SYMPOSIUM ON

SUSTAINABILITY AND VALUE THROUGH CONSTRUCTION PROCUREMENT

CIB W092 – Procurement Systems

CIB Revaluing Construction Theme

29 November – 2 December 2006

THE DIGITAL WORLD CENTRE

Salford, United Kingdom

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ISBN 1-905732-11-2
University of Salford

FOREWORD

CIB is the acronym of the abbreviated French (former) name: "Conseil International du Bâtiment" (in English this is: International Council for Building). In the course of 1998, the abbreviation has been kept but the full name changed into:

INTERNATIONAL COUNCIL FOR RESEARCH AND INNOVATION IN BUILDING AND CONSTRUCTION

CIB was established in 1953 with the support of the United Nations, as an association whose objectives were to stimulate and facilitate international collaboration and information exchange between governmental research institutes in the building and construction sector. At that time an implicit objective also was to help rebuild the European infrastructure for building and construction research following the ravages of the Second World War.

CIB has since developed into a world wide network of over 5000 experts from about 500 member organisations active in the research community, in industry or in education, who cooperate and exchange information in over 50 CIB Commissions covering all fields in building and construction related research and innovation.

CIB Commissions initiate projects for R&D and information exchange, organise meetings and produce publications. These meetings can be Commission meetings for members only or international symposia and congresses open to all. Publications can be proceedings, scientific or technical analyses and international state of the art reports.

CIB Working Commission 92 was established in 1989, and the initial aims and objectives established were:

- To research into the social, economic and legal aspects of contractual arrangements, appointment systems and tendering procedures used in relation to construction projects
- To establish and comment upon the practical aims and objectives of contractual arrangements and to define the participants and their responsibilities
- To review areas of commonality and differences
- To formulate recommendations and the selection and effective implementation of project procurement systems
- To compare and contrast standard conventions for the various systems of project procurement generally and specifically
- To report and liaise with relevant CIB Working Commissions and Task Groups.

For the purpose of this Symposium W92 has associated with Revaluing Construction – a priority research theme for CIB (http://www.cibworld.nl/revaluingconstruction). In addition CIB Task Group 61 - Benchmarking Construction Procurement Data are presenting their work at the conference. (http://www.pbsrg.com/overview/cibtg61.htm).

Since inception W92 has organised and managed many Symposia and worked with local and regional industry including in Montreal, Canada; Gavle, Sweden; Chiang Mai, Thailand, Durban, South Africa; Santiago, Chile; Port of Spain, Trinidad and Tobago; and Chennai, India. The inaugural meeting in 1989 was held in Liverpool and we are delighted to welcome the delegates back to England's North-West - to Salford, Greater Manchester, for the 2006 symposium.

Professor Steve Rowlinson, University of Hong Kong, Joint Co-ordinator CIB W92
Dr. Peter McDermott, University of Salford, Joint Co-ordinator CIB W92, Symposium Chair

PREFACE

Welcome to the 2006 CIB W92 Symposium, jointly hosted by CIB W92 Co-ordinators, the Salford Centre for Research and Innovation Research (SCRI), and the Centre for Construction Innovation, North-West (CCI).

The purpose of the symposium is to bring together researchers and practitioners from many parts of the world to share their research, knowledge and experience concerning construction procurement. All of the papers have been selected on the basis of strict review by the Scientific Committee members to ensure a high standard. In selecting the themes for the symposium the Organising Committee were mindful to identify issues that were not only common across international boundaries, but were equally relevant to researchers, practitioners and policy makers. The papers contained herein reflect that, and we look forward to a stimulating debate between the international researchers and with the UK industrialists.

The main themes identified for the Symposium include both the use of procurement to deliver wider *sustainability* (social, environmental, and economic) goals and the use of procurement to help maximize the *value* jointly created by the stakeholders to construction and the equitable distribution of the resulting rewards. Within those themes papers covering the following subjects have been attracted - Understanding Construction Markets and Competition; Public Construction Procurement; Policy Through Procurement; Public Private Partnerships/Private Finance Initiatives; Integrated Procurement Strategies; Value Procurement – Strategies and Processes and Theoretical Perspectives on Procurement.

The inaugural meeting in 1989 was held in Liverpool and we are delighted to welcome the delegates back to England's North-West – to Salford, Greater Manchester, for the 2006 symposium. Emeritus Professor David Jaggar (Liverpool John Moores University) was one of the co-hosts in 1989. This year he has steppped down as Joint Co-ordinator of CIB W92 and we would like to take this opportunity to thank him for his intellectual contributions and his enthusiasm over the years.

ACKNOWLEDGEMENTS

Our sincere thanks go to the Scientific Committee members who helped to review the papers and ensure the high quality of the conference. We would like to acknowledge the support of the Regional Centre of (Procurement) Excellence, based at Tameside Borough Council, Greater Manchester. We would like to give special thanks to the team – Karen West, Emma Looskin, Kathryn Harris, Sarah Adie and Scott West for their excellent administrative support and to Farzad Khosrowshahi and Matt Wetherill for their work on the conference website and Peter Unsworth, Chet Narsih and Ian Hanbridge for their IT support.

