990, with six new universities having been established after 1999. This has caused an increase in the number of student enrollments which have surpassed the universities' capacity to provide housing. This is a phenomenon not only encountered in Zimbabwe, but almost all over the world. The Brighton and Hove City Council (UK) (2013) reports that, as a consequence of increased student numbers, the supply of purpose-built student accommodation by the universities fall behind the demands of the expanding student population.

Because of, mainly, a lack of funding, state universities could not cope with the need to provide student housing on the various campuses in Zimbabwe and it became clear that new, innovative ways of solving this problem should be sought.

In light of the above problem, a study was conducted In order to determine whether Public Private Partnerships (PPP) between universities and private developers can be used as a possible solution to the problem.

2. Background on PPP

PPP can be defined as "co-operative institutional arrangements between the public and private sector" (Greve and Hodge, 2009). It is a partnership that involves private companies in the design, finance, construction, ownership and/or operation of a public sector service or project (Akintoye, Beck and Hardcastle, 2003). The South African National Treasury, the ministry governing PPP, defines a PPP as a contract between a public sector institution and a private party, in which the private party assumes substantial financial, technical and operational risk in the design, financing, building and operation of a project. As highlighted by Gerrard (2001), at the heart of all PPP is the deployment of private sector capital. This capital can result in greatly improved value for the government (public sector) in terms of the risks transferred to the that private sector and powerful private sector incentives for the long term delivery of reliable public services.

Amobi (2013) states that PPP is a model of public procurement, based on a long-term relationship between a public body and the private sector, for service delivery. What distinguishes a PPP project from traditional procurement, where government engage a private sector counterpart to construct an asset, the emphasis in PPP is on service provision, value for money and the length of relationships.

The three key principles underlying PPP arrangements in university infrastructure development, according to Amobi (2013), are:

- The risk allocation to the most appropriate party;
- Payment when and only for services delivered; and
- Ensuring that value for money is achieved through the structure of the PPP arrangement. This is in terms of both the overall cost to the client as well as the level of services delivered.

Earl (2003) reports that experience in Australia as well as other overseas countries suggests that in PPP projects the introduction of private sector innovation and efficiency within a balanced framework, can deliver cost savings, better services and lower prices to consumers.

2.1. PPP models in student housing

PPP can take several forms depending on the objective of the university to partner with a private party. According to Anderson Strickler (2000), a university can select from one of the following types of PPP models:

- University affiliated foundation model: In this model, a non-profit organisation, created by and affiliated to the university, develops the project and leases the entire facility back to the university. The organisation ploughs back any profits into more student housing as opposed to distributing it as dividends. The advantage of this model is that it removes risk of development and finance from the university. It also prevents excessively high rentals from being charged to students as the affiliated organisation does not seek to make profit out of students, but rather ploughs back profits into the project.
- Unaffiliated non-profit company model: This model is similar to the previous model with the exception that the non-profit organisation is not affiliated to the university, but is an independent body. The profit generated for the project will still be re-invested into student housing, as the private party is a non-profit making entity. The advantage of this model

is that it removes the project from the institution’s balance sheet because the university and the private party are not affiliated. The disadvantage is that there is no profit incentive for the private party to undertake the project.

- Fully privatized model: A private developer would undertake a ground lease with the university or build on land privately secured by the developer. The developer then proceeds to develop, finance, own and manage the housing facility. The advantage of this model is that the university does not have to spend any money in the development of student housing, while the disadvantage is that the developer’s motive is profit and can therefore charge exorbitant rentals to students.

2.2. **Case study: Montclair State University, USA**

Montclair State University (MOSU) was a pioneer in the development of privatised student housing in New Jersey, USA. In 2009 the university needed additional student residential facilities. After conducting thorough market research, MOSU calculated a housing demand for approximately 2 000 students in 2009 (Aska, 2012). The then State College contract law, on which the traditional way of student housing development was based, did not allow for an efficient and timely development of academic facilities at MOSU. Subsequently MOSU decided to use the unaffiliated, non-profit PPP model over the State College law.

The project was financed by a non-profit organization who acquired a USD 218 million loan from the New Jersey Economic Development Authority. According to Aska (2012), this loan was used to build an approximate 2 000 bed housing development, as well as a dining facility. The dining facility is notable because neither MOSU nor the Government contributed any funds for the development. It was rather funded through a PPP deal between the same non-profit organisation and MOSU. Ownership shall revert back to MOSU either in 40 years, or when the debt is fully paid, whichever comes first.

3. An evaluation of PPP in Zimbabwe

Zimbabwe has not implemented any PPP student housing to date. Currently the country does not have any legal framework for the operations of PPP (Zimbabwe National Chamber of Commerce, 2009). What exist are only guidelines on how PPP should be done and these are not contained into a specific statute. The country has implemented the following three PPP projects:

- Bulawayo – Beitbridge railway line;
- The Limpopo bridge linking South Africa and Zimbabwe; and
- The Newlands bypass road in Harare.

Although these projects do not include student housing developments, they do provide valuable insight that can help the development of PPP in student housing in Zimbabwe. Table 1 summarises these projects and lessons learnt from their experience. The issue of charging high tariffs to the end user is a common problem with PPP in Zimbabwe. To counter this problem in the context of student housing, it is suggested that universities should use a non-profit organisation affiliated to the university as the project owner.

Table 1: PPP in Zimbabwe (Zimbabwe National Chamber of Commerce, 2009)

Year built	PPP project	Project summary	Lessons learnt
1994 - 1995	Limpopo bridge	-A toll bridge over the Limpopo river linking South Africa and Zimbabwe. -Was a 20 year PPP	-Government should avoid total exclusion from financial contributions and control as its interests were undermined during tenure of PPP -High tariffs were being charged to the motoring public
1996 - 1998	Bulawayo – Beitbridge railway	-350km railway line connecting Beitbridge to Bulawayo	-Private partner was unable to properly maintain the railway line after construction -The operator charged high tariffs to the end user
2006-2007	Newlands bypass road	-A major 4-line highway in Harare and development of a near-by shopping centre	-The project was done under severe economic difficulties, but it succeeded -PPP are possible even under difficult conditions as long as there is commitment from both government and private sector

Such an arrangement, according to Anderson Strickler (2000), is common in the USA and it enables profits made to be re-invested into the project, as opposed to being distributed to shareholders. With such a model the PPP becomes a non-profit venture, thereby students will not be subjected to extraordinary high rental charges.

4. Research methodology

4.1. Target population

The student sample was selected from one university, *viz.* the Midlands State University (MSU) in the city of Gweru. MSU is one of seven state universities in Zimbabwe, it is among the top three largest universities in Zimbabwe in terms of size and student population, and it clearly exhibits the problems of student housing.

The student participants have been randomly selected from fourth year classes of various four year degree programs at the university. The main reason for choosing fourth year students was because they would have had the time to build up experience relating to problems with student housing and thus could provide useful information.

The second source of information was the dean of students at MSU, who has been selected as a participant to this study because of her knowledge on student affairs such as housing.

The third set of participants in the research was property developers, who were selected because they are the major role players in a typical PPP and their views on the subject were deemed to be most valuable.

4.2. Sample size and sampling method

The sample size for the study was 10% of the fourth year students studying at MSU. There are 2 450 fourth year students spread across seven faculties at the university. These students were divided into strata according to the faculties in which they were studying. Each faculty was therefore taken as the stratum from which 10% of the students were randomly selected to obtain a total of 246 students. A stratified random sampling technique was therefore used to obtain the sample, which was considered a suitable size for this study. The student sample distribution is shown in Table 2.

Table 2: Student sample size distribution

Faculty (stratum)	Total number of students	Total number of 4th year students	Sample (10% of 4th year students)
Social sciences	1 000	180	18
Natural resources management	1 150	238	24
Arts	1 700	360	36
Commerce	2 800	620	62
Education	1 100	590	59
Law	1 100	220	22
Science and technology	1 200	242	24
TOTAL	**10 050**	**2 450**	**246**

5. Research instruments

5.1. Survey questionnaires to students

The questionnaires to students comprised of fifteen questions that included both open ended and closed ended questions. The questionnaire was distributed to students in a lecture hall. Different lecture halls were selected from each faculty. By distributing the questionnaires in the lecture hall ensured personal contact with the respondents, enabling the researcher to explain the relevance and purpose of the study, clearing up any uncertainties regarding certain questions, and ensuring a very high response rate.

5.2. Survey questionnaire to property developers

A survey questionnaire was distributed via e-mail to a number of property developers in Harare. The advantage of e-mailing is that it is not expensive and can reach a large number of respondents over a short period of time.

5.3. Interview with the dean of students

The researcher opted for a face to face interview with the dean of students since it was only one person and an interview leans itself towards eliciting information, beliefs and opinions that cannot always be obtained through a questionnaire. After permission was obtained from the authorities at MSU to conduct field research on campus, the interview was arranged with the dean of students.

6. Results of the research

6.1. Student questionnaires

As mentioned, 246 questionnaires were distributed by hand to students. Of these, 12 questionnaires could not be used because respondents failed to answer all the questions. This represented a 95% response rate on the number of questionnaires answered fully. Some of the responses of the questionnaire are as follows:

a. Question: How much rental are you currently paying per month?

Table 3 shows that the majority of students are paying between USD60 and USD80 per month per bed.

Table 3: Net rental that students are paying

	USD0 – USD60	USD61 – USD80	USD81 – USD100	+USD100
Response	15%	75%	10%	0%

These are prevailing market rentals that can be used by a private developer as a basis for planning and development of student housing.

b. Question: How much utility costs (water, electricity, etc. are you paying per month per bed?

The survey revealed that the majority of students are paying operational costs of 18% to 20% of their gross income. These costs can also be used by private developers in their planning for student housing development.

c. Question: What is your source of income for paying rentals?

85% of students finance their housing needs through money received from their parents. There are no available grants from government to support student housing. 7% of respondents finance their housing needs through scholarships, whilst 8% generate their own finance for their housing needs.

d. Question: Do you have any problems in paying rentals on time? Question: If yes, state the reasons

55% of respondents revealed that they had some difficulties in paying rentals. On the subsequent question these respondents mentioned some of the challenges they are facing in paying rentals:

- Financial hardship for those who are self-financed
- Inability of parents to pay rentals on time, due to financial hardship
- High rentals and high escalation being charged by the landlord
- Student residences requires that full fees are paid in full before a student is admitted to a university residence

This information is very important for a PPP housing development because students may be required to pay full rental for the whole year at the beginning of each academic year. Therefore, if the majority of students are not able to pay rentals on time, it could impede student housing developments through PPP.

e. Questions: What kind of housing do you currently reside in? and; Where are you currently staying in Gweru?

Off-campus housing is mostly in the form of homeowners in residential areas surrounding MSU who rent their houses or part of their houses to university students. As shown in Table 4, the majority of students are housed in such houses in the Senga high density residential area. Senga is located less than 5km from the main campus, which is within walking distance. It is a high density residential area which was originally earmarked for the low income working class. The houses in Senga were, therefore, never designed for student accommodation, but for single families.

Table 4: Location of student housing at MSU

	University hostels	Senga residential area	Gweru CBD	Daylesford residential area	Mkoba residential area	Other
Distance from campus	0km	2 – 5km	15km	5 – 10km	20 – 30km	-
Response rate	18%	64%	4%	9%	3%	2%

f. Question: Please rate the following statement: I am satisfied with my current housing situation

In this question, 67% of the students indicated that they are mostly not satisfied with their current housing circumstances, as indicated in Table 5.

Table 5: Students' rating of current housing satisfaction

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Response rate	4%	11%	15%	46%	21%

Generally students sighted the following problems for their dissatisfaction with their housing situation:

- Congestion and overcrowding, as up to eight students sometimes share one room in off-campus housing, resulting in a lack of privacy and lack of security;
- Lack of proper sanitation;
- Rentals that are too high;
- Lack of entertainment such as televisions in current facilities;
- Residences that are far away from the campus; and
- Landlords exercising very strict control and having inappropriate house rules

Figure 1. Typical house rented to students in Senga Township.

6.2. Interview with the dean of students

The following is an abstract of some of the questions answered by the dean of students:

a. Question: Number of students in need of university housing

This question sought to investigate the need for student housing, as it would highlight the deficit in the current availability of student housing. The dean of students revealed that only 3 000 out of the current 12 000 students attending MSU are accommodated in university hostels. About 3 000 students will be, at any given time, on industrial attachment elsewhere, therefore the remaining 6 000 students have to be accommodated in private, rented housing in close proximity to the university.

b. Question: In your opinion, can PPP be used as an alternative model in the development of student housing at state universities in Zimbabwe?

The dean of students stated that PPP can be used as an alternative in developing student housing. In her opinion it will be an effective way of alleviating the student housing deficit.

c. Question: What is hampering the formulation of PPP between the university and private developers?

The following three major factors were named on the above question:

- Unavailability of funds. The university's sources of finance are government grants and funds derived from student fees. Government funding has been constrained due to economic hardship that the country has been facing the last decade.
- Lack of land for development. Not all universities are in a position to provide on-campus land for development of student housing. This would mean that land would have to be bought form surrounding areas, which will drive up the cost of a development
- Skepticism. According to the dean, both private developers and the university are skeptical about PPP since there are no precedents for such developments in Zimbabwe.

6.3. **Questionnaire to property developers.**

A total of 15 questionnaires were sent out via e-mail to property developers across the country. Of these, only six responded, resulting in a 40% response rate. Some of the questions are analyzed below:

a. Question: Are property developers willing to enter into partnerships with the universities to develop student housing?

95% of property developers responded that they will be willing to enter into partnerships with universities to develop student housing. However, in response to a further question asking their opinion on factors limiting property developers entering into PPP with universities, the majority of developers sighted the lack of capital and PPP legislation as major limiting factors.

b. Question: What return on investment are property developers willing to accept to develop student housing through PPP?

The majority of property developers stated that they would expect a return on investment between 9% and 15%.

7. Discussion

From the above it can be deduced that there is a need for student housing at most, if not all, state universities in Zimbabwe. Students have to live mostly in off-campus accommodation that was not designed for student accommodation and therefore most students are not satisfied with their current housing situation.

Because state universities cannot, for various reasons, afford to build on-campus student accommodation such as hostels, the obvious solution to address the problem would be PPP. However, this research project has highlighted the following problems regarding PPP in Zimbabwe:

- Legal framework. It has been mentioned that currently there is no legal framework that guides the operation of PPP in Zimbabwe. This lack of PPP legislation causes skepticism and uncertainty as to the procedure of conducting PPP. Property developers in Zimbabwe highlighted that for PPP to be successful, it is necessary for the country to have a well-established system of commercial laws that protect private sector interests.
- Lack of finance. This was mentioned by the dean of students as a major problem that is limiting the development of PPP in Zimbabwe. Property developers also echoed similar sentiments and mentioned that banks and other financial institutions are not willing to finance PPP projects due to political and institutional risk that is prevalent in Zimbabwe. An example of such institutional risk is the possibility that the government may decide to amend property rights or re-negotiate terms of a PPP. Such possible amendments pose a risk to PPP which are typically long term agreements between the government and private sector.
- Absence of PPP culture. Currently there exist a largely socialist culture in Zimbabwe, where it is expected from the government to provide free education, accommodation and infrastructure. This could be a hindrance to the development of PPP as students at state universities (as well as their parents) may find it difficult to accept privately owned and managed student housing.

- The viability of PPP schemes. Although a full feasibility study has not been conducted in this study regarding the viability of a PPP student housing development, it can be expected that such a development for, say, 800 students paying USD100 per month, based on current rentals, should be viable. Such a development would generate an annual gross income of USD9.6 million, which can be escalated over the 20 years of the duration of the PPP, and should be sufficient to provide an acceptable return on the investment, especially if the university provides the land for the development. The concern, however, to this viability is the risk associated with student's inability to pay rentals on time as the majority of students finance their housing needs through parents' income, which may not always be reliable.

8. Recommendations

Emanating from the above research the following recommendations can be made towards contributing to the success of PPP in Zimbabwe:

8.1. **PPP legislation**

The country should have a PPP legislation enacted as an Act of Parliament which will cover student housing partnerships between universities and private developers. This Act should include a student housing manual and the establishment of a PPP unit or agency which will oversee operations of PPP in student housing.

8.2. **Lack of finance**

Universities should attempt to attract private developers from other countries, as local developers indicated that they do not have access to finance. Therefore, universities should attempt to lure international private partners who will provide finance through foreign direct investment.

In order to make it attractive for such foreign investors, universities should provide a guarantee to private developers in case students fail to pay rentals. This will safeguard the rental income needed by private developers.

Furthermore, the government can give tax benefits to private parties in the PPP development as a further incentive.

8.3. **Type of accommodation**

This research did not cover the size, type, etc. of accommodation that can be provided. Thought should, however, be given to the grading of student rooms to make the accommodation more affordable for students. There can be, for instance, basic rooms with two to four students sharing a room. This will be cheaper than a standard room for a single occupant.

As the majority of students sighted power cuts and water shortages as major problems in private accommodation, PPP developments should look at providing alternative power sources such as solar power for lighting, and low pressure gas (LPG) for cooking purposes.

9. Conclusion

Although this research was based on a single case study with a relative small population, it can be stated that PPP between state universities and private developers can be used as a viable option in the development of some of the student housing backlog in Zimbabwe, provided that the recommendations mentioned above are put in place. It is doubtful, considering the economic and other constraints in Zimbabwe as discussed before, that PPP will be able to solve this problem alone, and therefore other alternatives should be investigated. In this regard Scott (2015) mentions that in the UK the privately owned purpose –built student accommodation market has become increasingly popular with students. Such accommodation differs from typical university residences as the accommodation is let directly to students, rather through the university.

Areas that need further research are the following:

- Analysis of a legal framework of PPP in student housing
- The effective management of on-campus student hostels
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Sustainability and Environmental System

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The role of effective contingency planning in managing extreme disasters in UAE

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Abstract:

The ability to manage extreme disasters of any type and their aftermath has been observed to be a challenge for government. This is because extreme disasters are known to disrupt and harm social, economic, business, human welfare and the environment when preparation for them are inadequate or ineffective. Complex, extreme or catastrophic events have inherent characteristics which put a considerable demand on time, communication and other forms of resources which are at times limited or unavailable. This shows that inadequate preparation for disasters can have significant impacts on the environment and people. While the scale of disasters and level of their impact are sometimes difficult to determine prior to their occurrence, it is still the responsibility of emergency organisations to prepare to manage them. The UAE and many countries in the world have had their share of difficulties manage extreme disasters. This is because extreme disasters become complicated quickly, unpredictable in scale and can impact many people at once. Thus this paper will analyse case studies of extreme disasters in the UAE. The paper defines extreme disasters and examines the capabilities of current practices in the UAE in responding effectively to them. Challenges, drivers and barriers will also be identified and critically evaluated. This will enable the paper to achieve its aim which emphasises the importance of contingency in UAE to manage disasters. The paper will benefit both academic and professional field of disaster and emergency management.

Keywords:

Contingency planning, Emergency Management, Extreme disasters, Planning, United Arab Emirates

1. Introduction

Incidents which have occurred across the world including the United Arab Emirates (UAE) in the last decade have put the disaster response arrangements to test. While some of these incidents have recorded fatalities, many had significant impact on the public and livelihood (Sylves, 2006). The response to some of these incidents have shown that it can be challenging to effectively manage and mitigate the impacts of large scale or complex incidents (Perrow, 2011), therefore emphasising the need to improve planning and ensure that response to all types of incidents is more effective (Renn, 2008). Although many countries can boast of sufficient levels of expertise, equipment, communication and collaborative arrangement to manage any type of incident, the extent of impact some of these incidents have caused have proved that more needs to be done (Neef and Shaw, 2013). According to Neef and Shaw (2013) recent disaster reports have identified that factors such as time pressure, operational issues, and logistical infrastructure and insufficient capacity often hinder response to extreme events (Perrow, 2011). For example even though resources had been allocated and planning had been done for large scale hurricane in form of exercise, when hurricane Katrina made landfall in

2005 in United States of America (USA), the extreme way the disaster occurred overwhelmed all planning and resources (Sylves, 2006). The lessons learnt from Hurricane Katrina disaster suggest the need and importance of being better prepared for any unforeseen or extreme incident which might prove complex to manage or occur in unprecedented scale.

Therefore, the aim of this paper is to develop guidelines based on best practices which have been identified from case studies of extreme disasters evaluated in this research. The guidelines developed as a result of this research is expected to help UAE government authorities to manage extreme disaster through effective contingency planning. To achieve this aim, this paper analyses case studies of extreme disasters in the United States of America (USA), Japan and United Arab Emirates (UAE). The paper draws from existing literatures, reports and accounts of some of the extreme incidents in these three countries. The definition of extreme disasters are identified and clarified in through these literatures, while lessons drawn from these lessons also emphasised the need for contingency planning. In order to achieve the research aim, this paper is divided into four main sections which include a section on disaster management in general, another section on definition and case studies of extreme disaster. Subsequent sections focused on explanation and role of contingency planning in mitigating and improving response arrangement to extreme disaster and ways forward in managing future extreme disasters.

2. Disaster Management in General

Events which are hazardous are described in different ways and they can be considered as incidents, emergencies, disasters, accidents etc. depending on the number of organisations involves, coping capacities of organisations and the scale of the event (EMA, 1998). This is because disaster can be defined as an unplanned devastating event that causes severe damage to mankind, environment and which exceeds the capacity of local response but requiring external support from other countries to manage (Haddow et al, 2006). This as it may, EMA (1998) define emergency as any event, actual or imminent which endangers or threatens to endanger life, property or the environment and which requires a significant and coordinated level of response by two or more emergency agencies (EMA, 1998). It can also be an unplanned situation arising from accident or error, in which people and/or property are exposed to potential danger from hazards (EMA, 1998; Perrow, 2011). As such for several years, the argument between the difference between disaster and emergency is largely based on scales and impact (Rosenthal *et al.,* 2008) which has caused many countries with good emergency capacities to move more towards the usage of emergencies rather than disasters.

However the scale of some of the disruptive events has brought the term disaster more into frequent use in developed countries to emphasize the significant impacts of some events. This is considered the case in the United States of America (USA) and Japan who have experienced large scale or unprecedented scale of disruptive events in the last two decades. Irrespective of whether the foreseen hazards or imminent events are disasters or emergencies, the process for managing them are subjected to the same management process. This process is called emergency phases which are; mitigation (preventive or reduction), preparedness (readiness), response and recovery (rehabilitation) (Alexander, 2002; EMA, 1998). This phases are important to emergency and disaster management as a whole.

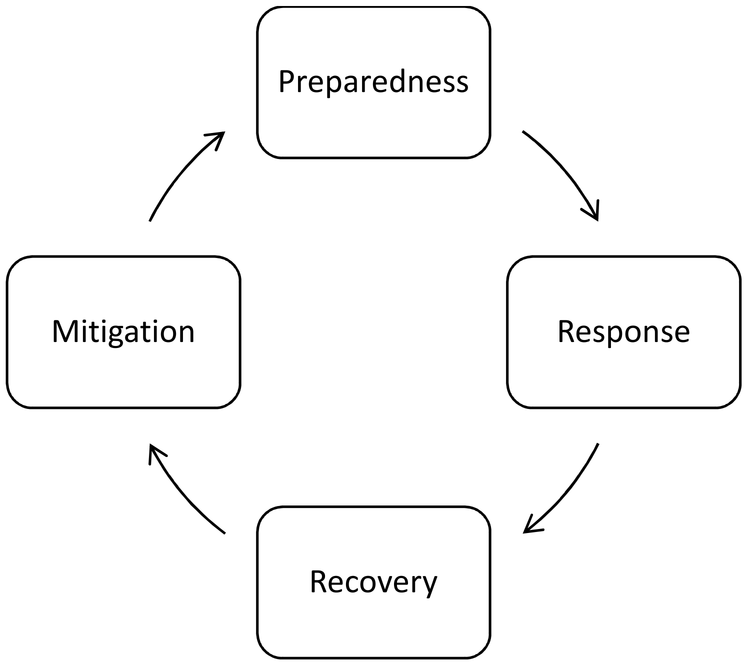

Figure 1. Emergency management cycle (adapted from Alexander 2002; Haddow et al 2006)

This cycle shows that there are four phases which interact as a process that begins at any point in the continuum of the process (Haddow et al. 2006). However, usually measures are taken from the mitigation or preparedness phase to prevent an event or to reduce the impact of event which are foreseen to occur (Lindell et al. 2006). The preparedness phase involves the planning for various emergencies and the documentation of plans, procedures, and test of effectiveness of capacities to respond to foreseen events (Andrew and Carr, 2013). This phase is followed by response phase if the events occur and then the recovery phase will be based on the effort to resume formal activities. The impact of any event often determine if the recovery will be multi-stepped process with several other intermediate steps that will ensure eventual recovery (Alexander, 2002). This is probably why Lindell et al. (2006) states that after every event, the process should be started again with a post event evaluation which can help to improve mitigation and planning efforts.

This explanation suggests that emergency or disaster management cycle usually begins with mitigation and preparedness phase and ends with the need to improve planning efforts. According to Alexander (2002) and Haddow et al. (2006), the preparedness phase entails a planning process which is collaborative and collective efforts through which agreement are reached and documented between people and organisations to meet their emergency management needs of the community. The preparedness phase also involve the formal documentation of a plan which contains the scheme of required responsibilities, actions and procedures assigned to emergency organisations in the event of any incident (Neef and Shaw, 2013). Thus, the preparedness phase is very important for effective response and for the occurrence of any event to be properly managed and mitigated (Boin and Lagadec, 2002). It can also be inferred that if this phase lacks coordination, which leads to assigning responsibilities, action and procedures for response, then events will have significant impacts (Eiser et al 2012). It is rational to conclude that if any event occurs on a scale which is unplanned for, or if it is unforeseen, or the event escalates rapidly as observed during extreme disasters, then response will be problematic. Therefore the emphasis for contingency planning and its need is influenced by the possibilities and evidence of events occurring in an unprecedented scale, in an extreme manner or unforeseen period of the year.

2.1. **Extreme Disasters**

Extreme disaster can be described as any event with initial physical phenomena like flooding, tsunami, earthquakes, terrorist attack, war, fire, motorway accidents etc. which is escalated by human components other than related to climate change that result in consequential physical impacts with severe outcomes on human, society and ecosystems (Ritchie 2004; Perrow 2011). It can also be described as a rare and usually very severe event with great magnitude which exceeds regular occurrence with impacts that overwhelms capabilities of regular emergency response organisations (EMA 1998). This explanation of extreme disaster eliminates the influence of human factors as the agent of escalation (Coombs, 2009), but emphasises the event itself as one which is rare and with greater magnitude than capacity of emergency organisations. Also, this explanation does not consider vulnerability as the influencing agent of extreme disaster as argued by Wisner et al. (2004), but considers such events as independent ones which occur in great magnitude, beyond expectation and exceeding the response capacity of emergency organisations. This explanation appropriately describes the extreme events such Hurricane Katrina (2005), highway collision (2014, 2013 etc.), Tsunami extreme disaster in Japan (2011) which has occurred in USA and Japan in recent years.

In 2011, an unusual chain of events occurred in Japan which illustrated the potential impact multiple hazardous events can have on a community and in developed economies. On March 11, 2011 a magnitude 9 earthquake shook north-eastern Japan which unleashed a tsunami and then resulted in a level 7 meltdown after the tsunami (Demetriou, 2011). Japan like many countries rely on nuclear power as source of energy, but the meltdown caused by the impact of the tsunami which occurred after the earthquake has left many homeless (Demetriou, 2011). Earthquake of such magnitude and a large scale tsunami were not expected in the northern region of Honshu, but a mere recognition of a big event by a handful of Japanese geologist a decade before the event occurred (Demetriou, 2011). The characteristics of the series of events as they unfolded demonstrates the catastrophic effect of extreme disaster which overwhelmed the capacity of emergency organisations and causing the death of thousands of people who died from drowning (Demetriou, 2011). A situation which emphasises better and more effective planning and response.

In a similar reaction, chain-reaction crash or multi-vehicle collision is motorway accidents involving many vehicles, but caused by bad weather condition (Pearce, 2012). Although chain-reaction crashes usually caused by low visibility conditions, they can also occur when there is good visibility (Pearce, 2012). However, most of the severe accidents have been caused by heavy fog, snow, dust storm, floods and heavy rainfall and have occurred frequently in different scales in USA and in different countries in Europe. In November 22, 2012, there was a chain-reaction crash in Texas USA caused by fog. The event involved over 100 cars, 100 people injured and 2 deaths (Pearce, 2012). While chain-reaction accidents are common in the USA, they occur in unpredictable scale depending on weather conditions and regardless of warning signals put in place.

The characteristics of the two events in Japan and USA suggest the need to have special preparedness arrangements in addition to regular preparedness measures for responding to extreme disasters should they occur and when they occur. These events occur on scales and magnitudes which are unprecedented or their impacts are unforeseen even when they are regular events due to severe weather conditions. While these characteristics indicate the predictable nature of extreme disasters, the difficulties of responding to them is yet to be better prepared for. Furthermore, the rate these events escalate, involving many people and cause vast impacts is generally acknowledged (Moynihan, 2008), but unfortunately the planning for them have not measured up to the required response capacities required.

2.2. **Extreme Disasters in the UAE**

In March 2014, the Abu Dhabi Police (ADP) operations received 2,156 traffic calls with 1,828 incidents in Abu Dhabi and 328 in Al Ain due to incidents caused by flooding from people living in Al Reef, resulting in traffic on Al Samha Bridge (Bell, et al. 2014). Similarly in January 2014, the police command room in Dubai received 2,198 calls between 5am to 2pm on rain-related incidents (KT Team, 2014). Although this incident resulted in the death of one person on Shaikh Mohammed Bin Zayed Road where flood water had accumulated, there were injuries to people and near misses. But more severely, in 2008 and 2011 there were motorway accidents caused by fog and low visibility. The 2008 incident which occurred in March and resulted in 3 deaths, 347 injured people and about 200 cars involved (Alshamsi, 2012). Although, the 2011 incident was less complex as the cars did not catch fire like that of 2008 incident, the 2011 incident however resulted in 1 death, 61 injured people and 127 cars (Alshamsi, 2012). Incidents of this dynamic nature have continued to occur in the UAE since emphasising the importance of contingency planning.

These series of incidents directly caused by bad weather or weather related issues have continued to cause planning and response concern for emergency services in the UAE especially ADP who take a lead on every emergency, crisis and disaster in the UAE. The pattern of extreme disasters in UAE also suggest the need for special preparedness and planning which can increase awareness, warn and response to them. Based on general observation of trends of incidents in UAE, it seems the incidents tend to escalate quickly in similar manner as those in US and Japan. While the disaster in Japan is due to large scale natural disaster which further triggered nuclear emission, and that of US is caused by severe weather such as snow or fog which resulted in multiple collision of cars, the events in UAE is also caused by severe weather resulting in multiple car collision. Thus, extreme disaster as explained here seems to have similarity in terms of scales, unprecedented occurrence and/or mixture of natural and man-made incidents which make them complex to manage (Perrow, 2011). However, while snow, fog, earthquake and tsunami are common hazard events in US and Japan, rain and flooding are not common events even though fog is a common occurrence. This probably accounts for the high level of incidents which occurred in 2014 January and March due to rain and heavy flooding.

3. Contingency Planning

Contingency planning provides guidance for managing catastrophic events by defining who possess the capabilities, resources and ability to coordinate response to foreseen, unforeseen and extreme disasters (Knight 2001). Contingency planning is also considered as measures developed to prepare for and to react to possible event change which exceeds normal response efforts but whose impact can severally affect security, resources, assets, human and the society (Schneider 2004). These two definitions indicate the relevance of contingency planning for increasing preparedness for and response to extreme disasters. It also infers that contingency planning needs to be based on realistic parameters for response with detailed planning and preparedness (Choularton, 2007). An understanding of contingency planning is important because lack of understanding of its meaning, application and relevance can potentially lead to in effective response to an extreme event of disaster.

According to Choularton (2007), contingency planning has been confused with emergency preparedness and disaster management and as such, the adequate measures which need to be put in place for managing extreme events are omitted. Emergency preparedness is made up of activities which are put in place in anticipation of a risk, hazard or actual or eventual emergency to expedite effective emergency response (Choularton, 2007:p4). Within the context of this definition, emergency preparedness include contingency planning, but not limited to plans, exercise, training, organise and equip, review of plans, early warning, public education and information, etc. (Knight, 2001, Choularton, 2007). Therefore, contingency planning is often used to determine the scope and mechanisms for preparedness in respect to location, potential emergency and the type of organisations that needs to be partnered with to implement the contingency procedures (Boin and Lagadec, 2002). Consequently, the outcome of the contingency planning process leads to developing a contingency plan which is a document. According to Choularton, (2007) this document describes the procedures, response strategy, implementation process, operational support, and which formalises the commitments of organisations, equipment, and expertise to respond to extreme events.

Thus, the main difference between contingency planning and other types of emergency planning is that while emergency preparedness revolves around planning to respond to known emergency situation and identified risks, contingency planning is planning done based on predictions of previous events and assumptions about potential events which can have significant consequences (Choularton, 2007; UNHCR, 2011). So while emergency preparedness covers normal emergencies and incidents, contingency planning are central to ensuring that extreme events are adequately managed without causing any devastating impacts. The case studies have provided some insights into the characteristics of extreme events which can caused by natural hazards and compounded by human activities due to lack of contingency planning and response. This lack of contingency planning is also evident in the UAE since many emergency events in the country in the past eight years has either escalated quickly or were extreme events.

3.1. **Lack of contingency Planning in UAE**

According to Knight (2001) and Choularton (2007) contingency planning is most effective when carried out along the parameters of a well-defined and functional emergency preparedness framework. According to FEMA (2015) emergency preparedness or planning frameworks presents an important progressive step which describes how levels of government, the private sector, nongovernmental organisations and the public in general work together to build and sustain the capabilities needed to prevent, protect, mitigate against and respond to the threats and hazards. Furthermore, framework informs processes which can be organised in order to improve a nation's preparedness efforts (FEMA, 2015). This is also called preparedness system which can be used to influence decision, activities and plans which are used as proactive approach to mitigate the impacts of all types of incidents (FEMA, 2015). According to Andrew and Carr (2013) preparedness efforts are ongoing efforts to ensure safety and collaborative planning which can ensure that risks are mitigated.

The emphasis on mitigation and preparedness and ensuring that preparedness efforts, plans, capabilities are effective and appropriate is due to the nature and complexity of incidents, disasters and emergencies (Perrow, 2011). Andrew and Carr (2013) and Perrow (2011) further state that in the current built environment, any incident can be challenging to manage without the back-up of any framework, systems or coordinated arrangement deployed by competent organisations. With this understanding, the legislative framework to guide emergency management practices are evident in the UAE, however there is no type of planning which fits the description of contingency planning in the UAE. While there are preparedness arrangement to respond to normal incidents (Bruins, 2000), the manner in which emergencies have occurred and escalated in the past decade in the UAE indicate the absence of contingency planning. Thus, the need for contingency planning which can be used to mitigate the impact of, prepare for and protect against and respond to the occurrence of extreme incidents when they occur next in the UAE as they have been occurring in the past decade.

The absence of documents referring and outlining the procedures for preparing for emergencies in general confirms the lack of preparedness framework as well as contingency planning. While there is a National Response Framework (NRF) (NCEMA website) which have been developed using the emergency management standard in the United Kingdom, there is no preparedness framework or cycle which guides the planning process. This major gap does not only limit effective planning for normal emergencies or incidents, but ability to initiate effective contingency planning process and develop a contingency plan. Therefore, the importance of contingency planning does not only justify its relevance to ensuring that extreme events are effectively managed, but has also helped to identify the gap with the preparedness phase in the UAE.

3.2. **Roles of Effective Contingency Planning**

In a world filled with ever-changing activities, emergencies and disasters have occurring any time due to a range of human error or factors to extreme acts of natural large scale hazards events (Haimes, 2009). The role of emergency and disaster planning in general is to reduce the chances of these emergencies happening and if this cannot be done, the aim becomes to reduce their impacts on people and the environment to the minimum. While planning is based on identified and prioritised risks peculiar to certain areas, contingency planning can be generic in view of any emergency occurring on a larger scale or extreme complexity (Knight, 2001). Therefore, effective contingency planning is considered as a dynamic process which helps to determine which organisations to engage and how to engage them for both planning for and response to extreme disasters (Alshamsi, 2012). As explained in previous sections, contingency planning does not exist in isolation, but in relation to foreseen extreme events which may happen. Although UNHCR (2011) states that some scenarios might not occur, scenario-based planning which contingency planning ensures still helps to approach planning from a more operational perspective.

Essentially, contingency plan contains response strategies in addition to some basic concepts which can be activated or used to trigger mechanisms for emergency coordination and to determine what should be prioritised for more effective response to extreme disasters. Hence, contingency planning are process-driven, include regular updates but easy and simple to implement (Choularton, 2007). According to UNHCR (2011:p6), contingency planning process can be conceptualised into four basic steps

1. Preparation
2. Analysis
3. Response planning
4. Implementing preparedness

These basic steps links the role of effective contingency planning with ensuring that preparation involves coordinating and preparing for the process which analyses the context and scenarios which can occur. However, this can only be done by achieving the aim of emergency or disaster preparedness through readiness measures that can expedite response, rehabilitation and recovery based on timely and result-driven assistance for the target people (Alexander, 2002). This expected outcome provides a focus for the entire preparedness phase as a continuous process which is integrated from a wide range of activities and resources and which requires contributions of many different areas, inclusive of contingency planning.

Thus, while concept of preparedness covers measures aimed at enhancing safety when emergency occurs (Haddow et al. 2006), effective contingency planning helps to create a synthesis between preparation and analysis of hazards and risks of extreme events (Choularton, 2007; Alshamsi, 2012). A synthesis which is possible by identifying the triggers and early warning indicators of such events during the planning stage and being able to identify them when they occur (Birkland, 2006). This makes effective contingency planning crucial to response strategies and the coordination of arrangements and implementation of preparedness procedures. It is on the basis of the relationship between concepts of preparedness and contingency planning that response strategies are activated, so that responsibilities of response operations are well carried out in response to specified extreme events ((Birkland, 2006). However, being able to understand this relationship as well as the role of effective contingency planning is based on ability to learn from patterns and dynamics of past extreme events and in-depth understanding of risks and hazard management in built environment.

4. Conclusions and way forward

This paper has examined disaster and emergency management in general. It has also drawn in the importance of preparedness phase and its concepts for ensuring public safety. However, the review of extreme disasters in Japan, US and UAE has helped to identify the need for more tactical type of planning for event of such nature and dynamics, hence the relevance of contingency planning. An evaluation of what contingency planning is and explanation of the component and basic concept of contingency has helped to emphasize the role of effective contingency planning for both preparedness and response phase. Although effective contingency planning is not an end in itself, it is a tool for enhancing response to extreme events which can be catastrophic in their impact. This paper has also stated the lack of contingency planning in the UAE, although the continued occurrence of extreme events in the US does not indicate the presence of contingency planning either.

However, this paper has been able to provide an understanding of contingency planning and the importance of having a contingency plan which is developed in anticipation of scenarios which need dynamic response strategy especially in the UAE. In view of progress, this paper has contributed to the field of emergency and disaster preparedness with more focus on better planning for extreme disasters and complex emergencies using contingency planning. It has also influenced the development of guidelines based on best practices which have been identified from case studies of extreme disasters evaluated in this research. The guidelines developed as a result of this research is expected to help the UAE government authorities to manage extreme disaster through effective contingency planning. Therefore the way forward for this research is to embark on the primary data collection which will provide more in-depth explanations of the current emergency preparedness practices in the UAE. Thereafter, a conclusion will be drawn from the research findings to determine the appropriate measures to take in the UAE so that response to future extreme disasters will be more effective and mitigate the impact on people, properties and the environment.

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Motivational Factors Employed in the Ghanaian Construction Industry

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Abstract

This paper presents the factors that promote positive motivational behaviour among construction workers to improve production at construction site. Productivity is directly linked to motivation and in turn dependent on productivity. Suitable motivation is a contributor to maximising workers' productivity. It is known that lack of motivation contributes to high employee turnover in the industry and this might have contributed to the declining productivity observed in this industry. This paper therefore seeks to unravel the factors that affect construction workers' motivation, impacts on workers' performance and overall productivity. A survey was conduction on 32 active large building construction companies which were selected through snowball sampling approach. A total of 183 questionnaires were administered to site managers and workers selected via accidental sampling. Frequency index was used in analysing the rated motivational factors and ranked. Kappa statistic for multiple raters was further employed to test the level of agreement between respondents. The survey revealed five significant motivational factors that impact positively on construction worker productivity in Ghana. These include: teamwork, late payment of interim certificate, communication, opportunity to undertake challenging task, and work based on contract. The paper therefore makes practical recommendations to improve worker productivity by looking at factors that motivate the construction site worker.

Keywords:

Construction, motivation, performance and productivity

1. Background

The construction industry is one of the largest employment providers in the developing world. An estimated proportion of 25%-40% of direct capital cost of large construction projects is accounted for by site workers and there is the need to maximise the productivity of human resources (Hassan et al, 2013, Ng, 2004). Also, 30%-50% of workers time is spent directly on work hence, there is the need for proper utilisation (Ng et al, 2004). Construction companies in Nigeria applied various non-financial incentive schemes aimed at improving operatives' motivation. This has significantly improved bricklayers' productive time and accounted for 6%-26% of variations in output between block laying and concreting activities measured (Olabosipo et. al., 2004). Considering the fact that the construction industry in Ghana and Nigeria are similar, it can be expected that the introduction of a non-financial incentive will contribute to worker motivation in the Ghanaian construction industry. This will, in effect, enhance workers output and the overall productivity within the construction industry and further contribute to the national economy.

Suitable motivation is a contributor to maximising workers' productivity. It can be inferred that, the low motivation of construction workers has contributed significantly to the declining productivity that cannot be determined in the construction industry. This paper therefore seeks to unravel the factors that affect Ghanaian construction workers' motivation.

All paragraphs are justified. One line space will be added automatically between paragraphs. Do not insert page numbers for your paper. Do not use headers or footers.

Harvard style references are to be used, i.e., Jones (1998) where author's name appears in the text, or (Jones, 1998) where author's name is not cited explicitly in the text. All references should be listed at the end of the paper in alphabetical order. Please follow the pattern given for all references.

2. LITERATURE REVIEW

2.1. **Motivation In The Construction Industry**

Every organisation is concerned with what should be done to achieve a high level of performance through its workforce. This means giving close attention to how individuals can best be motivated through means such as incentives, rewards, leadership etc. and the organisational context within which they carry out the work (Armstrong, 2006). The study of motivation is concerned basically with why people behave in a certain way and it has been established that motivation is concerned with the factors that influence people to behave in certain ways.

The absence of workers' motivation on sites has been known to contribute to high employee turnover (Ng et al, 2004). This has generated numerous attempts over the years at enhancing worker motivation. According to Shun (2004), management is often frustrated by lack of motivation generated by the end of the year bonuses. In a Nigerian study, it was revealed that workers do not work well as a result of feeling cheated hence, affecting productivity negatively (Aiyetan and Olotuah, 2006). There is the need therefore for employees to be well motivated by providing them with right conditions and opportunities. Ng et al. (2004) stated that, an unsatisfactory work environment can have an adverse effect on worker motivation. Individuals within this environment tend to exert minimal effort towards work thereby lowering performance. This has contributed to the dwindling productivity problem confronting the industry today. The labour cost of projects constitutes about 25%-40% of direct capital cost of large construction projects hence the need to address the declining productivity through motivation (Hassan et. al. 2013; Ng et. al. 2004). Table 1 show factors affecting motivation conducted on various studies.

Non empirical evidence shows that financial incentive is understood by the craftsmen to be a motivator to improve productivity in the Ghanaian construction industry. In a preliminary survey conducted on 10 organisations, 7 respondents indicated that management is not happy with the output, supervision and productivity on projects. The motivational levels was indicated to be low or fair while the remaining 4 found it high (Adjei, 2009). However all respondents indicated that when the current motivational level is improved, it will go a long way to improve productivity. Workers resign from various establishments or lay down their tools to demand improved working conditions and these impact negatively on productivity.

2.2. **Theories of Motivation**

Various theories have been postulated by theorist to enhance motivation at work places. These theories have been categorised into two namely: (i) Content Theories (ii) Process Theories

2.2.1. Content Theories

These theories attempt to explain specific things which actually motivate the individual at work. These theories are concerned with identifying people's needs, their relative strengths and goal pursued to satisfy needs. These theories place emphasis on the nature of the needs and what motivates individuals. The basis of these theories is that the content of motivation consists of needs (Mullin, 2005). These theories are about taking action to satisfy needs, and identify the main needs that influence behaviour. An unsatisfied need creates tension and a state of disequilibrium. In order to restore balance, a goal that will satisfy the need should be identified and select behaviour pathway that will lead to the achievement of that goal. Not all needs are important to individuals at a time; some may provide a much more powerful drive towards a goal than others. This is dependent on the background and the present situation of the individual. The complexity of needs is further increased because there is no simple relation between needs and goals. The same need can be satisfied by a number of different goals. The stronger the need and longer its duration, the broader the range of possible goals (Armstrong, 2006). The various postulated content theories include:

- Maslow's hierarchy of need theory
- Alderfer's need modified theory
- Herzberg's two-factor theory
- McClelland's achievement motivation theory

2.2.2. Process Theories

These are extrinsic theories and attempt to identify the relationships among the dynamic variables which make up motivation and the actions required to influence behaviour and action. They provide further contribution to understanding of the complex nature of work motivation (Mullins, 2005). Process theory is also known as cognitive theory because it concerns peoples' perceptions of their working environment, the ways in which they interpret and understand. According to Guest (1992) as cited in Armstrong (2006), process theory provides a much more relevant approach to motivation than Maslow and Herzberg. It further stated that process theory can certainly be more useful to managers than need theory because it provides more realistic guidance on motivation techniques (Armstrong, 2006). The process theories are:

- Goal theory
- Equity theory
- Expectancy theory
- Reinforcement theory

Table 1: Factors Affecting Motivation Conducted On Various Studies

Motivational Factors At Work	Source
Material shortage on site	Kadir et ai., (2005) Thomas and Sudhakumar (2014), Makulsawatudom et al., (2004) Mojahed (2005)
Late issuance of construction drawings by consultant	
Inadequate site planning	
Late payment of interim certificate	
Rework due to construction error	
Workers strike due to unpaid work	
Unrealistic deadline for project set by client	
Slow response of consultant's site staff attending to inspection work	
Inadequate site staff	
Poor weather condition	
Poor buildability of design	
Contractor staff absenteeism	
Disrespect from co-workers	
Safety plans	
Provision of equipment for work	
Overtime	
Communication	
Site Congestion	
Job security	
Salary	Barg et al., (2014), Chase (1993)
Promotion	
Worker participation in decision making	
Employee training	
Communication	
Orientation for new employee	
Opportunity to undertake challenging task	
Teamwork	
Work based on contract	Business Roundtable (1989)
Supervision based on leadership by example	
Love and belongingness	
Opportunity to undertake challenging task	
Identification with goal	
Waiting for other crew	Preliminary Survey
Transportation	
Constant disruption of work	
Project confusion	
Working with unqualified persons	
Equity	
Canteen for employee	
Medical care	
Accommodation	

3. METHODOLOGY

The methodology used in this study is questionnaire survey which can be categorised as quantitative research. It is more specific, result oriented and involves the collection of numerical data in order to explain, predict, and/or control phenomena of interest (Mojaheed, 2005). The survey sought perceptions of respondents on the most prevailing motivational factors.

3.1. Design of Questionnaire

Self-administered questionnaires were utilized for the survey and consisted of closed and open-ended questions. Questionnaires were administered to the construction workers and management. Employees' questionnaire was divided into three sections whereas that of management had two sections.

The first set of questions sought information on the construction companies in which the various construction practitioners are employed. The second set of questions dealt with the demography of the construction workers or respondent and the third set of questions was related to motivation. Construction workers were requested to give their opinion on the motivational level within the work environment. In addition to these, a 3-point likert scale was employed to indicate the frequency of the motivational factors where "1" represented low, "2" represented medium and "3" represented high.

The questionnaire for management was divided into two sections. The first section also sought information on the company, ranging from classification, years in existence and worker-strength and status (i.e. permanent, contract and casual). The second section dealt with the factors affecting the motivation of the construction workers in the company. Management were requested to indicate how these factors affect motivational level of the construction workers using the 3-point likert.

3.2. Sampling Technique and Sample Sizing

The targeted group was class 1 contractors and this class of companies was chosen because of the large projects undertaken that requires large numbers of workers to execute these tasks. Non empirical evidence also shows that D1 companies have good organisational set up that lend themselves to refined academic research work than the lower classes of companies.

As a result of the difficulties encountered in assessing the population of the class, snowball sampling was employed in selecting the various D1 companies. This technique was used to overcome the problems associated with hard-to-reach populations (Dragan and Isaic-Maniu, 2013). This according to Berg (1988) cited in Atkinson and Flint (2001), the process is based on the assumption that a 'bond' exists between the initial sample and others in the same target population, allowing series of referrals to be made within a circle of acquaintance. A list of 32 companies was obtained through this technique and a total of 40 sites were visited.

The targeted respondents comprised managers, construction professionals and tradesmen. Managers were asked to provide opinion on the effect the various motivational factors have on workers engaged in the respective establishments when they exist. Tradesmen were on the other hand were asked to give their opinion of the effect of the factors on their motivation which enable them to improve on their productivity or output.

3.3. **Data analysis tools**

Two different analytical techniques were used in analysing the responses from the survey. These are frequency index and Kappa statistic for multiple raters.

3.4. **Frequency Index**

Frequency index explains the usual occurrence or exhibiting of the characteristics of the factors. The nearer the value of frequency index of the identified motivational factor is to unity (1), the higher the effect on worker motivation. A ranking of frequency indices was done to establish the most frequent factors. Kadir et al. (2005) used this method to establish the factors affecting construction labour productivity in Malaysian residential projects hence its adoption

$$\text{Frequency Index (F.I)} = \frac{3n_1 + 2n_2 + n_3}{3(n_1 + n_2 + n_3)}$$

Where:

- n_1 –number of respondent answered 'high'
- n2 –number of respondent answered 'medium'
- n3 –number of respondent answered 'low' (Kadir et al, 2005)

3.5. **Kappa Statistic for Multiple Raters**

Kappa $\hat{k}$ statistics for multiple raters using categorical classifications was employed to test the level of agreement among respondents. This analytical tool is used to test the consistency of values and is employed when there are more than two raters and or subjects. The determination of $\hat{k}$ is demonstrated as follows.

$$m = \sum_{j=1}^{k} x_{ij} \qquad (1)$$

$$\bar{m} = \frac{\sum_{i=1}^{n} m_i}{n} \qquad (2)$$

$$\Rightarrow \sum_{i=1}^{n} m_i = n \times \bar{m}$$

$$\bar{P}_j = \frac{\sum_{i=1}^{n} x_i}{n \times \bar{m}} \qquad (3)$$

$$\hat{k}_j = 1 - \frac{\sum_{i=1}^{n} x_{ij}(m - x_{ij})}{nm(m-1)\bar{p}_j\bar{q}_j} \qquad (4)$$

Where $\bar{q}_j = 1 - \bar{p}_j$

Hence the overall kappa value for occurrence $= \hat{k} = \frac{\sum_{j=1}^{k} \bar{p}_j \bar{q}_j \hat{k}_j}{\sum_{j=1}^{k} \bar{p}_j \bar{q}_j}$ (5)

Where: m = number of different raters

x_{ij} = number of ratings on a subject

i = subject

n = number of subjects

j = category of rating k = number of category

$\bar{m}$ = mean number of ratings per subject $\bar{p}_j$ = overall proportion of ratings

$\bar{q}_j$ = overall proportion of non-ratings $\hat{k}_j$ = kappa value per category

$\hat{k}$ = overall kappa value

Green (1996) explained that a perfect agreement will exist when $\hat{k}$=1.00. Also, a high degree of agreement beyond chance is said to occur when kappa value is $0.75 \leq \hat{k} \leq 1.00$. This means that there is no divergence in response from respondents. In addition when $0.40 \leq \hat{k} < 0.75$, a fair or good agreement is said to exist which gives the indication that there could be the possibility of divergence in opinions but not much. Finally when $\hat{k} < 0.40$, there is said to be the existence of low agreement beyond chance.

4. RESULTS

4.1. Survey Findings

Thirty-two (32) D1 construction companies were involved in the survey. The companies were engaged on 40 construction sites. A total of 183 questionnaires were sent out to 36 managers and 147 workers respectively. A response rate of 73.22% of the 183 questionnaires sent out for the survey was obtained.

Table 2 represents respondents from to the questionnaires.

Respondents	Responses
Employers	28
Project Managers	7
Engineers	14
Quantity Surveyors	18
Foremen	22
Masons,	21
Carpenters	11
Steel benders were obtained	13

In addition the motivational level of workers were analysed. Respondents to this effect were asked to give their perceptions on the effect of the selected factors on motivation.

4.2. Demographic Variables

The respondents of the survey represented construction companies undertaking works in 5 geographical locations namely Accra, Kumasi, Sekondi, Koforidua and Obuasi which were obtained from the implementation of Snowball sampling technique employed. The years of operation of the various companies range between 5-60 years and 19 out of 28 companies representing 67.86% have been in operation for less than 20 years. An average of 18.95 years of operation was observed and therefore, these companies were assumed to have a good setup and in active operations over a fair long time period.

A total of 106 responses were received from 101 male and 5 female worker respondents. The educational level of the worker respondents which included tradesmen and professionals ranged from primary to university education. Figure 1 shows the educational level distribution of the respondents.

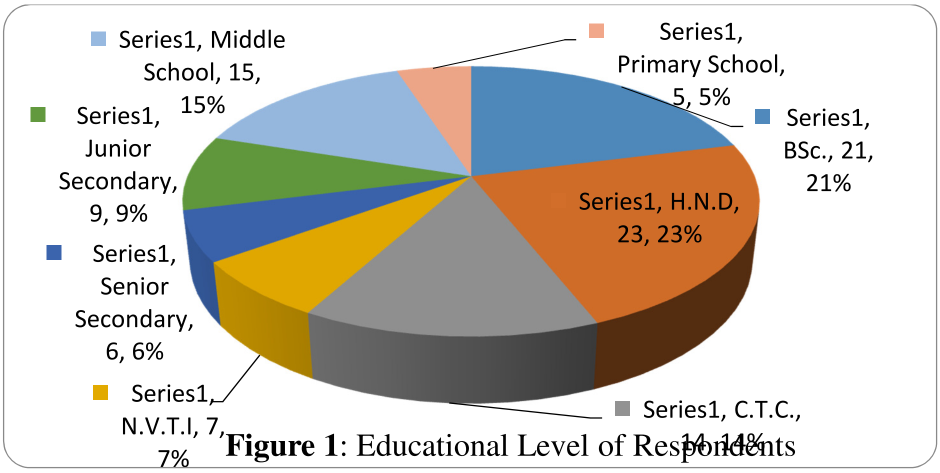

Figure 1: Educational Level of Respondents

In addition, the survey in the area of worker-strength of the various companies revealed that an average of 90 workers were permanent, 67 on contract and 134 were casuals. Although casual workers were reported by managers to be majority in respective companies, 61 out of 106 permanent workers representing 57.55% were interviewed and this resulted in the survey sample size being dominated with permanent workers (Figure 2)

Although 67.92% of the respondents have at most 10years of experience in the construction industry, 79.25% of respondents have been with the present employers for less than 5 years. It can, therefore, be deduced that, workers always changed companies after a short period.

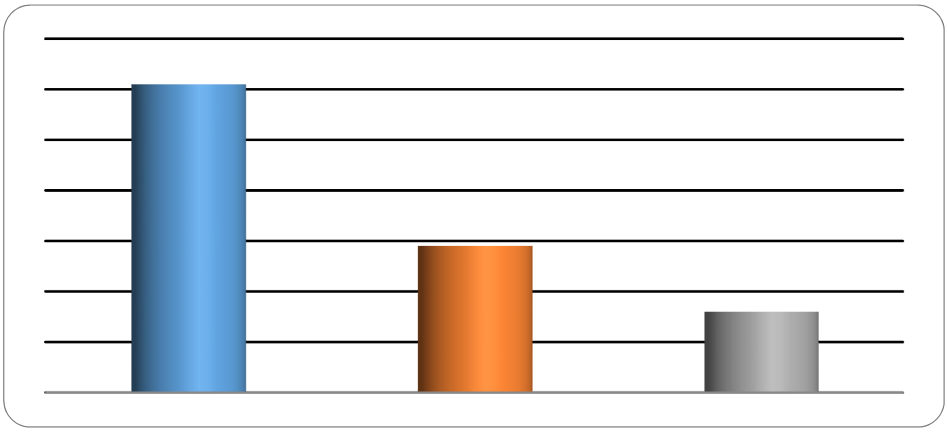

Figure 2: Term of employment of respondents

5. DISCUSSION

5.1. **Response on Motivation Level**

A 2.39 weighted motivation level of workers was computed from responses by managers whereas that from the workers' responses was 2.44. This meant that majority of the workers (i.e. 79.67%) are happy at work. This further gives an indication that there exists a high level of motivation among workers. Workers cited lack of employment in the country and had to be content with whatever environment in which one is engaged. More so, strike actions affect progress of works, hence impact negatively on productivity and therefore, should be discouraged. Strike actions which were revealed by 32.14% and 10.38% of managers and workers respectively were said to have arisen as a result of the following reasons:

- Non-increment in salaries
- Delay in salary payment
- Poor condition of service

5.2. **Concordance of Response**

Kappa statistics for multiple raters using categorical classifications was employed to test the level of agreement among respondents. The agreement among responses on motivation can be tested as follows:

With reference to eq (5)

$\sum_{j=1}^{k} \bar{p}_j \bar{q}_j \hat{k}_j$ = 0.622 and $\sum_{j=1}^{k} \bar{p}_j \bar{q}_j$ = 0.953

$$\hat{k} = \frac{0.622}{0.953} = \mathbf{0.653}$$

From the results obtained, it can clearly be seen that there exist a good level of agreement in responses gathered from the various respondents. This means that there existed a possibility of slight divergence in opinions on individual motivation which can be attributed to the demographic variables.

Table 3: Results of Motivational Factors Employed

Motivational Factors At Work	Response motivation			Frequency Index (F.I.)	Rank (F.I)
	1	2	3		
Teamwork	19	42	71	*0.798*	*1*
Late payment of interim certificate	22	35	72	*0.796*	*2*
Communication	25	44	60	*0.757*	*3*
Opportunity to undertake challenging task	19	62	56	*0.757*	*4*
Love and belongingness	25	55	52	*0.735*	*5*
Work based on contract	19	63	44	*0.733*	*6*
Supervision based on leadership by example	31	45	56	*0.730*	*7*
Provision of equipment for work	31	45	54	*0.726*	*8*
Worker participation in decision making	38	44	60	*0.718*	*9*
Equity	23	58	38	*0.709*	*10*
Identification with goal	33	49	49	*0.707*	*11*
Transportation	35	46	51	*0.707*	*12*
Promotion	37	40	48	*0.696*	*13*
Job security	39	45	42	*0.675*	*14*
Employee training	37	53	40	*0.674*	*15*
Salary	43	37	45	*0.672*	*16*
Safety plans	33	58	35	*0.672*	*17*
Overtime	37	48	36	*0.664*	*18*
Orientation for new employee	36	56	32	*0.656*	*19*
Late issuance of construction drawings by consultant	35	66	29	*0.651*	*20*
Accommodation	55	34	46	*0.644*	*21*
Medical care	55	25	46	*0.643*	*22*
Bonus at the end of project or year	59	29	45	*0.632*	*23*
Slow response of consultant's site staff attending to inspection work	40	60	22	*0.617*	*24*
Constant disruption of work	57	41	37	*0.617*	*25*
Material shortage on site	49	59	24	*0.604*	*26*
Waiting for other crew	49	58	24	*0.603*	*27*
Disrespect from co-workers	53	55	25	*0.596*	*28*
Canteen for employee	65	25	37	*0.593*	*29*
Unrealistic deadline for project set by client	51	60	19	*0.585*	*30*
Poor weather condition	53	54	21	*0.583*	*31*
Inadequate site staff	61	51	23	*0.573*	*32*
Poor buildability of design	59	49	22	*0.572*	*33*
Congestion	64	47	24	*0.568*	*34*
Working with unqualified persons	67	39	23	*0.553*	*35*
Project confusion	66	37	21	*0.546*	*36*
Inadequate site planning	75	37	18	*0.521*	*37*
Rework due to construction error	79	33	20	*0.518*	*38*
Workers strike due to unpaid work	69	39	13	*0.512*	*39*
Contractor staff absenteeism	80	40	14	*0.502*	*40*

5.3. Factors Affecting Motivation

The five most frequent factors that affect worker motivation were summarised from responses from management, professionals and tradesmen in Table 3 and shown in Table 4 below.

Table 4 : Five Most Important Factors That Affect Motivation

Frequent factor	F.I
Teamwork	0.798
Late payment of interim certificate	0.796
Communication	0.757
Opportunity to undertake challenging task	0.757
Love and belongingness	0.736

5.4. Teamwork

Teamwork was ranked first with frequency index of 0.798. This is because a sense of team spirit is more conducive, motivational and productive for workers. This can be attributed to the number of permanent and contract workers which forms 76.12% of the worker respondents. It enables workmates to share ideas and find solutions to problems encountered on a task assigned and increases competitiveness by improving:

- Worker motivation and commitment,
- Productivity,
- Quality and encouraging innovation

Communication, worker confidence enhancement, trust and clarity in expressing ideas are benefits of teamwork. Also less skilled workers will always be motivated to learn from skilled workers in a team as well as contribute to the formation of unionised bodies.

5.5. Late payment of interim certificate

Late payment of interim certificate was ranked the second most frequent factor with 0.796 frequency index. This can be associated with the hindrances to progress of work since it affects cash flow that influences payment to workers and suppliers of goods and services. Vendors retain service to be provided until settlement of full payment that result in shortage of materials and breakdown equipment. Workers will have less resources to work with compared with projected resources and that reduces motivation and also performance. Construction works are capital intensive therefore lock-up capital affects all activities negatively, cause distortion in progress and affect overall performance.

5.6. Communication

With a frequency index of 0.757, communication was ranked third motivational factor. This might have resulted from the influence communication has on factors such as teamwork, participation in decision-making and recognition. The inclusion of this factor among the first five can be supported by the above mentioned factors of which teamwork and recognition or identification with goal happen to be part of the most essential factors.

5.7. **Opportunity to Undertake Challenging Task**

Workers feel motivated being provided with opportunity to undertake challenging tasks using self initiative. This portray trust management have in employees and contributes to performance improvement and this changes behaviour that encourages workers to explore and exhibit personal skills and abilities. Respondents stated that management acknowledges the accomplishment of challenging tasks by assuring them of work regularly and this leads to job security which affirms McClelland (1988) theory which states that high achievers value money as a symbol of successful task performance since salary is not a priority to them.

This factor was ranked the fourth motivating factor with F.I.= 0.757. Aynur and Serdar (2006) revealed that undertaking challenging tasks can be encouraged by providing workers with greater access to key information on projects. This has the potential to performance enhancement in a range of trades. In construction labour motivation, craftsmen should be motivated by giving the right conditions and opportunity to achieve cost effectiveness on projects (Business Roundtable, 1989).

5.8. **Love and belongingness**

Love and belongingness is essential in any working environment and was ranked fifth frequent factor with F.I=0.736. Workers always feel motivated when superiors, colleagues and subordinates show concern and care to one another. The organisation of regular meetings to interact and identify problems of workers makes them feel that they belong to the setup. According to Aynur and Serdar (2006), workers always rely on the company to provide opportunities for social activities after work. The most popular activities are sports and entertainment but sports are the most affordable to all construction companies. This affirms Aynur and Serder's (2006) findings that physical activities are the most preferable among workers. This will, therefore, motivate workers and further enhance their performance which will in effect increase productivity.

6. Conclusion

The study revealed that motivation varies among individual and can be attributed to the age, trade or profession, qualification, years of experience and years with which the individual has been with firm. It can, therefore, be concluded that when attention is directed towards the revealed five factors, it will enhance workers' motivation at their respective establishment that will provide a congenial environment. This will impact positively on performance, hence its corresponding effect on individual and aggregate productivity. It should therefore be the prime responsibility of mangers of construction companies and various players in the construction team to play their respective roles as stipulated on any construction project.

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Organisational Adoption of Sustainable Procurement in the Construction Industry: Development of a Conceptual Model

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Abstract

Sustainable procurement is a growing area of research. Sustainable procurement in developing countries has received little research in the adoption of sustainable procurement in these countries in comparison with developed countries. Moreover, researchers have also bemoaned the lack of theoretical foundation in sustainable procurement research. The objective of this study was to develop a conceptual model to guide the study on effective adoption and diffusion of sustainable procurement in construction organisations.

The study explored the processes involved in the adoption of sustainable procurement and verified the key factors that influence sustainable procurement adoption in construction organisations by building an integrative model grounded in the diffusion and adoption approach. The study utilised the Innovation Diffusion Theory (IDT) and Technology-Organisation-Framework (TOE) to develop a conceptual model to explain sustainable procurement adoption process and the factors that influence the various stages of the adoption process. Based on this model, it is hypothesised how sustainable procurement adoption processes are influenced by technological contexts: (relative advantage, compatibility, complexity, trialability, and observability), Organisational contexts (top management support, organisational values, reputation, organisational readiness, employee influence) Environmental contexts: (competitive pressure, regulatory environment, stakeholder's pressure and industry sector) at the construction organisation level.

Keywords:

Adoption and Diffusion, Conceptual Model, Construction Organisations, sustainable procurement

1. Introduction

Sustainable procurement has gained increasing attention within both academia and industry (Walker et al., 2012; Brammer and Walker, 2011; Walker and Phillips, 2009). Walker et al (2012) analysed 35 journals in the field of sustainable procurement from 1998 to 2010. It shows a steady increase in the number of papers dealing with sustainable procurement. The study reveals that from 2009 to 2010, the number of sustainable procurement papers more than doubled from approximately 40 to 100.The Department for Environment, Food and Rural Affairs (DEFRA) defined sustainable procurement "as a process whereby organisations meet their needs for goods, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organisation, but also to society and the economy, whilst minimising damage to the environment" (DEFRA, 2006). In the context of construction, sustainable procurement is a process whereby the client and participating organisations meet design and development requirements in a way that achieves value for money on a whole life basis - so as to generate benefits not only for project stakeholders but also to society and the economy, while minimising any environmental damage (Alkilani and Jupp, 2012).

More companies have accepted the need to include sustainability practices in their policies (Fairfield et al., 2011). According to Myers (2005) the construction industry has its own sustainability agenda; relatively few companies have changed their business paradigm. However sustainable procurement is seen as the vehicle for the attainment of sustainability in the construction industry (Gunatilake, 2013; Glass et al., 2012; Sourani, and Sohail, 2013).The need to include sustainability in construction procurement has been identified by several researchers (Sourani, and Sohail, 2013; Berry and McCarthy, 2011). Adetunji et al. (2008) note sustainable procurement has become a major focus in many industries with the construction industry lagging behind. Laryea et al. (2013) recommend clients to incorporate sustainability practice in their corporate missions, policies and objectives, and procurement approaches.

Moreover Glass et al. (2012) and Belfitt et al. (2011) suggest that currently there is limited research agenda on sustainable procurement in the construction industry. Early research on sustainable procurement has focused on the environmental aspect of sustainable procurement particularly energy and eco-efficiencies (Walker et al., 2012; Meehan and Bryde, 2011). Walker et al (2012) reviewed literature from 2000 to 2010 found environmental aspects of sustainable procurement outnumber those concerning the social aspects by more than two-to one. Environmental aspect of sustainable procurement accounted for about 69% and social aspect contributed to 31% published research papers. Furthermore, the concepts of sustainability research had been conducted mainly in developed countries mainly in North America and Europe, (Walker et al., 2012). Goodland (1995) observed that the 'paths needed by each nation to approach sustainability will not be the same'. Researchers have also bemoaned the fact that little theoretical attention has been given to sustainability research (Grob and Benn, 2014; Hoejmose and Adrien-Kirby, 2012). Laryea et al. (2013) called for more research with theoretical background in sustainable construction procurement studies. The purpose of this paper is to propose a conceptual model for the adoption and diffusion of sustainable procurement in construction organisations.

2. Theoretical Perspective of Sustainable Procurement Studies

Adopting or developing theories of sustainable procurement is scarce (Grob and Benn, 2014; Hoejmose and Adrien-Kirby, 2012; Conelly et al., 2010).This was supported by Hoejmose and Adrien-Kirby (2012) reviewed literature on sustainable procurement from 2000 to 2010. It was revealed that only 3.7 % had theoretical perspectives. Despite that a number of researchers have adopted established theories to study sustainability practices (Sarkis et al., 2011). Carter and Rogers (2008) combined Resource Dependency Theory and Population Ecology; Vachon and Klassen (2006) adopted a Transaction Cost perspective; Sarkis et al (2010) employed institutional theory and resource based theory; So et al., (2012), Grob and Crawford (2008) adopted diffusion of innovation theory. Walker and Jones (2012) used legitimacy theory to study sustainable supply chain management. More recently Grob and Benn (2014) conceptualised the adoption of sustainable procurement using institutional theory perspective. Zhu et al. (2012) also viewed green supply chain management (GSCM) as a management innovation and applies the seminal Bass model to analyse GSCM practices diffusion. In the context of the construction industry, Vanegas and Pearce, (2000) developed a model for organisational change to increase the sustainability of the built environment and Sourani (2013) also in the addressing sustainable construction in procurement strategies by UK public clients developed a theoretical framework.

However Vidal (2009) and Sarkis et al. (2011) note diffusion and adoption of sustainability is poorly understood. Laryea et al. (2013) called for more research in the diffusion of sustainable construction procurement. Moreover there is a need for more focused theory building and testing, and the development of further models and conceptual frameworks that draw closely on sustainable procurement practice (Grob and Benn, 2014; Hoejmose and Adrien-Kirby, 2012;Conelly et al., 2010). However, none of the above mentioned studies or other studies to the authors' knowledge presents a model for the adoption, diffusion of sustainable procurement in construction organisations. This study addresses an existing literature gap by building an integrative model grounded in the diffusion of adoption approach to examine how construction organisations adopt sustainable procurement.

3. Theoretical Foundation

3.1. The Diffusion of Innovation Theory

Rogers (2003) defines the diffusion to be a process by which an innovation is communicated through certain channels over time among the members of a social system. Diffusion of Innovation Theory (DIT) defines an innovation as an "idea, practice, or object that is perceived as new by an individual or other unit of adoption" and is highly predictive of the adoption of new innovations by individuals and organisations (Rogers, 2003). Rogers (2003) provides five main steps in the innovation diffusion process namely (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Rogers, (2003) contends that numerous diffusion studies show that successful adoption of innovations can be predicted from the perceived innovation characteristics of relative advantage, compatibility, complexity' trialability and observability. This study contends that relative advantage, compatibility, complexity' trialability and observability influence the adoption of sustainable procurement in construction organisations.

The literature shows that the DIT has provided a solid theoretical foundation for the innovation diffusion adoption studies especially information technology innovations (Hameed et al., 2012; Premkumar and Roberts 1999). Hameed et al. (2012) adopted DIT to develop a conceptual model for the process of innovation adoption in organisations. Peansupap and Walker (2006) also adopted DIT in construction innovation studies. However, DIT has seen limited usage in the area of sustainable procurement and sustainability adoption studies (Smerecnik and Andersen, 2010; Zhu et al., 2010; Grob and Crawford, 2008). According to Sarkis et al. (2011), Diffusion of Innovation Theory provides a very valuable source of theoretical underpinnings for investigating and furthering research in Sustainable Procurement. Moreover despite the wide usage of DIT in the study of adoption of innovation in organisations, it has limitation in organisational level (Hameed et al., 2012). To correct the limitations, DIT is combined with other theories to describe the adoption process in organisations (Hameed et al., 2012; Thong, 1999).

3.2. Technology–Organisation–Environment Framework (TOE)

Tornatzky and Fleischer (1990) developed the technology-organisation-environment framework described in his book The Processes of Technological Innovation (1990) to study adoption of general technological innovation, which identified three aspects of a firm's context that influence the process by which it adopts and implements technological innovation: organisational context, technological context, and environmental context (Baker, 2012). According to Baker (2012), the TOE framework provides organisational level theory that explains three different elements of a firm's context influence adoption decisions.

Technological context refers to both the internal and external technologies relevant to the firm. This includes existing technologies inside the firm, as well as the pool of available technologies in the market (Baker, 2012; Zhu et al., 2006; Tornatzky and Fleischer 1990). Organisational context is typically defined in terms of several descriptive measures: firm size; the centralisation, formalisation, and complexity of its managerial structure; the quality of its human resource; and the amount of slack resources available (Baker 2012; Zhu et al., 2006; Tornatzky and Fleischer, 1990). Environment context is the arena in which a firm conducts its business (Baker, 2012; Zhu et al., 2006). Its industry, competitors, access to resources supplied by others, and dealings with government (Baker, 2012; Zhu et al., 2006). The TOE model has serve as theoretical foundation in many researches across a number of technological, industrial, and national/ cultural contexts (Baker, 2012).

3.3. Innovation Adoption Diffusion Decision Process

Rogers (2003) presents two stage models for the innovation adoption process: the general innovation-decision process for the context where individual adopters make voluntary decisions to accept or reject an innovation and a process model tailored for the organisational context. He conceptualises five main steps in the individual process: knowledge, persuasion, decision, implementation, and confirmation. Rogers (1995) categorised the innovation process in an organisation into initiation and implementation. Wolfe (1994) suggests ten stages including idea conception, awareness, matching, appraisal, persuasion, adoption decision, implementation, confirmation, routinisation, and infusion. Meyer and Goes (1988) also presented a three a stage innovation decision process: knowledge awareness, evaluation-choice and adoption-implementation. However according to Hameed et al. (2012), researchers have divided adoption process into various stages, all these phases fit into three groups of pre-adoption, adoption-decision and post-adoption stages consistent with Rogers' (1983) model of initiation, adoption-decision and implementation. Sarkis et al. (2011) suggest that sustainable procurement can be viewed as a process of initiation, persuasion, planning, adoption, and confirmation. So et al. (2012) also in context of sustainable procurement developed a conceptual framework using Rogers' (2003) Innovation Diffusion Theory; within a manufacturing supply chain context. The present study adopts three-stage model of initiation, adoption-decision and implementation to distinguish the stages of sustainable procurement adoption by construction organisations.

4. Research Method

The research process commenced with a critical review of literature to identify factors that drive sustainability. The study developed an initial adoption model based on Rogers (1995), Technology- Organisation- Environment Framework by Tornatzky and Fleischer (1990) and innovation adoption process. In the conceptual model the study proposed how these technological, organisational and environmental factors should interact with and within construction organisations during the process of adoption. The next stage of the study is to design a semi structured interview and a survey instrument to collect, collate and analyse data to test the model.

5. Theoretical Development

5.1. Conceptual Model

The study develops a conceptual model based on Diffusion of Innovation Theory (DIT) theory and Technology-Environment-Organisation (TOE) Framework as shown in Figure 1. The study posit sustainable procurement adoption in construction organisations as initiation, adoption decision, and implementation as dependent variables (shown in the middle-right box in Figure

1) and factors that were found to be influential in prior sustainability studies as explanatory variables. These factors are categorised into technological, organisational, and environmental contexts (represented by the three boxes on the left side, top and down of adoption stages of Figure 1).the study hypothesise how technological, organisational and environmental contexts influence sustainable procurement adoption at the construction organisation level.

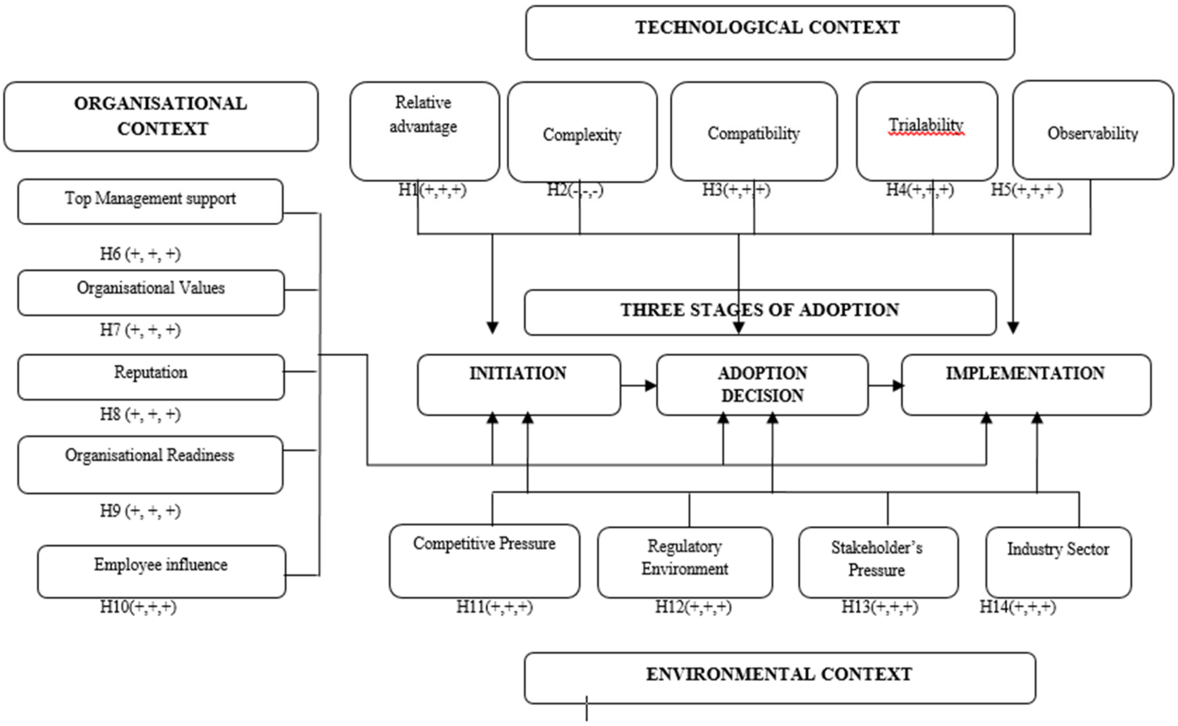

Fig 1: conceptual model

5.2. Adoption process for sustainable procurement in construction organisation

The study adopts three stages of initiation, adoption-decision and implementation. The study initiation stage consists of activities related to recognising a need, acquiring knowledge or awareness, forming an attitude towards the innovation and proposing for adoption (Hameed et al., 2012; Zhu et al., 2006; Rogers, Rogers, 1995). The adoption-decision stage described by Meyers and Goes (1988) reflects the decision to accept the idea and evaluates the proposed ideas from a technical, financial and strategic perspective. The study also considers the implementation stage which involves acquisition, preparing the organisation for use, performing a trial for confirmation, acceptance by users and continued actual use of the innovation (Rogers, 1995).

5.3. Factors Influencing the Adoption of Sustainable Procurement and Development of Hypothesis

Understanding how organisations adopt sustainability practices through innovation can benefit both industry and policy makers (Zhu et al., 2012). Zhu et al. (2012) posit that to understand the diffusion and adoption of sustainable procurement, the factors which promote sustainable practices must first be understood. Consistent with the Rogers's DIT (2003) and Technology-Organisation-Environment (TOE) framework, factors are categories in three contexts. Factors within each context are identified based on the literature review of factors influencing sustainable procurement and sustainability adoption by organisations.

5.4. **Technological Context**

Sustainability adoption is consistent with the five basic characteristics of an innovation: relative advantage, compatibility, complexity, trialability, and observability (Smerecnik and Andersen, 2010; Zhu et al., 2010; Grob and Crawford 2008.Researchers have examined all of the five attributes in the context of sustainability (Smerecnik and Andersen, 2010; Grob and Crawford, 2008). The study adopts the five (5) technological characteristics proposed by Rogers (2003) and equate with the TOE's technological context (Baker, 2012).

Relative advantage is "the degree to which an innovation is perceived as being better than the idea it supersedes (Roger, 2003). Studies have found it to be significant variables, positively related to both the adoption and implementation stages of innovation (Songip et al., 2013; Hammed et al., 2012). Relative to sustainability studies relative advantage has been identified as strong predictor and positively related to adoption (Smerecnik and Andersen, 2014; Zhu et al., 2010). Therefore, it is hypothesised that, when construction organisations' perceive distinct advantages offered by sustainable procurement are more likely to initiate, adopt and implement.

Hypothesis 1**:** Relative advantage is positively related to sustainable procurement initiation, adoption and implementation.

The degree of compatibility between the innovation's characteristics and the current practices of the organisation also impacts new technology adoption (Premkumar, and Ramamurthy, 1995).Sustainability is compatible with procurement criteria of time, quality or price (So et al., 2012).Grob and Crawford (2008) and Zhu et al. (2010) found it to be positively related to the adoption of sustainable procurement. There is a positive relationship with compatibility at initiation, adoption decision and implementation stage of innovation (Hameed et al., 2012).

Hypothesis 2**:** The initiation, adoption and implementation of sustainable procurement are positively correlated.

Complexity is defined as the degree to which innovation is perceived as relatively difficult to understand and use (Rogers, 2003).The adoption of new technology or idea can bring in significant changes to the work practices of organisations (Premkumor and Roberts, 1999).Persson (2009) acknowledges complexity of sustainability implementation in construction works by industrialised countries. According to Smerecnik and Andersen, (2010) the complexity of changing values to adopt sustainability innovations may be inherent in the paradigm shift that is taking place. Organisations tend to consider less complex innovations in the initiation and adoption-decision stages (Hameed et al., 2012; Zhu et al., 2006).

Hypothesis 3: complexity is negatively related to sustainable procurement initiation, adoption decision and implementation

Observability is defined as the degree to which the results of an innovation are visible to others (Rogers, 2003). According to Rogers (2003) observability has a positive influence in the adoption of innovation. The observability of innovations was more significant in the adoption-decision stage of innovation adoption (Hameed et al., 2012). According to Hameed et al. (2012) organisations that have the opportunity to observe others using the innovation have a more positive view of the innovation and are more likely to adopt the technology.

Hypothesis 4: the greater observability of sustainable procurement in the construction industry, the more likely organisations will be initiated, adopted and implemented.

Trialability is defined as the degree to which an innovation may be experimented with limited basis (Rogers, 2003). Trialability is positively related to adoption (Hameed et al. 2012).Sustainability practices can be implemented successfully in one enterprise and their success can be extended to other enterprises (Shaw et al .2010), indicating trialability.

Hypothesis 5: triability is positively related to sustainable procurement initiation, adoption decision and implementation.

5.5. **Organisational Context**

Literature review identified different organisational variables that influence adoption of sustainability in general namely top management support**;** competitive Strategy; reputational issues; organisational readiness; employees influence; and resources and capabilities.

Top management support has been found to be one of the best predictors of sustainability adoption by organisation **(**Gunatilake, 2013; Walker et al., 2008**).** Gunatilake (2013) argues that top management is a key driver for sustainability practice, because top managers are responsible for the organisation's activities and influence the culture of organisations. Previous studies on innovation adoption decision have also suggested that top management has positive relationships to the organisational decision to adopt an innovation (Yen and Yen, 2012; Hameed et al., 2012).

Hypothesis 6: top management support positively related to sustainable procurement initiation, adoption and implementation.

Organisational Values has been identified by researchers to be one of the determinants of sustainability practices (Gunatilake, 2013; Hoejmose and Adrien-Kirby, 2012; Walker and Brammer, 2009; Grob and Crawford, 2008; Walker et al., 2008). Studies show that organisations with strong environmental values and policies are more likely to adopt sustainability innovations (Gunatilake, 2013; Smerecnik and Andersen, 2010; Walker and Brammer, 2009; Grob and Crawford, 2008).

Hypothesis 7: organisational values positively related to initiation, adoption decision and implementation

Employees influence has been determined to be organisational factor in the adoption of sustainable procurement (Hoejmose and Adrien-Kirby, 2012; Gunatilake, 2013).

Hypothesis 8**:** Employees influence is positively related to initiation, adoption decision and implementation of sustainable procurement

Organisational readiness refers to the availability of the needed organisation resources for adoption (Iacovou et al. 1995).Organisational readiness, availability of financial and technological resources (people, technology, expertise) of a firm, has been found to be a key driver of sustainable procurement adoption (Gunatilake, 2013;Hoejmose and Adrien-Kirby, 2012; Grob and Crawford 2008). Rogers (1995) suggests that the availability of organisational resources positively influence the organisational adoption of innovations. Previous innovation adoption studies (e.g. Hameed et al. 2012; Zhu et al., 2006) found organisational readiness to be positively related to innovation initiation, adoption and implementation.

Hypothesis 9**:** organisational readiness positively relate to initiation, adoption decision and implementation of sustainable procurement.

Reputation motivates companies to improve the sustainability of their supply chain (Belfitt et.al. 2011, Glass et al., 2011; Seuring and Müller, 2008). Companies use sustainable procurement as a method of ensuring that their supply chain meets sustainability criteria in order to maintain their reputation (Belfitt et al. 2011).

Hypothesis 10**:** Reputation is positively related to initiation, adoption decision and implementation of sustainable procurement.

5.6. **Environmental Factors**

Environmental factors include external stakeholder's pressure; industry/sector; regulation; and competitive environment (Hoejmose and Adrien-Kirby, 2012).

Competitive pressure has been empirically supported in sustainability adoption literature as one of the major factors in the environmental context (Zhu et al., 2006). Sustainable procurement is often adopted in situations of competitive pressure because it better placed organisations to respond to emerging competitive threats (Zhu et al., 2006). Hameed et al. (2012) and Zhu et al. (2006) found that competition is more important for the initiation stages of innovation adoption.

Hypothesis 11**:** Competitive pressure is positively associated with the initiation adoption and implementation of sustainable procurement in construction organisations.

The regulatory environment has been recognised as a critical factor influencing innovation decision (Zhu et al., 2006).In the context of sustainability Bose and Luo (2011) argued regulatory support in terms of supportive government or state policies and legislation on the national level can help organisations achieve sustainability. The study proposes supportive regulatory environment is a greater predictor of sustainable procurement.

Hypothesis 12**:** A supportive regulatory environment is positively related to sustainable procurement initiation, adoption, and implementation.

The industry/sector has been identified as a driver of sustainability (Hoejmose and Adrien-Kirby, 2012; Glass et al., 2012). There construction sector has received increased attention to move to sustainable practices (Berardi, 2012; Glass et al., 2012). Policies, laws and regulations has pushed the sector to adopt sustainable innovation in terms of products and processes to encourage more sustainable buildings (Hellstrom, 2007).

Hypothesis 13**:** construction industry environment is positively related to sustainable procurement initiation, adoption, and implementation.

Stakeholder pressure and a desire to reduce the risk of negative publicity has been described has a key external driver influencing sustainability adoption (Seuring and Müller, 2008).Yen and Yen (2012) notes that government; stakeholders and customers give rise to pressures toward sustainability upon the focal company in a supply chain.

Hypothesis 14**:** Stakeholder pressure is positively related to sustainable procurement initiation, adoption, and implementation

6. Results and Conclusions

Ghana is implementing a sustainable public procurement to embed the principles of transparency, accountability and sustainability in public procurement by strengthening the monitoring and evaluation system and by increasing the supply of more sustainable goods, works and services procured by the government (Roos, 2012). However, currently sustainable procurement is not fully integrated into the Ghanaian construction industry (Adjarko et al., 2014).Literature has identified several factors that impact the adoption and implementation of sustainability. The study explores the processes involved in the adoption of sustainable procurement and verifies the key factors that influence sustainable procurement adoption in construction organisations. The study proposes sustainable procurement initiation, adoption decision, and implementation as dependent variables (shown in the middle-right box in figure 1). The conceptual model also incorporates the technological, organisational, and environmental contexts. The model is a theoretical combination of Diffusion of Innovation Theory (DIT) and Technology-Environment-Organisation (TOE). The model represents sustainable procurement adoption as a stage-based process, progressing from initiation to adoption-decision to implementation. The conceptual model features technological (relative advantage, complexity, compatibility, trialability and observability); organisational (top management support, employee influence; organisational readiness; reputation and organisational values) and environmental contexts (competitive pressure; regulatory environment; stakeholder's pressure and industry sector) contexts as influence on the stage process adoption.

This paper makes contributions to the literature on sustainable procurement adoption. The study conceptualised three stages in adoption of sustainable procurement, and integrated it with the technology organisation-environment framework. To the best of our knowledge this approach has not been used in previous studies. The study has also added to the development of conceptual model in sustainable procurement studies contextualised in a developing country perspective. In summary the figure shows the key three processes of how adoption and diffusion takes place in a construction organisation: (1) initiation; (2) adoption decision; and (3) implementation. Secondly the framework shows how adoption and diffusion is influenced by technology, organisation and environmental factors.

The study is an ongoing PhD research, the next stage is to collect data to test and validate the model.

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Change management in public agencies to attain low carbon efficiencies

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Abstract:

There is great impetus to implement change in all areas of the UK economy. Key aims are to reduce costs and CO2 emissions, and increase efficiency and growth. There are often difficulties in putting change into practice, evidenced by the perceived lack of progress on 1990s recommendations by Latham and Egan. Change can be most difficult in the public sector, whereby long established ways of working are culturally ingrained. The basis of this research is a comprehensive literature review. It forms the foundation for an electronic survey of practising professionals in a leading government agency that procures major construction projects; findings from this survey will be reported in subsequent work. The survey embraces the whole supply chain of the agency, since many authoritative sources call for integration, and for change to be implemented in partner organisations. The research will also be supported by interviews, both at early stages in the development of the main research instrument, and in later stages during interpretations of findings. The main analytical approach will be quantitative. There is a focus upon the role of leadership in implementing change and judgements are made about whether the knowledge level of practitioners is sufficient to allow them to drive new initiatives. Conclusions and recommendations are made regarding training, knowledge management and Building Information Modelling.

Keywords:

BIM, change, CO2, leadership, procurement

1. Introduction

There is great impetus to implement change in the UK economy but with the distraction of an economy that has been in recession, public sector staff subject to pay restrictions and at risk of redundancy, trying to put change into practice becomes a challenging task. The difficulties of implementing change however, are not specific to the here and now. The UK construction industry has had many attempts to move to a more 'Lean' and innovative industry with recommendations by Latham, (1994) and Egan, (1998) highlighting the need for the industry as a whole to improve. These previous attempts have been limited with Egan stating that "Since 1998 we could have had a revolution and what we've achieved so far is a bit of improvement" (Wolstenholme, 2009). The question then is why have previous attempts at implementing change been received with enthusiasm but the results have been limited in their effect? According to Wolstenholme "the construction industry has been sheltered by a strong economy. This has enabled construction to prosper without having to strive for innovation".

"Today's economic climate is different and offers an opportunity to think again" (Wolstenholme, ibid; GLA Economics 2008 cited in Sundar, 2013). In order to address the underlying issue of whether the construction industry and the public sector will be successful in implementing current Government initiatives for change, further understanding of organisational culture and change is required. The public sector has a long established way of working and the culturally ingrained practices appear to be a barrier to implementing change, whereby the democratic leadership approach results in discussions with unions or employees before organisational change occurs, slowing down the timescale for its implementation and reducing the sense of urgency needed to gain support for change initiatives. Employees in both public and private sectors of construction need to be bought-in to the process for change, in order for this to be successful; the process for change needs to be linked to organisational culture. Understanding whether public sector construction is (or is not) different from private sector construction, is dependent on the individual organisations and the "complex interrelations between organisational culture and organisational climate" (Mehmet, 2006).

A literature review has been undertaken focusing on the implementation of these Government initiatives within the construction industry; the effect of organisational culture on change implementation and the need for clear leadership in organisations to implement and sustain change within the industry through knowledge management and training.

2. Public Sector Construction

The challenge for public sector organisations and their supply chain is to ensure that Government priorities for a low carbon economy, increased efficiency and the introduction of Building Information Modelling (BIM) are fully understood, embedded and prioritised on public sector construction schemes. This is in addition to the demand for construction schemes to be built on time, to the required engineering and environmental quality and cost, and meeting the needs of partnership funding bodies and stakeholders. All of these requirements do not cohesively work together but often result in conflicting priorities, relying on public sector agencies and their supply chains collectively working towards targets set by Government.

The construction industry has been affected by many Government initiatives focused on improvement. The Latham report (1994) highlighted the need for driving productivity and improvements, offering leadership, coordinating the production of Codes, guidance and advice, and setting specific targets for progress The Egan report (1998) outlined the need for committed leadership, focus on the customer, integrated processes, quality driven agendas and commitment to people, all of which still apply to the 'here and now'. However a review in 2009 evidenced the lack of progress in both the Latham and Egan recommendations. The 'Never Waste a Good Crisis' report (Wolstenholme, 2009) suggests that changes have not been wide ranging or self-evident due to the lack of incentives created by a buoyant economy, and it is only since the recent recession within the UK that organisations are having to make cutbacks and demonstrate that they are not only adding value to the work they do, but leading the way with green technology and low carbon initiatives. Moving to a low carbon economy is the right thing to do, for our economy, our society and for future generations (HM Government, 2011). This is supported by the UK Low Carbon Transition Plan, which clearly outlines the implications of a low carbon economy and its effect on the construction industry; however all of this is dependent on the construction industry operating at its best (Innovation and Growth Team, 2010).

The demonstration of how the construction industry is pursuing a low carbon industry to date, is arguably somewhat lack lustre, despite Government setting clear targets. This view is supported by Thornley-Walker (2010) who states that engineers have been given clear advice on their duty through (i) The Institution of Civil Engineers in its 2009 State of the Nation report (ICE, 2009) that recommended that carbon should become a 'key aspect' of all design, and (ii) The Engineering Council (UK) in 2009, which issued its document 'Guidance on Sustainability' (Engineering Council, 2009), stating that engineers should: (a) undertake a comprehensive risk assessment before a project begins, (b) ensure that the risk assessment includes the potential environmental, economic and social impacts, beyond the lifetime of the engineering project or product, (c) recognise the potential long-term aspects of risk, and (d) give sustainability the benefit of the doubt, adopting a precautionary approach where scientific knowledge is not conclusive.

Under the Construction, Design and Management Regulations (CDM) (HSE, 2007 cited in Thornley-Walker, ibid), all those involved in construction have "a duty either to design-out dangers, or to reduce risks to acceptable levels"; this view is supported by the Department of Business Innovation and Skills (BIS, 2010) who state that design can make an impact of reducing CO2 through in-use emissions. However, very few members of construction design teams feel compelled, or justified, to cut down or design-out and replace the high-carbon materials on the above advice or to meet government advice (HM Government, 2005; cited in Thornley-Walker, ibid). The Innovation and Growth Group recognise that Government needs to drive change and innovation amongst the construction community and has stated that "this will involve both push (e.g. legislation) and pull (e.g. incentives to create a market). It will require a definite long-term plan allowing business to adapt and plan ahead to deliver the infrastructure and buildings required for the UK to meet its low carbon targets in the long-term. Without their backing and support there will not be impetus to move forward and work towards a low carbon society. This in turn will aid in trying to change the perception of the general populous" (Bryne, et al., 2010).

3. Implementing new initiatives

For public sector organisations undertaking construction schemes it is not just the organisation itself but the supply chain that needs to be influenced. Implementing change in commercial construction organisations should focus on the need to stand out from their competitors making them more commercially attractive. Understanding the drivers and vision of private organisations and the climate that they operate in, highlights the type of influencing and incentivisation requirements needed by public sector agencies to implement change within their supply chains. As many public organisations operate under specific framework agreements, a set criteria is outlined at framework tender stage with a clear outline of the vision and aspirations of what the public sector organisation wishes to achieve with the support and influence of the private sector supply chain. Such vision and aspiration however needs to lead to economic competitiveness, and is defined as the ability to maintain or expand market position based on cost structure; the loss or gain of competitiveness can be caused by a relative increase or decrease in cost compared with competitors (Sathre and Gustavasson, 2007). However, due to the current culture of the construction industry after initial and basic requirements are met, the cheapest construction materials are usually utilised. This highlights "the importance of the public sector client driving and providing incentives for the use of low carbon dioxide materials in the construction industry" (Ng, et al, 2012).

Similarly the requirement to include carbon emissions in risk assessments has not been emphasised and climate change has been specifically excluded from the UK National Risk Register (HM Government, 2010) on the grounds that it would not affect the safety and security of the UK within a five-year time scale (Thornley-Walker, ibid).

The use of Carbon Calculators within public sector construction schemes enables project teams to demonstrate that they have achieved savings on the carbon output from appraisal, through to detailed design and at construction end. This information is monitored within the public sector and contributes to the carbon target for each agency. Although monitored to ensure that set targets are not exceeded, it falls short in both (i) recording the full carbon figure, as operational carbon is not taken into account, and (ii) failing to actively motivate project teams to prioritise low carbon within their schemes. With no clear project level targets set or the ability to accurately and routinely challenge the cost of low carbon solutions, construction professionals who are frequently in a position to reduce GHG emissions, for example by specifying granular material instead of concrete in many locations, are not adequately incentivised to do so. Utilising the correct incentives or pressures, effort in the design and the procurement processes, could affect changes each week that most members of society would hardly achieve in years (Thornley-Walker ibid). However the current likely outcome is that cheaper cost solutions are prioritised over low carbon solutions, resulting in low carbon targets being missed by the promotion of efficiency targets. This is likely to be due to the level of understanding and ability to see tangible results and cost savings from pursuing low carbon solutions.

The Government's efficiency initiative has tasked public sector organisations to provide a year-on-year efficiency savings on their construction schemes. "An efficiency saving is a monetary saving which has been incurred by undertaking works in a different way or with a different resource, but still achieving either the same output or a greater standard" (Agency ibid). Baselined in 2010, the Government's 20% efficiency target resulted in many quick wins with project teams recording reduced travel and the increased use of teleconference and videoconferencing as an efficiency saving.

Going forward the efficiency target has become more challenging with project teams having to innovate to find alternative solutions to demonstrate actual savings. No longer are these only reviewed at detailed design or construction stage but project teams are being encouraged to identify potential efficiency savings at project start, with contract targets and project budgets being set on the basis of project efficiency savings being achieved. This early reporting and identification of savings to Government, acts as a driver to motivate teams to achieve the savings identified (Agency, 2011). However, for some, the basic identification of savings requires a change in mindset and motivation, to ensure that the innovative use of alternative technology and approach to construction solutions is progressed.

The utilisation of Building Information Modelling has the potential to offer both efficiency savings and cost improvement to public sector construction work. Although BIM has been available to the construction industry for a number of years, it has only recently become a priority for Government whereby clear targets have been set for its use by 2016 (Cabinet Office, 2012). Although for some public sector agencies this may be viewed as a tough target to achieve, it is not so much the achievement of the target, but the suitability of implementing BIM into their organisation and the requirement to identify and define the data requirements required. According to Arayici, et al. (2011) there are several challenges in implementing BIM into the UK construction industry, including "overcoming the resistance to change, and getting people to understand the potential and the value of BIM over 2D drafting;. .. adapting existing workflows to lean oriented processes; training people in BIM, or finding employees who understand BIM; the understanding of the required high-end hardware resources and networking facilities to run BIM applications and tools efficiently; the required collaboration, integration and interoperability between the structural and the MEP designers/ engineers; and clear understanding of the responsibilities of different stakeholders in the new process".

As with the progression of low carbon construction solutions and efficiency savings, BIM requires the construction industry to change the way it works at all levels. For BIM specifically it requires training in new software applications, the reinvention of workflow, how to train staff and assign responsibilities, and changing the way of modelling the construction (Bernstien, 2004; Eastman, et al., 2008; Aryaici et al., ibid).

The lean principles and elimination of waste raised by Egan and Latham form the implementation strategy and focus for BIM (Construction, 2010; Arayici et al, ibid). The confusion for some is that BIM is not just about technology and knowing "what every object is, where it is, how big it is and what it is made of" (Construction, ibid) but about people and process. Ensuring people are engaged in the process and receive the right level of training that allows the organisation and businesses to build their capability, is a core requirement for successful BIM implementation (Arayici et al, ibid). Tekla UKs' Managing Director Andy Bellerby commented in the New Civil Engineer (2012) "the Government's decision to make the use of BIM on all public projects mandatory is a positive step towards prompting this behaviour change". Bellerby also comments that "Specifying level 2 BIM isn't really taking it much beyond where most people are already. Only when you get to level 3 and beyond are you really changing cultures. At the moment the biggest outcome of the mandate is that the industry is now much more aware of BIM". Bellerby fears that it does not go far enough to change a great deal or force a cultural shift. This view is supported by Ayaici et al. (ibid).

The implementation of Low Carbon, Efficiency and BIM can collectively offer mutual benefits with BIM offering greater efficiency and the ability to link Low Carbon to the data held in BIM (Ng, et al, 2012). This collective implementation requires the support of public sector agencies and their supply chains in the construction industry, all focusing on the prioritisation and organisational leadership of these initiatives, and the knowledge sharing and training requirements to make them successful. In order to test the level of success of these initiatives and whether they are fully embedded into the organisation and proactively pursued, an understanding of employee's knowledge is required alongside their view on their organisational culture and ability to implement these initiatives.

4. Organisational culture

Culture is viewed as the foundation that establishes the trust that impacts on the degree at which employees buy-in to change, and highlights the commitment to drive and sustain change. In addition to this, it focuses on employees' willingness to share information and collaborate, which ultimately determines organisation ability to survive disruptions, thus effecting ability to advance (Alavi et al., 2005; Barney, 1986; Janz et al., 2003; Taylor, 2013). According to Gaplin (ibid) there is no single component to describe organisational culture as each element is individual to the organisation, and relies on how each element interacts on a day-to-day basis. Understanding and diagnosing organisational culture can assist in implementing the type of change needed and establishing organisational readiness for change (Burnes, 1996; Sundar, ibid). This view is also supported by Gaplin (ibid) who states that "the primary motive for managing culture during change is to implement and sustain changes. Too often, executives and managers struggle when implementing changes because they don't understand how to make them important to employees".

Gaplin does state that there are ten components that contribute to organisational culture description that can be used to establish which items can be managed to help implement and sustain change: (1) rules and policies, (2) goals and measurement, (3) customs and norms, (4) training, (5) ceremonies and events, (6) management behaviours, (7) rewards and recognition, (8) communications, (9) physical environment, and (10) organisational structure.

Including change initiatives into as many of the ten components as possible will assist in embedding them into the culture of the organisation. Bascal, (2009, cited in Ibbotson, 2009) emphasises that the success of organisational change "requires the understanding of how individuals change, associating this understanding with the specific phases such as Preparation, Acceptance and Commitment whereby an individual gains more of an understanding of the changes and therefore automatically has a positive acceptance of these stages". In contrast Kubler-Ross, (2009) and Fisher, (1999) focus on the psychological changes associated with individual positive and negative feelings and reactions. As each individual and their reaction are different, this poses a risk that can form into negative attitudes towards work. This will in turn make them risk adverse and afraid to innovate (Scott, 1989; cited in Ibbotson, ibid).

The ability for individuals to cope with change varies; for some not enough pressure leads to boredom and low self-esteem, the correct amount of pressure can be a challenge improving performance and innovation, whilst for others too much pressure can lead to feeling out of control and poor quality of work, leading to stress and a loss of confidence in ability (Willis, 2008; Ibbotson, ibid).

Kotter and Schlesinger's (1979) methods for overcoming opposition, although for some mirror Galpin's (1996) organisational culture components, take a step further into how methods for change can be sustained through knowledge management thus: (1) education and communication, (2) involvement and participation, (3) facilitation and support, (4) negotiation and agreement, (5) manipulation and co-option, and (6) explicit and implicit coercion (Galpin, 1996).

Hogg (1996) believes for a public body, employee commitment is the way forward, utilising a marketing strategy of "trust, empowerment and effective communication". However, trust relies on having the confidence that people will do what they say they are going to do or are competent to do the things they say they are going to do (Mink et al.,1993 cited in Ibbotson, ibid).

5. Further research

In order to test the appetite for change and in particular the prioritisation of a low carbon in Public Sector Flood Risk Management projects, a pilot survey has been undertaken to focus on the areas explored within this paper. A quantitative approach is used to obtain results which may be inferred to reflect the whole of the population. The questionnaire comprises 33 questions, which include both quantitative and qualitative answers, and is divided into three main themes: (i) background information, (ii) organisational culture and organisational leadership, and (iii) low carbon initiatives. It has been designed to explore the current culture of public and private sector organisations, and to gain an insight as to whether it is public or private sector organisations leading on low carbon initiatives. Questions were developed based on issues in the literature, with the pilot survey highlighted the need to refine some questions on organisational culture and leadership. It is expected that the survey will result in greater insight into the strategies employed to promote low carbon initiatives and the level of success within each sector. The inclusion of a qualitative narrative has been undertaken to assist the individuals in responding to the implementation of new initiatives and their response to change. The survey was sent to 1000 public sector and private sector supplier staff involved in public sector flood risk management projects, a total of 37 returns were submitted in the three week timeslot. A further 150 automated emails were returned stating individuals were either no longer with the organisation or on long term leave. The analysis and results of this survey will be explored in a future paper. It may be anticipated that, consistent with authoritative sources in the literature being under-whelmed by progress being made to improve construction efficiency, that organisational culture and leadership is lacking and there is insufficient attention paid to low carbon initiatives.

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Managing Project Knowledge in Delivering Sustainable Retrofitted Buildings: A Decision Support Framework

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Abstract

This paper highlights the significance of knowledge management in construction activities, focusing particularly in the case of sustainable retrofitted building projects. It has been acknowledged that the industry has a poor attitude to project learning and the capture of project knowledge. Knowledge has been recognised as a most valuable asset in any industry because of its association with innovation, timely project delivery and competitive advantage. In a knowledge-based industry like construction, the work of the key stakeholders is ultimately about making decisions. However, the contribution of knowledge management to the area of decision-making has been largely ignored in the industry. Decision-making is the processing of knowledge that leads to action. Furthermore, most decisions in the delivery of sustainable retrofitted building projects are complex and interdisciplinary. Thus, there is a need for project knowledge to be managed and presented as a framework to enable the key stakeholders make an appropriate and informed decision. This paper presents a new knowledge management paradigm for assisting key stakeholders that are involved in delivering sustainable retrofitted building projects in making informed decisions. The proposed framework was developed after intensive reviews of the related literature.

Keywords:

Knowledge management, Project knowledge, Decision support framework, Sustainable retrofitted building projects, Key stakeholders

1. Introduction

The construction industry has been recognised as being poor at learning on a consistent basis and it is also particularly slow in adapting to progressive change (KLICON, 1999). The fragmented and sometimes unstable nature of the industry has led to steady loss, or 'leakage' of knowledge compared to other industries (Carrillo *et a*l., 2000, Kamara *et al*., 2000, Orange *et al*., 2003, Shellbourn *et al*., 2006, Anumba *et al*., 2006, Udeaja *et al*., 2008, Tan *et al*., 2010b, Duah *et al*., 2014). Knowledge management has been considered to be a means of harnessing and utilising intellectual resources to address some existing construction problems especially in sustainable retrofitted building projects (Abdul-Rahman and Wang, 2010). It could, of course, be argued that construction organisations have been managing knowledge informally for years, but the challenges facing the industry suggest that it needs knowledge to be managed with a more structured, coherent approach (Hari *et al*., 2005, Tan *et al*., 2006, Petri, 2014) in order to enable better-informed decisions. This is particularly the case with the delivery of sustainable retrofitted building projects: not only has the building sector been targeted to as one of the sectors most responsible for greenhouse gas (GHG) emissions, but also there is a general belief that the sector can address the problem most effectively through retrofitting of existing buildings (Jowsey and Grant, 2009, Ibn-Mohammed *et al.*, 2013). Hence the increased need for decision support frameworks, and these are all the more necessary because every project is unique due to largely variations of scope of work, specifications, geographic locations and discipline requirements (Wang *et al.*, 2009, Zhang *et al.*, 2009).

2. Background

The need to address climate change issues has imposed significant problems and risks to all countries around the world. It is widely-accepted that climate change is one of the all-encompassing global environmental changes that are having harmful effects on natural and human systems, economies and infrastructure. A major contributor to these changes has been GHG emissions into the atmosphere and this has produced a broad spectrum of policy responses and strategies for sustainable development at local, regional and global levels. It is recognised that with the fast increase in urbanisation and industrialisation, more GHGs are released or discharged into the atmosphere (Zhang *et al.*, 2014). Studies revealed that the built environment is responsible for some of the most serious global and local environmental change (Li *et al.*, 2013). In Europe, the Stern report pointed out that the built environment accounts for 50% of GHG emissions while in the UK more than 50 % of all emitted carbon can be attributed to energy use in buildings (Stern and Taylor, 2007). An Australian report has estimated that, in a developed economy, the replacement rate of the existing buildings by the new build is only around 1.0 to 3.0% per annum (ACC, 2007) therefore, rapid sustainable energy improvement is needed in the industry for timely reduction of energy use globally. In the UK, the government aspires to achieve zero-carbon reduction standards for new buildings from 2016 for domestic buildings, public sector buildings by 2018, and by 2019 for other non-domestic buildings (Petri, 2014). However, since an estimated 70% of the 2010 building stock will still be in use by 2050, it is clear that low carbon/sustainable retrofits will have a potentially huge contribution to the GHG reductions proposed by the UK by 2050 (Stafford *et a*l., 2012).

Sustainable building retrofit has been defined as incremental improvements to the building fabric and systems with the primary target of improving energy efficiency and reducing carbon emissions in the building (Fulton *et al.*, 2012). In the UK, the housing stock is dominated by existing homes, a huge number of which are energy-inefficient (Petri, 2014). Retrofitting of existing buildings has been shown to have tremendous economic, health, social, and environmental benefits (USEPA, 2010, Syal *et al.*, 2014). Expanding on the benefits of sustainable retrofitting, different research evidence from around the world continues to support the hypothesis that sustainable retrofit measures and programs result in highly cost-effective investments, even when the narrowest criteria are used (Clinch and Healy, 2003, Duah *et al.*, 2014) and further studies have revealed that it offers a significant opportunity for reducing energy consumption and GHG emissions (Ma *et al.*, 2012, Li *et al.*, 2013). Thus, sustainable retrofitted building projects has been considered as one of the main and best approaches to achieving sustainable development in the built environment (Ma *et al.*, 2012). Additionally, it has been argued that a substantial reduction in energy demand from existing buildings could reduce the pressures on energy security imposed by obtaining energy from potentially unreliable sources (Ibn-Mohammed *et al.*, 2013). However, delivering sustainable retrofitted building projects poses a challenge to the industry due to the relative absence of managed (i.e. captured and re-used) project knowledge (Shellbourn *et al.*, 2006, Petri, 2014). The part played in this by the fragmented and temporary nature of the industry has already been noted, and added to this is the frequent transfer of personnel between projects, the rarity of 'lessons learned' project feedback, and the shortage of skilled workers in the first place (Kazi, 2005, Tan *et al.*, 2010a). Although the industry has been described by (Shellbourn *et al.*, 2006) as knowledge-driven, the management of project knowledge has not been fully adopted and its absence has contributed to a lack of appropriate decision-making (Pietrosemoli and Monroy,

2013) by its key stakeholders. Thus Duah *et al.*, (2014) have highlighted the need for the management of project knowledge to underpin appropriate and informed decision support framework. In turn, DSFs would enable the key stakeholders to make an informed and appropriate decision hence solving the key knowledge issues in stakeholder engagement with sustainable retrofitted building projects.

3. What is Knowledge and Knowledge Management?

It is important to comprehend what constitutes knowledge and what falls under the category of information or data. This is because the word "knowledge" often takes on a variety of meanings (Davenport and Prusak, 2000, Frost and Ueda, 2010) and it is necessary to differentiate data and information from knowledge and what it constitutes. Davenport and Prusak (2000: 5) in describing of knowledge state that '*knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms*'. According to Thierauf (1999) and Bali *et al.* (2009) data are facts and figures which communicate a specific idea, but are not necessarily structured in any appropriate way and it provides no further information regarding patterns, context, etc. It is argued that for data to become *information*, it must be contextualized, categorised, calculated and condensed (Davenport and Prusak, 2000). Information therefore paints a bigger picture; it is data with relevance and purpose (Bali *et al.*, 2009). In essence, information is found in answers to questions that begin with such words as *who, what, where, when, and how many* (Ackoff, 1999). However, since a clear definition has been set between knowledge, information, and data, it is pertinent to go one step further to state the two ways knowledge exists. Knowledge has been recognised to exist both in explicit and tacit forms (Smith, 2001, Shellbourn *et al.*, 2006, Duah *et al.*, 2014).

Explicit knowledge is knowledge that can be codified and documented. This would include such things as project information, design drawing and specifications, cost reports and other information archived in paper or electronic format (Smith, 2001, Zhang *et al.*, 2009). Tacit knowledge is knowledge that is not expressed openly; it is difficult to articulate; which often resembles intuition; and that is a cumulative store based on practice, experience, mental maps, insights, expertise, know-how, trade secrets, learning, skills sets embedded in the past and present of people's experiences, processes and values (Smith, 2001, Hussain *et al.*, 2004, Turban *et al.*, 2005, Taylor, 2007, Lin *et al.*, 2005). Such knowledge is unstructured and intangible, it is difficult to codify (Zhang *et al.*, 2009). It is argued that much new knowledge is created through the synergistic link and interplay between tacit and explicit knowledge (Nonaka and Takeuchi, 1995). In order for knowledge management (KM) to succeed in the industry, one needs to understand what constitutes knowledge as aforementioned and this leads to definition of KM in the ensuing paragraph.

Knowledge management (KM) can be described as the organisational optimisation of knowledge to achieve enhanced performance, increased value, competitive advantage and return of investment, through the use of various tools, processes, methods and techniques (Skyrme and Amidon, 1997). Expanding upon this definition, Frost and Ueda (2010) stated that KM encompasses the understanding of: ''*where and in what forms knowledge exists; what the industry needs to know; how to promote a culture conducive to learning, sharing, and knowledge creation; how to make the right people at the appropriate time; how to best generate or acquire new relevant knowledge; how to manage all of these factors so as to enhance performance in line with the industry's strategic goals and short term opportunities and threats*''.

4. Knowledge Management in the Construction Context

Abdul-Rahman and Wang (2010) have argued that the construction industry's poor record in managing project knowledge results in huge wastage of resources, a detrimental effect to the quality of projects, and a constant 'reinventing of the wheel' (Abdul-Rahman and Wang, 2010). A research survey by Carrillo *et al.* (2004) of leading construction organisations in the UK shows that about 42 per cent have a KM strategy, and 32 per cent plan to have a strategy within a short term (Carrillo *et al.*, 2004). The percentages recorded indicate poor adoption of KM and the need for KM to be properly adopted and utilised in the industry for optimal performance in projects delivery. The success of a construction business in a competitive market relies critically on the quality of knowledge it possesses regarding its markets, products, services and technologies (Faraj *et al.*, 1999, Kamara *et al.*, 2000). The industry has been faced with different challenges ranging from tight time schedules, low profit margins and the complexity, diversity and non-standard nature of construction projects (Zhang *et al.*, 2009). To address these challenges, to remain competitive, productive and profitable, and to adequately respond to the needs of clients, many authors suggests that the management of project knowledge is critical (see, for example, Carrillo *et al.* (2000); Clough *et al.* (2000); Pathirage *et al.* (2006); and Pathirage *et al.* (2007).

Many research studies have given examples of the potential benefits of adopting KM in construction activities. These include: improved decision-making; improved efficiency of people and operations; improved innovation (Al-Ghassani *et al.*, 2004, Egbu and 2005, Anumba and P.M, 2005, Shellbourn *et al.*, 2006, Boddy *et al.*, 2007, Duah *et al.*, 2014). Others include increased flexibility to adopt and change; reduced process cycle times; shared best practices; improved management learning and improved construction project delivery (Skyrme and Amidon, 1997, Davenport and Prusak, 1998, Egbu and 2005). More benefits include: facilitation of the transfer of KM across a variety of project interfaces; increased intellectual capital; improved support for teams of knowledge workers (McCampbell *et al.*, 1999, Soliman, 2000, Al-Ghassani *et al.*, 2004); capacity to retain the tacit knowledge and explore explicit knowledge (Anumba and P.M, 2005, Shellbourn *et al.*, 2006, Udeaja *et al.*, 2008, Duah *et al.*, 2014) and finally, risk minimization (Robinson *et al.*, 2005). The next discussion will focus on the need for managing knowledge in delivering sustainable retrofitting building projects.

5. Managing Knowledge in Delivering Sustainable Retrofitted Building Projects

The lack of managing project knowledge as a hindrance to delivering sustainable retrofitted building projects has been specifically cited by Ala-Juusela *et al.* (2006); Shellbourn *et al.* (2006); Hakkinen and Belloni (2011) and Shari and Soebarto (2012). Hakkinen and Belloni (2011) argued that knowledge management in retrofitted building projects enable the consideration of wide spectrum of aspects including building performance, environmental issues, life-cycle costs and service life, and rapid adapting of the design to the specific requirement case. Robinson *et al.* (2005) agree that the lack of managing knowledge in the industry has posed a threat to delivering sustainable building principles and best practices and go on to conclude that KM principles are essential drivers for all improvements in construction organisations. In managing projects, Anumba and P.M (2005) and Shellbourn *et al.* (2006) agree that to achieve sustainable construction particularly sustainable retrofitted building projects, it is essential that the industry intensifies its efforts to move towards a knowledge intensive mode. Eliufoo (2008) agrees that sustainable buildings can be best achieved if construction activities are informed by new resources of knowledge and expertise.

Dewick and Miozzo (2002) and Pitt *et al*. (2009) argued that institutional challenges and limitations (such as corporate governance structure and the extent of stakeholder ownership) are at the root of the typical absence of KM in the industry and its reluctance to change this. Sayce *et al*. (2007) blame the lack of KM practices between construction stakeholders (which impedes dissemination of knowledge and information) for the reluctance in the uptake of sustainable retrofitted building projects as the lack of technical information and knowledge to manage them poses a challenge to the industry in their delivery. This further supports the contention that KM is a necessity for improving the delivery of sustainable building projects (Shari and Soebarto, 2012). To attain the goals of sustainable construction and sustainable development, it is essential to realise the need for KM to be properly embraced in the industry to manage knowledge issues. The need for KM in delivering these projects is vital in order to have an improved understanding of sustainable issues in the built environment and how key stakeholders grasp varied technologies as a solution in achieving sustainable construction (Anumba *et al*., 2006, Sayce *et al*., 2007).

Returning to the notorious fragmentation of the industry, Khalfan *et al*. (2002) and Shellbourn *et al*. (2006) have argued that knowledge is lost with the movement of people from one project to the other, and that any knowledge that is actually gained in a project is often poorly organised and lack in details without any mechanism or technology in place to retrieve it. This problem has prompted researchers such as Shellbourn *et al*. (2006) and Udeaja *et al*. (2008) to champion KM systems that properly manage knowledge through mechanisms that capture, store, share and reuse it. Such an integrated solution would arguably increase the uptake and effectiveness (from the point of view of their sustainability) of retrofitted building projects (Zhang *et al*., 2009) despite the peculiar difficulties of these projects which are articulated by, for example, Duah *et al*. (2014).

6. Knowledge through Informed Decision-making for Key Stakeholders

Menassa and Baer (2014) described *stakeholders* in this context as the people who directly or indirectly have a vested interest in the building, its operation, and the outcome of a future sustainable retrofit project. They considered that the building stakeholders can include clients, owners, tenants, and investors, building operators, designers (architectural, mechanical, civil and electrical) and project managers. Zhang *et al*. (2009) argued that knowledge will not generate any value unless it is actively used and this can be elucidated in a framework for optimal value. The need for stakeholders in construction especially in sustainable building retrofitted building projects to adopt implementation strategies that promote and support sustainable decisions through knowledge-based decision criteria has been suggested (Pan and Dainty, 2012). Decision support frameworks can assist the key stakeholders to confront uncertainties and ill-structured problems through direct interaction with data and information through managing knowledge (Anumba *et al*., 2006). The use of a decision support framework permits the user to draw upon a well-established pool of knowledge about a given domain to offer advice on how to best deal with technical or business problems (Sprague *et al*., 1989, Power, 1998). Sustainable retrofit projects involve complex processes that are typically unfamiliar to key stakeholders therefore the need to manage knowledge (Shellbourn *et al*., 2006) through an informed decision-making framework is necessary in order to align stakeholders' requirements and determine an economically, socially and environmentally acceptable engineering solution (Lapinski *et al.*, 2007, Klotz and Horman, 2010). During the building project life cycle, key stakeholders make decisions on daily matters based on their knowledge and expertise (Anumba *et al*., 2006, Menassa and Baer, 2014). This makes the domain of sustainable retrofitted building projects ideal for the deployment of a decision support system for many reasons particularly for project knowledge to be properly managed by the key stakeholders to make appropriate decisions for optimal project performance, timely delivery and competitive advantage.

Experience and expertise can be captured and encapsulated in a decision support system that provides a sound technical framework for decision-making (Anumba *et al*., 2006, Udeaja *et al*., 2008, Tan *et al*., 2010b). Sustainable retrofitted building project decisions are also influenced by many micro-level factors such as deterioration and obsolescence of a building, indoor environmental quality as well as social and economic factors (Kaklauskas *et al*., 2005). In order to achieve significant sustainable solutions in sustainable retrofitted building project, Boecker *et al*. (2009) emphasised that engaging all stakeholders early on the project is necessary in order for project knowledge to be well-managed from the early planning stages to help in making an informed decision. The authors further argued that a diversity of values, opinions, expectations and perspectives among stakeholders is to be expected but need to be properly managed to turn it from a liability that can significantly impede project success into an asset.

7. Review of Decision Support Frameworks Developed for the industry

An investigation of the relevant literature has revealed that some studies have developed decision support framework and frameworks for construction projects especially in sustainable construction as it regards to decision-making within the stakeholders. Anumba *et al*. (2006) developed an integrated decision support system to assess existing office building conditions and recommended an ideal set of sustainable retrofit actions, considering trade-offs between retrofit cost, improved building quality, and its environmental impacts. Juan *et al*. (2009) developed a decision support system for housing condition assessment and refurbishment strategies. Juan *et al.* (2010) developed a decision support system to assess existing office building sustainability conditions and recommend an optimal set of retrofit measures that considers the trade-offs between cost, resource consumption, energy performance, and greenhouse gas emissions. Juan *et al*. (2010) developed a hybrid decision support system for sustainable office building renovation and energy performance improvement. Entrop *et al*. (2010) investigated energy performance indicators in Dutch residential dwellings and developed a methodology that incorporated additional revenues within the financial analysis of energy saving techniques. The research integrated a long-term financial gain as a benefit for pursuing sustainable retrofits into the decision-making process and revealed that much shorter payback periods in return on investment (ROI) methodologies could be realised.

Furthermore, Bluyssen *et al*. (2011) presented a quantitative approach to determining the value of single or multi-phase investment in sustainable retrofits for existing buildings by taking into account different uncertainties associated with the life cycle costs and perceived benefits of the investment. The results of a case study in the research indicated that when uncertainty is high, dividing the decision into several phases helps increase the value of the investment and provides stakeholders with flexibility to abandon the retrofit project if necessary. Pan and Dainty (2012) developed a systematic approach for UK house building organisations to identify value-based decision criteria and quantify their relative importance for accessing building technologies systematically. Menassa and Baer (2014) developed a framework to assess the role of stakeholders in sustainable building retrofit decisions. Ibn-Mohammed *et al*. (2013) developed a decision support framework for evaluation of environmentally and economically optimal retrofit of non-domestic buildings, and in 2014 the same authors integrated economic considerations with operational and embodied emissions into a decision support system for the optimal ranking of building retrofit options (Ibn-Mohammed *et al*., 2014). Duah *et al*. (2014) developed a knowledge elicitation strategy to elicit and compile home energy retrofit knowledge that can be incorporated into the development of an intelligent decision support system to help increase the uptake of home energy retrofits. Syal *et al*. (2014) in their research developed an information framework for intelligent and decision support system for home energy retrofits. Zhang *et al*. (2014) developed a multi-criteria decision framework for the selection of low carbon building measures for office building in Hong-Kong. Ibn-Mohammed *et al*. (2014) developed the Integration of economic considerations with operational and embodied emissions into a decision support system for the optimal ranking of building retrofit options.

These studies have addressed some of the issues in delivering construction projects particularly sustainable retrofit projects, but have not addressed the need to properly manage project knowledge through decision support framework by the key stakeholders. Having acknowledged the gap in knowledge as it regards decision-making, this research aims to develop a decision support system that will enable the key stakeholders that are engaged in sustainable building retrofit projects make informed and appropriate decisions to avoid post decision project mistakes and at the same facilitate the uptake of such projects within the environment. The following discussion relates to Figure 1, which is the proposed Framework for Decision Making.

8. Proposed Decision Support Framework

The relevant literature discussed above was fundamental and also helped in the development of the proposed decision support framework shown in Figure 1. The objective of the proposed framework (Figure 1) is to enable key stakeholders involved in sustainable retrofitted building projects make an informed and appropriate decisions in delivering the projects. The processes involved in the framework will help key stakeholders involved in the project to address the knowledge gaps (such as, lack of capturing and reuse of knowledge) towards making an informed decision. The framework consists of eight stages of decision- making.

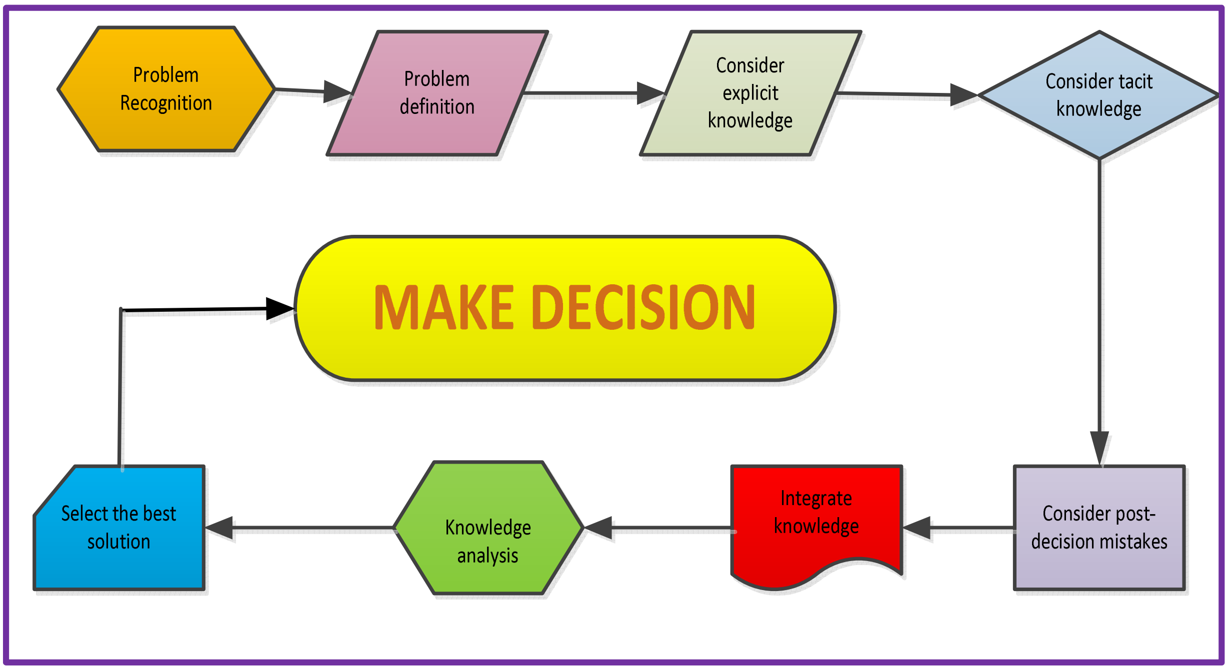

Figure 1. Proposed Framework for Decision Support

The first stage - *problem recognition* - refers to the recognition of an existing problem before going ahead with defining the problem (Courtney, 2001, Shim *et al*., 2002, Zhong, 2008). The the second stage is to *define the problem* and this involves specifying the purpose or decision goals (for example, articulating the parameters of objectives and functions, relationships etc.)

and this leads to the next step which is to consider tacit knowledge. The next step which is the third stage in the process is to *consider tacit knowledge*. The role and relevance of tacit knowledge has been considered earlier in this paper. This type of knowledge is very relevant to the framework's procedure, before making decisions because it would allow all the key stakeholders to make suggestions according to their professional and project experience and this would contribute to making better- informed decisions. The fourth stage is the *consideration of explicit knowledge* that relates to the decision in question. Again, the relevance of explicit knowledge has been afore-mentioned. This is very important in making an informed decision since the knowledge that exists therein has been readily articulated and transferable to others and this leads to consideration of post decision mistakes before making decision.

The fifth stage is the need to consider *post decision mistakes* which *is* very relevant in making an appropriate decision. This suggests the need to avoid past decision mistakes by considering the 'why', 'how' 'what' led to the inappropriate decision made in the past and also acknowledge lesson learned to avoid making same kind of mistakes. Taking this into consideration in decision-making harvests a platform of informed decision successes. At this juncture, steps that have been considered have to be integrated.

The sixth stage is *Knowledge integration* in making decisions has been referred to as the process of combining several types of explicit and tacit knowledge into new patterns and new relations in decision-making. In their study Nemati *et al* (2002) cited the work of Perkins (1986) on the 'Gestalt theory' of learning states; that all problems which may confront us have potential solutions, and these solutions are matters of relations. The authors further argued that our understanding of the problems demand our awareness of certain relations and we cannot solve any existing problem without discovering certain new relations hence the need to integrate knowledge available to make appropriate decision. Drawing conclusions from a number of authors such as (Steiger, 1998, Nemati *et al*., 2002, Metaxiostis *et al*., 2003) integration of explicit and tacit knowledge is the analysis of multiple related 'what-if' cases of a decision-making process and this helps to find new synergy that will determine the key factors of the decision problem and demonstrate how these key factors interact to influence informed decisions.

Following the integration of knowledge, the seventh stage is *knowledge analysis* and this will help the key stakeholders identify relevant knowledge necessary to be captured in order to help select the best solutions before making a decision. It will also assist the key stakeholders to understand knowledge perspectives at deeper level and develop new insights about them which will help in selecting the best solutions for informed decision-making (Goldkuhl and Braf, 2001). According to Cote and St-Denis (1992) this ensures coherence amongst the stakeholders and helps in resolving any decision conflicts that may exist.

The stage eight is penultimate stage in the process which is the *selection of the best solutions* which includes two steps, firstly, is the creation of evaluation indexes and their weight of importance which depends on the key stakeholders' preferences. Secondly, is the actual process of evaluation against the objectives and goals that have been set as explained by (Zhong, 2008). These will be necessary for the key stakeholders having analysed the integrated knowledge gathered. The key stakeholders having selected the best solution will be able to make an informed project decision. The proposed framework will enable the key stakeholders not only to make an informed decision, but also to transfer the decision process to new key stakeholders that may emerge during the project lifetime.

9. Conclusion

The essence and significance of knowledge management (KM) in the construction industry, particularly in sustainable retrofitted building projects has been critically discussed. The discussion in this paper has also been able to establish the need for KM to be properly adopted if the industry indeed wants to champion the cause of sustainable development through sustainable retrofitted building projects. KM has been described as a process that involves the creation, capture, storage, dissemination, sharing, utilisation, and reuse of knowledge. This processes should lead to industry benefits (e.g. innovation, improved performance and competitiveness) if put in place. It is important to note that KM is not an end in itself, but a means towards the achievement of good decision-making that in turn supports business goals. KM should reflect both individual and collective knowledge within the context of organisations, it should be supported by various tools (e.g. IT, frameworks), processes, methods and techniques. Knowledge managed and elucidated in form of a decision support framework as proposed, is necessary due to its relevance in enabling project stakeholders to optimise the benefits associated in delivering sustainable retrofitted buildings and also it helps them to avoid repetition of mistakes and post-decision dissatisfaction. This is because an understanding of what constitutes 'knowledge' has a bearing on the KM decision-making hence the development of the proposed decision support framework for the key stakeholders.

Furthermore, it is pertinent to note that the proposed decision-support framework will enable the researcher to develop a decision-support system prototype after empirical data has been collected from intended case organisations/studies.

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The Application of Behavioral Strategies to Motivate Sustainable Decisions in the Built Environment

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Abstract

This paper addresses the assertion that it is possible to develop behaviour change strategies that motivate people living and working in the built environment to make sustainable decisions. The most recent Intergovernmental Panel on Climate Change (IPCC) Synthesis report concludes that human influence on the climate is clear and that the continued emissions of greenhouse gases will have widespread impacts on human and natural systems. This warning is not new. For over four decades many academics and campaigners have claimed that there is ample evidence that global systems are being destabilised by a combination of the rate and nature of resource consumption, and issues of social injustice. However, even though the evidence supporting the need for sustainable change is available, many people operating either in groups or on their own, and as employees or residents have been slow to act on this information, either to mitigate or adapt to the predicted new conditions. The research described in the paper examines data collected from a number of work-based and residential respondent groups to determine how and in which context people are most likely to be influenced to respond to pro-environmental strategies. Some groups were employees working for companies that were trying to promote sustainable policies or products. In these cases the research aimed to determine whether these goals were reflected in the behaviour of the workforce. Other groups comprised residents who were being encouraged to carry out actions on their houses such as flood protection or energy conservation. The research sets the theoretical basis for the value-action gap, and offers illustrations and case studies to exemplify how this is manifest in populations. The paper concludes that a combination of behaviour change approaches, applied at the same time, may be effective in motivating some people to overcome cognitive and affective barriers and act differently to achieve pro-environment outcomes.

Keywords:

Behavior change, climate change, energy conservation, pro-environmental strategies

1. Background to the Research

The most recent Intergovernmental Panel on Climate Change (IPCC) Synthesis report concludes that human influence on the climate is clear and that the continued emissions of greenhouse gases will have widespread impacts on human and natural systems. It states that global warming is unequivocal and 'limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks' (IPCC, 2014). Specifically, these mitigating and adaptive measures might include the reduction of energy use, the decarbonisation of energy supplies, and the reduction of net emissions. Adaptive measures might include emergency plans or the retrofitting of buildings the anticipation of climate disruption due (for example) violent storms, flooding and drought, periods of extremes of hot and cold temperatures, and communication and logistics disruption.

These warnings of impending and profound change in both human and natural systems are not a recent phenomenon. For over four decades many academics and campaigners have claimed that there is ample evidence that global systems are being destabilised by a combination of the rate and nature of resource consumption, and issues of social injustice (Goldsmith et al., 1972; Homer-Dixon, 2006; and Wilkinson and Pickett, 2009 for example). However, even though the evidence supporting the need for sustainable change is available, many have observed (Elkington, 1997; Egan, 2004; and Porritt, 2005 for example) that people operating in groups or on their own have been slow to act on this information. While the literature does feature work on (mainly) attitudinal social psychology studies that investigate human response to environmental threats including climate change (see Campbell and Kay, 2014; Capstick et al, 2014; and Weintrobe, 2013 for recent examples) there has been relatively little devoted to how these influences affect the choices people make in the context of sustainable change in the built environment.

Schultz (2014) comments that environmental psychologists have worked for decades to understand 'the psychological and contextual antecedents of pro-environmental behaviour'. However, he explains that while many tools have been developed, 'there is little systematic guidance for determining when to use each tool'. The articles and other works that make up the portfolio for this PhD submission are informed by the theories and experimental research provided by those working in the field of social psychology and behavioural science. The author's research focused on a number of pressing issues that affect urban communities. These issues included the take-up of measures that could allow individuals or groups of people to mitigate or adapt to climate change, and to operate in a more pro-environmental or pro-social manner in the workplace or in their communities.

The research covered in this paper spans more than 7 years. The author worked with employers and employees to determine whether motivational techniques including the communication of ethical policies, or training sessions that communicated the importance of sustainability would have an effect on their pro-environmental tendencies in the workplace. Later, the author worked with the Environment Agency to determine if owner occupiers would invest in their houses to mitigate the influence of climate change. Specifically they were asked if they would invest in energy conservation measures and property-level flood protection measures. The remainder of this paper describes the theoretical basis for these projects, and proposes a behaviour change strategy based on the favoured theories and the field work carried out with the Environmental Agency.

2. Theoretical Framework of the Research

2.1. Exploration of the Theoretical Elements that Inform Influences on Sustainable Behaviour

While many might assume that people make decisions based on facts, behavioural scientists have shown over a considerable period of time that the way decision-making is influenced is a much more complex process. Fact-based campaigns do have the capability to change behaviour and can positively influence knowledge or attitudes, but they are largely ineffective at creating lasting changes in behaviour (Schultz et al., 2007). Changes in the law can also be effective, but if they are not supported by the population and do not change attitudes then they not only create a temporary change in behaviour, but they are also difficult or expensive to enforce (Schultz et al., 2007). Further, if the law is unpopular it could influence the political calculation to intervene in people's lives, depending on where law-makers are in the democratic cycle. This finding encouraged the author to adopt a strategy that extended beyond the offer of information and advice.

Dolan et al. (2010) argued that, in policy terms, it is very difficult to change people's minds, but it may be possible to change the context within which people make decisions. To capitalise on this it was necessary to understand more about the human condition and the grain of decision-making. One avenue of investigation was to understand how attitudes are formed. Arnold (2005) describes work that found that different components, some of which fit together but others that do not, mean that changing attitudes is difficult, but not impossible. Secord and Backman's (1969) seminal work defined attitudes as 'certain regularities of an individual's feelings, thoughts and predispositions to act toward some aspect of his environment'. They describe three components of an attitude including an emotional or 'affective' part, a thoughtful or 'cognitive' part, and willingness to act or 'behavioural' part. However, they say that an attitude should not be confused with a guarantee that the individual will act upon it. In other words, it is possible that holding an attitude, even if it is a strong one, will not necessarily be manifested in specific behaviour. The notion of changing contexts and not minds drew the author toward incentives which have the potential to motivate action without necessarily challenging prevailing attitudes.

Swim et.al. (2009) explain that individual decisions about how to react to the threat of climate change are weighed against the likely impact on the life of the individual. The way that people decide to act depends upon the ability to process the following list of factors:

- Threat appraisal – what is the likelihood that the threat materialises?
- Coping appraisal - if the threat occurs, what is the severity of its impact and how long will this last?
- Affective responses – are there strong emotional responses to the threat and how will these affect the decision to act?
- Motivational processes - how much priority should be placed on acting in a timely manner?

This was confirmed by workers such as Grothmann and Patt's (2005) theoretical model of private proactive adaptation to climate change, and Lamond and Proverbs's (2009) review of empirical studies on the mental steps that need to be completed by a resident living on a flood plain. These models assume that if a person has all, or at least some of these behavioural components, then action is likely to follow. Lamond and Proverbs explain that barriers to completion of these steps may be informational, financial or emotional (denial of risks; attribution of responsibility to others etc.). The author was particularly interested in the motivational processes and this informed many of the investigations contained in the research. At its simplest, the question centred on how much motivation was enough to overcome the barriers which were often missing or too weak to evince action.

It was important to identify a sociopsychological theory that would provide the context for the design and analysis of the later period of research. The author investigated theatre-based techniques to promote sustainable decision-making in a construction company, and analysed employee retention in relation to the ethical principles of their banking employer (see Bichard, 2008 and Bichard 2009 for details of these studies)

However, when the author undertook a research programme with the Environment Agency to determine whether it was possible to motivate homeowners to invest in order to protect their houses against the effects of climate change, a more considered theoretical framework was required to design the research.

There has been considerable recent developments in the field of environmental social psychology (see Darnton et al., 2006, Lucas et al., 2008, and the work of Paul C. Stern (Stern, 2009 and 2011 for example). These and other sources provided a range of frameworks and models that were reviewed and considered for adoption in the later stages of the research period. These included:

2.2. Stages of Change

Stages of change models describe behaviour as a series of sequential steps or processes (Weinstein, Rothman, and Sutton, 1998). The Trans-Theoretical Model or TTM (Prochaska and DiClemente, 1983) describes six stages of change in an individual's decision-making process, the final step being termination. At this point the individual is displaying behaviour similar to those around them (normal or within normative parameters) and is therefore unlikely to change back to their original behavioural position. TTM is often associated with strategies to help people give up smoking but has been extended to a number of other areas, including behavioural aspects of resource consumption (Bamberg, 2007).

While stages of change is a good model for describing behaviour change, it is less effective at planning to effect change. As this was the main aim of the author's later research it was rejected as a framework for the Trial.

2.3. Schwartz's Norm Activation Model (NAM)

Schwartz's work was developed in response to questions associated with altruism and altruistic behaviour (Bamberg and Schmidt, 2003). This theory focused on the role of personal norms which led the research towards an exploration of morals and ethics and personal value systems. While attracted to this aspect of decision-making, field work designed to test these components of behaviour requires considerable and personal questioning of respondents in order to understand their reactions to interventions. In addition to the other attitudinal and transactional questions being put to respondents, it was thought that this would over-complicate the Trial and NAM was consequently not adopted as a guiding theory.

2.4. Learning Loop Models

Learning Theory suggests that a change in human behaviour is cyclical and not linear. Agyris and Schon (1996) show how outside influences can overlap into the discover-choose-act loop to create an evolving set of behaviours. In the single loop process, individuals or groups oscillate between action strategies and reflecting on the consequences of their actions before devising a new strategy.

A double loop model adds a third element following the review of consequences which serves to question the governing values of the action. This effectively asks why the action needs to be taken as opposed to only considering what the action is and what it achieved. In the context of the research the author undertook for the Environment Agency, the Single Loop would require questions to be asked about residents attempt to protect against flooding and reduce energy consumption.

A double Loop would require further questions about the motivation to take action, and what would need to change before a decision to spend more on these measures could take place. This approach has merits but relies on a significant amount of questioning to establish awareness by the respondent and, for similar reasons to (consideration about) NAM, it was not adopted as a theory.

2.5. Theory of Interpersonal Behaviour

The Triandis model, the Theory of Interpersonal Behaviour (TIB) holds that behaviour can be predicted if both habits and intentions are known. Habits are repeated actions that allow activity with a minimum of thought. Intentions are more complex and are formed from a combination of emotions, social factors and attitudes. Bamberg and Schmidt (2003) explain that the main difference between TIB and the related Theory of Reasoned Action (see below) is the degree to which the subject is consciously making a decision. TRA assumes a large degree of control whereas TIB suggests that with habit comes a higher degree of unconscious action owing to the replacement of thought with automatic reaction. Another difference is the addition of 'personal norms' as a factor contributing to the intention to act. Triandis thought that an individual might be affected by their perception of their place in society which might inhibit or enhance their willingness to act. The challenge of testing for habit, a theme that is particularly of interest to behavioural economists (Thaler and Sunstein, 2008) was of interest but again beyond the ability to test in a trial context.

2.6. Theory of Reasoned Action

The Theory of Reasoned Action (TRA) incorporates the discrete elements or components of behaviour leading to action without the cascade or moral elements of other models. For these reasons TRA became the adopted theory for the trial with the Environment Agency and other partners. Ajzen and Fishbein (1980) developed the Theory of Reasoned Action (TRA) in order to show the relationship between attitudes and behaviour. This work explained that in order to predict how an individual was going to behave a number of factors needed to be understood. TRA is driven by the two concepts of compatibility and behavioural intention.

The theory relies on an individual to form the intention to act, based on an understanding and attitude about the issue (compatibility), and whether it is worth putting the effort into reacting to the issue (behavioural intention). In other words, the theory assumes that people rationally weigh up a situation according to their comprehension and the consequences of acting. Attitude is borne from the mix of emotions, thought and a predisposition to do something about it. Effort is calculated depending on how other people will react to their beliefs or actions. These are referred to as subjective norms. This work is not only helpful in explaining the barriers that inhibit action, but it can be summarised to show policy-makers how to shape campaigns by addressing each of the five questions that individuals ask themselves before acting. The author summarises these questions as:

1. Do I understand that there is a problem?
2. Do I care about the problem?
3. Do I know what to do about the problem?
4. Will my solution work or make a difference?
5. What will others think of me if I act?

TRA was criticised for a gap in its understanding of the role that society plays in influencing an individual's behaviour (Werner, 2004). As a response TRA was refined later into the 'Theory of Planned Behaviour' or TPB (Ajzen, 1991). This incorporated an additional factor (Perceived Behavioural Control) which determines an individual's perception of how easily a specific behaviour could be performed (Ajzen and Madden, 1986). The author considered the context of the fieldwork including the barriers to be tested, time constraints, budget, and tolerances of the respondent group before selecting TRA as the preferred sociopsychological theory for the trial.

2.7. Rationale for the Preferred Sociopsychological Theory

The preferred theory that was used in the design of the Timperley trial was TRA. Despite the criticism that the theory relied too much on rational thinking, the author considered that TRA was the best fit for the parameters that were planned to be tested in the field.

Specifically, TRA describes confusion as a barrier that disrupts a decision to take action. This was mitigated by the offer of face-to-face and immediate telephone support at each stage of the purchase and reward process. The barrier of doubt over whether the measure would work was mitigated by the draw of the reward, but also by the presence of community workers associated with the University as opposed to less trusted representatives from (for example) the utility companies. The barriers to the understanding and emotional investment in the problem (of dangerous climate change) was mitigated by the offer of attractive incentives. Finally, the concern over negative views from neighbours should the resident accept the offer and purchase the measures was mitigated by belief that others were also taking part in the scheme; a message reinforced by the community workers, mailings, and (later) the organisation of green community meetings..

3. Components of Behavioral Strategies to Motivate Sustainable Decisions in the Built Environment Behaviour Strategy

The author considered the evidence and postulated that it might be possible to devise a strategy comprised of three components that covered many if all of the five barriers that inhibit action as described by the Theory of Reasoned Action. These were:

- Information delivered at the point that decisions are made
- Sufficient incentives to overcome inertia
- The evidence that others were adopting the action (norm-based influences)

Information, delivered at the right time, combined with incentives and an encouragement to conform to norms are sometimes referred to as 'nudge-think' strategies (John et al., 2009). The 'nudge' aspect refers to the work of Richard Thaler and Cass Sunstein who argue this is 'any aspect of choice architecture that alters people's behaviour in a predicable way without forbidding any options or significantly changing their economic incentives' (Thaler and Sunstein, 2008). The 'think' element is associated with discussions between peers (neighbours and friends). This offers the potential to create a consensus around the need to support green initiatives and to overcome doubts by listening to those convinced of the arguments to live a more sustainable life. Others say engagement can take place in the private or public sphere and in the form of socio-political participation (Hoppner and Whitmarsh, 2011). This work argues that socio-political participation is important to stimulate people's belief that they can make a difference. Private sphere actions include (for example) domestic energy conservation, walking or cycling to work, using public transport, reducing or recycling or reusing waste, food choices and purchasing environmental products. Public sphere actions include: voting, taking part in an environmental campaign, responding to policy consultation, joining community groups, etc. The multi-strand approach was adopted by the author partly as a result of the concept of nudge/think.

4. Some Reflections on the Behavioural Theory as it Applied in the Field

The research undertaken with the Environmental Agency sought to motivate owner-occupiers to buy energy conservation and property-level flood-protection products for their home. The research was carried out in Timperley; a flood-threatened threatened part of the Manchester conurbation in North-west England. Attitudinal work showed that householders showed little interest in spending their money on either of these measures until the prospect of incentives were offered to them (Bichard and Thurairajah, 2013 and Bichard and Thurairajah, 2014)

At the end of the research period 5 householders out of a possible 24 accepted rewards including vouchers for fruit and vegetables, garden improvements, public transport, and beauty session at the local Further Education College in return for investing in energy conservation measures. The value of the rewards was equal to the money the householder spent on their house. No householder opted to spend money on flood protection.

The selective incorporation of incentives and the limitation to just two other influencers (i.e. information and norming) could be said to offer only a partial approach to a more complex problem. Some issues such as morality and ethics, the identification of the presence and strength of certain habits, and the existence of more deep seated affective (emotional) links to climate change (for example) could all have been investigated and, potentially, provided a more comprehensive set of conclusions.

There were a number of pragmatic explanations for the limitation of the research. The data collection method of choice was door-to-door surveys by prior announcement using an environmental action community group. Discussions with the group about the content and duration of each survey concluded that it should be limited to15-20 minutes and that personal questions should be minimised to ensure co-operation. The consensus was that answering personal questions from strangers may result in a refusal to participate, or a reticence to give full answers to the questions being put to them.

However, the selected motivational measures were identified as facilitating respondents to accept the offer of rewards. It was reasoned that if these selected measures were very successful, the conclusion might be that although there were other motivating factors, the ones chosen were the dominant influencers for this study. If the results were less than conclusive then there was room to speculate that the proposition needed stronger existing or additional new motivating factors to be successful.

Another interesting finding from the trial in Timperley was that the strategy did not motivate any of the owner-occupiers to invest in property-level flood protection. The attitudinal evidence suggested that householders did not believe that flooding was a high enough risk to promote action. The small number that progressed to valuations decided that the cost of the measures were prohibitive. In TRA terminology most did not perceive the problem. However, it was also undoubtedly true that there was no emotional (affective) connection with the issue, and there were no norm-base cues to suggest they should act despite their indifference. It is possible that creating a better connection with the implications of flooding, by holding a series of meeting with residents who had suffered flooding in other parts of the country, may have created a more powerful fear of the consequences and triggered some degree of action.

5. Conclusions

The research described in this paper sought to determine whether it is possible to develop behaviour change strategies that motivate people living and working in the built environment to make sustainable decisions. The paper set out the range of theoretical approaches that behavioural scientists have offered to bridge the value-action gap, and concluded that one; the Theory of Reasoned Action may represent the best fit to guide policy-makers to design behaviour change strategies for sustainability. Business-based research conducted by the author suggested that ethical or pro-environmental messages can potentially have an effect on employees. The attitudinal and field trial work with the Environment Agency which engaged with owner-occupiers tested a potential solution that relied on the simultaneous combination of information, incentives and norm-based influencing. This work achieved proof of concept for motivating householders to invest in energy conservation, but was not effective in persuading those owning their own house to invest in property-level flood protection.

The series of research projects described in this paper shows that while the literature reveals that the role of behaviour change has now been recognised as playing a significant part in the strategies used to mitigate the damaging effects of climate change, it is the way that these methods are applied in the field that could have an influence on policy-makers. It is hoped that the contribution of this research will have played a role in building the evidence base in the literature that has led to the rising interest in pro-environmental behaviour change strategies.

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Strategic approach in improving emergency preparedness

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Abstract:

The occurrence of disasters in the world has increased significantly and the United Arab Emirates (UAE) has had her share of devastating incidents. The impact of disasters in the UAE in recent years have become a major concern for the government and problems for businesses and residents in the country. These problems have therefore informed the need to be better prepared to manage disasters and emergencies when they occur in the UAE. The UAE like many other countries seek to be adequately prepared for any disasters regardless of its scale. While several preparedness measures are in place in the country, it seems there is need to improve preparedness for disasters in a more strategic way. This is because strategic approach for emergency preparedness is considered as an overall aim and means of achieving long-term effectiveness of emergency preparedness. Therefore the aim of this paper is to highlight the importance of strategic approach in emergency preparedness and how in-depth understanding and application of elements of emergency preparedness can help to strategically improve emergency preparedness in the UAE.

In view of this aim, this paper discusses the application of elements of emergency preparedness in countries such as the United States of America (USA), United Kingdom (UK) and Australia which are countries that have inspired emergency frameworks in the UAE. An extended literature review of elements of emergency preparedness and the limitation of their application in different countries forms both the theoretical and practical basis for identifying the problems in the UAE. It is expected that by so doing, issues which make emergency preparedness problematic in the UAE will be better understood and the areas which require improvement will be brought to light.

Keywords:

Disaster, Emergency preparedness, Preparedness elements, Strategic approach, UAE

1. Introduction

The impact of emergencies and disasters has been experienced in unprecedented manner. Many countries across the world are now experiencing incidents which are the result effect of climate change, rapid urbanization, and human activities amongst other factors (Waugh and Tierney, 2007). To this end, global efforts from the United Nations (UN) and the European Union (EU) are aimed at providing mitigating measures and recommending strategies which can help to better manage emergencies and disasters. For example, the efforts from the UN are reflected in the documentation of strategies such as Yokohama strategy and the Hyogo framework in Japan. Although attempts have been made by countries such as Bangladesh, Indonesia, etc. who are countries vulnerable to the impact of multiple hazards, there are still ongoing efforts to improve the level of preparedness to emergencies in many developed countries.

This overview provides an introduction to the aim of this paper which is to examine the emergency preparedness phase in the United States of America (USA), United Kingdom (UK) and Australia from an analytical perspective in relation to their application to ensuring effective preparedness. To achieve this aim, this paper has devoted the first section to explaining phases of emergency management and to evaluate the strategic approach to planning which is embedded in the systematic process of the emergency preparedness phase. The second section critically examines the strategic approach used in the US, UK and Australia which are all countries the UAE have partnership with in emergency management.

The discussion section emphasizes the implication of adopting strategic approach from the UK and having arrangement with the US and Australia to develop emergency preparedness in United Arab Emirates (UAE). While this combined approaches might have potentially caused confusion and the problems experienced in the UAE emergency sector, this paper focuses on emergency preparedness elements to determine areas that need improvement to ensure that events of emergencies and disasters are better prepared for in the UAE.

2. Literature review

2.1. **Background to Emergency Management in the UAE**

The impacts of emergencies and disasters across the world today, has motivated researchers to examine processes, standards, models and procedures used to manage them. By so doing, it is expected that areas which are insufficient or gaps can be identified and measures for improvement can be put in place. While this has been the issue for several researches in the US, UK and Australia devoted to investigating emergency management process, the UAE embarked on an investigation to determine which standard was more appropriate and comprehensive enough to be adopted to develop her emergency management standard. This drive and decision led the UAE to adopt the UK model because it was discovered to be the most comprehensive. However, the emergency management standard especially the preparedness phase has not been as affective as expected. This led the UAE to form partnership with the US, UK and Australia. This was done as a strategic approach for improving emergency preparedness approach in the UAE. Therefore, this paper draws inspiration from the assessment of emergency preparedness systems, cycle and models carried out in the US, UK and Australia, to conduct an examination of the preparedness approach used in the UAE. The fusion of best practice identified from these three countries are combined as strategic approach, recommended for improving emergency preparedness in the UAE.

2.2. **Emergency Management**

Emergency management is the managerial function which aims to create arrangement for reducing vulnerability to hazards and increase coping capacity for disruptive events or incidents (Drabek, 1991). Several authors and experts in emergency or disaster management have all coined several definitions for emergency management. Emergency Management is considered as “the process of managing emergencies, including the maintenance of procedures to assess, prevent, prepare for, respond to and recover from emergencies” (CCA, 2004:218). This definition by CCA is also the definition adopted by the UAE, because the UAE adopted the emergency management standards used in the UK (Dhanhani, et al. 2010). The definition by CCA (2004) emphasized the need for sets of procedures such as prevention, preparation, response and recovery from emergencies which are coordinated to achieve its expected result of preventing the impact of emergencies (Edwards and Goodrich, 2007). Waugh and Tierney (2007) states that one of the goal of emergency management is to reduce, avoid or prevent emergencies and/or to reduce their impacts when they occur and prevent them from escalating.

All these are done through what is called comprehensive emergency management which is based on enhancing the four distinct phases; mitigation, preparedness, response and recovery.

2.3. **Emergency Management Cycle**

Mitigation involves mitigating or eliminating either the likelihood or the consequences of a hazard, or both. Mitigation seeks to "treat" the hazard in such a way that it does not impact society to a higher degree. Mitigation measures and activities involve structural and non-structural measures (Waugh and Tierney, 2007).

Preparedness involves equipping people (the community) who may be impacted by a disaster and agencies and organisations that may be able to help those affected with the tools to optimise their chance of survival and to minimise any financial and other losses. This phase involves several stakeholders and thus has some essential elements which are designed to make the preparedness phase more result driven (Alexander, 2005). This phase is the focus of this research because it is critical for helping community, emergency agencies and organisations to be ready for any emergency (Dillon et al., 2009). It is also the focus of this research because it determines what is done during response phase, so if preparedness phase is inadequate, response to emergency will also be inadequate or ineffective (Edwards and Goodrich, 2007).

Response involves undertaking action to decrease or eliminate the impact of disasters which have occurred or are occurring so as to prevent further suffering, financial loss, or both combined. The term relief, commonly used in international disaster management, is one of the components of response. This phase is organised by some level of skills, expertise and organisation because of the level of risk and danger that might be involved (Alexander, 2005).

Recovery involves returning the lives of the people back to a normal state after the impact and consequences of the disaster. The phase of recovery usually starts after the immediate response has come to an end, and can take months or years to complete (Edwards and Goodrich, 2007). Thus, it can be inferred that these phases of emergency management influence the management of disaster events and emergencies. These phases also help to clarify the type and nature of activities which are undertaken at each phase in order to ensure that emergencies or disasters are effectively managed in the countries.

These four phases are generically used across the world for both emergency and disaster management. However, the terms used for these phases differ from country to country depending on their preference and understanding of emergency management. While no academic explanation have been provided for this variation of terms, the activities, procedures and elements undertaken during each phase are have been researched to be similar. Table 1 provides a brief comparison of these terminologies as used in the case study countries.

Table 1: Emergency Management Phases and Activities

Generic Four phases	US	UK (IEM)* activities	Australia (PPRR)
		Anticipation Assessment	
Mitigation	Mitigation	Prevention	Preparation
Preparedness	Preparedness	Preparation	Prevention
Response	Response	Response	Response
Recovery	Recovery	Recovery	Recovery

***IEM is integrated emergency management geared to the idea of building greater overall resilience in the face of a broad range of disruptive challenges which requires coherent multi-agency effort.**

As indicated in Table 1, the US process of emergency management involves four phases: mitigation, preparedness, response, and recovery (Drabek, 1991). Such terms are widely used by policy makers and researchers, and are often described as a continuous process or cycle. Australia works on the US system and follows the "4 phases", however, Australia use the term preparation rather than mitigation to describe the phase that leads to prevention, response and recovery. The UK calls her EM Phases activities and has two additional activities to increase the preparedness for any emergency (Cabinet Office, 2013). The UK has done this because of their need to embrace holistic approach within the wider context of Integrated Emergency Management (IEM) (Cabinet Office, 2013) for better preparedness. Therefore, the first four activities address the issue of preparedness (before), whilst the last two; response and recovery deal with "during" and "after" emergencies or incidents. However, the current UAE emergency management standard has not replicated this arrangement.

Regardless of the terms used for the emergency phases or activities the procedures in the phases leading to response are considered important to achieving the purpose of emergency management (Edwards and Goodrich, 2007). The importance of the pre-emergency phases or activities is also reflected in the UK's devotion to resilience by increasing activities which can make response more effective. Hence, the rationale of this paper focusing on the preparedness phase which is also embedded with all-risk planning, training and public information (CCA, 2004). As reviewed in emergency management texts, the preparedness phase involves a continuous process of inputs, activities and outputs of resources, expertise, information (Alexander, 2002), communication, training and planning (Edwards and Goodrich, 2007). This process of ensuring effective planning for emergencies is also considered as strategic planning. According to Mintzberg and Quinn (1996) strategic planning is considered as a process of defining strategies, direction and making decisions on resources allocation. It also involves the control of mechanisms which guides the implementation of strategies (Allison and Kaye, 2005), hence ensuring that planning is done based on the strategy formation activities (Allison and Kaye, 2005). This explanation suggest the need to evaluate the interaction and management of inputs, activities and outputs of activities in the emergency preparedness phase in the US, UK and Australia. An evaluation which is essential for the UAE to learn from as they have learnt from these countries to develop their emergency management standard.

2.4. Strategic Approach to Emergency Preparedness

Emergency planning involves the development and maintenance of agreed procedures to prevent, reduce, control, mitigate and take other actions in the event of an emergency (CCA, 2004:218). In basic terms, it involves steps taken to make sure that people are safety before, during and after a disruptive emergency event. Alexander (2002) and Edwards and Goodrich

(2007) have explained emergency planning as a continuous process of assessing risk and preparing for emergencies using procedures to ensure emergency managers are ready by validating plans and procedures. The reference to continuous process reflects in the model used by many countries and organisations to prepare for emergencies and disasters. Therefore, strategic approach to emergency preparedness is the ability to utilise elements with long-term characteristics for gaining overall planning for more effective response to emergencies or disasters (Alexander, 2005; Allison and Kaye, 2005; Mintzberg and Quinn, 1996

2.4.1. US Emergency Preparedness Model

Some of the threats, hazards and risks experienced in the US include but not limited to tsunami, hurricanes, earthquakes, floods, extreme weather and impacts of act of terrorism to mention a few. Variety of threats and risks as this means that the US embarks on several proactive measures to ensure that there is adequate preparation and planning for any emergency or disaster. Despite this, the US through the Federal Emergency Management Agency (FEMA) uses a preparedness cycle as guidance for ensuring that planning inputs, activities and outputs are sufficient for response. This cycle is shown in Figure 1.

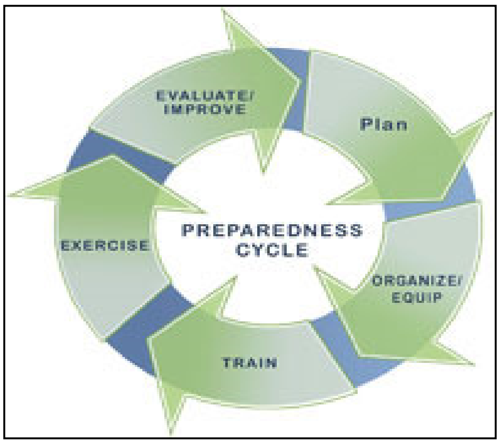

Figure 1. The Preparedness Cycle (FEMA, 2012)

Figure 1 shows that the preparedness cycle used by the US is an ongoing process made up of five elements, namely, plan, organise/equip, train, exercise and evaluate/improve. This process echoes many definitions of preparedness provided in the academic and practice field of emergency management. FEMA's preparedness model addresses the issues of emergency from an early stage through the preparedness cycle. The cyclical pattern emphasises the **continuous process** that need to be followed in order to achieve adequate preparedness for any emergency or disaster. While the **continuous process** of elements in the US model is a plus and can be considered as good practice which can be adopted for the preparedness phase, there is no clear reference to risk assessment. It can only be assumed that this cycle is based on the result of a risks assessment or at least the plan is informed by an identified risks based on the likelihood and potential impact of their occurrence.

According to Edwards and Goodrich (2007), it is good to subject preparedness to a continuous process which involves evaluation, review and improvement of the plan, but Kapucu (2006) also emphasised the importance of being able to identify and assess the potential impacts of foreseen threats, hazards, risks or emergency in a place. One of the importance of risks assessment in preparedness phase is that identified risks or threats help to determine the resources, inputs, activities and procedures documented in plan. However, what this model lacks by not making reference to risk assessment or management, it makes up for in clarity of direction using the circular process showing the direction in which activities should move. While it is difficult to say that this preparedness cycle is insufficient, one can infer that from the continued impacts of emergencies and disasters in the US this preparedness cycle might be insufficient.

2.4.2. UK Emergency Preparedness Model

In the UK emergency planning cycle includes two main processes; embed and consult (CCA, 2004), which are expected to serve as guidelines for the preparedness phase. The CCA (2004) clearly states that these two major processes must be facilitated by taking direction from the risk assessment, of which the risk assessment helps to set the objectives of the entire preparedness phase. The next step involves determining the actions and responsibilities of organisations required to manage the risk after which all actions and responsibilities are agreed on. These four steps are considered essential for the consult process to jointly determine how best to manage any identified and assessed risks. Fig 2 illustrates the two processes and the interaction of inputs and activities aimed at facilitating preparedness.

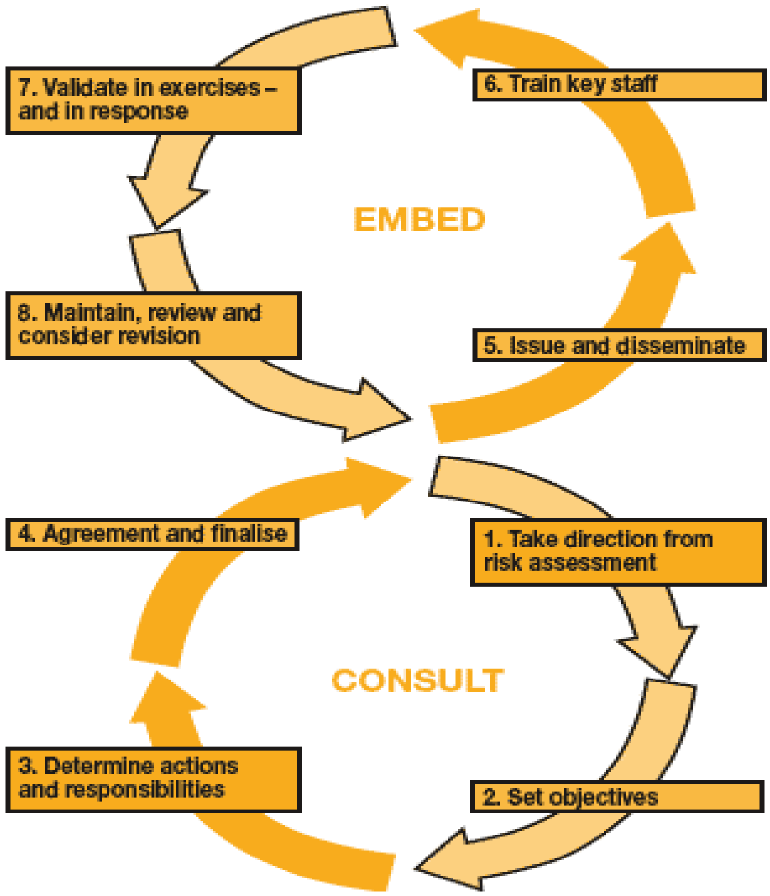

Figure 2. The UK emergency planning cycle (CCA, 2004:54)

The fifth step then moves to the 'embed' process which is to issue and disseminate the plan within organisations who will be responsible for them. According to Dillon et al. (2009), this step which is 'issue and disseminate' is expected to help decide the information system and communication equip and organise required for implementing the plan. By so doing, staffs and personnel of emergency organisations who will be involved in emergency response will be trained, and then steps will be taken to validate the plan through an exercise to prepare for response (CCA, 2004). Step seven which is ‘validate in exercise and in response’ influence the eighth step which is ‘maintain, review and consider revision’. A combination and review of these steps also influence the review (if necessary) of the emergency plan (Cabinet office, 2005).

According to Canton (2007), other activities which might be required during the preparedness phase include profiling of the risk elements, setting the objectives of the plan, making tasks and resources, organisation and responsibilities (Canton, 2007). All of which shows the extent to which actions are determined to achieve goals of preparing more effectively for response to any emergency. The UK preparedness model demonstrates that certain elements needs to interact as inputs and activities by showing the rigorous interaction between two main processes. The UK emergency planning cycle seems to be detailed, comprehensive and holistic cycle when compared to the US model. By having two processes in a cycle with serial numbering, the model shows the logical flow of activities. However, having two independent processes might be confusing to link the interaction or too demanding to coordinate eight steps before the event of an emergency.

2.4.3. Australian Emergency Preparedness Model

The location of Australia makes it vulnerable to different hazards. The country experience both natural and non-national hazards such as cyclones, bush fires, terrorism, tourism risks, technological hazards, biodiversity, tsunami, avalanche, storm surge and flooding (EMA, 2004). Emergency Management Australia (EMA) takes both 'comprehensive' and 'integrated' approach to managing these hazards (EMA, 2004). EMA uses sets of activities to ensure that preparedness is sufficient for managing various hazards experienced in the country. Although there is no major preparedness cycle like the US and UK, Australia has specific activities which are undertaken for effective response.

Preparedness		
Emergency response plans	Mutual aid agreements	Training programs
Warning systems	Public education	Test exercises
Evacuation plans	Public information	Refuge shelters
Emergency communications	Resource inventories	

Figure 3. Australian Preparedness guidance (EMA, 2004)

In general, the Australian model for preparedness mirrors the comprehensive principle of emergency management. As observed in the preparedness model for Australia, the preparedness activities are clear activities ready which are monitored for implementation (EMA, 2004). While the model does not indicate the first activity, it however specifies the direction, resources and outputs which needs to be achieved. For example, the reference to **emergency response plans** in the preparedness model indicate that the output/outcome of all the activities is to achieve effective emergency response. Furthermore, outlining activities such as **communication, information, warning systems and education**, indicate the level of emphasis placed on the mechanism of communication. The implication of these characteristics and others identified in the US and UK model will be discussed to explain what the UAE can learn from these emergency preparedness models in order to ensure the model in UAE is more effective.

3. Discussion

The examination and overview of emergency preparedness models in US, UK and Australia has demonstrated that strategic approach to planning is a process which engages different inputs, activities and outputs. However, ensuring that stated objectives, strategies, direction or procedures are implemented as documented is another issue. While ability to implement documented procedures and strategies can be challenging, it is expected that the minimum requirements are carried out during response to actual incident. By examining the emergency preparedness models from these three countries from which the UAE has different types of partnership with, it is evident that each model has its limitation and strengths from which UAE will do well to learn from. The implication of these lessons for the UAE also depends on the ability to identify these lessons, learn and implement them. Till date, it seems the implication of lack of reference to risk assessment or management and lack of clarity about how the steps in the US preparedness cycle translate to effective response is yet to be conceived. The basis for the steps indicated in the cycle are simple, yet unclear of their direct link to effective response. Despite this, the circular process shows that these steps are subjected to continuous interaction until an emergency occurs. In principle, this is considered good practice (Alexander, 2002), however it begs the question for its sufficiency in ensuring effective emergency response.

The UK preparedness model seems to be the most comprehensive and detailed. It has a logical and serial flow of activities starting with risk assessment. The reference to risk assessment emphasizes the basis for emergency preparedness. However, the process seems cumbersome and demanding to follow through. Since the UAE had adopted the UK emergency management standard and models, perhaps ability to coordinate and translate all these eight steps as a continuous process leading to response to emergency might be the problem for emergency managers who are not as experienced as their UK colleagues. The implication of this for the UAE is evident in its limited procedures and continued quest for country partnership and recruitment of foreign experts to help improve and support the emergency management sector in the country. While the comprehensive state of the model is advocated and considered one of the principles of emergency management, it is perhaps a country which is still developing her emergency sector like the UAE requires a more basic model to grow into such model.

The Australian model can be said to be the most basic and lucid to understand. The model is not a circular process like the US nor a combination of processes like the UK, but an outline of required sets of activities which needs to be implemented to as part of the emergency response plan. The Australian model makes specific reference to the emergency response plan as its goal while also outlining other equally important activities such as public education, emergency communications, public information, exercise, mutual aid etc. All these activities are all documented in a plan, but stated the sets of activities perhaps makes it a model for easy implementation. The implication of this simplicity for the UAE is that the emergency managers in the country might find this model more easy to implement, but might also doubt its effectiveness since it is not as comprehensive as the UK model. While this is based on perception, it does not negate the actual benefits of this strategic approach used in Australia to help them mitigate the impact of many of the emergencies they experience.

4. Conclusion

Therefore in conclusion, it can be inferred that the comprehensive principle applied to the UK emergency preparedness model is consistent with the generic approach used in emergency management to ensure that activities and procedures are subjected to rigorous process which are effective when implemented. It is also noted that the Australian model has managed to combine both the principle of comprehensiveness and integration of strategies to her preparedness model. While more explanation has been provided for the UK and Australian model in this paper, the implication of this model evaluation is the lessons the UAE can learn from them all. Therefore in view of improving the emergency preparedness model or process which is currently problematic in the UAE, the UAE will do well to adopt the simple and circular process from the US model, the logical and clear steps used by in the UK model while imbibing the detailed and specific activities used by the Australian model to implement outputs and activities. Like many things in life, these models have their limitations, but they have been drawn to meet specific needs and efforts ought to be made by the UAE government and emergency managers to investigate, identify and apply the strategies which are applicable within UAE context bearing the needs of the country and the capacity of the emergency managers in mind.

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Material Resources Optimization for Sustainable Construction in Nigeria

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Abstract

The aim of this paper is to examine the ways by which construction material resources can be optimised towards sustainable material resource preservation. Material waste in construction contributes approximately 30-35% of project cost; thus leading to material loss and project cost overruns.Lack of concern by Governments and developers globally and Nigeria in particular is continuously affecting the use of these resources materials. Questionnaire method has been used. To achieve the objectives of the research, the questionnaire was administered among Consultants (Architect, Quantity Surveyors and Builders) in Nigerian construction sector. A total of 70 questionnaires were administered to construction practitioners; 53 were returned giving a 75% response rate. This was analysed using Descriptive Statistics.The findings reveal that selection of low quality products and inexperience of method are the major sources of material wastage at the design stage. Construction stage major sources of material wastage are design changes during construction and re-working due to incorrect use of material and labour. While at procurement stage the major source of materials waste are lack of possibility to order small quantity and waste encountered during loading/transportation. Finally, at the handling stage the major sources of material wastage are theft and inappropriate storage. The study also revealed that lack of adequate security in the country and inadequate knowledge of recycling are the main challenges that occur more frequently in resource management.The study found that the following factors should be considered for sustainable material resources optimisation and include, use of standard space product design, adoption of supply chain management, and developing of material schedule software will assist in reducing materials wastage. It recommends that better utilization of resources through adopting lean production and prefabricated component processes, use of appropriate equipment and specification, recycling/re-using of old materials for new construction projects will assist greatly in reducing visiting of base materials, hence leading to resource optimization and protection of the environment. Lastly, there is the need for policy establishment and implementation for resource optimisation for the Nigeria construction industry

Keywords:

Construction, Material, Resource Optimization, Sustainability, Waste.

1. Introduction

The world has witnessed significant population development, technological advancement and is equally increasing in the use of its resources following the industrial revolution.It is acknowledged that technological advances have impacted on the utilisation of these resources and causes ozone depletion, deforestation particularly in the developing nations, global warming, flooding etc. These factors are affecting the sustainability of the earth in terms of the resources ability to meet the need of current and future generations (Cartlidge, 2004). Lack of concern by majority of governments and developers globally and Nigeria in particular is continuously affecting the use of these construction resource materials.

Various policies related to construction industry and environment sustainability in Nigeria have emerged in recent time such as Building Codes, Environmental Impact Assessment (EIA ACT 1992), Federal Environmental Protection Agency (FEPA ACT 1988) etc. All these acts have aims of protecting the environment against damages, the regulation of potentially harmful activities and the punishment of persons deliberately damaging it whenever this occurs (Nwokoro & Onukwube 2011). More so, policy on how to deal with sustainable sourcing of construction materials, its waste management and structure for green buildings are not yet in place. This lack of policy encourages uncheck utilisation of natural base materials resources in the country.

In Nigeria context, existing practice has shown that industrial Barons particularly in cement industry uses their trucks to transport up to 40 tonnes of cement as against 30 tonnes specified by highway codes and road design criteria. The implication is that roads get damage before their full lifespan and specified periodic maintenance period. For instance Abuja-Kaduna-Kano dual carriage highway started experiencing significant failures at various sections within the first three years of its usage, this is similar to buildings in the country, property meant to last between 60-70 years lasts between 30-40 years useful lifespan. This assertion is supported by Cartlidge, (2004) that buildings that attracted good tenants and high rents in 1980s and early1990s are now tending to attract only secondary or tertiary covenants, leading to lower rents and valuations as result of the deterioration of properties and unsustainable construction practice.

The use of material resources in the construction industry touches areas such as financial, human, and equipment. The optimum use of these resources collectively leads to preservation of the base material resources and more affordable construction works. Hence, this paper aimed to examine the ways by which construction material resources can be optimised towards general resource preservation; through these specific objectives identifying the major sources of Material wastage, challenges of resource optimization and lastly the means of material resource optimization.

2. Construction Materials Wastage

The word waste means loss during usage or decay(Adeagbo&Kunya, 2002). In other word, waste is any activity which does not add value (Slack et. al 2004). Material wastage is define as the difference between value of those materials delivered and accepted on the site and those properly used as specified and as accurately measured in the work. This has been recognized as a major problem in the construction industry. There is concern in recent time on both implications of the efficiency of the industry through materials wastage and the environmental impact of construction projects (Motete, et. al. 2003). According to Bin Ibrahim et. al. (2010) the cost of materials is over 50% of the total construction cost, depending on the construction form. They further stressed that the causes of material wastage were "poor workmanship, setting outerror, order not meeting specifications, excessive use of materials, material not meetingrequirements, breakage in handling materials, improper storage, and misdemeanour". This kind of waste typically accounts for 15 - 30% of urban waste (Forsythe and Marsden 1999).

Materials wastage on construction site has recognizable implication on the stakeholders. To the contractor, it significantly reduces the predictable proceeds from a project, whereas to the client, it escalates the development costs and undermines values. High rates of material wastage on construction site perhaps may be responsible for the project cost overruns reported in several literatures. Hence there is the need for maximizing material wastage management on construction site to enhance profit maximization, achieving value for money and also reduce cost of development Ogunsemi (2006) and are used as an important criterion for project success (Abdulrahman et. al. 2013). They further stressed on the function of material management system in construction projects to be identifying, acquiring, storing, distributing and disposing of materials.

Table 1: Major Sources of Materials Wastage at Various Construction Stages

S/N	Design Stage	Operational Stage	Procurement Stage	Material Handling Stage
01.	Design changes while construction	Damages to work done due to subsequent trades	Lack of possibility to order small quantity	Material supplied loose
02	Inexperience of methods/sequence	Errors by trademen/Labourers	Ordering errors (too much or too little)	Inappropriate storage
03	Lack of attention to dimension	Required quantity unclear due to improper planning	Purchase not comply with specification	Damages while transporting
04	Lack of knowledge about standard sizes	Re- working due to incorrect materials/Labour		Theft
05	Complexity of detailing	Delay in passing information to the contractor		Unfriendly attitudes of project team and labourers
06	Lack of information in drawings	Accident due to negligence		Use of materials close to workplace
07	Selection of low quality products	Inclement Weather		
08	Inconclusive contract documentation	Malfunctioning of Equipment		
09	Errors in contract documents			

Table (1) above are some of material wastages identified at various stages of construction projects as generated in the literatures.

3. Minimizing Material Wastage

According to National Specialist Contractors Council (UK) - over 10% of construction waste (13 million tonnes) in Britain consists of unused materials (i.e. materials delivered to site but not being used). Al-Hajj & Hamani (2011) were of the viewed that it is 13%. Construction waste is understood in different ways and its represents a large percentage of production cost (Viana et. al. 2012). The following may be means of minimizing materials wastage and reduce visiting base resource materials for sustainability purpose:

a. Use with minimal/without waste

Waste minimisation is a process which avoids, eliminates or reduces waste at its source or permits reuse/recycling of the waste for environmental benign purposes (Jaillon et. al. 2009). The quality and/or experience of the personnel used in the execution of the works will determine the extent of the non-value activities.

b. Selection of Alternative Building Materials

The use of alternative building materials will reduce touching of the base materials thereby preserving them for future generations needs and as well as minimizing their impact on the environment (WBDG Sustainable Committee, 2010)

c. Use of Appropriate Equipment

To select appropriate equipment required for a project it is necessary to first determine machine productivity. To perform such analyses, the planner must consider both machine capability and methods of employment (Peurifoy et. al. 2006).

d. Appropriate Specification

Choice of appropriate material at both the design and implementation stages of construction will assist construction works to have full life span they were design for. For instance use of wall tiles/Glass on the toilet wall as against plastering and painting, will assist in preserving the building against early and subsequent maintenance.

e. Lean Production

This is a process where sizes of the products are optimize and ensuring robustness. This encourage 50% reduction on everything leading to half human effort in the factory, manufacturing space, tools, engineering hours to develop a new products, and produces a greater and ever growing variety of product designed both to eliminate waste and constantly improve production output and quality (Womack, et. al 1990; McGivern, et. al. 2001).

f. Supply Chain Management

Approximately 13% of waste generated in the construction industry is new, unused materials. Solution to the above problem is adoption of supply chain management (SCM) principle; through finding suppliers who accepts returns or exchanges. Exchange materials-which might appear to be of no value to you, may be of value to someone else (Al-Hajj &Hamani 2011). SCM can assist with delivery that is just-in-time for the required building stage; and it avoid keeping materials in storage for too long as this ties up your funds and may lead to damage, spoilage and pilfering (Begum et. al. 2009).

g. Recycling /Reusing

There are many ways to improve the sustainability of the built environment and include among others using non-toxic and using materials in such a way that they can be re-used or recycled. The use of high recycle content construction materials on prospect projects will reduce frequency of visit to base material resources and this will reduce waste and protect the environment (Cartlidge 2004; Begum et. al. 2006).

h. Prefabricated Construction

According to Jaillon et. al. (2009) "Prefabrication is a manufacturing process, generally taking place at a specialised facility where various materials are joined to form a component part of the final installation". Prefabrication has been recognised as a means to reduce waste arising during design and construction phases. Hence, it is possible to reduce waste level up to approximately 52% through prefabrication. Hence, prefabrication could considerably reduce construction waste generation and alleviate the burdens associated with its management (Jaillon et. al. 2009).

4. Resource Optimization at Various Stages of Construction

a. Design Stage

About 5–10 percent of building materials end up as waste on building sites Nehru (2009) and laps been an extended joining of materials for increasing their length or width are also between 5-10 % part of item rate (Holm, et. al, 2006). Waste and laps can be reduced through the design process. Designing to module will assist in reducing/eliminating waste or eliminate non standardization.

b. Costing Stage

It is a standard practice when estimating for any rate of construction item or element to include waste; but in the first instance why inclusion of waste in to these items of works during costing? The following factors could be the reasons: storage waste, transit waste, residue waste, loading waste, application waste, stock pile waste, cutting waste.

c. Construction/Implementation Stage

Most of the above explanation can be applied at post contract stage. The most importance factors during construction stage is the purchasing and supplying procedure of the materials (further encourage waste by over estimating and rounding up of purchasing requirements), purchasing not complying with specification and non-challant attitudes of tradesmen/labor force during execution.

5. Current Challenges to Resource Optimization in Nigeria

a. Untraceable Income

Inordinate income stream in Nigeria encourages economic vulgarism, which leads to wasteful spending and minimum attention to resource optimization. Because of the poor policy framework and implementation capacity, income(s) are not properly monitored generally and specifically during construction process.

b. Ambiguous Bills Items

Items that serve as cover in the contract that is usually used as decoy/ conduit to siphon money from the project such as provisional sum, prime cost sum and sometimes contingency sum need to be avoided for sustainable construction purpose.

c. Status Symbol / Cultural Attitude

The tendency of Nigerians to define their economic status by making statement with bogey structures, this tend to make the spending on such structures very high without adding functional values: for e.g. is the case of concrete fascia that is currently in vogue in Nigeria. When comparing concrete facial with timber/wooden facial board; the cost of concrete facia is eight times the cost of timber type.

d. Seeming Abundance of Resources

Make up call to the realization that the seeming limitless materials can actually get exhausted. For e.g. sand can get exhausted through weathering effect, which is related to volcanic/ rock formation activities.

e. Lack of Security

Inadequate security has led to excessive protection of the structures (high fencing, burglar proofing, concrete fascia, double roofing etc). This waste form is avoidable if the overall security of the country is improved. The idea is paradoxical if actually does not.

f. Inadequate Knowledge of Recycling

The internalization of the benefit of recycling within some projects is insufficient because a good link has not been established between understanding of recycling and resource optimization. Typical case in Nigeria is when a client bought a building, instead of re-using or recycling part of the building, they will prefer to demolish the whole structure and redesign and reconstruct from the beginning.

g. Lack of Political Will on the Part of Government

Adherence to rule of law in entrenching policy frame work aimed at ensuring advancement in the methods of resource utilization, sourcing, development, production and manufacture; within the context of optimizing resources for the benefit of all and the environment is not in place. Hence, there is the need for policy establishment and implementation for resource optimisation in the Nigeria construction industry by the government; giving rooms for new ideas or concepts such as "Rethinking Construction".

6. Methodology

Optimizing resources for sustainable construction was considered a necessary foundation for this study. To achieve this, secondary data were generated from literature and pilot interview was conducted with Construction Practitioners (Architects, Contractors, Builders, Engineers and Quantity Surveyors) on material wastage with a view to develop questionnaire content. The data collection process consisted of a questionnaire survey developed by the researchers. The questionnaires were personally administered by the researchers. A survey design was used because it is effective in seeking the views of people about a particular issue that concerns them and can be used to generalize. A survey design is one in which a group of people or items is studied by collecting and analysing that data from only a few people or items considered to be representative of the entire population. The questionnaire aimed to establish the major sources of construction, the challenges of resource optimization and the means of resource optimization in the Nigerian Construction Industry. A summary of the analysis of the data collected is presented in Figures 1 to 3.

First, the research assessed the major sources of material wastage. The questionnaire identified 27 major causes of material wastage under four headings representing four stages (Design, Construction, Procurement and Handling).

Secondly, the research also identified challenges to resource optimization in Nigeria; prior to this a pilot study was conducted to identify the challenges. The challenges were classified into two sections first the frequency of occurrence of the challenges and secondly the impact of each challenges identified. Each of the sections had eight questions.

Lastly, the questionnaire identified the means of material resource optimization. The questionnaire had twelve questions in this section. The questionnaire consisted of a total of 51 questions. The 51 questions formed the basis of the questionnaire which was developed to sample the opinion of Construction Practitioners. The respondents views were sought using 5 point likert scale method “1” is the lowest score and “5” is the highest score. The ranking of the factors were based on the meanscalculated,the higher the mean, thehigher the ranking. The questionnaire was constructed in simple clear language to enhance the respondents' exercise of sound judgment. Majority of the respondents are practitioners based in the Federal capital Territory and Kaduna City. A total of 70 questionnaires were administered and 53 were correctly completed and returned representing a response rate of 75%. This was considered adequate for the analysis based on the assertion by Moser and Kalton (1971). No questionnaire was discarded. Thus 53 number were used for the analysis

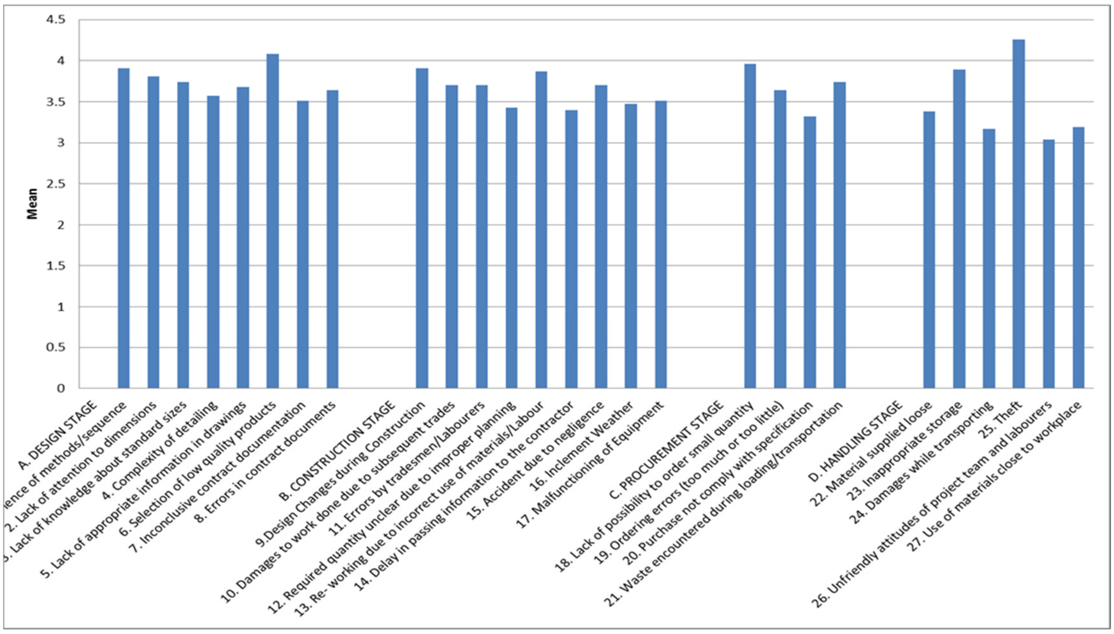

Figure 1: Major Sources of Construction waste

Figure 1 shows the various factors responsible for material wastage in the Nigerian Construction Industry. The major sources of Material wastage at the design stage is selection of low quality material with a mean of 4.08 while inconclusive contract documentation has the least impact with a mean of 3.51. At the construction stage, a design change during construction is the major source of material wastage with a mean of 3.91, while unclear required quantity due to improper planning is the least with a mean of 3.43. At the procurement stage, the major source is lack of possibility to order small quantities with a mean of 3.96 while the least is purchase not comply with specification with a mean of 3.32. Finally, at the handling stage the major sources of material wastage are theft and inappropriate storage with a mean of 4.26 and 3.89 respectively; while damages during transportation are the least with a mean of 3.17.

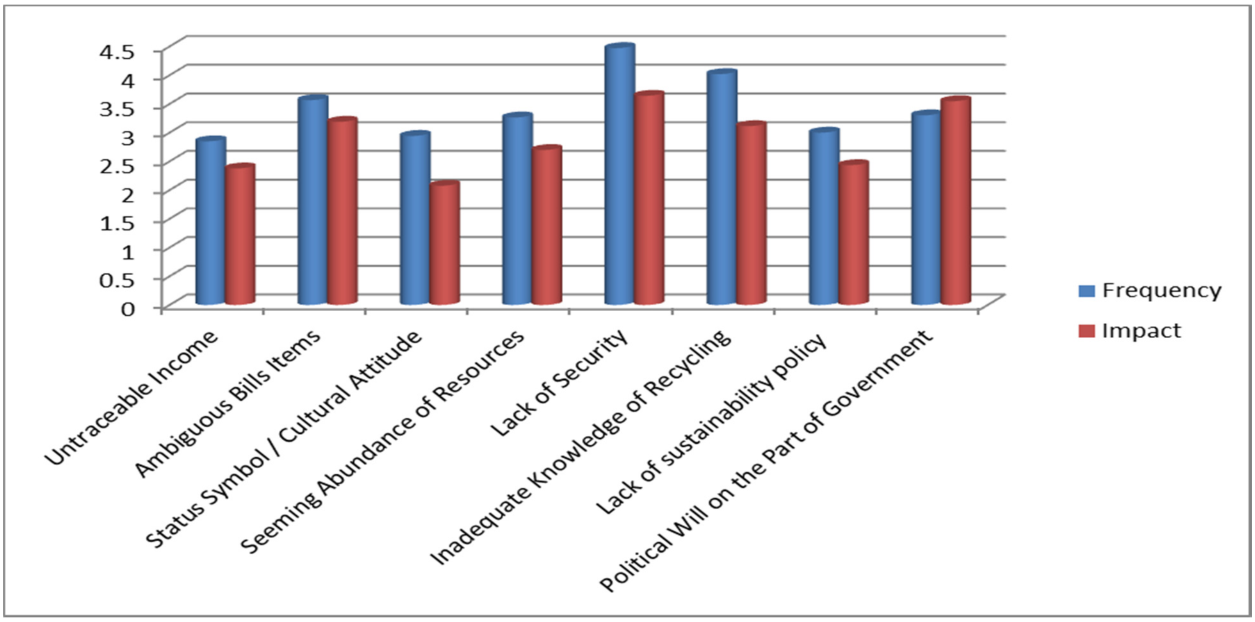

Figure 2: Challenges to resource optimization in the Nigerian Construction Industry

Figure 2 shows the challenges to resource optimization in the Nigerian Construction Industry. This was achieved by analysing the impact and the frequency of occurrence of the challenges. The result shows that lack of security has the highest frequency with a mean of 4.47, while untraceable income has the least frequency with a mean of 2.85. On the other side, lack of security has the highest impact with a mean of 3.64 while untraceable income has the least impact with a mean of 2.35

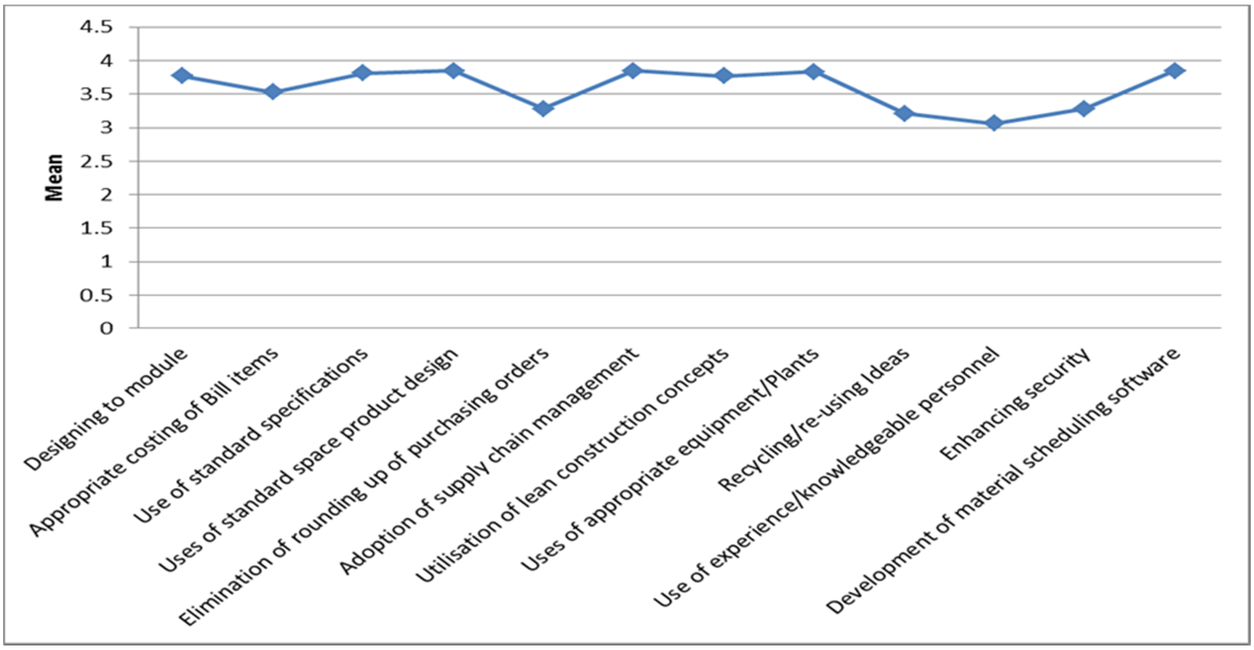

Figure 3: Means of material resources optimization at various stages of construction

Figure 3 shows the means of material resource optimization strategies at various stages of construction. The findings reveal that use of standard space design and adoption of supply chain management are the major means of resource optimization with a mean of 3.85 while Recycling/re-using Ideas is the least with a mean of 3.21

7. Analysis of Findings and Discussion

This study set out to achieve Material Resources Optimisation for sustainable construction in Nigeria. Resource materials optimization can be achieved at the various stages of construction. The first objective meant to identify the major sources of material wastage at various construction stages (see Figure1). The figure shows the various factors responsible for material wastage in the Nigerian Construction Industry. The findings reveal that, selection of low quality products and inexperience of method and sequence by the labour force are the major sources of material wastage at the design stage. Currently a large number of substandard products influxes into the Nigerian Market, most don't fit or are damaged and have to be replaced thus generating more waste. More so, experience practice have shown that using experienced and competent personnel in manning construction works will significantly reduce waste generation; although hiring them could impact on the total cost of the project. More so, at the Construction stage, the major sources of material wastage are design changes during construction and re-working due to incorrect use of material and labour. The way construction activities are carried out also impacts on the quantity of waste produced. Design changes during construction can and should be avoided wherever possible. Design changes while construction is in progress can result in waste in different ways. Firstly if the construction materials have already been purchased based on the original design, waste will result if the materials cannot be resold or returned to the supplier (considering supply chain principle utilisation is limited), also if a structure has already been constructed, a change in design may result in partial demolition, thus resulting in material wastage (Bekr, 2014). At the procurement stage, the major sources of waste are lack of possibility to order small quantity, and waste encountered during loading/transportation. The solution is the adoption of a robust system that enables the production of accurate estimates of material requirements at the start of a project that then links to real waste figures on completion. Only by focusing upon these material quantities will sub-contractors be able to understand what their wastage rates are and subsequently, be able to take action to reduce them. Finally, at the handling stage the major sources of material wastage are theft and inappropriate storage.

The second objective investigated the challenges of resource optimization in the Nigerian construction industry. The study revealed that lack of adequate security in the country and inadequate knowledge of recycling strategy are the challenges that occur more frequently in resource management. Also, lack of security (burglar proofing, high fencing, double roofing) has the highest impact on resource management and over utilization of resources without value. This is in accordance with the study by Oladiran (2009). Efficient Material Management is an important criterion for the success of any project considering the portion of material resources in the overall constructions project cost. More so, adoption of recycling/re-using principle will help significantly in reducing project cost and visiting of natural base material resource. Chui (2007) agreed with the above "Reuse/Recycling program has assisted Hong Kong to reduce approximately 30% of construction waste to be disposed of in landfills and achieved economic benefit of around US$7 million from the construction waste disposal charging scheme".

In line with the last objective investigated, the study found that the following factors should be considered for sustainable material resources optimisation and include, use of standard space product design, designing to module and supply chain management. Designing to module is one of the major strategies and will assist in reducing/eliminating waste and/or eliminate non standardization. For instance doors and windows are usually design to standard modules and this usually assist manufacturers minimize wastage during production, hence assist in reducing selling cost to consumers. Lack of standard space allocations is another problem which can cause cutting materials to different sizes in building projects and the materials usually affected by this include among others floor tiles, ceiling board, block work, roofing trusses, roof covering; this is in agreement with Holm et. al. (2006). Also, adoption of supply chain management principle and development of material schedule software will help in achieving sustainable material optimization. This is in agreement with the study by Saka and Mudi (2007). There is obvious case of lack of comprehensive and value enhancing approach to supply chain issues in Nigeria.

8. Conclusion

Following all of the above mentioned, material resources optimization can be achieved at the various stages of construction. In line with the first objective (identify the major sources of material wastage at various construction stages) - the findings reveal that, selection of low quality products and inexperience of method and sequence by the labour force are the major sources of material wastage at the design stage. At the Construction stage, the major sources of material wastage are design changes during construction and re-working due to incorrect use of material and labour. While at the procurement stage, the major sources of waste are lack of possibility to order small quantity, and waste encountered during loading/transportation. The solution is the adoption of a robust system that enables the production of accurate estimates of material requirements at the start of a project that then links to real waste figures on completion. Finally, at the handling stage, the major sources of material wastage are theft and inappropriate storage. The paper also found that lack of adequate security in the country and inadequate knowledge of recycling are the challenges that occur more frequently in resource management. Also, lack of security has the highest impact on resource optimisation and over utilization of resources without value. Lastly, the following factors should be considered for sustainable material resources optimisation and include, use of standard space design, designing to module and adoption of supply chain principle will assist in reducing or eliminate waste and/ or eliminate of non-standardization.

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Voluntary Compliance and Regulatory Enforcement: the case of site waste management plans

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Abstract

To overcome the problem of excess generation of construction demolition and excavation (CD&E) waste and the resulting environmental pollution, waste management plans (WMP) are considered very effective. In the UK, site waste management plans (SWMP) were voluntary from 2004 until it became a regulatory requirement in 2008. A DEFRA red tape regulation challenge however repealed the SWMP (2008) Regulations in December 2013. Based on the theories of voluntary and regulatory compliance, the regulatory impact assessment (RIA) of the regulations, consultations leading to the repeal of the regulations and critique of literature, this paper ascertains the performance of the SWMP in England 4 years as a voluntary code and the same as a regulatory requirement. The results indicate that the performance of the SWMP (2008) Regulations was affected to a large extent by the design of the regulatory instrument, the enforcement style used and the lack of capacity on the part of some firms to comply. The paper concludes that; be it voluntary or regulatory, the goals of such interventions can be well achieved by using a well-designed instrument and building the capacities of firms to meet the demands of waste management. The paper recommends that normative compliance should be induced in firms by regulators collaborating with all stakeholders to ensure the burden imposed by compliance is offset by the gains of waste management through capacity building.

Keywords:

Site waste management plans, Regulatory enforcement, Voluntary compliance, Construction and demolition waste, waste management

1. Introduction

To overcome the problem of construction, demolition and excavation (CD&E) waste and its adverse effects on the environment, efforts in the UK have concentrated on changing waste behaviour in the construction industry to ensure sustainable management of waste. These efforts have mainly been pursued through the use of waste management plans (WMPs) and government legislation. According to Tam (2008), waste management plans (WMPs) are a very effective means to ensure waste is sustainably managed. Studies by Osmani *et al*. (2008) and Wang *et al*. (2010) on success factors for waste management, suggest that WM legislation is the most critical factor to ensure the negative effects of CD&E waste on the environment are controlled. In 2004, the then Department of Trade and Industry (DTI) introduced site waste management plans (SWMPs) as a voluntary code of practice in the UK to serve as an industrial best practice for waste management. Due to the successes of the voluntary code and the need to create a level playing field for all construction projects to manage waste, the English Parliament saw the need to make the SWMP mandatory in the construction industry in England. The English Parliament's intention to create a level platform for waste management by making site waste management plans a statutory requirement was seen as a good step (according to results of the consultation before introducing a regulatory requirement) as regulations have the ability to alter the behaviour of people for a set goal or target (Black, 2002).

The English Parliament in 2008, made SWMPs a legal requirement for all projects in England with a cost of £300,000 or more. One would generally expect, that putting together the most effective means to manage waste (site waste management plans) and the most critical success factor for CD&E waste management (government legislation) would easily result in sustainable management of waste in the UK construction industry. The Site Waste Management Plans (SWMP2008) Regulation (statutory instrument number 314, 2008), was repealed as part of a Red Tape Regulation challenge by the Department of Food and Rural Affairs (DEFRA) in December 2013. Based on voluntary and legal compliance theories, this research reviews the performance of SWMPs in England, four years as a voluntary code and four years as a legal requirement to determine compliance factors that affect the performance of SWMPs. The paper is structured as follows: the paper reviews literature on regulations and compliance theories to determine issues that affect the compliance efforts of firms. The research then reviews the performance of site waste management plans as a voluntary code and a regulatory requirement. Based on the outcome of the reviews, the paper analyses the performance of the regulation and voluntary code in the light of compliance theories to determine issues that affected the performance of SWMPs in England.

2. Methodology

This research adopts a literature review approach to determine the performance of the SWMP. The performance and general acceptance of the SWMP is reviewed from the perspective of compliance theories by exploring the compliance literature to determine issues of voluntary and regulatory compliance which may have affected the performance of the site waste management plans in England. Based on the outcome from the review of compliance literature, the research uses secondary information from the regulatory impact assessment (RIA), results from the consultation conducted before the repeal and published works on the performance of the SWMP (2008) Regulations to identify compliance issues with the SWMP (2008) Regulations.

3. Regulations and compliance

Before looking into the subject of the SWMP2008 Regulations, definitions for both regulation and compliance adopted for this research are given to set the context for this review. Although various scholars have defined regulation in different ways (Tamanaha, 2000; Ogus, 2004)), this research adopts the definition proposed by Julia Black. Black (2002), defines regulation as 'the sustained and focused attempt to alter the behaviour of others according to defined standards or purposes with the intention of producing a broadly identified outcome or outcomes, which may involve mechanisms of standard-setting, information gathering and behaviour modification' (Black, 2002 P.20). This definition of regulation is adopted because it takes into consideration the three key aspects of regulation: behaviour modification; sustained and focused attempt; and identified (targeted) outcomes. For the purpose of this study, a definition for compliance is adopted from Foorthuis and Bos (2011), who define compliance as "a state of accordance between an actor's behaviour or products on the one side, and predefined explicit rules, procedures, conventions, standards, guidelines, principles, legislation or other norms on the other". From the definition, compliance is seen to encompass two main things: the behaviour of the actor and the predefined rules, procedures and standards. This suggests conformity between the demands of the rules, standards or legislation and the behaviour of the people or firms who are the targets. In reviewing the literature on compliance and regulation within the construction industry in general, majority of the research on environmental regulation and firms tend to study compliance behaviour (decisions) of firms and measures to achieve/increase compliance with regulations (See for example Mitchell, 1996; Zaelke et al, 2005; Burbey and Paterson, 2005; Foorthuis and Bos, 2011) These studies suggests that there are a number of reasons for compliance and non-compliance.

Compliance behaviour, the tendency for individuals or firms to comply or not comply with the requirements of regulations or standards, can be grouped into automated, planned compliance or non-compliance. Whereas some (people or organisations) automatically comply with the requirements of legislation (automated compliance), planned compliance or non-compliance is said to epitomize the intentional pursuit of various goals, such as to maximize one's utility, fulfil a moral obligation such as duty or trust, or dispose of one's fear of sanctions (Etienne, 2011). The factors responsible for the intentional pursuit of compliance or non-compliance develop in the form of material, emotional and normative goals (Fisman and Miguel, 2007 in Etienne, 2011). Theories on decision-making posit that people and groups select among alternative lines of action in a limited number of relatively simple and universal ways (see James and Bennet, 1994). According to Suchman (1977), these ways of decision-making can be divided into three leading perspectives – rational/instrumental, normative/moral and cognitive/constitutive/definitional and these translate into behaviour (see Suchman, 1997). Whereas rationalistic perspectives analyse the decision making process as based on pure material self-interest, normative perspectives hold that decision making is primarily on the basis of ingrained moral beliefs. Cognitive perspectives on the other hand analyse decision-making as primarily on the basis of 'taken-for-granted' roles and scripts, without consciously exploring alternative possibilities at all (Suchman, 1997). In the area of compliance behaviour, these ways of decision making can be said to diverge into two basic perspectives; instrumental (rationalist), and normative (moral) perspectives (Kirchler *et al*., 2008; Foorthuis and Bos, 2011). These two perspectives have also been labelled by Mitchell (2007) as the logic of consequence (rationalists) and logic of appropriateness (moralists).

The logic of appropriateness or normative (moral) perspective is responsible for voluntary compliance of firms or actors where people see legislation, standards or industrial codes as appropriate for a common good making them willing to comply. The logic of consequence or rationalistic perspective on the other hand induces rationalistic compliance in that compliance behaviour is based on the calculation of costs and benefits. Analogous with the theory of rational crime (Becker, 1996), a profit maximizing firm will comply with environmental regulation only as long as the expected penalty for non-compliance exceeds the cost of compliance and there is a high likelihood of noncompliance being detected (See Becker, 1996). In the area of environmental regulation, Heyes (1998) reports that, regulations are only useful if firms comply, and this comes by way of enforcement of regulation as compliance efforts come with cost implications. Normative theories however, depict that compliance behaviour is not solely determined by cost and benefit analysis (see Sutinen and Kuperan, 1999, Heyes, 2000). Normative theories according to Foorthius and Bos (2011), do not take the stance that an actor's behaviour is irrational, but tend to broaden the scope to prevent reducing the discussion to costs and benefits. For instance, it is acknowledged that there may be non-compliance or hindrance in implementation due to lack of capacity, knowledge or commitment where regulations are ambiguous, complex or continuously changing, or are too numerous. Normative theories require that both regulators and industry work together to ensure goals of regulation are met. Some authors report that regulation is 'co-produced' (Black, 2002), which suggests that both regulators and 'regulatees' have problems (needs) and solutions (capacities) leading to a mutually dependent relationship for the resolution of each other's needs (Kooiman, 1993). This dependent relationship requires efforts from both parties to ensure mutual goals are met. Wong (1961), suggests that three main factors promote compliance within organisations: fear of formal legal sanctions; fear of informal sanctions; and the internalization of legal norms or a moral commitment to comply with the law. For these three factors to lead to compliance there must be enforcement (by the regulators), which will be able to detect and punish non-compliance as well as the moral commitment to comply with the law (by the regulatees). Moral compliance can be linked to moral/normative compliance efforts, which can lead to voluntary compliance within firms whereas enforcement and the fear of sanctions lead to compliance with legislation.

The promulgation of regulations has not always been successful in meeting the intended objectives. Black's (2002) research on *rethinking of regulation*, suggests that a number of factors are responsible for the failure of regulations to meet the intended goals. These factors are: instrument failure (inappropriate and unsophisticated instrument); information and knowledge failure (insufficient knowledge about problems to design regulations); implementation failure; and motivation failure (on the part of the regulated entities) (see Black, 2002). Information failure suggests that no single actor (government or industry) has all the required knowledge and overview required to solve complex problems or make regulations effective (Black, 2002). For regulation to be effective there should be ample information regarding the cause of problems that need to be tackled by the regulation. Instrument failure on the other hand occurs when the laws backed by the sanctions (instrument) are deemed inappropriate and unsophisticated leading to the failure of regulation. Implementation failure suggests that failure occurs when there is inadequate implementation of regulation. Motivation failure occurs when those regulated are insufficiently inclined to comply and those doing the regulation are insufficiently motivated to regulate in the public interest. In this light, Braithwaite proposed a motivational posture as the best means to implement regulations. The motivational posture is defined as ''an interconnected set of beliefs and attitudes that are consciously held and openly shared with others'' (Braithwaite, 2003 in Kircher *et al.*, 2008). This posture helps regulators to overcome the issue of motivation failure as there is the recognition that legal sanctions alone are not sufficient. According to Kircher *et al.* (2008), a motivational posture leads to a responsive regulatory approach as it tends to favour a focus on education, persuasion and dialogue as strategies to gain and maintain compliance.

These factors suggest that regulations can fail on any of these aspects, undermining the efficacy of the regulation (one of two major critiques of regulation). The second major critique of regulations, the value based critique, also suggests that regulations are normally not directed at the correct goals and this may affect motivation to comply (motivation failure). Combining the results from the reviews of regulation and compliance, the success or failure of regulation to induce compliance can be said to be a combined effect of the efficacy of the regulatory instrument, the behaviour of the regulated entities or people and the efforts of the regulators in implementing the demands of the regulation. The next section reviews the implementation of SWMPs in the UK to determine aspects of complaince and regulatory enforcement which may have affected the performance of the regulations.

4. Performance of Site Waste Management Plans (SWMP)

SWMPs in the UK as a voluntary code of practice (introduced by DEFRA in 2004) was mainly adopted by large firms who had knowledge of the benefits of using SWMPs. The voluntary uptake can be linked to normative compliance on the part of the large firms who either saw it appropriate to use SWMPs (logic of appropriateness), or as a moral obligation. Voluntary SWMPs was not adopted by small and medium firms. Chen (2005), reports on surveys on environmental behaviour of small and medium firms in the UK conducted in 2003 which suggests that, for such small firms, the issues of lack of available (adequate) resources and time to address environmental issues are the main problems affecting the adoption of environmentally significant programs. Additionally these small and medium firms are less aware of their negative impact on the environment as well as relevant environmental regulation applicable to their activities. These findings were similar to results from Solomon and Mihelcic (2001) on large firms. They suggest that, larger firms have a greater likelihood to implement voluntary compliance programs due to their greater level of resources and perceived benefits and positive press coverage (which positively affects the image of large firms).

Thus whilst the larger firms have factors that favour them to implement voluntary programs (or environmental programs in general), the lack of adequate resources and general lack of information on the impact of their activities on the environment prevents smaller firms from pursuing voluntary programs. This can be seen to have reflected in the behaviour of small and medium firms towards the voluntary SWMP code introduced by DEFRA in 2004. Such firms are only likely to adopt SWMPs if it is a mandatory requirement. Regulatory SWMPs has the ability to cause small firms who otherwise would not take up the plans to comply due to the consequences of non-compliance (logic of consequences).

For instance, during the regulatory impact assessment (RIA) of the SWMP (2008) regulations, many respondents were of the view that regulatory SWMPs will have the power to get small and medium firms, who are known to be culprits of fly tipping, to sustainably manage their waste. Issues such as the aforementioned (lack of voluntary compliance, and inadequate knowledge of effect on environment), the positive results of using SWMPs, and the need to create a level playing field for managing waste, made the use of regulations necessary.

The English Parliament in February 2008 thus made SWMPs a mandatory requirement for all projects with a cost of 300,000 pounds and above. SWMP (2008) regulation was set to ensure that clients and contractors in the construction industry take responsibility and account for any amount of waste arising from their construction as well as demolition activities. SWMP (2008) regulations sought out to achieve three main aims: to improve resource efficiency in order to reduce the amount of waste produced and recover as much as possible; to help prevent the rising levels of waste crimes and reduce flying; and to reduce the administrative burden of the industry by providing a mechanism for complying with all existing legal requirements. The responses from the consultations in 2007 on making SWMPs a regulatory requirement generally favoured the making of SWMPs statutory. 75% of the respondents from the board of all relevant stakeholders and 58% of industry responses favoured the regulations. This suggests that, for the respondents, making the SWMPs regulatory was welcomed and they saw the need to support it. Majority of the responses, 85% in total, also suggested that the regulations would help in terms of improving resource efficiency. The move to make SWMPs a regulatory requirement was seen to be in the right direction (according to the consultation before making SWMPs a legal requirement) as the goal of ensuring all actors in the construction industry manage waste according to the plans was unlikely to happen without a legal requirement. This was also due to the fact that the voluntary code was only acting as a checklist and there was no legal obligation for the industry. SWMP as a regulation was however short lived as it was repealed in December 2013.

5. Results from Consultation before the repeal of the regulation

In 2012, DEFRA proposed the repeal of the SWMP (2008) Regulation as part of the Red Tape Challenge which was targeted at removing unnecessary legislation to free-up businesses. In line with this, DEFRA in August 2013, undertook consultations with five (5) categories of respondents namely: contractors; private businesses; health and safety officers; local authorities; and clients (DEFRA, 2013). The purpose of the consultation, which was done through an open ended questionnaire survey, was to ensure government understood the implications of the proposed repeal (DEFRA, 2013). A total of 169 respondents undertook the survey. Results of the consultations before the repeal of the SWMP2008 regulations suggested mixed reactions to the repeal. For the 72 contractors consulted, 41 agreed to the repeal whiles 29 disagreed with the repeal. Out of the total 72 however, 55 suggested they would still use the SWMP even if it is repealed. Similar results were received from the other groups consulted. For private businesses, out of the 38 consulted, 18 agreed to the proposed repeal whereas 20 disagreed and were in favour of the regulation. For local authorities, out of the 9 respondents, only 2 agreed to the repeal while the remaining 7 were against the repeal of the regulation. For clients, out of the 6 consulted, 5 were against the repeal with only 1 client supporting the repeal of the regulations. 24 respondents from the repeal consultation cited the lack of engagement with designers and architects as the main weakness of the Regulations and also as a reason to repeal (DEFRA, 2013).

A very significant comment from the consultation document reads: "SWMP legislation by-passes the construction design phase which also wields huge power and influence in the creation of resource-efficient outcomes e.g. by 'designing-out' waste and specifying recoverable/recyclable products/materials" (DEFRA, 2013). This comment can be linked to both the value based critique of regulation and information failure on the part of the regulators. Considering the recognition that the design phase of projects has the highest impact on waste management, the design of the regulation should have taken this information into consideration and targeted designers with the obligation to reduce waste by design.

Of the reasons cited by the respondents to the consultation, both for and against the repeal, it was suggested that enforcement was a major issue regarding the SWMP (2008) regulations. The lack of enforcement was seen as a major reason either contributing to, or causing the failure of the Regulations as per the responses obtained. The report captures the enforcement view succinctly as per the following quote 'those against the repeal believe that if enforcement had been more effective, then the Regulations would be more successful, as currently they may be ignored which may reduce the gains that they were supposed to bring' (DEFRA, 2013). Central to enforcement was 'which statutory body was responsible for it'. The report findings suggest that though local authorities and the Environmental Agency have a power to enforce the regulation, none of the two was given a specific duty to enforce the regulation thus preventing effective enforcement.

Also of importance from the consultation was the confusion over the importance or benefits of having site waste management plans as a legal requirement. As stated in the consultation responses, some respondents found it confusing that "England wants to repeal the SWMP (2008) regulations and Wales at the same time wants to introduce SWMP regulations; this suggests that the thinking about the benefits of SWMPs is confused". The confusion on the benefits of the regulations can also be said to be a major impact on the responses of the industry to the regulation. As shown, from the extract above, there is confusion on the importance or impact of the regulation on waste management in the industry and this could have accounted for the poor performance of the regulation.

From the results of the consultation, it is evident that the regulations could not achieve that aim of regulation (to lead to a broadly defined outcome, efficient waste management in this case) and this was due to a number of factors affecting compliance. Though administration burden and the bureaucratic nature of the regulation were the main arguments of those in favour of the repeal of the regulation, from the review of literature and the consultation results however, the regulation can be said to have suffered mainly from enforcement failure. Due to the failure on the part of the regulatory body to properly implement or enforce the regulations, compliance levels were low especially for small and medium firms. This can be linked to the factor of time and resources which is cited as a major problem for complying with regulation (Chen, 2005). This weakness in the regulation which affected compliance and its goals falls within the effectiveness critique of regulation. Though the regulation had clear goals to be achieved, the design and enforcement issues (not targeting the correct people) defeated the main purpose of the regulation making it not very effective in its approach.

In reviewing the performance of SWMP (2008) Regulations, Baldwin (2010) before the repeal of the regulations suggested that the regulations suffered an enforcement failure, as there were no clear lines of authority as to who would enforce the regulation. Shiers et al. (2014) also report that implementation of the SWMP regulation failed making it ineffective (implementation failure). This is in line with the effectiveness critique of regulation (Black, 2002) which is caused by wrong enforcement tactics or little enforcement on the part of the regulators. As reported in Hayes (1998), without enforcement, environmental regulations are not effective, as some firms will not comply. The poor performance of the regulations can also be seen in the light of implementation and motivation failure (See Black, 2002), as the consultation before the repeal suggested some firms saw the regulation as an extra burden and a strain on resources.

These factors, (enforcement, implementation, motivation and instrument failure) affected compliance to a very large extent especially with small and medium firms who do not have the luxury of resources and time and possess a tendency to be rationalistic in their approach. The issue of lack of resources and motivation affecting compliance can be seen in the performance of the SWMP (2008) where it was reported (during the repeal) that for big firms, there is a high probability to continue the use of SWMPs even with no legal requirement. Just like the voluntary code in 2004, it is evident that large firms are generally endowed with resources and their quest to invest in 'environmentally significant behaviour' (Stern, 2000; Kollmuss and Agyemang, 2002) will make them continue to use SWMPs. For this reason, it is not surprising that some larger firms propose to still use the SWMP even when it is no more legally required. For small firms however, the lack of resources and time suggest they will not go out of their way to use SWMPs unless there is a legal requirement and enforcement tactics are likely to capture non-compliance. This demands enforcement approaches that are likely to detect and punish non-compliance with and the cost of non-complaince being higher than the cost of compliance. That Wales wants to make SWMPs regulatory and some firms willing to use the plans after the repeal of the regulations in England emphasizes that the SWMP is actually an essential aspect of waste management and has been accepted widely in the industry as some researchers claim. This is a more reason why a better design and enforcement of the SWMP (2008) Regulation to encompass small and medium (rationalistic) firms would have positively affected waste management in the construction industry in England.

For effective enforcement of regulations, the motivational posture (Braithwaite, 2003) which is a normative approach to regulatory enforcement is encouraged. This form of normative compliance approach when used for regulations, especially for environmentally targeted regulation, has the ability to not only induce compliance behaviour but to help firms who lack the capacity to pursue such actions. This posture helps to create the mutually dependent relationship (Kooiman, 1993), needed to increase compliance. The education aspect of this approach can help firms who are not aware of their role in such environmentally significant behaviours to have a changed posture both in knowledge and abilities. Doing so will lead to increased compliance be it regulatory or voluntary instrument.

6. Conclusion

Considering the evidence of this review, it can be said that the Site waste management plans are an integral part of construction, demolition and excavation waste management. The poor performance of SWMP as a regulatory requirement can be linked to wrong enforcement approach and target of the regulation leading to poor compliance (non-compliance). The review suggests that, because site waste management plans were accepted as voluntary code by a section of the industry who have the means to produce these plans, a better approach could have been used for the legal SWMPs to capture those who did not take up voluntarily compliance (those with rationalistic behaviour) through better regulatory enforcement tactics.

This research concludes that, be it voluntary or regulatory, compliance with environmental standards both in the construction or any other industry is affected by three main factors: a well-designed and targeted instrument; industry possessing knowledge of the importance of the regulation/code; and the ability of industry to meet the demands of such regulation or code. To achieve this, a normative compliance strategy where industry or businesses are empowered to build their capacity to comply is encouraged. Such an approach has the tendency to help industry make the best out of their compliance efforts, cut down costs and lead to real benefits.

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The energy assessor's use of energy models for the calculation of carbon and cost savings on residential property: how effective are retrofit measures?

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Abstract

The 2008 Climate Change Act has bound the UK to reducing carbon emissions by 80% in 2050 from 1990 levels. Key to achieving this is a focus on reducing carbon emissions in residential property, where more than a quarter of the nation's carbon is emitted. Within this context, this paper will look at the building energy modeling system in place for reporting carbon reductions, with a focus on the system's user. In doing this, the author will simulate errors in data collection and input, and analyse their ramifications. The paper will conclude by looking at how these errors and their impacts may be mitigated, and touch upon potential alternatives to the current system which may produce more robust carbon reporting.

Keywords:

Energy Efficiency, Residential, Surveying, SAP, RdSAP, ECO

1. Introduction

There are approximately 26 million houses in the UK. In total, the residential sector accounted for around 29% of overall energy consumption in 2009 (ONS, 2009), and the residential sector accounts for 26% of overall UK CO_2 emissions (Swan and Ugursal 2009).

These figures are easily obtained from literature published in many genres of research, because there is a general consensus around the assertion that the climate is changing, and a corresponding political focus on how this might be addressed. The European Union has implemented policies and targets that have cascaded through to individual member states, outlining mitigation measures by reducing carbon emissions which were based on data identified in the 1995 Intergovernmental Panel on Climate Change (IPCC) report (HM Government, 2006). The figures above point to the residential sector as a key contributor, and there is an ever more urgent need to tackle this if the 2008 Climate Change Act's binding target of reducing carbon emissions by 80% in 2050 from a 1990 baseline are to be achieved.

The UK's residential building stock is ageing when compared with the rest of the world. Approximately 40% of buildings were constructed prior to 1944 (Dixon & Gupta, 2008). Furthermore, it is estimated that over 75% of buildings in use today will still be standing in 2050 (Boardman et al., 2005: Sustainable Development Commission, 2007, p 41). The slow replacement of housing stock at consistently under 1% annually (DCLG, 2013) means that proposed changes to the way we build new homes (zero carbon is proposed by the UK government in a revision to Part 1A of the building regulations from 2016, four years earlier than the European requirement under the EPBD (Energy Performance of Buildings Directive) in 2020)) will make only a minimal impact on energy use within the domestic sector. This in turn will mean minimal inroads into policy issues including climate change and fuel poverty. Transforming the nation's *existing* building stock may therefore be considered essential.

However this is a challenge that has a number of facets. Residential energy consumption is a complicated issue, related to a number of factors including the physical attributes of the homes in which people live, the electrical systems or appliances they use, as well as the occupant's behavior (Yao and Steemers 2005) (Swan, Wetherill et al. 2010). To increase complexity yet further, one can add in fuel prices and inflation (Kavgic, Mavrogianni et al. 2010). It may be considered very challenging to bring all of these factors together and address them for the purpose of creating effective energy policy.

The focus of this paper is primarily that of assessing a property's energy efficient status by the surveyor, and the resultant information produced, however this is reviewed within the political, economic and social context of the above. This is because an integral part of the wider context is the ability to be able to measure the energy efficiency of a building (a residential building for the purpose of this paper) accurately and consistently, so that progress against targets can be measured and current emissions can be calculated. The surveyor's function is directly linked to the social, economic and political context outlined because the production of the Energy Performance Certificate – the product of the surveyor's assessment, contains information that feeds directly into all these areas. This will become clear during the course of this paper.

2. Energy Performance Certificates

An Energy Performance Certificate (EPC) represents a report undertaken by a surveyor, or to give the proper title, 'Domestic Energy Assessor' (DEA – in the case of residential property) on the calculated energy performance of a single dwelling. EPCs were introduced in various stages throughout the UK from 2007 to 2009, in order to fulfill the requirements of the EU Directive 2002/91/EC on the Energy Performance of Buildings Directive (Brussels: European Parliament and Council, 2003). The reports contain two key indicators: a 'SAP' (standard assessment procedure) score, and an EI (environmental impact) score (see Fig 1). Despite popular belief, SAP does not estimate building energy efficiency per se but instead attempt to estimate the cost effectiveness of energy efficiency measures, and thus create perverse incentives which may lead to an overall increase in CO2 emissions (Scott, Kelly, 2013). This assertion will be touched upon later in this paper.

The primary function of these reports was initially (and may still be considered to be) to 'enhance the role of building energy efficiency for all buildings sold and let; use the SAP rate as a trigger for improving the energy efficiency of buildings; and introduce minimum SAP rates into the building regulations for the construction of new buildings' (Kelly, Crawford-Brown et al. 2012). The report has to be made available to prospective buyers or tenants prior to entering into a contract, and is valid for up to 10 years (The Energy Performance of Buildings Regulations, 2007). This is a headline figure, with the caveat that any material changes that would affect the energy efficiency of the property would render the EPC invalid (Appendix S, RdSAP 2009 version 9.91 January 2012, BRE). In addition to the arbitrary SAP scale noted above, which may be considered the primary indicator of the EPC, the certificate also includes an 'Environmental Impact' rating (see figure 1) and information on the estimated running costs of the building broken down by service type.

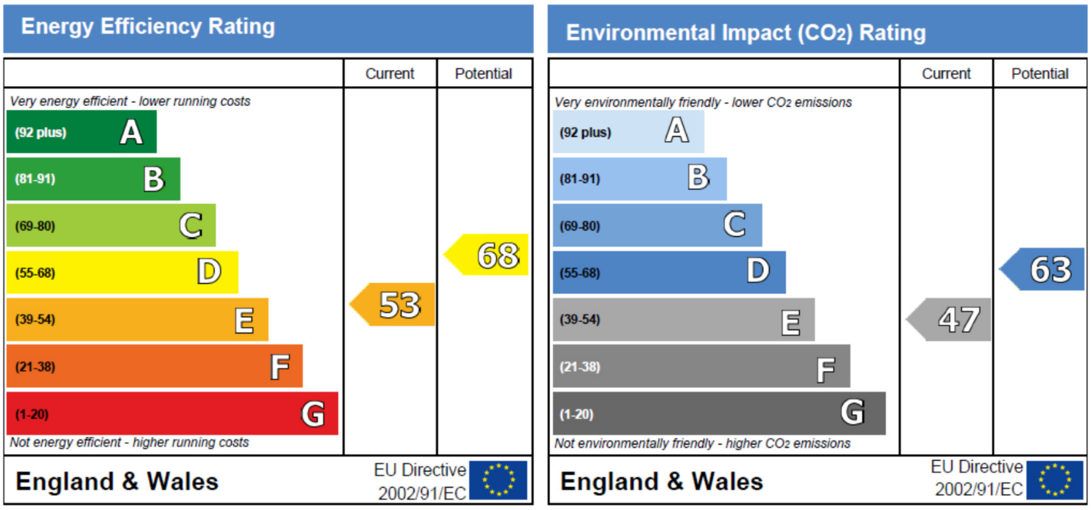
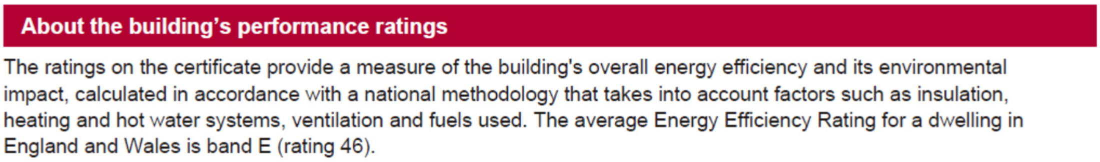


Fig 1: The SAP and EI scores on an Energy Performance Certificate ***(Source: W-Y-P Gledhill 2009)***

Average building performance of all UK dwellings is also included (currently Band E) but such information is not particularly helpful, because different building archetypes (or categories of dwelling) perform very differently (see figure 2).



About the building's performance ratings

The ratings on the certificate provide a measure of the building's overall energy efficiency and its environmental impact, calculated in accordance with a national methodology that takes into account factors such as insulation, heating and hot water systems, ventilation and fuels used. The average Energy Efficiency Rating for a dwelling in England and Wales is band E (rating 46).

Fig 2: information from the EPC including average rating for a dwelling in England and Wales, presented on all EPCs. ***(Source: W-Y-P Gledhill, 2008)***

For instance, a circa 1930 constructed detached house with high ceilings and a large floor/wall area would perform poorly in comparison with a mid-terraced bungalow of the same age, by virtue of the increased volume of internal space there is to heat, and the increased surface area of wall through which heat will be lost. If the average performance of a building in the same building category (i.e., same building type, age and construction material) were given instead, as is the case in Germany (Andaloro, Salomone et al. 2010), it would give owners a better indication of whether their property was over or under-performing for that particular building category. Such an addition might in turn lead to more attention being paid to this scale, and consequently, increased uptake of energy efficient measures. The certificate would also then represent a more tailored, dwelling specific form with this addition.

However Kelly et al. (2012) write that, using the SAP model, there has been tremendous growth in energy efficiencies of residential property since 1970, citing the data source of DECC's Domestic Energy Consumption in the UK Tables. These show an average SAP rating of residential property in the UK of 18, rising to 54 in 2010. Kelly et al make the point that continual growth at the same rate would see an average SAP rating of 88 by 2050, and conclusions are drawn from this within the body of their paper. However, a considerable number of 'easy wins' have been obtained over the period to 2010, including loft insulation, cavity insulation and double glazing. The measures required to continue the rising trajectory at the same rate are arguably more difficult and costly to achieve, such as solid wall insulation, 'hard to treat' cavity insulation to older properties (Swan, Wetherill et al. 2010), or the insulation of renewable energy measures such as solar PV. It could be regarded as more likely therefore that the increases in energy efficiency seen during the period from 1970 to 2010 are not likely to be sustained at the same rate to 2050, and that steadier progress may be made, especially to the 75% of current housing stock that is estimated to be remaining in the UK in 2050 (ECI, 2005).

In 2008 the provision of EPCs to householders constituted their primary, if not their sole function. There was no further purpose outlined for them under the EPBD that instigated their widespread, mandatory use throughout the UK. However, since then their role has widened, and the extent to which this data is relied upon by policy makers, analysts, energy efficiency installers, as well as the money that changes hands based on the contents of each report (in the form of carbon trading)(Nick Duxbury, 2013)(ECO, 2013) are all recent developments (since 2008) that were possibly not foreseen during the inception of the EPC. The UK government currently lists in bullet points the current uses of SAP as being: (Gov.uk, 2014):

- Buildings Regulations for England and Wales and the Devolved Administrations
- HM Treasury's Stamp Duty exemption for zero carbon homes
- Energy Performance Certificates
- Code for sustainable homes
- Warm Front (now defunct)
- Energy Company Obligation
- Local Authority housing stock reporting
- Green deal
- Renewable Heat Incentive
- Feed in Tariff (FiT)

Furthermore, the national English Housing Survey (EHS) energy data is reported using SAP scores (EHS, 2012).

3. The Energy Company Obligation

The Energy Company Obligation (ECO, 2013) is the most recent incarnation of the government's plan to reduce carbon emissions in the UK residential sector. This began in January 2013. The framework is broadly similar to that of CERT and CESP schemes (Previous Energy Efficiency Schemes, ofgem, 2013). The ECO scheme places three separate obligations on energy suppliers: the Carbon Emissions Reduction Obligation (CERO), the Carbon Saving Communities Obligation (CSCO) and the Home Heating Cost Reduction Obligation (HHCRO, but more often now referred to as 'Affordable Warmth'). Each of these are met by installing insulation measures which reduce carbon emissions (or energy bills in the case of Affordable Warmth) in the domestic sector. In the same way as in CERT and CESP that preceded ECO (Previous Energy Efficiency Schemes, Ofgem 2013), the targets imposed on the energy companies are a reflection of their shares of the market, and they are expected to meet these obligations by promoting and subsidising the measures.

ECO's carbon targets will total a relatively modest 27.8 Mt CO_2 (in comparison with annualised targets for CERT/CESP schemes, (ofgem, 2013)) (Energy Company Obligation, 2013) over the initial period from January 2013 to March 2015. These targets were initially apportioned as a 20.9 Mt CO_2 target under CERO, and 6.8 Mt CO_2 under CSCO (of which at least 15%, or 1 Mt CO_2 must be delivered to rural households – the 'rural safeguard', thus ensuring that these more difficult to access areas do not fall by the wayside). Since the outset, CERO targets were revised downwards from 20.9 Mt CO_2 to 14.0 Mt CO_2, after talks between energy companies and the government. This reduction might be seen as successful lobbying by the utilities.

The Affordable Warmth targets are independent of the carbon saving targets, quantified as cost savings, and a total reduction of lifetime notional space and water heating costs were set at £4.2bn by March 2015. Ofgem's January 2015 compliance update points to reasonable progress toward these figures, and the targets are widely expected to be met (ofgem, January 2014).

4. RdSAP and carbon calculating

With a context in place, this paper now moves on to model a variety of scenarios using SAP methodology, in an attempt to see how fit RdSAP might be considered for this carbon calculating purpose, as well as other purposes for which the model is now used. More specifically, the brief under this heading is to look at variations in RdSAP's *carbon calculating* outputs. This is with a view to how carbon reporting (and ultimately energy efficiency reporting) might be affected by small changes in input data for the same property. This section is divided up into two distinct parts: the first part looks at what impact might be seen in human error: simple input variations, innocent in nature, that may arise from a lack of understanding or slight variations in site measurement/data collection by the Domestic Energy Assessor (the DEA).

The second section will look at those variations that may be considered to have been applied deliberately. Energy Assessors working for unscrupulous installers might be recruited as, or for this purpose referred to as 'carbon catchers' – the sole aim being to try and glean as much carbon from any particular property as they possibly can using the RdSAP model. The paper will present briefly some of the ways in which additional carbon can be easily obtained in potentially unscrupulous fashion from the same property, while still working (arguably) within the boundaries of the DEA's professional obligations to his/her Accrediting Body.

In doing this a control property provides a benchmark. This control property will be a simple property: a 1950's constructed semi detached house, of traditional cavity construction, measuring 7.0x7.2m = 50.4m per floor, 101m2 overall, with no cavity insulation, 50mm loft insulation, gas central heating from a modern, condensing combination boiler, double glazing, no secondary heating (ie gas fire to living room/stove etc) and no renewable energy sources or other anomalies.

The carbon counting is paramount to this exercise, but the paper will report on three outputs from each drafted Energy Performance Certificate (EPC): the SAP score, the Environmental Impact score (EI) and the annual carbon emissions. This is because some interesting results come back from these SAP and EI scores that may merit further investigation (although for the purpose of this paper the carbon is the key focus).

The Control Property's key attributes (for our purposes) are presented as follows:

SAP D65
EI D60
4.3 tonnes of CO2 emitted per annum

This property can be considered a benchmark therefore. The point of having this benchmark property is to see what happens when measures are applied, precisely the way they would be if they were to be submitted as a claim for carbon funding under ECO, (or a claim for Green Deal funding, or Renewable Heat Incentive, or FiT for that matter). For the purpose of this relatively short paper, the aim is keep it simple: loft insulation and cavity wall insulation measures are arguably the most simple and effective retrofit applications (Verbeek, G, 2005): these will be compared and contrasted. This is what happened to the control property when the measures were applied:

a. Control Property with Loft Insulation (300mm):

SAP D67
EI D63
4.0 tonnes CO2

b. Control Property with Cavity Wall Insulation:

SAP C72
EI C69
3.3 tonnes CO2

5. Control property variations: human error

Gathering site data for an EPC can be quite challenging: physical restrictions can impede access to certain areas of a property, which can have an impact on the accuracy of measurements taken, as well as reducing visibility to some important areas. Simple issues such as poor weather conditions or a rather overly attentive/inquisitive householder can contribute to rushed or inaccurate measuring and recording of data. The EPC inspection process is non-intrusive, furthermore a householder's possessions should not necessarily be moved. All this gives plenty of scope for human error. Even small errors can have a notable impact on the quality of the data, and hence the carbon calculation that is driven by these inputs.

The first set of simulated errors might reflect this then. The test case is therefore re-submitted with two key areas altered: a 5% margin of error has been applied to the original measurement of the floor area and ceiling height (now 7.35x7.56 = 55.57 floor area, 2.52 ceiling height, 22.26 heat loss perimeter), and an assumption has been made that the boiler model qualifier is obscured on this occasion, so the precise boiler model cannot be selected from the RdSAP software's 'PCDF' (Product Characteristic Data File)(BRE, 2012). Instead, a generic 'condensing combination boiler' is selected under RdSAP's 'main heating code' to account for dwelling heating. See Fig 3 below. All other data inputs are identical to the original Control Property.

Fig 3. Above: photograph of boiler without model qualifier available, and below, boiler with model qualifier to right hand side (W-Y-P Gledhill, 2015)

This is what the Human Error EPC looked like:

a. Human Error EPC

SAP D63
EI D56
5.1 tonnes CO2

b. Human error EPC with Loft Insulation (300mm):

SAP D65
EI D58
4.8 tonnes CO2

c. Human Error EPC with Cavity Wall Insulation:

SAP C70
EI C66
4.0 tonnes CO2

5.2. Test property variations: 'carbon catchers'

'Carbon catchers' is simply a term used for the purpose of this paper, that might refer to forced errors for the purpose of gleaning extra carbon savings, rather than straightforward human error.

To this end (and disregarding for the purpose of this study whether or not these errors are forced or unforced), the Human Error EPC has been given two further amendments. Firstly, one might be able to imagine that when inspecting a loft, it can be difficult to measure the depth of insulation very accurately. The difference between 50mm and 25mm of quilt, especially when, for example it is decades old, compressed in places by items of storage, and affected by condensation or damp, can be very difficult to decipher. Add to this the ergonomic difficulty for the DEA in balancing him/herself at the top of a ladder, holding a tape measure in one hand and a camera in the other, possibly a torch somewhere also, and taking a clearly focused photograph of the depth of insulation in order to provide appropriate evidence for his/her Accrediting body, and one can get an idea of the challenge this presents (See fig 4). This is the current requirement. Needless to say, it might be quite straightforward for even the most scrupulous of DEAs to record a 25mm depth of insulation over a 50mm depth, or a 75mm depth over a 100mm depth, and to provide robust photographic evidence in support of this. Indeed, there may well be a considerable range of depths available to record just from either side of the loft hatch. But this data makes a big difference to the EPC outputs. To reflect this, the next simulated errors have been to reduce the loft insulation depth from the 50mm recorded in the Test Property EPC and Human Error EPC, to 25mm. Furthermore, and in the same vein, many householders own small electric fan heaters or convector heaters for the purpose of drying clothes etc., or in the often misguided belief that using just the one heater saves them money over firing up the central heating. These are often stored away in cupboards, but for the DEA this represents another quick win when it comes to carbon income. An electric 'panel or convector' heater is now recorded under secondary heating in RdSAP.

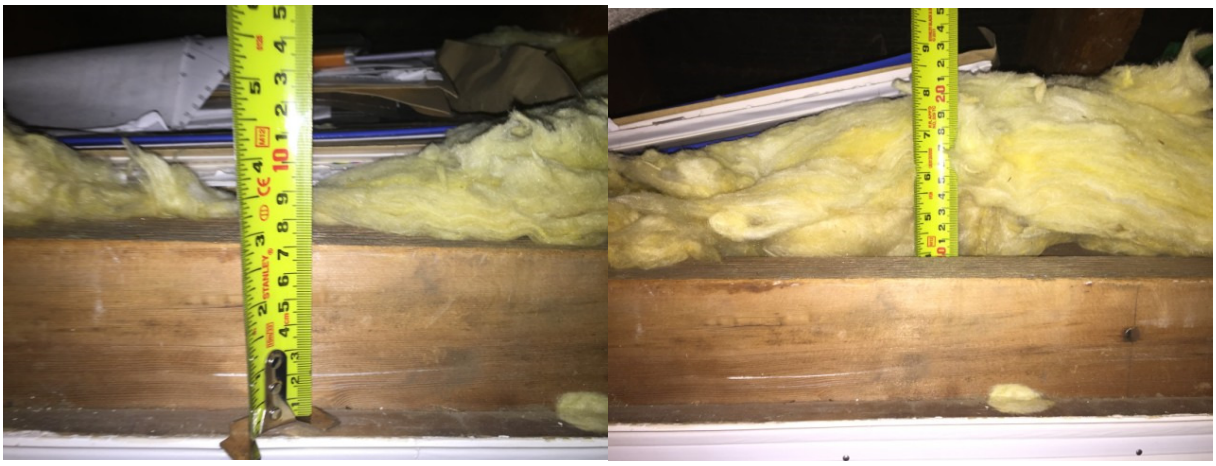


Fig 4: the same loft, with tape measure in photograph above showing circa 100mm of loft insulation, and below, showing around 200mm loft insulation. (W-Y-P Gledhill, 2015)

The results of this drafted EPC are as follows:

a. Carbon Catcher EPC

SAP D56
EI D51
5.7 tonnes of carbon pa

b. Carbon Catcher EPC with Loft Insulation (300mm):

SAP D60
EI D55
5.2 tonnes

c. Carbon Catcher EPC with Cavity Wall Insulation:

SAP C64
EI C64
4.5 tonnes

6. SAP and RdSAP for carbon calculating

One further dimension that can add notably to inflated, or inaccurate carbon counting, is the ability to be able to combine SAP with RdSAP. Wall U Values (a U Value is essentially an energy efficiency calculation for an individual dwelling element ie wall, roof, floor etc) are assumed in RdSAP, and defaults are applied based on the age and type of property that has been selected earlier in the data set. If s/he wishes, the DEA is able to record the constituent parts of the wall, for example brickwork 100mm, cavity 60mm, blockwork 100mm, plasterboard with ‘dabs’ 20mm (dabs are globules of adhesive that stick the plasterboard to the wall), plaster skim 3mm. A person with the qualifications outlined below can then record a U Value in SAP (or ‘full’ SAP) for use by the DEA in the RdSAP property assessment. While a qualification is required of the individual producing the U Value (see Fig 5 below, an extract from SAP 2009), none is defined as regards the site data collector.

Where the assessor has entered the U-value of any construction element that is used directly for the calculations.

U-value entry (walls, roofs, floors)

The U-value is that of the whole element, including any added insulation. Documentary evidence applicable to the property being assessed (see convention 9.02) must be provided and recorded if overwriting any default U-value. This evidence shall be either:

- relevant building control approval, which both correctly defines the construction in question and states the calculated U-value; or
- a U-value calculation produced or verified by a suitably qualified person.

Evidence of suitable qualification is through membership of a recognised U-value calculation competency scheme (BBA/TIMSA (UK)), OCDEA membership (England & Wales, Northern Ireland) or any other scheme formally agreed between Accreditation Schemes/Approved Organisations and Government.

Fig 5. RdSAP 2009 9-91, Appendix S, January 2012 (BRE, 2012)

For ECO, these site data collectors are usually the DEAs themselves, who are not necessarily trained or skilled in intrusive survey inspection, nor necessarily equipped with the understanding that is needed to provide an accurate description of the building materials identified. Hence there is plenty of scope for inaccurate data sheets to be turned into legitimate U Values by SAP assessors, often in turn generating far greater carbon gains than should really have been gleaned.

Briefly, see figures 6, 7 and 8 below, where two U Values show contrasting scores.

Fig 6: picture showing vented cavity wall (the red brick is a 'cavity vent') and sub-floor ventilation below it, painted grey. The inexperienced Energy Assessing Surveyor might mistake one for the other, and the consequences are outlined in figures 3 and 4 below. (W-Y-P Gledhill, 2005)

U-value calculator report

Page 1 of 1

Project Reference: Wall Calculations

Issued on Date: 25/01/2015

Project:

Type Ref: Wall U Value

Surveyor: Toby Gledhill, Tel: 01924249970 — Surveyor ID: C300-0001

Address:

Client: W-Y-P Gledhill, Wall calculations

Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.02r03

Building Elements:

Wall 7 Gibbs Leaze, NG3 4LA - Cavity wall U Value

Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.040	
Layer 1	**Brick, outer leaf**				
	Main construction	103 mm	0.770	0.133	82.81 %
	Bridging - Mortar	103 mm	0.941		17.19 %
Layer 2	**Standard cavity**				
	Main construction	68 mm	0.375	0.180	100.00 %
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	**Blockwork, medium**				
	Main construction	100 mm	0.570	0.175	93.43 %
	Bridging - Mortar	100 mm	0.880		6.57 %
Layer 4	**Plaster, standard**				
	Main construction	30 mm	0.400	0.075	100.00 %
Int surface				0.130	

Total resistance: Upper limit = 0.725 m^2 K/W Lower limit = 0.723 m^2 K/W Average = 0.724 m^2 K/W

U-value (unrounded) = 1.38 W/m^2 K

Unheated space: None

Total thickness: 300 mm **U-value: 1.38 W/m^2 K**

Fig 7. U Value 1, showing a final value of 1.38W/m2K, as reported by the site DEA (W-Y-P Gledhill, 2015)

U-value calculator report Page 1 of 1

Project Reference: Wall Calculations **Issued on Date:** 25/01/2015
Project: **Type Ref:** Wall U Value

Surveyor: Toby Gledhill, Tel: 01924249970 Surveyor ID: C300-0001
Address:
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Software Version: Elmhurst Energy Systems Design SAP 2009 version 4.02r03

Building Elements:

Wall 7 Gibbs Leaze, NG3 4LA - Cavity wall U Value

Layer	Description	Thickness	Lambda	R	Fraction
Ext surface				0.130	
Layer 1	**Brick, outer leaf**				
	Main construction	103 mm	0.770	0.000	82.81 %
	Bridging - Mortar	103 mm	0.941		17.19 %
Layer 2	**Standard cavity**				
	Main construction	68 mm	0.519	0.000	100.00 %
	Corrections - Cavity Ventilated, Emissivity: Normal				
Layer 3	**Blockwork, medium**				
	Main construction	100 mm	0.570	0.175	93.43 %
	Bridging - Mortar	100 mm	0.880		6.57 %
Layer 4	**Plaster, standar**				
	Main cons	30 mm	0.400	0.075	100.00 %
Int surface				0.130	

Total resistance: Upper .506 m^2 K/W Lower limit = 0.504 m^2 K/W Average = 0.505 m^2 K/W
U-value (unrounded) = 1.98 W/m^2 K

Unheated space: None

Total thickness: 300 mm **U-value: 1.98 W/m^2 K**

Fig 8. U Value 2. Here, exactly the same wall has been recorded, but the DEA has mistakenly identified sub-floor ventilation air bricks as cavity vents. (W-Y-P Gledhill, 2015)

The RdSAP assumed wall U-Value for a 1960's traditional cavity constructed property is 0.65 (BRE, 2012), so one can see how either of these figures, at more than double this level, will have a great impact upon the SAP score and subsequent carbon claim linked with this property.

The difference between these two values is worthy of note, and yet the error has been created by a simple misunderstanding. Both scores are potentially spurious, as it is unlikely that as much as 30mm of plaster would be applied to the inner wall. There are other similar errors that can be made during this process that will bring about similar margins of error. For instance, there are a number of different types of concrete block (BRE, 2009), many with a widely varied thermal mass, hence very different implications for overall U value and ultimately carbon, but superficially these blocks may appear the same. The DEA is not trained or qualified to know otherwise, necessarily, and so errors can be factored in to U Values in this way very easily. The process of measuring on site can be tricky, especially when it comes to measuring plaster thickness on inner walls, or cavity depth, where one can easily be mislead by mortar 'snots' (squeezed mortar between masonry, that sticks proud of the wall surface). The SAP assessor may wish to see some photographic evidence before s/he produces a report, but there is no requirement for this (in many cases it would be futile to review photographs: borescope images can be poor, and a traditional camera cannot reach within a cavity wall unless whole bricks are removed).

More sample EPCs can be produced to show the extent to which carbon claims can vary based upon these errors, and this may constitute reasonable grounds for further investigation. However for the purpose of this paper those errors made within RdSAP may be considered sufficient to draw some conclusions.

7. Calculating the carbon savings from the modeled EPCs

The process of calculating carbon is identified in Ofgem's ECO Guidance for Suppliers (DECC, 2012) (see Fig 9 below).

Calculating a carbon or cost saving using SAP or RdSAP

8.14. Once a supplier has calculated the SAP or RdSAP saving for a particular measure, it must then multiply that saving by certain additional factors, in order to produce the carbon or cost saving for ECO. The formulae suppliers need to calculate carbon and cost saving scores respectively are below.

Formula for calculating a carbon saving using SAP or RdSAP

Under CERO and CSCO, suppliers should use the following formula to generate a carbon saving for an ECO measure:

<u>If using SAP or RdSAP 2009 (version 9.90 and version 9.91 respectively):</u>

$$(A - (A \times B)) = \text{carbon saving } (tCO_2)$$

Where:

'A' is the lifetime carbon saving (ie the annual carbon saving calculated in accordance with SAP/RdSAP 2009 multiplied by the lifetime (in years)[103] of the measure;

AND

'B' is the in-use factor (IUF) of the measure (by percentage).[104]

<u>If using SAP/RdSAP 2012 (version 9.92):</u>

$$(A - (A \times B)) \times 0.925 = \text{carbon saving } (tCO_2)$$

Where:

Fig 9, Extract from ECO Guidance for Suppliers (DECC, 2012)

The purpose of this section is to compare and contrast those carbon scores identified in the earlier section of this paper, using the calculation method for ECO scoring, as outlined above, and then to analyse the potential impact that those variations in carbon income could have on the ECO scheme overall. Note, the 'In Use Factor' (IUF) is subtracted from the overall carbon calculated over the lifetime of the insulation measure, to account for inefficiencies such as loss of effectiveness over the lifetime of the system, or discrepancies during installation that detract from the overall effectiveness of the installed system, when compared with controlled tests undertaken on the system by its designer in ideal conditions. IUFs vary for each measure, as do their anticipated lifecycles. For loft and cavity insulation the lifecycle is 42 years in both cases, as is the IUF, which is 35%. See figure 10 below.

Cavity Wall Insulation	√	√	√		35%	42
Loft Insulation Ceiling : Virgin Level[8]	√	√	√		35%	42
Loft Insulation Ceiling : Top-up[8]	√	√	√		35%	42

Fig 10. Energy Companies Obligation (ECO) Measures Table, V1.6, 2013 (Ofgem, 2012)

8. The Control Property EPCs

Applying loft insulation to the Control EPC gleaned 0.3 tonnes of carbon annually. To turn this into a carbon claim under ECO we will apply the methodology above:

a. Loft insulation

0.3 tonnes x 42 years = 12.6 tonnes, - In Use Factor of 35% = 8.19 tonnes

Or

0.3x42=12.6/65%=8.19

b. Cavity wall insulation

1.0x42=42/65%=27.3

So a legitimate 27.3 tonnes of carbon could be claimed under ECO for cavity wall insulation, and 8.19 tonnes of carbon for loft insulation.

Now this can be compared to the carbon calculated for the Human Error and Carbon Catcher EPCs:

8.2. Human Error EPC

Loft insulation
0.3x42=12.6/65%=8.19
Cavity wall insulation
1.1x42=46.2/65%=30.03

So while the consequence of the simulated human error on this occasion did not make any difference to the loft insulation carbon claim, the carbon gleaned when installing cavity wall insulation has increased by 3 tonnes, or approximately 10%.

8.3. Carbon Catcher EPC

Loft insulation
0.5x42=21/65%=13.65
Cavity wall insulation
1.2x42=50.4/65%=32.76

The Carbon Catcher loft insulation has gleaned an extra 5.46 tonnes of lifetime carbon under ECO over the Test Property EPC, and by coincidence cavity wall insulation has gleaned an extra 5.46 tonnes also. The carbon catcher EPC allows for a combined extra 11 spurious tonnes of carbon under ECO therefore. At its peak in February 2013, carbon was trading at £120 per tonne (Nick Duxbury, 2013). At these levels this represents a significant boost to the installing company's bottom line, as the costs to install each measure remain unaltered. But maybe even more importantly this saving will have made greater inroads into the utility company's obligation than it should have done: the carbon catcher's EPC produced a carbon saving of exactly 20% more than the saving of 27.3 tonnes recorded by the Test Property EPC, and the Carbon Catcher's loft insulation gleaned over 65% more carbon than that of the Test Property EPC. Extrapolate these figures, and the utility companies will work their way through their obligations at a far more rapid rate than that intended. This may constitute compelling evidence in support of further study.

9. Conclusions

The beginning of this paper sets the context within which the EPC has an increasingly important part to play. After touching upon some pertinent literature, there is an attempt, albeit rather crudely, to simulate errors in data collection and input using the RdSAP model to generate an EPC, that have been shown to create notable discrepancies in the carbon savings that are gleaned from installing insulation measures. While the EPC could be described as a blunt instrument for the purpose of carbon calculation, this has not been the focus of this paper. Rather, the *user* of RdSAP is called into question. Their skills, background and training may be considered to fall short of what may be required to provide consistent and accurate site data, especially as this data is now relied upon by a widening and more varied group than ever before. There is little within the site survey and data collection methods involved in producing an EPC that can be attributed to a DEA's professional opinion. The methodology is very prescribed, but there are some areas where the DEA will see and record things differently, and this provides scope for variability of outcomes. This might be complicated further if DEAs may feel incentivised to achieve a particular outcome. The point where genuine human error or lack of understanding of the increasingly complex 'Conventions'[7] (rules relating to data collection and input, (BRE, 2012)), become gratuitous forced errors might be considered hard to identify. Ideally the DEA would never be placed into an ethical position.

As regards improving the current system, initially, one might suggest that boiler installs, for example, recorded on the 'Gas Safe' register could be integrated into information available from CIGA (Cavity Insulation Guarantee Agency), and SWIGA (Solid Wall Insulation Guarantee Agency) to form a robust, fact-based platform upon which to build energy data about a specific property. PAS 2030 (Publically Available Specification, 2012) specifies installation standards for almost all insulation measures. All installers provide PAS2030 compliance records to utility companies upon completion of their work, and it wouldn't be a great step to record these details on a publically available, central database. Assumptions could then fill in the gaps, or maybe a DEA could fill in the gaps while measuring for technical aspects for installation of the proposed new measure. Or, maybe the system could be turned on its head, and the DEA could become a customer facing advisor, visiting the property post installation, who explains how the system is best used (heating systems especially can be complicated, and users may not fully understand how to use them without a full and detailed explanation, possibly wasting a great many of the potential benefits of the system). This same DEA could check the automated data collected pre-work at the same time, as well as the quality of the installation – a sort of technical monitoring exercise with added value for money. S/he could possibly be employed independently of utility and installer, thereby having no bias or ulterior motive, with a utility company levy being applied for their independent commissioning (the same money that is currently paid direct to installers so they can employ their own DEAs).

This might be considered an area that merits further investigation, and further study to model EPC outcomes, or better still to test them in the field with a group of DEAs, which could provide interesting material upon which to base improvements in methodology, or the application of a realistic 'confidence factor' that accompanies the publication of EPC data when used en masse.

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ID 094

Soft Soil Stabilisation Using High Calcium Waste Material Fly Ash

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Abstract:

Civil engineering projects located in areas with soft soil present some of the most common problems in many parts of the world. Depending on the nature of the project, expensive solutions are sometimes used, which commonly involves the removal and replacement of the weak soils. Alternatively, ground improvement is now considered the best solution for such problems. Soil improvement can be achieved either by mechanical and/or chemical stabilisation. To reduce the use of cement and lime as the most traditional stabilizers applied to soft soils, sustainable waste materials have been increasingly used for soil stabilisation. This paper presents the results of a laboratory study on the stabilisation of silty clayey soil using a waste material fly ash (FA) with high calcium content produced from the incineration processes in domestic power stations. The FA used in this study has a high content of calcium oxide CaO and suitable content of silicon dioxide SiO_2 (more than 25%). These cementitious and pozzolanic properties are responsible for the self-cementing characteristics of this fly ash. An intermediate plasticity silty clayey soil with medium organic matter content has been used in this study. The effect of FA on the physical and engineering properties on the selected soil such as the consistency limits, compaction characteristics (optimum moisture content and maximum dry density), and soil strength (unconfined compressive strength (UCS)), has been investigated. Different percentages of fly ash were added to the soft soil (1.5, 3, 6, 9, 12, and 15%) to produce different admixtures. Improvement levels were evaluated dependant on the UCS tests carried out on specimens at different periods of curing (zero, 7, 14, and 28 days). Results indicated that the maximum dry density decreased and the optimum moisture content increased with the increase of the FA content. In terms of the UCS tests, the results yielded the optimum value of the FA used in this study to be 12.0%, as this percentage decreased the index of plasticity (IP) significantly. The results of this study indicated that the use of this waste material could produce a significant cementitious reaction when added to the soil, and it could be used as a supplementary cementitious material.

Keywords:

Waste materials, high calcium fly ash, unconfined compressive strength, and soft soils.

1. Introduction

Soft soil is one of the most problematic soils in civil engineering because of its high compressibility, the tendency to swell when its water content increases and its low compressive strength. Soil stabilisation is a technique introduced a number of years ago in order to render the soil capable of meeting the requirements of specific engineering projects (Kolias, et.al. 2005). More specifically, soil stabilisation is recommended to aid the engineer in being able to employ the natural soil of a project's site as an engineering material with specific properties, especially strength, volume stability, permeability and durability. Stabilisation of subgrade soil has traditionally relied on treatment with lime, cement, and special additives such as Pozzolanic materials. Overall, lime and Ordinary Portland cement (OPC) have been involved as binder materials in soil stabilisation which have the responsibility for the hydration reaction to bond the soil particles to each other as indicated in numerous of researches (Miura et al., 2002; Raoul, et al., 2010; Farouk and Shahien, 2013; and Önal, 2014).

The manufacture of 1 tonne of OPC assumes the consumption of 1.5 tonnes of quarry material, energy consumption of 5.6 GJ/tonne and a CO2 emission of approximately 0.9 tonne. Thus, cement manufacture represents 5% of total anthropogenic CO2 emission (O'Rourke et al., 2009). A growth of about 6.95 % annually has been recorded with a highest increase of 9.0 % in 2010, and 2011 with a slowdown to 3.0 % in 2012 to reach 3.7 billion tons (Merchant Research & consulting ltd, 2013). Overall, the global cement market is predicted to increase at 5% per year. Due to the high cost and negative environmental impact of cement production, researchers have been driven to find alternative materials to replace, or decrease the use of, OPC in the concrete industry. These materials are called supplementary cementitious materials (SCM). They are in general by-product materials and most of these are called pozzolans, which by themselves do not have any cementitious properties, but when mixed with cement, react to form cementitious compounds (National Ready Mix Concrete Association, 2000).

Pozzolanic materials such as micro silica fume (SF), rice husk ash (RHA), pulverised fuel ash (PFA), ground blast furnace slag (GBS), etc., which are regarded as waste materials, have been used individually for soil stabilisation. They improve some of physical and engineering properties of soft soils dependant on their specific surface area and fineness which causes in decrease the cohesion and increase the density for soft soils as indicated in recent research projects (Abd El-Aziz, et al., 2006; Lin et al., 2007; and Yadu and Tripathi, 2013)

On the other hand, many researchers have used waste materials as SCM in soil stabilisation to reduce the use of OPC and lime and to boost the hydration reactivity dependant on the pozzolanic reaction of these materials. RHA, palm oil fuel ash (POFA), ladle furnace slag (LFS), SF, and coal waste have been used as SCM in recent research projects (Brooks, 2010; Ahmed et al.,2011; Manso, et al., 2013; Fattah et al., 2014; and Modarres and Nosoudy, 2015).

The current study has used the waste material fly ash as self-cementing material in order to replace the traditional binder (OPC and lime) used in soft soil stabilisation completely. The level of improvement in the physical properties of the soft soil was evaluated dependant on the results obtained from consistency limits test and compaction parameters. Additionally, the development in the geotechnical properties of the soft soil stabilised with this waste material was investigated dependant on the results yielded from unconfined compressive strength test. UCS test was conducted on specimens of the soft soil treated with different amount of the FA (0.0, 1.5, 3, 6, 9, 12, and 15%) with different ages of curing (zero, 7, 14, and 28 days).

2. Materials

2.1. Soft Soil Sample

The soft soil used in this study was collected from a site located in High Town to the north of Liverpool. The soil samples were extracted from the riverbank of the estuary of River Alt from a depth about 30-50cm below ground level, then placed in sealed plastic packs 20-25kg each before the transferring to the laboratory. Figure 1 shows the site where the soil samples used in this study were extracted. The site in general is an alluvial plain and the soil's visible description is medium soft, dark grey clayey silt with traces of sand and the smell of algae.

Figure 1. Extraction Site

After transferring the soil samples to the laboratory, a soil specimen was taken to calculate the natural moisture content in accordance with BS EN ISO 17892-1:2014 (European Committee for Standardization, 2014), and the rest of the soil was air dried inside the lab to be prepared for other classification testing. The physical and geotechnical characteristics of the soft soil were determined in accordance to BS EN ISO 17892-4:2014 for particle size distribution and in accordance to BS 1377-2 and 4:1990 (British Standard, 1990) for Atterberg limits and compaction parameters respectively. The results are shown in Table 1, and Figure 2 shows the particle size distribution of the soft soil used in this study. According to the Unified Soil Classification System (USCS), and depending on the particle size distribution, LL, and IP, the soil in this research project is an intermediate plasticity silty clay with sand (CI).

Table 1. Main physical and engineering properties of the soft soil

Property	Value
Natural moisture content NMC %	52.14
Liquid Limit LL %	44
Index of Plasticity IP	20.22
Sand %	13.08
Silt %	43.92
Clay %	43.00
Specific Gravity (Gs)	2.61
γ_{dmax} **g/cm^3**	1.57
Optimum moisture content OMC %	23
pH	7.78
Organic matter content %	7.95
Unconfined Compressive Strength qu, kPa	202

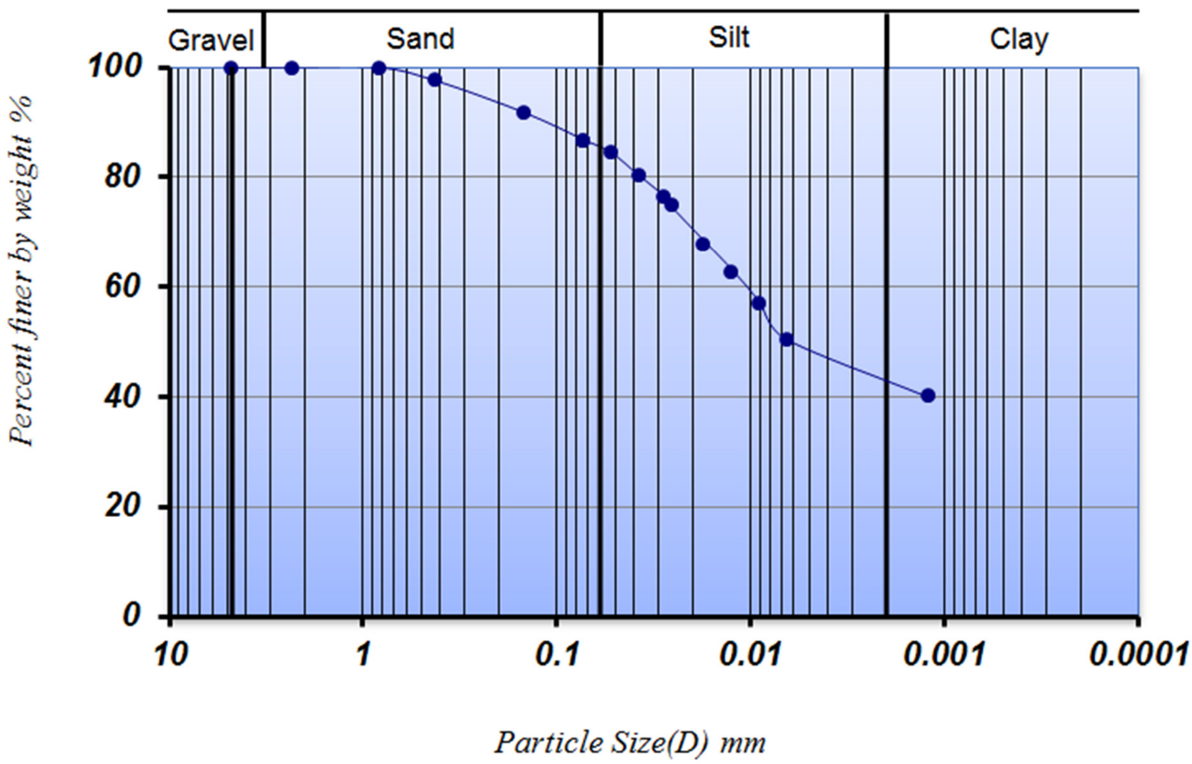


Figure 2. Particle size distribution of the soft soil

2.2. **The Waste Materials Fly Ash (FA)**

The fly ash used in this study is a waste powder material produced from the incineration processes in a domestic power generation station. It has high calcium content and a sufficient amount of silica. This material is slightly coarse in comparison to the Ordinary Portland Cement as shown in Figure 3. A Scanning electronic microscopy test (SEM) showed that the particles of this material have a coagulated and flocculated shape as shown in Figure 4. Particle size distribution of binder material has an undeniable effect on the compressive strength of stabilised soil. It was found that the finer the particles of fly ashes used in concrete with cement, the higher compressive strength obtained (Celik et al., 2008). Therefore; it is expected that the coarse particles of the FA could retard its performance during the hydration reactivity.

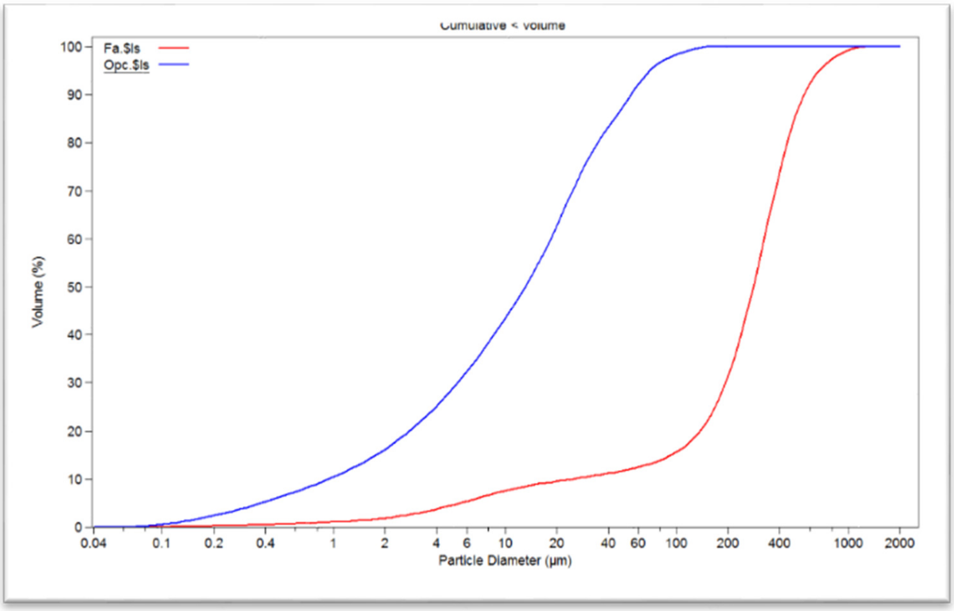


Figure 3. Comparison of cumulative particle size distribution of OPC and FA

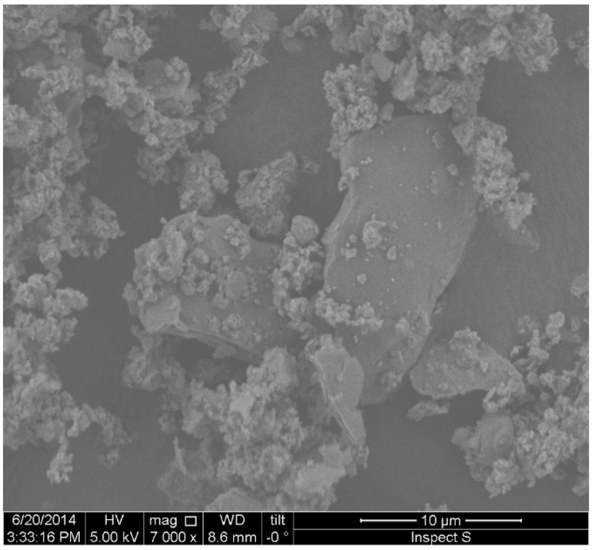


Figure 4. SEM image of the waste material used in this study

3. Experimental Work

3.1. Sample preparation and conditioning

Five different percentages of the FA (1.5, 3, 6, 9, and 12%) were added to the soft soil to determine its effect on the Atterberg limits of the soft soil. The unconfined compressive strength test was conducted according to BS 1377-7:1990 (British Standard, 1998) for untreated compacted soil and soil stabilised with the FA with 1.5, 3, 6, 9, 12, and 15% based on the dry weight of the soil. UCS values were determined by using a computerised and motorised triaxial machine but without applying any lateral load in the triaxial cell ($\sigma_3 = 0$). Remoulded specimens 38mm in diameter and 76mm in height, with specific densities and moisture contents (dependant on the maximum dry density (MDD) and optimum moisture content (OMC) obtained from compaction tests for each corresponding percentage of FA) were prepared using a constant volume mould, which was subjected to static load provided by a manual hydraulic jack as shown in Figure 5. After compaction, the specimens were extruded from the mould, weighed, then wrapped in cling film, sealed in well-sealed plastic bags, and stored for curing in the room at a temperature of 20 ± 2°C. Four groups of specimens were prepared for four different curing periods (0, 7, 14, 28 days), and for each corresponding period of curing, two specimens were prepared for each percentage of FA for more reliable results.

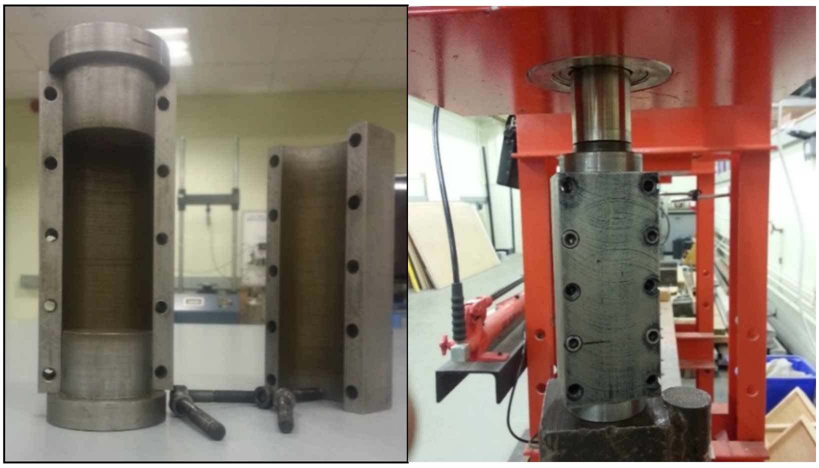


Figure 5. Constant volume mould and the hydraulic jack

3.2. **Laboratory tests**

Three fundamental tests were conducted to investigate the effect of the FA on the physical and engineering properties of the soft soil in this study. These tests were:

- Atterberg limits test - (Liquid Limit (LL), Plastic Limit (PL), and Index of Plasticity (IP)). These limits were determined in accordance to BS 1377-2:1990 (British Standard, 1990). A Cone Penetrometer device was used to find the LL.
- Standard Proctor compaction test - conducted in accordance to BS 1377-4:1990 (British Standard, 2002), 2000g of dry powdered soil was mixed with five different water contents. For each value of water content, soil paste was compacted in a standard mould using a 2.5kg rammer with three layers; each layer was subjected to 25 blows.
- Unconfined compressive strength test - carried out according to BS 1377-7:1990 (British Standard, 1998) on four groups for each corresponding percentage of FA which were tested in four different periods of curing (zero, 7, 14, and 28 days).

4. Results and Discussion

4.1. **Atterberg Limits**

Figure 6 shows the relationship between the Atterberg limits and the FA used in this study for the soft soil treated with 1.5, 3, 6, 9, and 12% of the waste material by the dry weight of the soft soil. From this figure, it can be seen that the FA has a positive effect in reducing the Index of Plasticity from 20 to below 14, and that LL values increased with the increase of the FA content. This reduction in soil plasticity is attributed to the process of exchange of cations between the soft soil and the FA (Gharib, et. al, 2012). Since Atterberg limits play an important role in soil identification and classification, and give an indication about soil behaviour in the presence of water such as the workability and expansion problem, the FA used in this study can increase the workability by increasing the LL, and decrease the swelling and shrinkage potential by decreasing IP.

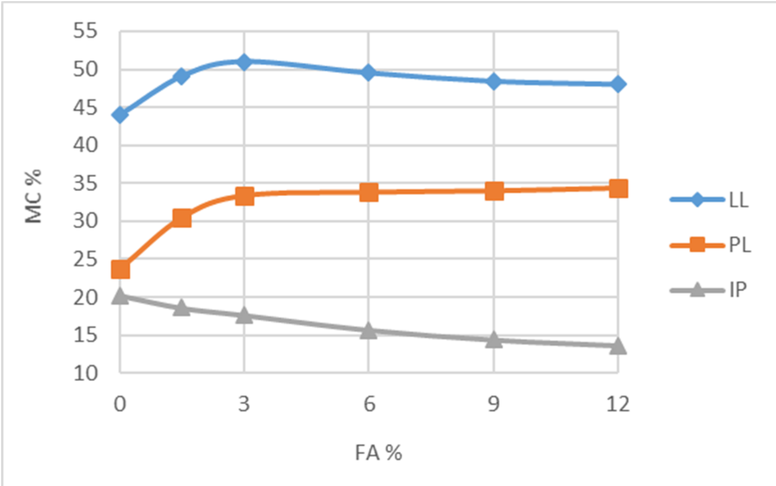


Figure 6. Effect of the FA on the Atterberg limits of the soft soil

4.2. Compaction parameters

The aim of this test is to find the maximum dry density and optimum moisture content for untreated soil and soil stabilised with different percentages of stabiliser material. The values obtained from this test are very important and they are considered to prepare the required specimens for several geotechnical experiments such as UCS, CBR, compressibility, triaxial test and swelling potential. Standard Proctor compaction tests were carried out on the soft soil using different percentages of the FA (0, 1.5, 3, 6, 9, 12, and 15%). The results of the compaction tests are shown in Figure 7. It can be observed easily that the MDD decreases and OMC increases with the continuous increase in FA content because of high water absorption of the FA.

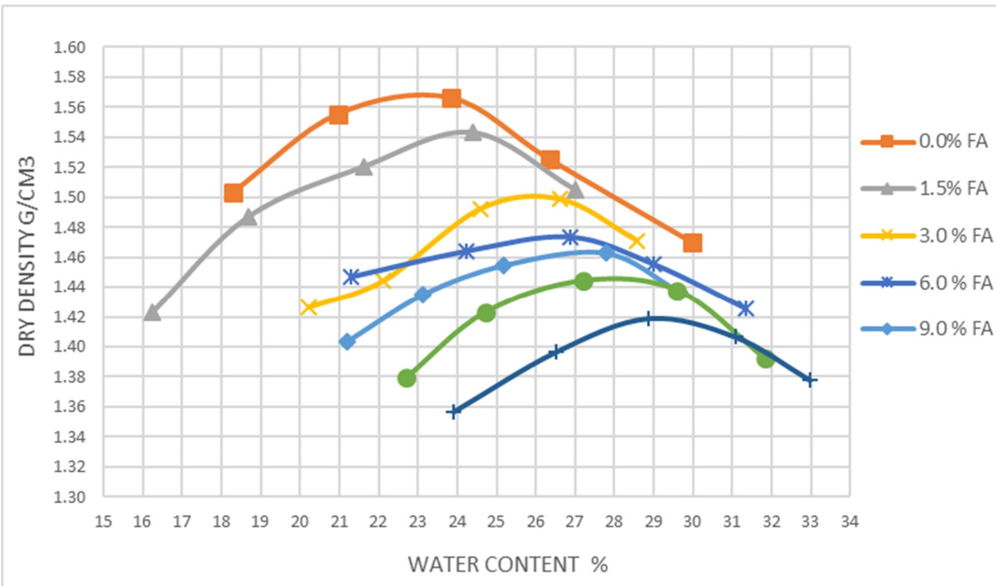
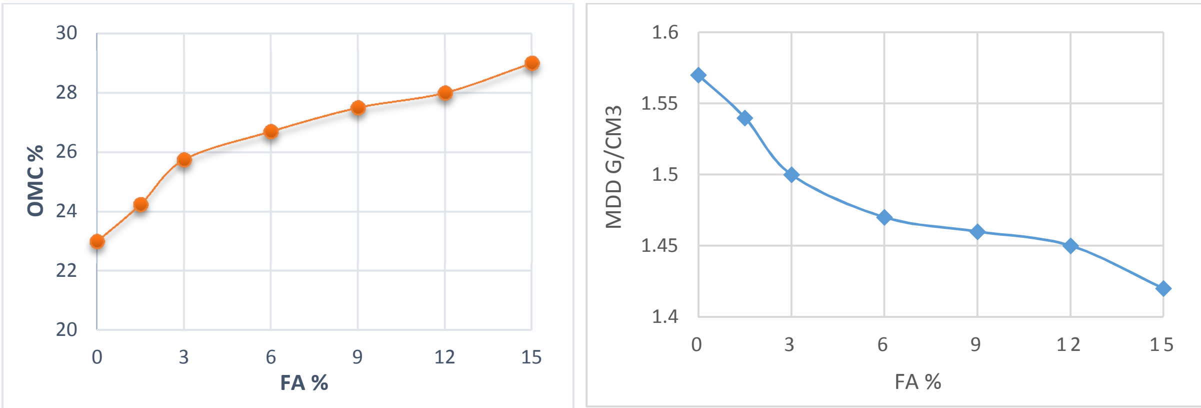


Figure 7. Effect of FA on the compaction parameters of the soft soil

Figures 8 a and b show the effect of the FA on the MDD and OMC for the soft soil respectively. From Figure 8a, it can be recognised that there is a significant decrease in MDD with the continuous increase with FA percentage to less than 1.45 g/cm^3 for soil treated with 15% of FA. OMC also recorded a dramatic increase with the increase of FA to reach approximately 29% at 15% FA as shown in Figure 8b. The results of compaction tests reflect the high water absorption of the FA. This could be beneficial because it leads to a decrease in the required compaction effort on site to achieve the desired degree of relative compaction.

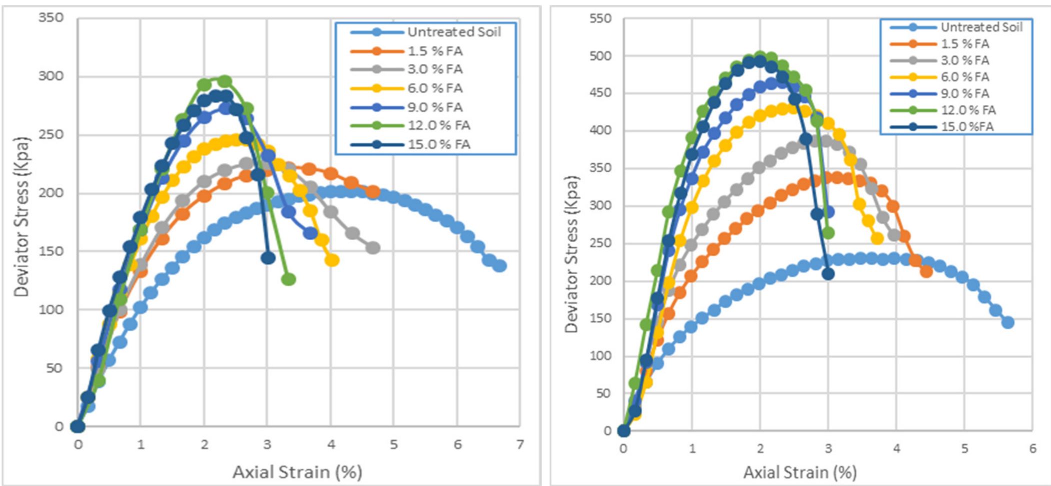


(a) (b)

Figure 8. (a) Effect of FA on the MDD, and (b) Effect of FA on OMC

4.3. Unconfined compressive strength test (UCS)

Figures 9 a and b show the laboratory results in the form of stress-strain diagrams from unconfined compressive strength tests for the soft soil treated with different percentages of the FA (1.5, 3, 6, 9, 12, and 15%) for zero days and 28 days curing respectively. It can be seen that the compressive strength increased with the increase of curing time for each corresponding percentage of FA. Overall, the results indicated a significant improvement in UCS of the soft soil treated with the FA; UCS increased from about 200kPa for the untreated soil to over 500kPa for the soil treated with 12% of FA after 28 days curing.



(a) (b)

Figure 9. Stress-strain relationship for soil treated with different contents of FA (a) zero day curing and (b) 28 days curing

The unconfined compressive strength values measured for different FA content with different curing periods are shown in figure 10. From this figure, it is clear that 12.0% of the FA implemented the maximum values of UCS for different curing times and the improvement in UCS for the soft soil can be recognised clearly after adding 9% of FA.

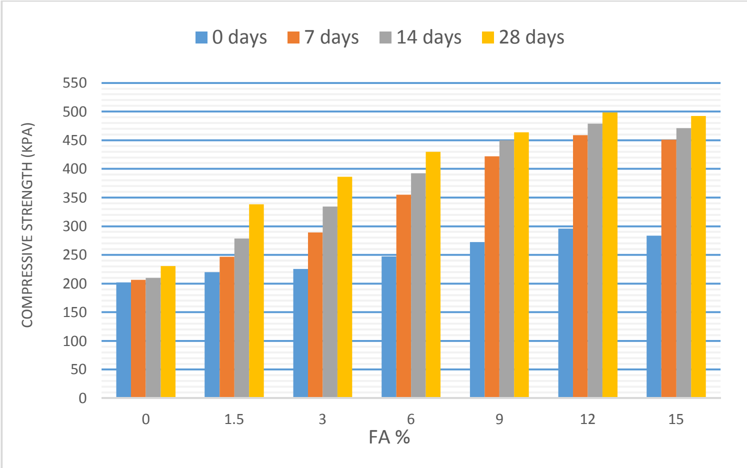


Figure 10. Relationship between UCS and FA percentage in different periods of curing

From another point of view, Figure 11 shows the development in UCS with the time of curing for untreated and treated soil with the optimum percentages of the FA. It can be seen that the UCS of the stabilised soil increased significantly through the time of curing from just under 300kPa for uncured specimens up to about 500kPa at 28 days of curing. It should be noted that there was a dramatic increase in UCS for stabilised soil with the optimum content of the FA for an earlier curing time (7 days curing), which provides about 90% of the total development of UCS. After this, the rate of UCS development began to plateau as shown in Figure 11. This indicates that the waste material used in this study has a fast curing property which means that it has the ability to stabilise the soft soil within short period.

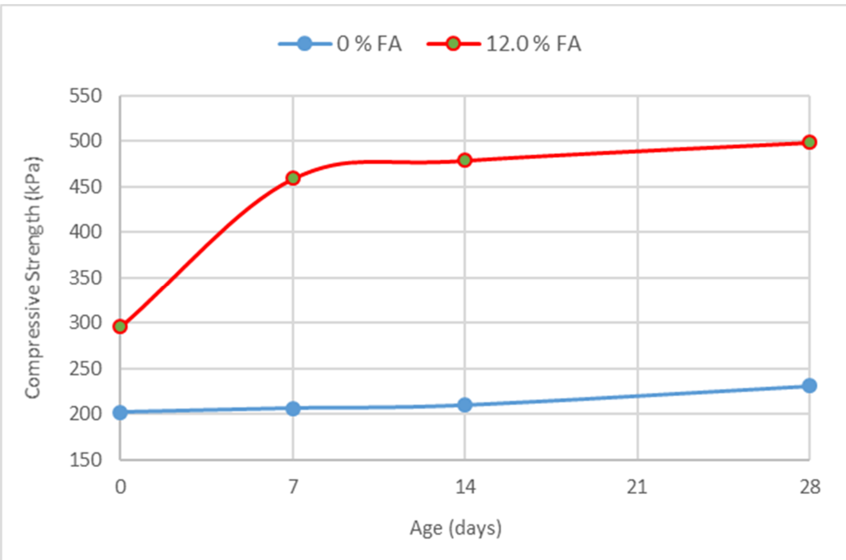


Figure 11. UCS development with curing time for soil stabilised with optimum FA

5. Conclusions

In conclusion, the effect of the waste material FA used in this study on the physical and engineering properties of the selected soft soil can be summarised as follows:

The FA has a positive effect on the physical properties of the soft soil. The results showed that IP was decreased by approximately 1/3 of its original value with the use of 12% FA, which would improve soil resistance against swelling and shrinkage effects.

Furthermore, MDD decreased and OMC increased with the increase of the FA, which would increase the workability of soil mixing in the field and decrease the required effort to achieve the desired degree of compaction for the soil.

The FA has significantly improved the unconfined compressive strength of the soft soil. The results showed that UCS was increased by approximately 250% with 12% FA after 28 days curing in comparison to UCS of untreated soft soil.

The waste material FA used in this study has the potential to be used as soft soil stabiliser and it has the ability to improve the physical and engineering properties within short periods of curing.

6. Recommendations

1. Depending on particle size distribution, the FA is a slightly coarse material, it is expected that it would produce a better results in soil stabilisation if it were to be ground using low energy grinding effort.
2. Study the effect of the FA on the other geotechnical properties of the soft soil such as the consolidation and California bearing ratio (CBR).

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An innovative use of flow columns in electrocoagulation reactor to enhance the water mixing process.

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Abstract

Water mixing is a key factor in the electrocoagulation process because it helps to create big enough flocks to settle down later and to create a good homogenization of flocks. Traditional electrocoagulation cells (bench scale) usually use mechanical or magnetic stirrers in order to achieve the required degree of mixing. In addition, electrocoagulation studies still have a clear deficiency in the variety of reactor design. Thus, in order to fill a part of this gap in literature, the objective of this study is to suggest a new design of electrocoagulation reactor (ECR1) due to a novel use of flow columns (which are widely used in chemical industries) to achieve water mixing process. The perforated disks of the flow column work as electrodes and water mixers at the same time. The performance of this new reactor was compared with four different conventional reactors (ECR2, ECR3, ECR4, and ECR5). Water mixing efficiency was measured by pumping coloured water samples through the rectors and monitoring the colour changing. Monitoring was conducted by two methods: visible tracing and measurement of effluent concentrations. An accurate camera was used for the visible tracing, while a Hach-Lange spectrophotometer was used to measure the effluent colour concentration. Coloured water samples were prepared by adding a proper amount of red drain dye (RDD) to deionized water. The Pumping done in back and direct flow patterns.

The obtained results indicated that after 9 minutes of back flow pumping, through the ECR1, the effluent and the influent RDD concentrations became equal (100% mixed). While, the other reactors ECR2, ECR3, ECR4, and ECR5 achieved a mixing efficiency of 96.3%, 96.5%, 92.7%, and 93.1% respectively. The mixing efficiency decreased when the flow pattern was changed into direct flow, it reduced to 85.7%, 79%, 88.2%, 93.8%, and 92.6% for ECR1, ECR2, ECR3, ECR4, and ECR5 respectively. A visible tracing for the mixing process has been conducted using an accurate camera to give a clear view of the mixing process during the course of experiment .Camera records revealed that at a flow rate of 80 ml/min, direct flow pattern, ECR1 created a homogenous colour over all the reactor body (100% mixing efficiency). While, it was found that about 11%, 9%, 10%, and 11% of the treated water remained undisturbed inside ECR2, ECR3, ECR4, and ECR5 respectively. Back flow pattern exhibited different mixing ratios for the same flow rate, where it was found that ECR1 required 5 minutes only to create a homogenous colour over all the reactor body. On the other hand, 19%, 11%, 10%, and 5% of the treated water remained undisturbed inside ECR2, ECR3, ECR4 and ECR5 respectively.

Keywords:

flow columns, electrocoagulation, water mixing proces

1. Introduction

In spite of having acknowledged the advantages of electrocoagulation (EC) techniques to remove a wide range of pollutants such as turbidity, heavy metals, organic matter, and bacteria, from waters and wastewaters, wider uses of the technique have been limited by several operational parameters (such as electrolysing time, current density, distance between electrodes, electrodes material, and mixing degree) (Donald 2000; Ghosh et al, 2008; Charles et al, 2009; and Vasudevan et al, 2012). In term of mixing efficiency, the previous investigations widely used mechanical or magnetic stirrers, which increased the cost of electrocoagulation process, in order to reach the required degree of mixing and homogenization of flocks. For instance, Charles et al (2009), used magnetic stirrer in order to enhance the mercury removal as well as to create a good homogenization of flocks. Gao et al (2010) stirred the electro-coagulation–flotation cell with a magnetic stirrer at 200 rpm during their investigation about algae removal. Paula et al (2010) applied the magnetic stirring into the electrocoagulator to evaluate the decolourization of crystal violet dye by electrocoagulation. Mikko et al (2012) used a magnetic stirrer, at a speed of 300 rpm, to mix the samples during their study about the effect of electrocoagulation cell construction on natural organic matter removal. Moreover, lack of reactors design represents another problem in the electrocoagulation studies (Tezcan et al, 2013).

In order to fill a part of this gap in literature, flow columns have been innovatively used in the designing of a new electrocoagulation reactor (ECR1). The perforated disks of the flow column work as electrodes and water mixers at the same time. This reactor was designed to utilise the hydraulic flow to achieve water mixing, instead of using mechanical or magnetic stirring, which make it a cost effective alternative for the traditional reactors. Other four different types of conventional EC reactors have been set up, in order to make a comparison between the performances of the new reactor with that of the traditional ones. A series of experiments were commenced, under direct and back flow patterns, on each one of these reactors to measure their water mixing efficiency.

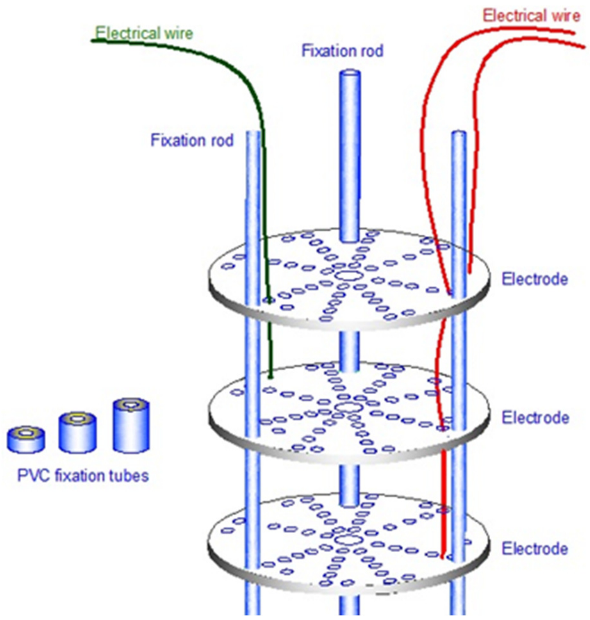


Figure 1: Flow column of the new reactor.

2. Methodology

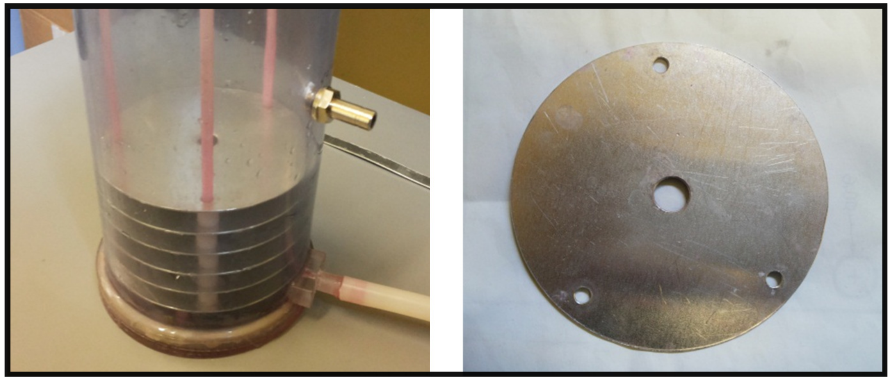
2.1. Electrocoagulation reactor

In this study, a new cylindrical electrocoagulation reactor has been designed depending on the innovative use of perforated flow columns, which are widely used in chemical industries, to create high mixing efficiency. This reactor consisted of a Perspex made cylinder container having dimensions of 25 cm in height and 10.5 cm in diameter with a controllable working volume of 0.5 up to 1 L. It supplied with a flow column that consisted of perorated discoid electrodes that made from aluminium with a diameter of 10.4 cm. These perforated electrodes were vertically installed inside the reactor; each electrode was rotated horizontally by an angle of 22.50 from the one above it. This is to ensure that the following water will follow a zigzag path to increase residence time and mixing efficiency. These electrodes have been held in the required position inside the reactor by using three PVC (Polyvinyl chloride) (supporting rods and PVC fixation tubes that have different heights according to the required distance between electrodes. PVC supporting rods are movable that enable the user to shake or rotate the electrodes, manually or mechanically, to expel the accumulated air bubbles on the electrodes during the treatment process. Aluminium was selected as the electrode material because of its cost effectiveness, ready availability, and it requires comparatively less oxidation potential (Ghosh et al, 2008). A peristaltic pump (Watson Marlow type, model: 504U) has been used to circulate the water being treated inside the reactor. An accurate camera (type: HUE HD) was used to record the mixing process over the treatment period inside each reactor in order to locate the unmixed areas in the closed bench-scale batch system. Camera records will then be separated into many frames in order to calculate the unmixed areas by using Auto CAD program.

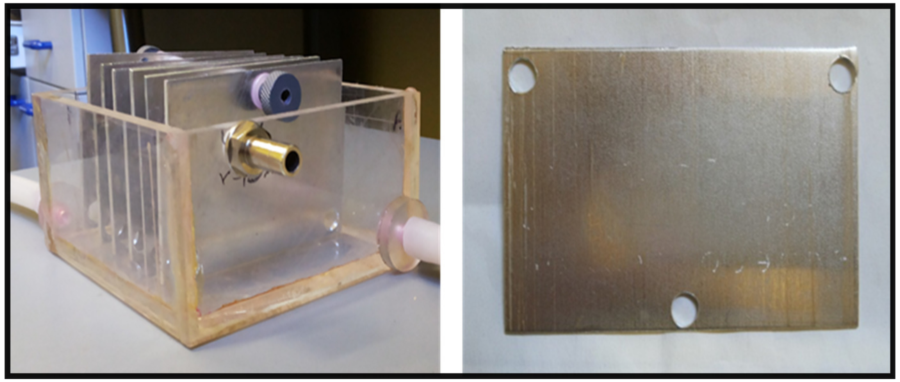
The other traditional reactors have different shapes and electrodes, they were as follows: a cylindrical reactor similar to the ECR1 but with solid discoid electrodes (ECR2), a traditional rectangular reactor with parallel perforated rectangular electrodes (ECR3), a reactor with parallel solid rectangular electrodes (ECR4), and a traditional rectangular reactor with solid rectangular electrodes arranged in a zigzag arrangement (traditional reactor with spiral flow pattern) (ECR5). Both ECR1 and ECR2 have the same dimensions and characteristics except the electrodes were different in design. ERC3, ERC4, and ERC5 have the same shape of container, a rectangular plastic container with a working volume of about 0.5 L, but their electrodes are different in design and positions (figure 2). All experiments were conducted at room temperature.

2.2. Water mixing efficiency

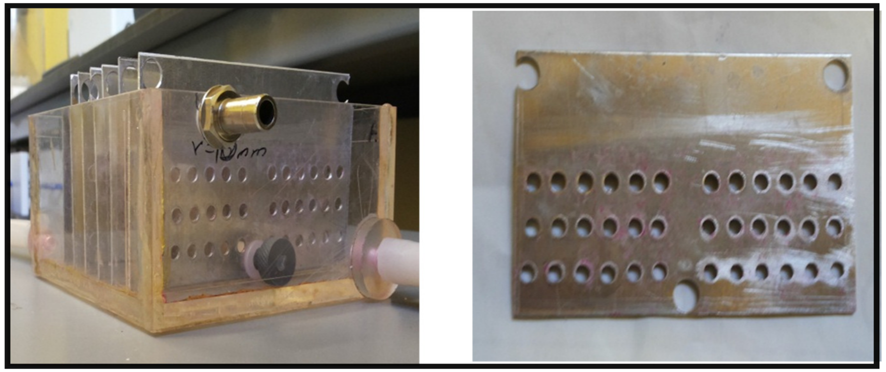
Water mixing efficiency was measured by filling each reactor with 0.5 L of tap water. Then, a peristaltic pump used to pump the coloured water, which was stored in aplastic container near to the reactor, continuously to the reactor for 10 minutes. Coloured water samples were prepared by adding a proper amount of RDD, which is a red coloured dye, to deionized water. A 5 mL effluent water samples were collected at 20 second intervals during the course of experiment. The optical density of the effluent water samples was examined by using a Hach-Lange spectrophotometer (Model: DR 2800) to determine the effluent concentration of RDD depending on a pre-prepared calibration curve. The optimum mixing efficiency (100%) occurred when the influent and effluent RDD concentrations became equal. To validate the obtained results and to locate the unmixed areas inside the reactor, a visible tracing for water mixing process across the reactor was conducting using an accurate camera (HUE HD type). Camera records then were separated into frames in order to calculate the unmixed areas.



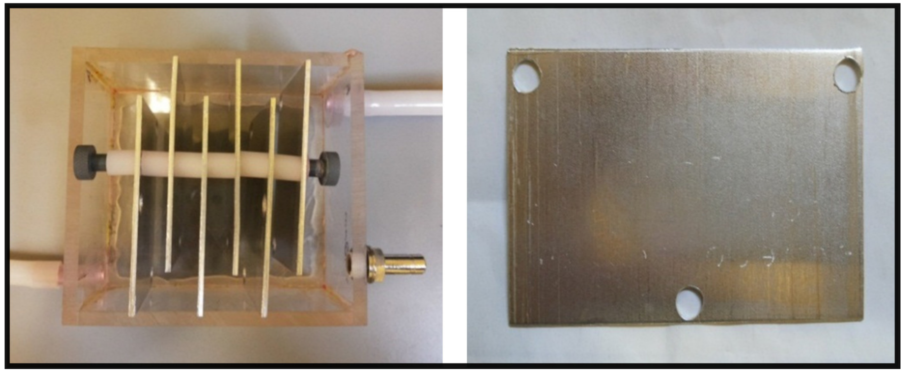
A) ERC2 and its electrodes



B) ERC4 and its electrodes



C) ERC3 and its electrodes



D) ERC5 and its electrodes

Figure 2: The studied electrocoagulation reactors and their electrodes.

3. Results and discussion

3.1. Selection of the best wavelength (Spectrophotometer)

A 5 ml coloured water sample (by RDD) has been tested by using a HACH- Lange spectrophotometer at different wavelengths ranging between 400 and 600 nm to determine the maximum absorption value. The wavelength region has been selected between 400 and 600 nm as a visible red colour was used. The absorption was read and recorded at 50 nm steps to find the nearest wavelength region (which was between 500 and 550 nm). This process was repeated at 10 nm steps and then at 5 nm steps. It was found that the best wavelength was 525 nm which gave the maximum absorption value.

3.2. Preparation of the calibration curve

As was stated earlier, water mixing efficiency was measured by the determination of the effluent RDD concentration in the effluent water samples that collected at 20 second intervals over a 10 minutes period.

The first step was the preparation of the calibration curve for the dye. In order to achieve this, 55 coloured water samples with different concentrations of RDD (varying between 0 mg/L to 2000 mg/L) were used to find the corresponding spectrophotometric OD_{525}. OD_{525} are represented graphically in figure (3). The graphical representation of the obtained results shows a direct relationship between the absorption values and RDD concentrations for the region between 0 up to 600 mg/L of RDD, but after this region the curve sharply spiked making the relationship unclear; which means the sensitivity of the Hach-Lange spectrophotometer for RDD concentrations became very low. Therefore, the mixing process was studied within the range of 0 up to 600 mg/L of RDD.

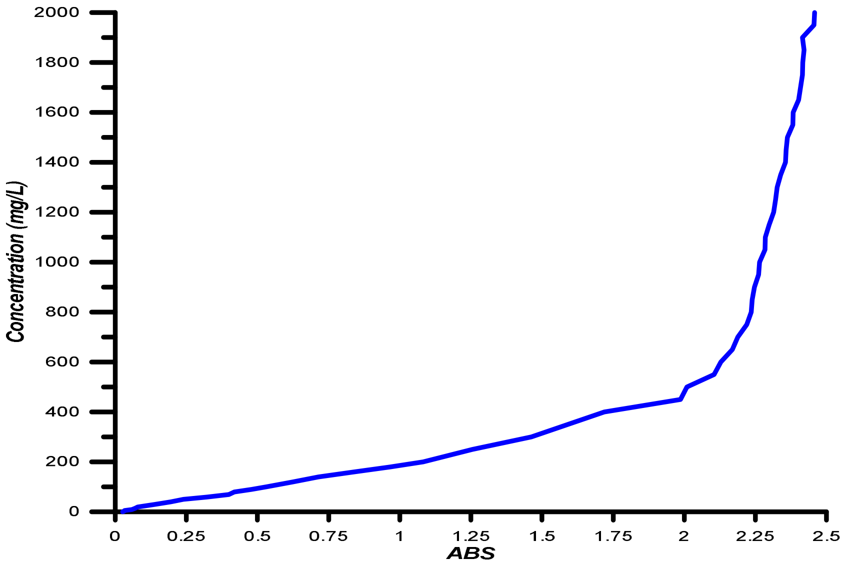


Figure 3: Spectrophotometric absorption values for standards concentrations of RDD.

3.3. Water mixing efficiency

After the preparation of the calibration curve, measurement of water mixing efficiency was initiated by filling each reactor with clear tap water and then coloured water, with known initial concentration of RDD, was pumped continuously into the reactor by using a peristaltic pump. Water pumping was conducted in direct and back flow patterns at different flow rates (80, 180, 280, and 380 ml/min). These flow rates covered most of the studied flow rates by the previous researchers; such as those of Katsounaros et al (2006); Prabhakaran et al (2010); Emilijan et al (2012); and Susan et al (2013). Initially, the experiments conducted at a flow rate of 80 mL/min at the room temperature. The obtained results demonstrated that the maximum mixing efficiency was achieved by ECR1 under back flow conditions. Where, it was found that the effluent and influent concentrations of RDD became equalled (100% mixed) after 9 minutes of water pumping through the ECR1. While, the other reactors ECR2, ECR3, ECR4, and ECR5 achieved a mixing efficiency of 87.6%, 96.3%, 91.9%, and 87.9% respectively (as shown in figure 4). The mixing efficiency decreased under the direct flow conditions, where it reduced (after 10 minutes of treatment) to 85.7%, 78.9%, 88.1%, 93.8% and 92.6% for ECR1, ECR2, ECR3, ECR4, and ECR5 respectively (as shown in figure 5). This may be explained by the weight of the water column (water being treated) which worked on strengthening the turbulent flow and enhancing the mixing efficiency.

In order to validate these results a visible tracing for the mixing process has been conducted using an accurate camera, this camera was installed as close as possible to the studied reactors to give a clear view of the mixing process during the 10 minutes of treatment. Camera records, during the direct flow pattern, revealed an important phenomenon; they showed that the mixing process in all reactors, except ECR1 which create a homogenous colour distribution, take place near to the water inlet in the lower part of the reactor only while water in the upper part of the reactor (near to the outlet) remains undisturbed. It was found that, at a direct flow rate of 80 ml/min, ECR1 required only 6 minutes to create a visibly homogenous colour over the entire reactor. While, it was found that about 11%, 9%, 10%, and 11% of the treated water remained undisturbed inside ECR2, ECR3, ECR4, and ECR5 respectively (as shown in figure 6). Back flow pattern exhibited different mixing ratios for the same flow rate, where it is found that ECR1 required 5 minutes only to create a homogenous colour over all the reactor body. On the other hand, 19%, 11%, 10%, and 5% of the treated water remained undisturbed inside ECR2, ECR3, ECR4 and ECR5 respectively (as shown in figure 7).

The obtained results clearly showed that the new reactor ECR1 achieved the highest mixing efficiency in terms of effluent RDD concentrations and the visible observations. ECR1 gains its high mixing efficiency due to the novel use of flow column in its design. Where, the disks of the flow column (the electrodes) were designed to utilise the hydraulic flow to achieve water mixing by enforcing the water being treated to pass through their small orifices in a zigzag path creating mini fast whirlpools around each electrode. These mini whirlpools work as a hydraulic mixer for the treated water. It was also observed that the mixing efficiency, under the backflow conditions, was better than it in direct flow. This may be explained by the weight of the water column (water being treated) which worked on strengthening the turbulent flow and enhancing the mixing efficiency.

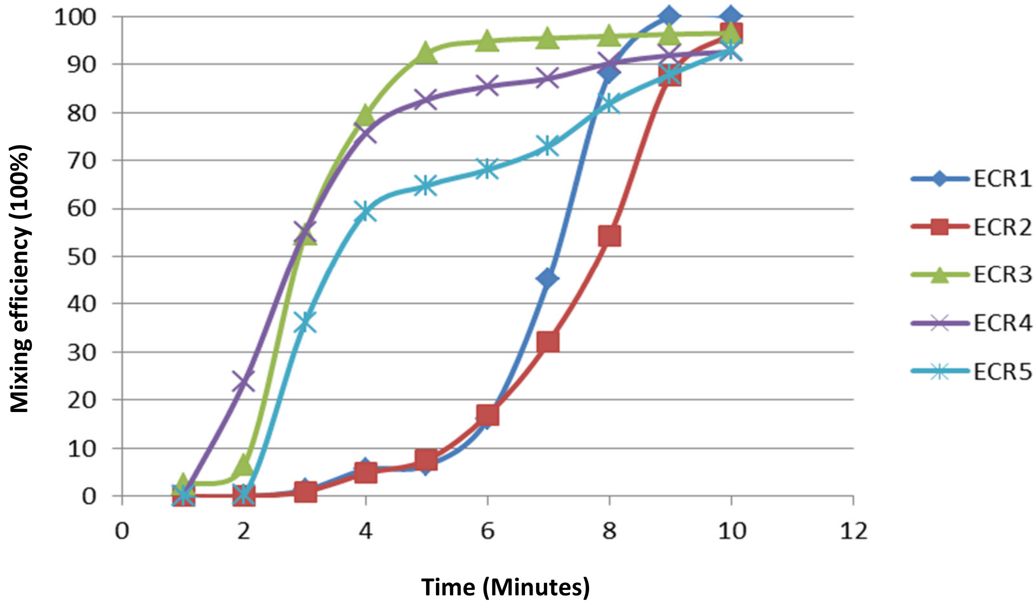


Figure (4): Mixing efficiency of the selected reactors under back flow conditions.

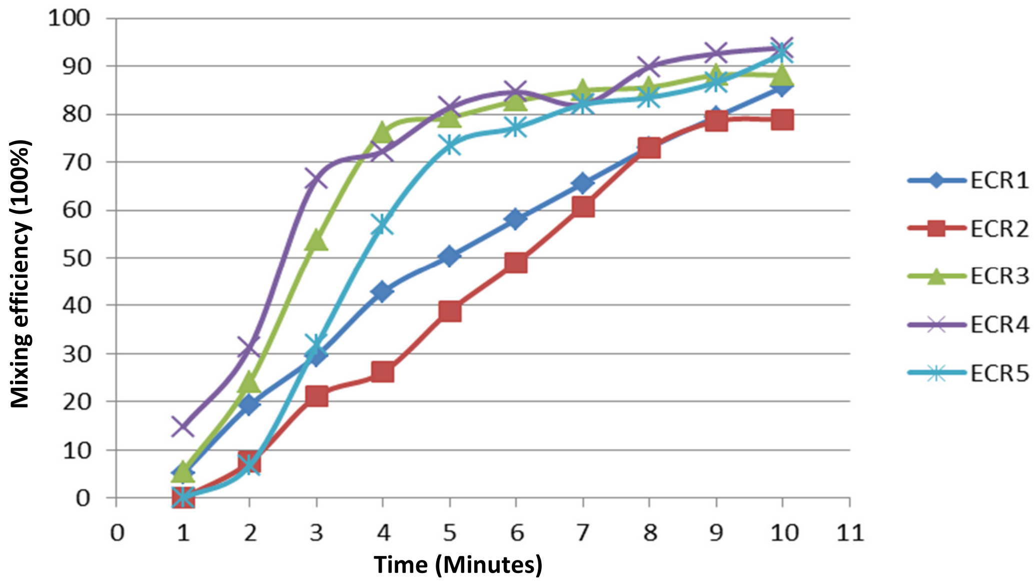
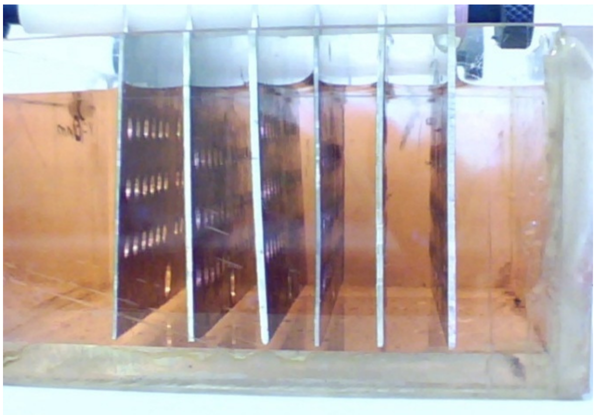
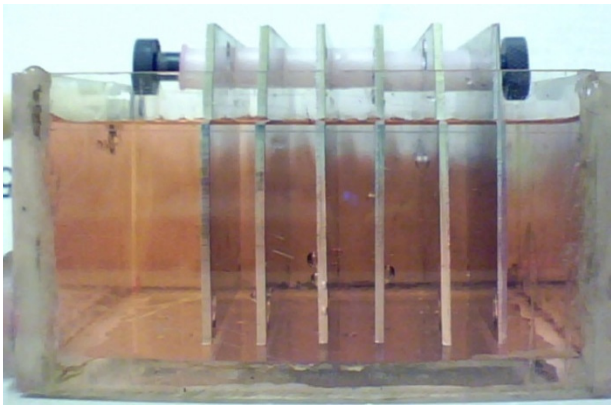


Figure (5): Mixing efficiency of the selected reactors under direct flow conditions.

A) ECR1, Perforated electrodes.

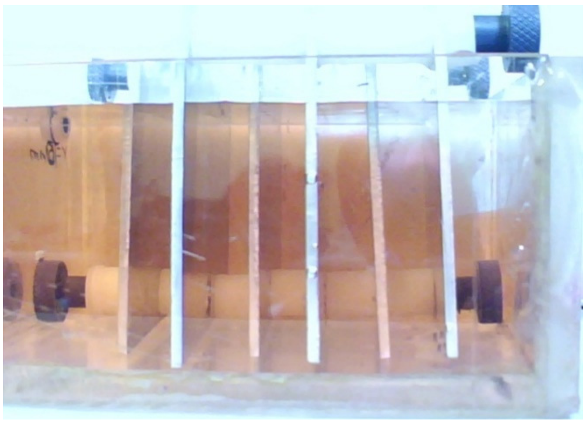
B) ECR2, Solid electrodes.





C) ECR3, Perforated electrodes.

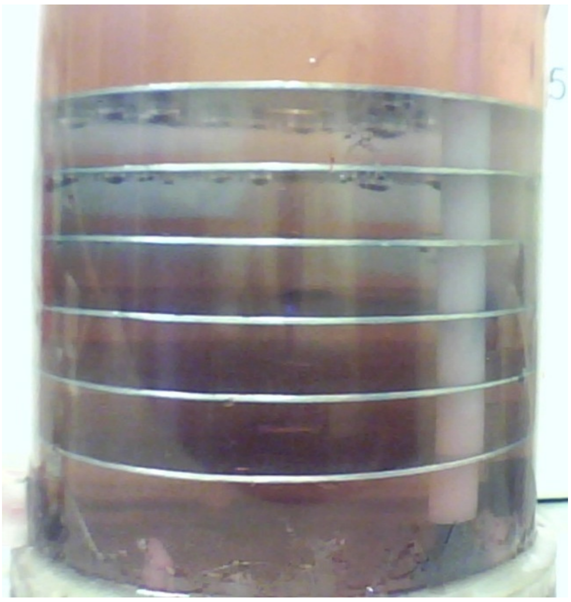
D) ECR4, Solid electrodes.



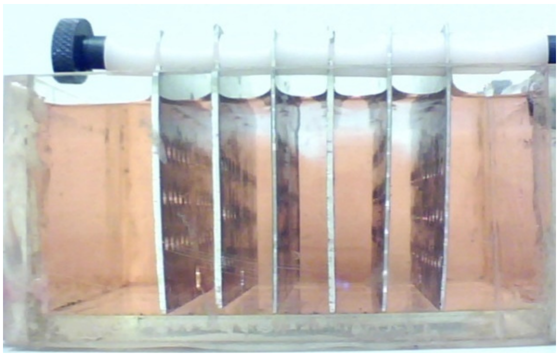
E) ECR5, Spiral path.

Figure 6: Mixing efficiency after 6 minutes of direct flow pumping, red marks represent the undisturbed water.

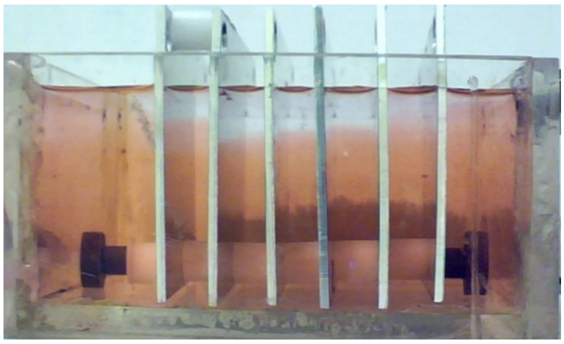
A) ECR1, Perforated electrodes.



B) ECR2, Solid electrodes.



C) ECR3, Solid electrodes.



D) ECR4, Solid electrodes.

E) ECR5, Solid electrodes.

Figure 7: Mixing efficiency after 5 minutes of, back flow, pumping, red marks represent the undisturbed water.

3.4. **Effects of flow rate on the mixing efficiency**

Effect of flow rate on water mixing efficiency, of ECR1, has been investigated by applying different back flow rates (80, 180, 280, and 380 ml/min). The obtained results, figure 8, showed a direct relationship between mixing efficiency and water flow rate; it was found that the ECR1 achieved a full mixing efficiency within 9, 5, 3, and 2.2 minutes at back flow rates of 80, 180, 280, and 380 ml/min respectively. These results highlighted an important fact; that the required time to achieve full mixing is inversely proportional to the flow rate, i.e., mixing time can be reduced by increasing the flow rate. The most likely explanation for this phenomenon is the increase in flow rate increased the velocity of the mini whirlpools, and consequently improved the mixing efficiency.

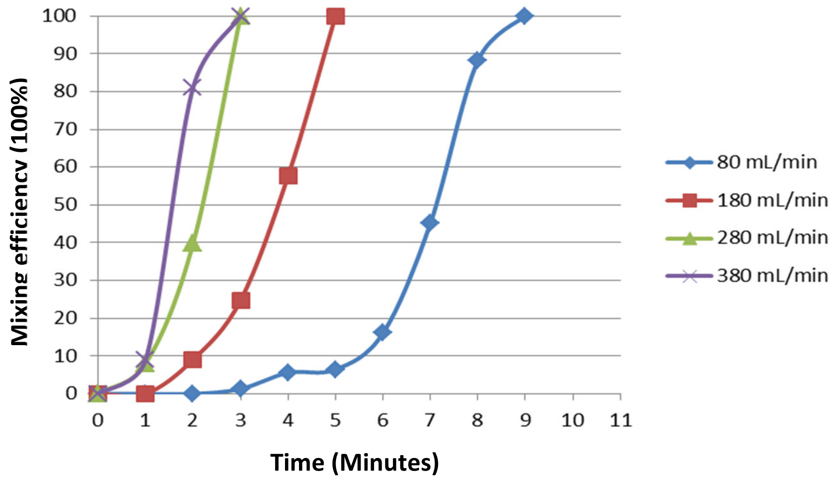


Figure (8): The effect of flow rate on mixing efficiency of the selected

4. Conclusion

A quick glance on the obtained camera records revealed an interesting phenomenon; it can be clearly seen that water being treated in traditional EC reactor remain incompletely mixed. This phenomenon would significantly affect the performance of the EC unites. This defect has been overcame by using flow column in the designing of the new EC reactor. It is believed that flow column works to create mini whirlpools that significantly enhance the mixing process. The obtained results demonstrated that ECR1 achieved 100% mixing efficiency after 9 minutes of back flow water pumping. According to the obtained results, the mixing time is inversely proportional to the flow rate. Where, it was found the ECR1 achieved a full mixing efficiency within 9, 5, 3, and 2.2 minutes at back flow rates of 80, 180, 280, and 380 ml/min respectively. Another outcome must be highlighted; the need for magnetic or mechanical stirrer, in traditional reactors, has been reduced and compensated by the hydraulic mixing process.

In conclusion, the results demonstrated that the ECR1 reactor is a promising cost effective alternative for the traditional EC reactors. Where, its high mixing efficiency and ability to homogenise pollutants inside the reactor would enhance the coagulation process greatly (this will be investigated later using different pollutants).

5. Recommendations

1 This new reactor can be applied to remove different pollutants from water as it has high mixing efficiency which would enhance the removal efficiency.

2 It is highly expected that this reactor can increase the aeration process by holding some of its perforated electrodes out of the water being treated. These unsubmerged will work as water diffusers that will promote the dissolved oxygen concentration in the water being treated.

3 Material of electrodes can be changed depending on the target pollutant. For instance it can be made from iron, steel, or cobalt.

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Issues Relating To Petroleum Pipelines Condition-Based Maintenance in Nigeria Oil and Gas Sector

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Abstract:

In the current industrial practice, Performance Measurement Approach (PMA) is paramount to industrial development, especially to Petroleum Pipelines (PPs) maintenance in the Oil and Gas (O&G) sector. PMA efficacy is to ensure credible maintenance are done correctly in the O&G sector, PMA have to be involved in the entire duration of maintenance practice, to assist in assessing maintenance performance and technician reliability. Moreover, the efficient operations of these pipelines determine the effectiveness of the sector's entire business. In the current time, Condition-Based Maintenance (CBM) approach is often one of the last options considered to maximise cost savings in maintenance in the competitive global economy. However, not all CBM practices adopted in the oil and gas sector have been totally successful owing to different issues like technical/human errors during maintenance, inadequate data available for CBM maintenance, and poor collaboration between the management and low level staff. An extant literature review is used as the main methodology to achieve the study. The results presented in this paper are part of an on-going PhD study. The investigation indicates that inadequate PMA is the main contributing factor in CBM failure in the O&G sector. Thus, the study improves on extant PMA framework to redirect effectiveness in collaboration, value focused information, creating common understanding, and inherent knowledge that PMA posits in PPs maintenance. It also integrates the concepts of generic CBM operational management frameworks and communication reliability in resolving inefficiencies in CBM.

Keywords:

Condition-Based Maintenance (CBM), Oil and Gas (O&G), Performance Measurement Approach (PMA), Petroleum Pipelines (PPs)

1. Introduction

The Oil and Gas (O&G) sector operates globally in four broad spectrums: exploration/extraction of crude, refining, transporting (often by pipelines), and marketing petroleum products (Newell, 1999; Duncan and Wang, 2014). Although, there are several ways in which O&G can be transported (i.e. through pipelines, ocean moving vessels or tankers). Pipelines are the most energy-efficient, safe, environmentally friendly and economic way of transporting crude/refine O&G product (Stenström, and Parida, 2014). In addition, O&G sector are where the combination and sequence of operation usually very specific to the characteristics of crude oil (i.e. raw materials), which is transported through pipelines for refining and distribution of refined O&G to consumer (Duncan and Wang, 2014; Shafiqur and Al-Hadhrami, 2014).

The efficient operations of these pipelines determine the effectiveness of the O&G sectors entire business (Prajapati et al., 2012; Duncan and Wang, 2014). Furthermore, Qian et al., (2011) state that, petroleum pipelines (PPs) are seen as being more secure because the flow of O&G is not open to interruption. Nevertheless, as PPs pass through different terrain, the condition of pipelines varies widely across their length and throughout their life cycle (Simões et al., 2001). Based on length and variation in terrain, PPs tends to be susceptible to failures with catastrophic consequences. However, the potential for major accidents is inherent in most industries that handle or store O&G substances. For example several major accidents have been experienced in the O&G sector over the years, in 1998 Jesse pipeline explosion in Nigeria was a devastating type that almost claims an entire village, burning to death over 250 people as a gas pipeline failed (Aroh et al., 2010, Effiong, 2010). Texas City refinery explosion (2005), Ijegun explosion in Nigeria (2008), and the Macondo Blowout (2010), these are few examples of pipelines accidents with devastating consequences (Okoh and Haugen, 2013). Pipelines failures have also occurred in the UK, Russia, Canada, Mexico, Pakistan and India. Hence, PPs failure causes fatalities as well as disruptions to operations, which may lead to heavy losses (Jardine *et al.,* 1999; Rios-Morales *et al.,* 2011; Duncan and Wang, 2014).

Most PPs operators ensure that during the operational stage, safety provisions are considered to guarantee pipeline safety (Duncan and Wang, 2014). However, even with the safety conditions in place, there can be failures and/or damages to PPs. These need to be repaired or replaced efficiently and effectively to allow minimum disruptions to the O&G operations. Usually, repair and replacement procedures are mostly done using condition-based maintenance (CBM) approach in a corrective way (Hamid and Pouresmaeeli, 2014). CBM is a management philosophy that posits repair or replacement decisions on the current or future condition of pipelines (Parida and Chattopadhyay 2007; Veldman et al., 2011b); it recognises that change in condition and/or performance of pipelines is the main reason for executing maintenance in the O&G sector (Gao et al., 2010; Arruda, 2014). CBM is usually used to minimise the total cost of inspection and repairs of PPs (Kumar et al., 2013). However, not all CBM practices adopted in the O&G sector have been totally successful owing to different issues such as technical/human errors during maintenance, inadequate data available for CBM maintenance, and poor collaboration between the management and low level staff (Okoh and Haugen, 2013). Therefore, how well CBM approaches are performed in the oil and gas sector are greatly important (Barabadi, 2014).

The paper is presented in several sections, and the discussion of the paper will be focused in the Nigeria O&G sector. The next will be the use of CBM, follow by need for the study. The other three sections below will be discussing on performance measurement in CBM, vandalism in petroleum pipelines and conceptual framework for CBM. The last one will be conclusion of the findings.

2. The Use of Condition-Based Maintenance

As the commercial implications of technical systems' malfunctions and non-availability become more apparent, oil and gas (O&G) sector have begun to resort to novel means to assess condition-based maintenance (CBM) technical systems' performance challenges (Juuso and Lahdelma, 2013). These performance challenges in operational strategies require changes in CBM strategies related to facility selection to optimise the maintenance activities with respect to operations objectives (Asplund *et al*., 2014). So, to maintain petroleum pipelines (PPs) reliability, most O&G sector departments of petroleum pipelines maintenance adopt purely reactive approach (fixing or replacing equipment after it fails) or blindly proactive approach (i.e. servicing equipment on a routine schedule whether servicing is needed or not) (Emmanouilidis *et al.,* 2009; Hamid and Pouresmaeeli, 2014).

The two approaches are often used to counter failure in the O&G sector. Though, if not properly managed/monitored, it can lead to failure, loss of resources as a result of total reliance on monitoring instrument and unnecessary proactive maintenance (Parida *et al.,* 2015). For example: in a case where most machine field services and petroleum pipelines components run on sensor-driven management systems that provide alerts, alarms and indicators, the moment the alarm goes off, in most cases the damage has already been done. It is therefore, too late to prevent the failure (Okoh and Haugen, 2013; Hamid and Pouresmaeeli, 2014). Maintenance may also cause major accidents directly by triggering unwanted events in the cause of maintenance. Hence, there is a need to prevent maintenance related causes of major accidents. In recent years, attention in accident investigations has tended to be more on organisational issues than technical and human causes of accidents in maintenance (Zhang and Luo, 2012). Moreover, substantial research efforts have been devoted to technical and human causes to petroleum pipelines fault diagnostics in reducing downtime (Adewunmi *et al*., 2012).

Feasible maintenance can only be achieved by having the knowledge of the various types of maintenance and method of application. Maintenance types are: corrective maintenance, emergency maintenance, preventive maintenance, proactive maintenance, predictive maintenance, periodic maintenance, reliability cantered maintenance, reactive maintenance and turnaround maintenance etc. (Veldman et al., 2011; Parida *et al.,* 2015). Preventive maintenance is an extensive term that consists of a set of activities to improve the overall reliability and availability of a system. However, preventive maintenance scheme often tend to be time-based, and does not consider the current state of the pipeline and this may lead to unnecessary maintenance (Liyanage and Kumar, 2003; Moghaddam and Usher, 2010). The predictive maintenance scheme is a maintenance scheme that provides sufficient warning of an impending failure on a particular equipment, allowing that equipment to be maintained only when there is objective evidence of an impending failure (Dhillon and Liu, 2006; Umar, 2011). Corrective maintenance scheme is usually conducted when failure has occurred and when the original condition is to be restored. From the above explanation of the different types of maintenance and their functions, the corrective and preventive maintenance could be classified as early form of CBM philosophy (Al-Bedoor *et al.,* 2006; Jardine *et al.,* 2006). Because CBM task is performed to detect incipient failures long before their occurrence, CBM uses condition-monitoring approaches to determine whether a problem exists in equipment, how serious the problem and how long the equipment can run before failure. It can detect and identify specific components in the equipment that is degrading. That is identifying the failure mode and to determine the root cause of the problem through diagnostic function before executing maintenance. CBM function both in routine and continuous monitoring approach in pipelines. CBM is said to be proactive, effective and efficient in initiating failure finding strategies in PPs (Kagaari *et al.,* 2010; Parida, Kumar *et al.,* 2015).

Condition-based maintenance when properly tailored through research and development will be the frontrunner in perfecting maintenance problem in O&G industry. Ever since the introduction of CBM by the Rio Grande Railway Company in late “1940s”, CBM have thrived to make a remarkable success in efficiencies and cost savings in the following industries such as: Automobile, Aerospace, General Electric and other manufacturing industries (Khazraei and Deuse, 2011; Damjan *et al.,* 2012). Based on the success recorded, CBM techniques have gained the ability to remain as the frontrunner in detecting and addressing matters relating to O&G leakages, changes in temperature and pressure readings in O&G operation (Asplund *et al.,* 2014). Although great success is recorded in the adoption of CBM practice in the oil and gas sector, it has not been without flaws (Jardine *et al.,* 1999; Kumar and Markeset, 2007; Parida *et al.,* 2015).

Pollitt (2014), explain one of the devastating failure recorded from British Petroleum in the Deepwater Horizon in the Gulf of Mexico. Where CBM of the oilrig (oil platform) gave an early warning weak signal, thereafter, an explosion occurred in the offshore oilrig, leaking hundreds of tons of crude O&G, causing severe contamination to the built and natural environment in the region. Likewise, in the repair of gas turbine and compressor systems, where CBM often posed to be a complex type of maintenance, it is difficult to interpret the system as a result of inadequate information about the process as a result of the nonlinear time variable behaviour of the machinery (Basim, 2012; Prajapati *et al.,* 2012). Equally, CBM prove to be the most difficult maintenance practice in the Nigerian O&G sector, as a result of the underperformance of the three (3) Nigerian refineries located in Port-Harcourt, Warri and Kaduna owing to inadequate maintenance culture (Aroh *et al.,* 2010).

The failures recorded so far, makes decision management staff to oversight CBM as a practice of needless maintenance type (Ritson, 1997; Basim, 2000; Bogue, 2013). However, CBM strategy is indispensable in maintenance of petroleum pipelines integrity. CBM can perfectly function through effective collaborative effort (Crespo *et al.*, 2009; Khazraei and Deuse, 2011; Duncan and Wang, 2014). In addition, Parida and Kumar (2006) suggested some important components to be considered in improving CBM.

- Adapting to new trends in operation and petroleum pipelines CBM strategy;
- Organisational structural changes;
- Focus on knowledge management;
- Measuring value created by the maintenance;
- Reviewing resource allocations;
- Health, safety and environment issues; and
- Justifying investment.

The listed components will be discussed in the section 4.4 below using performance measurement approach.

3. Need for the Study of Petroleum Pipelines

The O&G sector is the main contributor to Nigeria's economy. However, the sector faces a number of challenges, the most prevalent of which is petroleum pipelines vandalism. A collective research effort is needed to better understand the circumstance surrounding these negative human interactions. A number of studies have explored knowledge management creation in business from different perspectives (Anumba; 2009; Massingham, 2014 part 1-2). However, there is dearth of research that has attempted to investigate the interactions between the O&G host communities and the multinational O&G companies from knowledge management approach. Studies that have explored this topic in Nigeria O&G sector have done so with inconclusive results for example: Effiong (2010) investigated the impact of Oil spill in the Niger Delta region; Aroh et al., (2010) investigated pipelines vandalism and disaster; Rhuks (2012) investigated illegal O&G activities and pipelines vandalism and Idemudia (2014) Researched into Oil multinational companies as money makers and peace makers.

It is now being recognised that the management of maintenance project knowledge, especially within the O&G sector, where projects are implemented by temporary 'virtual' groups or contractors within the Nigeria O&G sector is open to considerable improvement (Taguchi, 1986; Anumba and Scott, 2001). The emphasis on Knowledge Management (KM) reflects the growing realisation that it is a core business concern, particularly in the context of the emerging knowledge economy like Nigeria, where the know-how of an enterprise is becoming more important than the traditional sources of economic power such as capital and land (Anumba and Scott, 2001). In addition, Anumba (2009) explained that, understanding site management problems, including current approaches, is important to manage knowledge successfully. However, approach towards addressing site management problems differs from one company to another (Sarajul and Anumba, 2009). Notwithstanding, knowledge management or knowledge creation often leads to improvement and effective deployment of quality management that support knowledge creation processes (Anumba and Scott, 2001). Therefore, organisations that effectively deploy maintenance management practices should have a system that supports knowledge creation processes (Taguchi, 1986). From this perspective, it is not sufficient to deploy maintenance practices that merely satisfy the dimensions of customer satisfaction, continuous improvement, and systems view, but maintenance deployment should also consider quality practices that support the knowledge creation processes such as training, collaboration, and performance measurement (Linderman *et al*, 2004; Anumba, 2009).

In Nigeria, all activities in the industry or otherwise, are prone to calamities, but petroleum pipelines are especially vulnerable. The main causes of petroleum pipelines failures in Nigeria are variation in terrain, corrosion attack, mechanical failure, poor construction; combined with inadequate inspection, low quality materials, human and operational error. Currently, vandalism happens to be the major reason why petroleum pipelines frequently fail in Nigeria. The Nigerian National Petroleum Corporation (NNPC) provided details of how the activities of pipeline vandals have complicated the free flow of petroleum products and crude supply leading to a colossal of over US$42.952million spent to execute a two-phase repair work which started in September, 2009 on 74 damaged points in system 2C-1. Escravos –Warri crude oil pipelines to enable the start up of the Warri and Kaduna refineries (NNPC, 2015). Therefore, it is important to adopt performance measurement approach in order to understand the issues relating to CBM in petroleum pipelines.

4. Application of Performance Measurement for Condition-Based Maintenance Approach

Several authors such as: Basim AL-Najjar (2012); Söderholm and Norrbin, (2013); and Parida *et al.,* (2015) have investigated the purpose of performance measurement approach and how performance measures are used in different types of organisations. In their work, they classify some measures to be leading indicators and lagging indicators in order to distinguish between process and results in petroleum pipelines CBM. Based on their classification, CBM process could refer to as leading indicators, while measures of maintenance results could be refer as lagging indicators. In detail, leading indicators are indicators that give early warning signal to petroleum pipelines manager about objectives beforehand, the leading indicator act in the ‘same capacity as early warning signal indicator in identifying external environmental issues that could impinged on PPs integrity (Damjan *et al.,* 2012; Barabadi, 2014; Stenström and Parida, 2014). A leading indicator is one of a statistical series that fairly reliably turns up or down before the performed CBM lagging indicator is observed. However, both Leading and lagging indicators are essential to petroleum pipelines status because they assist in monitoring the effectiveness of maintenance process in real-time (Hamid and Pouresmaeeli, 2014). Whereas lagging indicators are basis for describing the over-all performance and for deciding between maintenance, overhaul, or replacement, that is to decide if a damage or vandalised petroleum pipelines is worth repairing or not.

Hence, Damjan *et al.* (2012) suggest that, management needs to use a combination of leading and lagging indicators in order to achieve the desire or reliable performance measurement result. Furthermore, Juuso and Lahdelma (2013) State that, performance drivers are equivalents to leading indicators, because they have the ability to predict future outcome in detecting weak signal in CBM before commencement of task. In measuring CBM performance, several authors also refer leading indicators to be performance drivers, because they assist in identifying early warning signal in CBM job success or failure (Dong *et al.,* 2013). In contrast, performance killers are issues that reduce performance without being strong enough to stop a process. Examples of performance killers are: equipment with critical uptime, pipeline vandalism, health, safety and environment, bottlenecks in workforce capacity, poor administration and inventory, lack of proper tools, faulty procedures and checklists, inadequate information, communication flow and systems, delay of resources, materials, and low quality spare parts some of the examples of performance killers. But petroleum pipelines vandalism tends to be the major performance killers within the Nigeria O&G sector (Essoka *et al.,* 2006; Kumar, 2005). Therefore, it is better to understand why these human infractions persist.

4.1. **Vandalism in Petroleum Pipelines**

Anifowose *et al.,* (2012) state that, petroleum pipelines vandalism and other malicious activities are common issues that often impinge petroleum pipelines integrity in both develop and developing countries. Also, Ai-Khalill *et al.,* (2005) argue that, petroleum pipelines vandalism would appear more often in economically deprived regions, while mechanical damage will become more pronounced in industrially developed regions. Though, human infractions are considered to be the major setback to CBM practice as shown in Figures 1.2 illustrating human infraction or misdemeanor on PPs.

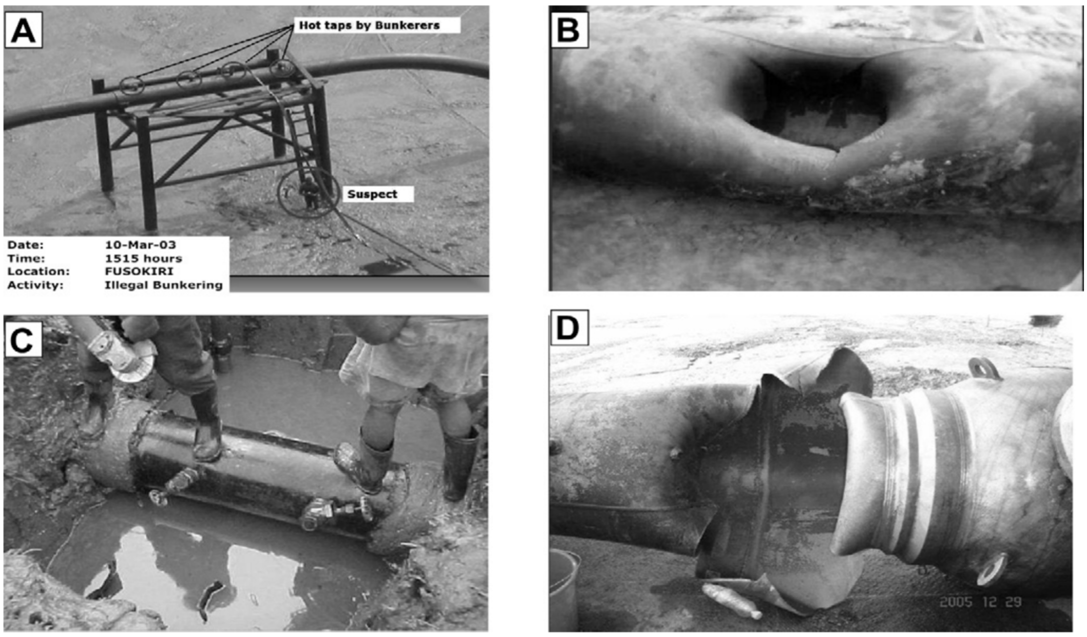

Figure 1.1: Petroleum pipelines vandalism. A: A suspected illegal oil bunker; B: Explosive detonated at the 24" Uvwiamuge pipeline (7 May 2003); C: Repair work after crude oil theft; D: Damaged section of the 24" NNPC pipeline riser (29 December 2005). Source: Anifowose *et al.,* (2012).

Hence, when defining petroleum pipelines maintenance strategies, it is important to understand the issues that could further affect petroleum pipelines transportation (Prajapati *et al.,* 2012; Zhang and L 2012). Also, to considering the environment where petroleum pipelines CBM is performed. Though, corrosion is one of the problem confronting petroleum pipelines within the

Nigeria O&G context (Berends, 2007; Emmanouilidis *et al.,* 2009; Gao e*t al.,* 2010; Anifowose *et al.,* 2012). Furthermore, issues of PPs vandalism could be as a result of lack of employment, lack of relationship between the host communities and O&G companies, lack of information, and environmental degradation caused by the O&G multinational companies operating in the developing countries, as major factors causing pipeline vandalism in the region where incessant vandalism of oil and gas production facilities and installations are predominant (Essoka *et al.,* 2006 Dhillon and Liu, 2006; Okoh and Haugen, 2013).

4.2. A Conceptual Framework for Condition-Based Maintenance in Petroleum Pipelines

The application of a conceptual framework will assist managers to assess petroleum pipelines performance, and to achieve maximum success in condition-based maintenance in petroleum pipelines. To conclude the review of literature, Nix and Kwee, (2013) state that, collaboration has been referred to as the driving force behind effective maintenance strategy in identifying early warning signals in PPs operation. Also, knowledge becomes a key strategic resource, especially in a turbulent environment where PPs infractions are common. Hence, collaboration involve higher levels of engagement, lead to greater knowledge gains, which in turn lead to better performance and stronger relational outcomes in PPs monitoring. Furthermore, managers should engage in the value of deep collaboration in order to improve CBM performance outcomes and be willing to share information and learn from the knowledge and experience of the others (Khazraei and Deuse, 2011; Qian, *et al.,* 2013). Since, performance measurement can be used to identify problems that may arise in future as presented in Figure 1.1 below (Khazraei and Deuse, 2011).

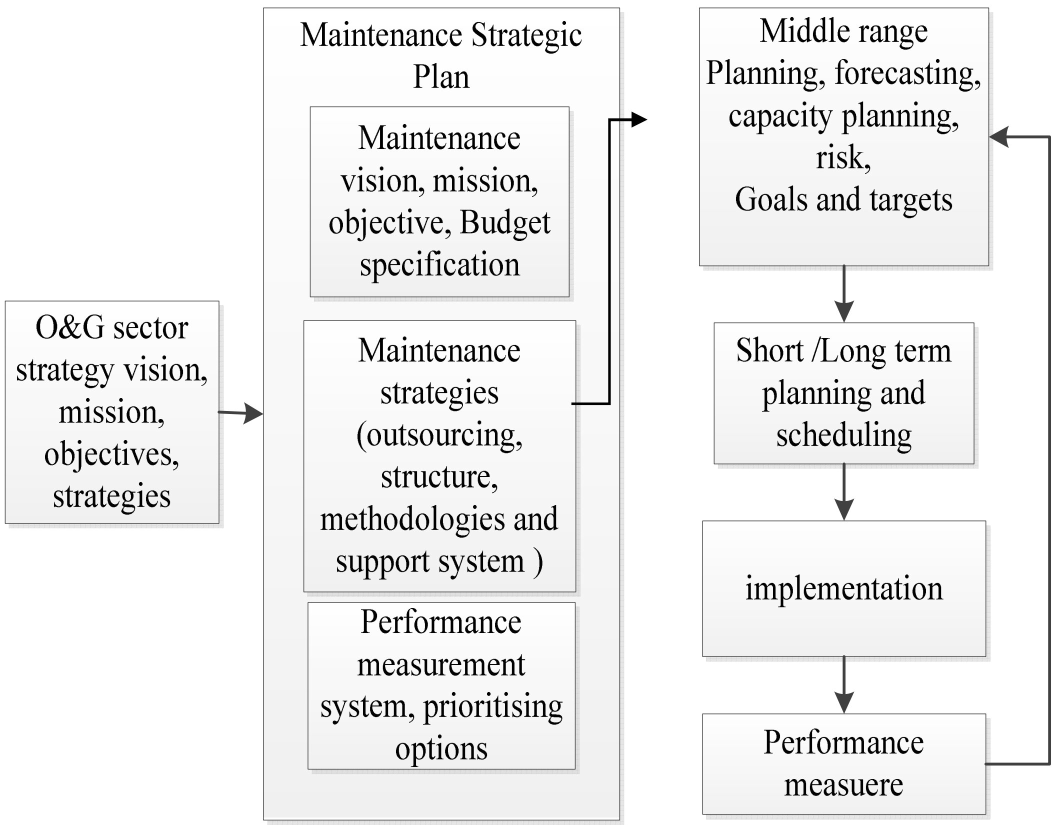

Figure 1.1: Strategic Planning for petroleum pipelines maintenance (source: Adopted from after Umar Al-Turki, 2011)

Various techniques are routinely used to monitor the status of petroleum pipelines. In this context, manager and employee should collaborate and review overall expectations in CBM and develop performance objectives as depicted in **Figure 1.1** above. Individual development goals should be appropriated where necessary and updated. Manager should proactively develop a spectrum of performance plan that directs the employee's efforts toward achieving specific results to support organisational excellence and employee success (Parida and Chattopadhyay, 2007; Umar Al-Turki, 2011). The project aim and objectives should be discussed often in order to monitor emerging issues in short/long term project or make a checklist specifying some key factors to be considered in CBM, and the need for effective feedback should be emphasised. From the feedback given, develop a framework to training employees in order to ensure employees achieve results through coaching and mutual feedback (Albert, 2002). The manager should review the employee's performance against expected objectives, as well as the means used and behaviours demonstrated by employees in achieving the set objectives. This will assist in identifying area that needs improvement, basically in the area of collaboration, communication and commitment to work (Salminen, 2005)

5. Conclusion

The literature review undertaken attempted to include all the relevant PMA and PM analysis in this paper, which are analysed from PM context. In this paper, various developed analysis of CBM and emerging PM are presented. However, not much work has been carried out on the process of actually planning the performance measurement approach in CBM of petroleum pipelines vandalism or to ask if the CBM is worth doing in a challenging environment where petroleum pipelines are often vandalised. From the literature review, which have sought results in the plan of measurement systems, and as stated by Parida *et al.,* (2015), it has become apparent that much of the writing about PMA to date has been too phony, in that it ignores the complexities involved in the actual plan of performance measurement systems incorporating real environmental concern into the organisational performance in the O&G sector.

These issues and aspects are applicable for the PM framework. The implementation of the PM framework and the measures presented for the organisation are the real challenges for the managers. In future, the study will be related to increase in the availability and capacity utilisation of the operational system as per the objectives of the management. Also, the future trends in PM will be mapping the maintenance process and activities, collection and analysing the data to identify the performance killers and drivers in CBM, which forms part of the balanced and integrated PMA. Besides, the CBM performance measurement framework needs to assess the contribution of maintenance function to achieve the strategic maintenance objectives using qualitative and quantitative data approach to correct decision making and benchmarking to achieve uncompromised petroleum pipelines integrity within the Sub-Saharan region (Ai-Khalill *et al.,* 2005; Simões et al., 2011).

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POSTER

ID 133

The Digital Narrative for Architectural Design (Ideation, Generation and Story Telling)

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Abstract

Over the latest few decades, the world has been passing through a radical change caused by the rapid evolution of the digital technology which is fundamentally affecting the way humans live, communicate and interact.

Being an integral part of our society, Architecture was substantially affected by these changes. The digital tools, media and modelling techniques have changed the design process and eventually, they started to influence our aesthetic perception, our understanding of space, materiality and tectonics adding new dimensions and levels of design narrative.

The main objectives of the research is to investigate the integration of the digital media and tools into the contemporary architectural design practice, and to explore the state-of-the-art technology and software solutions, in order to accomplish a profound and knowledgeable comprehension of the impact and future potential of the "Digital" on the ideation, creation and representation of design artefacts.

By looking at the digital techniques, tools and methods for the creation of design artefacts and narratives, and the creation process and their fit for specific purposes, and the way these techniques affect/influence the creative and collaborative process in architecture, we find out that the potential of the digital narrative lies in its being interactive (process running across different disciplines), iterative (between the time of the ideational expression and the time of its verification) based on a wide range of modelling techniques (model-based, parametric, real-time, etc) and responsive to the very process through which it's created. The digital narrative surpasses static dimensions of time (from 3D to nD) and space (through augmented/mixed reality).

Through a design-led research methodology, the proposed research aims to explore new methods and techniques of the integration of the digital narrative into the design formation process.

Keywords:

Architectural Design, Digital Narrative, Generative Design, Parametric Design, BIM

ID 134

Game Changing on Assessing Healthcare System in Developing Countries

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Abstract

Purpose: To explore the essence of game changing on applying joint venture approach for healthcare system improvement in developing countries Design/methodology/approach: Review of literatures and investigating various relevant concepts assist in exploring the factors affecting the successful implementation of Joint venture (JV) as outsourcing relationship for healthcare services in low an mid-income courtesies (LMICs). By leverage on indicators appears from survey finding and result analysis that asses me to discounted factors that more applicable to developed countries and give more close attention to factors related developing countries. Findings: My research findings indicates that the LMIC healthcare system would benefit from affiliation with leading technology partner for healthcare reform. The results support the view of LMIC healthcare systems needs to incorporate the implementing of JV model as outsourcing relationship for services improvement and knowledge transfer in LMIC healthcare systems that contribute in country economic growth, development and stability. My explored evidence support the views toward issues related to decision making and management control of JV to be established in different ways in comparison with developed countries. Conclusion: The findings presented in my research, help support views on expending the use of JVs as approach for improvement LMIC healthcare system. My research results provide support for need of the partner involvement in the joint venture as compared with your initial expectations at the time the business venture was formed. Also I shown evidence of international partner knowledge of the market and business practice will helps overcome culture difference and create added value to business and contribute in country growth and stability.

Keywords:

Joint venture, outsourcing, healthcare, Low and Mid-income countries, developing countries

ID 135

Climate and Infrastructural Change in Agrarian Communities

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Abstract

Agriculture is the main source of livelihood for most rural communities in developing countries, these communities contribute to the national economy of these countries. Agriculture is heavily dependent on climate (mainly temperature and rainfall) therefore; its productivity and all production process are highly vulnerable to changes in climate. Changes in climate can have direct or indirect effects on land use, agricultural productivity and infrastructure.

A combination of complex drivers such as climatic, physical and human factors has adverse effects on the built environment and its infrastructure. Almost all sectors and particularly basic infrastructure are expected to be at risk from the negative impacts of the projected warming trend over Africa resulting in high food insecurity and livelihoods for millions of people.

This research is a PhD proposal which attempts to assess the impacts of climate on basic infrastructure in agrarian communities of Jos Plateau, Nigeria. A mixed method / case study approach intending to use both qualitative and quantitative techniques to the research. At the end, the research will explore the appropriateness of infrastructure by identifying and rating infrastructures that are most vulnerable due to climate change and agricultural land use pressures and to identify the coping strategies of communities' resilience to impacts of change.

Results of this research will help build models that will identify areas that are suitable for agricultural land use considering the availability of basic infrastructure within the area and also help planning authorities to channel their development processes through policies that will yield the most desired results. It will also help in capacity building of communities that have been affected by the impacts of change.

Keywords:

Climate, Infrastructure, Vulnerability, Coping strategies, Agrarian Communities

ID 136

Application of project risk analysis and assessment tools and techniques during the investment appraisal stage in the oil and gas industry in Libya

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Abstract

Libya holds the largest quantity of proved crude oil reserves in Africa. As for January 2014 according to the oil and gas journal (OGJ), the country had proved crude oil of 48 billion barrels being the largest in Africa. Although there is a slowdown in project investments as a result of the global economic recessions, the interest in creating investments in the oil and gas development by multi-national oil companies and major national oil companies continues to increase.

Oil and gas industry projects are known to be complex and are accompanies by significant amount of risk and uncertainty, because every investment decision requires substantial capital expenditure. Therefore, oil and gas industry investment decision-making is a major concern and that is why various techniques have been developed and made available to support project risk management. However, these techniques lag behind the existing theories and fail to explain why some of these implemented techniques succeed while others fail.

The research aims to investigate the techniques used in project risk analysis and assessment at the investment appraisal stage and develop a best practice framework that provides the oil and gas companies working in Libya with the knowledge to perform an effective risk management process.

Keywords

project appraisal, risk management, risk analysis, risk assessment, oil and gas

ID 137

Culture Lead Urban Development through Creative Hub Concept

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Abstract

The concept of creative hub both in theory and in practice to understand the role of creative hubs and their policies in urban development ,and also look at the main four visions about how culture lead urban development through this concept are the aims of this paper .

This concept refers to a mobilization of the 'creativity' inherent in art and culture to create new industries and employment opportunities for the purpose of urban development, and meanwhile pay attention to the problems of homelessness and the urban environment; it is believed that such an approach can raise comprehensive urban regeneration. Also design transitional model based on conceptual background, and evolutionary adaption of relevant existing resources and tools by using three mono-casual culture-led development schemes (Florida, Porter, and Sen. Concept) to define complex social-cultural dynamics towards a new thinking for culture-led development concept.

Keywords

Culture, Urban development, creative, hub

ID 138

The Framework of Multidisciplinary and Multi-Functional Teams in A Collaborative Architectural Design

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Abstract

Background and rationale for research: Collaboration among involved people in AEC(Architecture, Engineering, and Construction) of Construction project is driven by information and communication technology (ICT), 2D and 3D of CAD or CAAD, and BIM. These tools are widely used for developing building design. However, the point of weakness is that collaboration between them has still loss of some crucial information. Moreover, CAD and BIM tools are continuously a steep curve learning and non-simplicity of Interface.Collaborative tool system and involved technology should be explored and developed to efficiently solve design problems in concept design stage. Firstly, Collaborative design framework based on communication should provide easy access of sharing project information for semantics, synchronization, and communication. Secondly, the digital tool in the concept design stage should be simplified to learn and encourage designer to flow their thinking. Finally, this framework should support users to communication under holistic view in this stage for appropriated compromise of multidisciplinary information.

Research outcome and Implication: In this research, A prototype of collaborative tool will be developed for cooperating in concept design stage. It should support user in terms of simple user interface from sketch recognition interface. In addition, event ontology model is developed to manage contents of dialogue in holistic view for negotiating, through the cloud storage system for facilitating between of them in the smart and ubiquitous surface.

Its outcome will become a prototype of simplified user interface so that software development community will concern about users as the centric design of digital tool in concept design stage.

Aim: To develop a collaboration framework system between stakeholders in concept design stage of construction project. Objectives: 1. Developing a digital prototype for collaboration between multidisciplinary teams in concept design stage. 2. Developing an interface system in 2D and 3D collaborative working environment of multidisciplinary teams. 3. Developing a collaborative content system to support communication among stakeholders.

Methodological Approach: 1. Studying and applying involved technology in 2D sketch recognition, the cloud storage system and Ontology theory. 2. Analysing Case study in terms of collaborative software tools and User Interface of these tools. 3. Developing user interface and developing system of event ontology model in concept design stage.

Keywords:

Collaboration, Architectural Design, Sketch recognition, ontology

ID 139

Maintain Architectural Identity While Modernizing Iraqi Cities

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Abstract

The issue of architectural identity has been a global concern for many nations, especially in the last century. In the few past decades, many cities are losing their character and getting more and more ambiguous.

Basra is the second main city in Iraq after the capital Baghdad; it is the most important economic, cultural, touristic city in Iraq. It is a city distinguished by its architectural style and identity. However, this identity was threatened many times by external and internal factors in order to distort or obliterate it, such as a colonial, modernity, policies of previous governments, in addition to the three main wars in 1980, 1991, 2003. These factors led to a significant effect on society and demography of the city. As well as disappearance, most of architectural city landmarks due to dereliction and destruction that happened during war periods.

Since 2003 many of investment companies in varied disciplines entered Basra city to carry out different projects in various aspects, these companies adopted foreign designs, however, it was far from a city spirit and did not respect the city's history and identity. The poster is a demonstration of study to develop a framework for maintaining architectural identity in Iraqi cities while modernization processes. The proposed framework will guide the professionals in producing urban design solutions which will consider maintaining identity while enabling modernization.

Keywords:

Identity, Architecture, Modernity, Basra, Iraqi cities

ID 140

Seismic Performance of Structural Silicone Sealant in Glazing Curtain Wall

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Abstract

A modern architectural feature in building is external glazing curtain systems, which have become increasingly popular in buildings. If all four sides are attached using structural silicone (SS) is considered a Four-Sided Structural Silicone Glazing (4SSG) Curtain Wall. Another is Two-Sided Structural Silicone Glazing (2SSG) Curtain Wall. 2SSG is mechanically captured on two glass panel edges and the other two are adhered with SS. Silicone sealants are the most outstanding sealants for use in SSG systems due to its special performance, such as excellent adhesion and sealing effect, thermal stability and elasticity, effective bonding strength. It resisted the stress imposed by the wind on the glass elements. In addition, it withstands the imposed movement created by the differential thermal dilatation between the glazing element and the internal structure. However, most of the previous researches were concentrated on durability of SS affected by environmental factors, few attention on the seismic.

So the purpose of this study is to review previous researches on the seismic performance of structural sealant, and to attract researchers take more attention on the importance of this area. Existing researches show that earthquakes cause damage to the main structural components as well as to the nonstructural elements, the replacement cost and life-safety hazard gave recognition to the importance of research and design of non-structural elements such as glazing systems to resist seismic activity.

Several researches indicated that damage occurred to the weather-seals due to in-plane longitudinal shear and the structural sealants due to in-plane-transverse shear. The sealant shear deformation is related to the glass-to-frame clearance, glass pane width and height. Some dynamic racking test had been carried out on mockups, the results indicated some sealant tearing occurred but not sufficient for any glass to become disengaged at drifts close to the design drift, and sealant tearing progressed at drifts beyond the design drift, and the SSG curtain wall systems can be designed to satisfy the seismic provisions of the building code.

Keywords:

Structural silicone sealant, glazing systems, curtain wall, seismic performance, resistance

ID 141

A Strategic Approach to Land Tenure Security in Iraq: Case Study of Al-Nassiriya City

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Abstract

Land Tenure Security (LTS) is a significant way in which the land user's rights are protected. It can be safeguarded under different forms that are included in various concepts, practices and influences which can be registered and protected officially. In Iraq, land tenure administrations have deep historical foundations reaching back to different periods related to land tenure, however, the current land systems such as registration and recording systems are greatly influenced by conflicting policies and ideologies that control its programs and reforms, and this indicates a real need for more research within this area.

Therefore, this research is targeting to develop a strategic approach for effective management and monitoring of LTS in Iraq, using Al-Nassiriya city as a case study. The aim of this research is to develop a strategic approach for effective management and monitoring of Land Tenure Security (LTS) in Iraq, using Al-Nassiriya city as a case study. Therefore, the research methodology of the study employed both qualitative and quantitative approaches. Accordingly, the major questions which this research seeks to answer are: How has Iraqi conflict period encouraged and accelerated the security of tenure formation? Is Iraqi formation a determinant of security of land tenure? How has informal tenure deepened the incidence of poverty and enhanced insecurity of land tenure in Iraq?.

The research has the following as the key objectives: To develop an understanding of the Land Tenure Security (LTS) systems, definitions and their classifications in general; To study the history and development of LTS in Iraq identifying its social, political and religious sittings; To develop a conceptual framework that underpins the main factors which impact the LTS in Iraq; To evaluate the conceptual framework using quantitative and qualitative methods of data; To draw a set of recommendations for the strategic approach to manage and monitor LTS in Iraq.

Therefore, the research makes a contribution to knowledge by evaluating Iraqi current LTS issues and policy options, focusing on tenure security situations, and using Al-Nassiriya city as the case study.

Keywords:

Strategic Approach, Urban Land, Tenure, Security, Iraq, Al-Nassiriya City

ID 142

A Transformational Organisational Framework to Improve the Iraqi Quasi-Governmental Construction Companies' Performance

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Abstract

Iraq has one of the fastest growing economy worldwide. However, most of the national economic development programmes are planned, managed and implemented by Iraqi state-owned enterprises. These entities have faced many criticisms in recent years due to their poor performance which affects negatively on the national economy.

Iraqi quasi-governmental construction companies are amongst those enterprises that the government attempts to reform in order to promote their effectiveness and efficiency through engaging them in private partnerships as a step to move towards an open market economy. However, these efforts have often failed, due to the poor performance of those companies, which does not encourage investors to enter into a partnership with them. Consequently, this research project aims to develop a conceptual transformational framework which works as a route map guiding Iraqi quasi-governmental construction companies to improve their performance through making a step change in their management systems (core business processes) and thereby prepare them for privatisation.

To achieve this aim, a critical review of the published literature has been conducted to identify the main factors that affect the performance, the related performance improvement models and techniques, and the key elements of the conceptual framework. The researcher then will adopt a qualitative approach to evaluate the usefulness and validation of the conceptual framework in practice. This will involve selecting three Iraqi quasi-governmental companies as case studies and a semi-structured interview survey will be conducted with a number of professionals, senior managers and project managers in each case study. The thematic analysis method will be adopted to analyse the collected data. The analysis will begin with the intra-case analysis of each case and will be followed by cross-case analysis for all organisations involved. The Nvivo programme will be used to facilitate the analysis processes.

Keywords:

Performance improvement, Business process orientation, Iraqi quasi-governmental construction companies

ID 143

Collaboration challenges for detailed design and optimisation via building performance simulation

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Abstract

Building Performance Simulation (BPS) has been an underdeveloped field in AEC industry. The reasons for this delay are technical more than lack of interest by AEC professionals. The interoperability has been the largest issue that is hindering a wide use of BPS through the lifecycle project. The interoperability had been more developed in areas such design coordination, in detriment of other areas such as BPS. As a result of a poor interoperability, the early collaboration is discouraged, and the simulations are carried out late when is more expensive to introduce changes into the project.

The context for this research is based on the current environmental concern and its projection for a coming future. Currently the European Union (EU) consumes 15% of world energy production, 40% of this energy is used in heating, cooling and electricity of residential, commercial and public buildings. This fossil fuel consumption generates carbon emissions responsible for Green-House effect, contributing to climate change. Concerned for this problem, the EU has signed the Kyoto Protocol, by which it commits to reduce the carbon emissions in 30% by 2020. Unfortunately BPS tools have not been developed enough to promote their use in early stages of the design, where is possible to affect considerably the design performance at low cost.

This research recognizes these issues in BPS tools and aims to improve them making possible early collaboration between authoring tools. To achieve the aim will be used the Information Delivery Manual (IDM) methodology, this is a procedure created by BuildingSMART to improve the interoperability breaking down a complex workflow making explicit the functional part to be exchanged between different applications.Finally, the outcomes from this research will bring flexibility in the design process, making possible the early collaboration developing and reviewing of different design alternatives.

Keywords

Building Performance Simulation, interoperability, collaboration, Information Delivery Manual

ID 144

Improving Competition within Public Private Partnership (PPP) Procurement Process: A Malaysian Case Study

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Abstract

Driven by the motivation to attain greater efficiency and value for money, governments worldwide have been innovatively searching for the best methods of procurement to deliver goods, services and infrastructure to the public. This saw the rise of PPP. PPP has taken the world by storm, and currently there is no sign that it will stop anytime soon. Although PPP has been successfully used internationally to procure infrastructure to the people, there has been highlighted flaws of the procurement.

Although PPP has been reflecting the practice of public procurement, the complex nature of PPP may tend to restrict competition from being upheld. Competition has been identified as an important element in PPP to achieve value for money. An effective competition policy in PPP also increases the rate of attracting the propensity of the private sector to invest in PPP programmes. There are numerous ways of incorporating competition in PPP internationally. This can be seen in multiple approaches by countries to deal with selection of a private partner and dealing with unsolicited proposals.

Within the context of Malaysia, PPP is getting more widespread in infrastructure projects. This research view that, even though there is still a long way for Malaysia to be on the same level with other experienced PPP practitioners, nevertheless there are many lessons that can be learnt through the experience of other PPP practitioners on addressing the issue of organizing competition. The research intends to analyse international and Malaysian PPP practice and the competition policy incorporated in the procurement process.

The research aim is to develop a competition based framework for PPP procurement processes in Malaysia which could serve as a guideline in increasing the effectiveness of competition in PPP.

Keywords:

PPP, Procurement, Malaysia, Competition

ID 145

Multiple treatment of loading and unloading with variable stiffness pile foundation for high-rise building tilting accidents

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Abstract

Due to the increased demand on engineering construction in China, more and more high-rise buildings are constructed rapidly. However, as a result of deficiencies in design, construction, technological survey etc, a few high-rise building-tilting accidents had occurred in the past in China. Building tilting is a very serious problem to the safety of high-rise buildings and its occupants.

A case study of high-rise building tilting accident from China is introduced and discussed in this poster. It presents a multiple treatment method to a high-rise building tilting accident and this gives engineers a method to design and treat the tilting accident projects, specifically with pile foundations. By analysing reasons for differential settlement of the high-rise buildings, the integrated reinforcement technologies and measures are established.

In order to stop the high settlement and inclination ratio and ensure that the deformation of the buildings meet the standard requirements, the project implemented four measures: First, unload and reduce the settlement on one side, upload and increase the settlement on the other side; Second, take variable stiffness reinforcement by using concrete-filled steel pipe with post-grouting technology; Third, add the foundation pressure on low-settlement side with post-cast strip cutting method, so as to make the settlement larger; Fourth, arrange a scientific and reasonable sequence of construction to get expected outcomes.

As a result, the settlement ratio of the building decreased from 0.8mm/d to 0.006mm/d; the stable tilting value also decreased from 2.8% to 2.28%, which both satisfy the requirements of China's National Standard. The multiple treatments of loading and unloading with variable stiffness pile foundation for the high-rise building tilting accident can be considered very effective. Related research results and treatment experience of this project provide a tested solution for similar projects.

Keywords：

High-rise building, Tilting, Variable stiffness, Post-cast strip

ID 146

Developing an Assessment Model for the Implementation of Market Orientation in Saudi Construction Organisations

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Abstract

Rapid evolution in the internationalisation of developing construction markets (along with increased global competition, technological innovation, and economic and political issues) has led organisations to become more efficient and effective. This has in turn enabled construction organisations to adapt and survive in today's highly competitive business environment. Dealing with such challenges while carrying out ongoing construction work requires the adoption of suitable strategic business approaches, such as the market orientation approach. Market orientation focuses on understanding customers' conflicting desires and needs, staying up-to-date with competitors' activities, and reforming organisational policies and procedures accordingly. Several conceptual and empirical studies have investigated the relationship between market orientation and firm performance. These studies found strong support for the positive impact of market orientation on firm performance in a number of different environments and contexts, especially in developed countries such as the United States, the United Kingdom, and Australia. Studies set in developing countries, such as Saudi Arabia, are still limited.In recent years, the Saudi economy has experienced marked improvements in many industries, including the construction industry. This reflects Saudi Arabia's successful economic development. In order to retain these improvements, however, the Saudi construction industry has to face a number of economic, cultural, global, and market challenges. Bhuian (1995; 1997; 1998; 2012) has investigated the relationships between such factors and business performance in Saudi industries; however, examining these effects in the Saudi construction sector may yield different results. All of these considerations have motivated the present research project, which aims to develop a model for assessing the implementation of market orientation in Saudi construction organisations.In order to achieve this aim, a comprehensive review of the literature was undertaken. This literature review focused on factors that prompted Saudi construction companies to become market-orientated. These factors were then drawn upon to form a number of hypotheses. The findings of this study support the proposed hypotheses. In particular, the study indicated that the market orientation of Saudi construction companies is determined by 15 factors across the following four dimensions: Communication and Interaction, Risk-Taking, Competition, and Organisational Systems. On the basis of these findings, an assessment model for market orientation in Saudi construction companies was developed. Subsequently, a supplementary model was built in order to help company managers to implement the market orientation concept using the interpretive structural modelling (ISM) technique, which is an effective qualitative method for developing such models.

Keywords:

Market Orientation, Construction Industry, Saudi Arabia

ID 147

Development Implementation Strategies of Offsite Construction Technique in the Kingdom of Saudi Arabia

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Abstract

Offsite construction is considered a new method of building in Saudi Arabia in comparison to other developed countries. The aim of this research is to examine the main factors affecting offsite construction in Saudi Arabia in order to propose a feasible strategy for its wider implementation. The broad range of factors affecting the impact of its application, the reasons for its use, and the challenges it faces were extracted from existing literature. As a result each reflects a factor affecting the offsite construction. To achieve the research aim, the researcher adopted a mixed method approach combining Semi-Structured interview and Questionnaires. The interviews were administered amongst 6 expert participants in the construction industry in Saudi Arabia while 136 participants from this industry filled in the questionnaire. All the data was gathered and analysed based on scientific methods of analysis. The interviews have revealed many factors that affect the implementation of offsite construction in Saudi Arabia and highlighted that there are four main offsite construction techniques (Offsite Preassembly, Hybrid system, Panelised System and Modular building); this was also confirmed by the questionnaire. The questionnaire revealed that an increase in labour productivity and product quality and an overall reduction in project schedule are the main attributes of offsite construction. However, there are many challenges facing offsite construction in Saudi Arabia, including the inflexibility in making on-site changes, limited design options, associated cost and risk, low awareness and resistance to OCT. An ISM validation confirmed similar outcomes. All factors are discussed in relation to the literature review in the discussion chapter, based on which the researcher developed an OCT implementation strategy which he tested using ISM methodology.

In its investigation of the viability of offsite construction in Saudi Arabia, this study extends its scope beyond standard considerations of time and cost in construction, to examine these and other factors in the context-bound circumstances in which they are applied. This approach sets the background for a detailed examination of offsite fabrication in Saudi Arabia. This study considers the individual factors of cost, quality, environmental impact and negative perceptions etc., and some of the implementation-related drivers and barriers. It also includes an examination of the social and cultural factors which could hasten the successful implementation of OCT, such as Saudi society's capacity to collaborate by adopting an open minded questioning approach to sharing information and to innovate by anticipating and responding to change

Keywords:

Offsite Prefabrication (OSP), Offsite Manufacturing (OSM), Modern Methods of Construction (MMC), Offsite Construction Technique (OCT)

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