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Key Organisational Concepts in PFI Projects

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Abstract: PFI (Private Finance Initiative) is a collaborative venture; therefore it must have an established clarity of purpose. The purpose should be common to all the parties involved in the procurement, construction and concession period. The clarity of purpose provides something to aim for and serves as a fundamental unifying force for the collaborative venture. PFI is a form of business partnering; therefore special challenges become apparent when two (or more) organisations (both public and private) are involved in a collaborative effort.

In order to create synergy and ensure a common purpose for collaboration across organisational boundaries a common vision must be developed regarding the desired outcome and the establishment of clear and measurable objectives.
It is important to clarify the roles, responsibilities and accountabilities in PFI procurement since collaboration across organisational boundaries where specifics of organisations (public and private) such as policies, procedures, practices and politics are different. In such collaboration the parties are expected to be creative and innovative. The inevitable fuzzy boundaries, with respect to roles and responsibilities should be managed with the utmost care since there are overlapping roles and responsibilities; there is a need for new ways of doing things for new situations and opportunities for innovation. It must be kept in mind that the values; beliefs and guiding principles; customs; strategies and success measures are different between public and private parties. Whilst the public sector is: structured, bureaucratic and organised and the private sector is: flexible, spontaneous and entrepreneurial (able to do whatever it takes to get the job done) this creates potential tensions within the PFI project delivery.

In any PFI project a significant number of parties are involved in the collaboration/partnering scheme and the contractual arrangements can be complex. Effective project management, which is considered to be a key determinant for project success, will save time and cost overruns and solve the problems which could not be anticipated at contract signing.
PFI requires the building of teams across organisational boundaries of different collaborating parties and opens up new ways of working. Partnering in a PFI project encourages a relationship of trust and mutual support towards goals that are perceived as common instead of conflicting. Successful procurement therefore requires an effective project procurement structure.

This paper proposes new organisational structures which have been developed from the detailed analysis of two PFI road projects and triangulated against further PFI projects. The new structures have been accepted by both SPV and granting Authority representatives as a major improvement for future PFI projects.

Keywords: Collaboration, Governance, Organisational Structure, Partnering, PFI, Roads, Trust.

1. Introduction

PFI requires the building of teams across organisational boundaries of different collaborating parties and opens up new ways of working. Partnering in a PFI project encourages a relationship of trust and mutual support towards goals that are perceived as common instead of conflicting. Successful procurement therefore requires an effective project procurement structure (Akbiyikli, 2005). Such a structure has to provide:

1. Clear chain of reporting;
2. Defined areas of responsibility;
3. Defined levels of decision-making and authority.

A detailed analysis of these issues is excluded from the paper. However, Collaboration Partnering and Governance which underpin these issues will be detailed in the text.

2. Concepts of Collaboration, Partnering and Governance

2.1 Collaboration

PFI is a both creative process and a creative product. The structure of the PFI contract has to define the basis for the future long-term operational and managerial relationship between the Public Sector (Authority) and the private sector Special Purpose Vehicle (SPV). A Special Purpose Vehicle is a legal entity created by a firm (known as Sponsor) by transferring assets to the SPV, to carry out some specific purpose. SPVs have no purpose other than the transaction(s) for which they were created, and they can make no substantive decisions; the rules governing them are set down in advance and carefully circumscribe their activities. The legal form for a SPV may be limited partnership, a limited liability company, a trust, or a corporation. In short, SPVs are essentially robot firms that have no employees, make no substantive economic decisions, have no physical location, and can not go bankrupt (Gorton and Souleles, 2005). The overall aim of the relationship between the Public Sector and the SPV is to work together.
Kanter (1994) defines collaboration as:

> *"creating new value together rather than mere exchange, getting something back for what you put in".*

Préfontaine et al, (2000) define collaboration for public service delivery referring to:

> *"the reciprocal and voluntary support that two or more distinct public sector agencies, or public and private administrations, including non-profit organisations (NPOs), provide each other in order to deliver a public service, i.e. one that is part of the government mission".*

Co-operation between the public and private sectors can take many forms such as joint ventures, concessions and privately financed investment projects (PFI scheme). The common factor for all of these different models is that the public sector delegates an element of day-to-day control over service delivery to a private sector entity. Team-working on PFI projects and an effective governance structure is therefore crucial.

The service delivery focused nature and the extended duration of the PFI projects require a team to oversee the whole life of the project. Furthermore, effective co-ordination and integration is crucial and necessary. This necessity for effective co-ordination and integration of the stakeholders in the case study projects upon which this paper is based was a cardinal issue for both the public and private sectors.

The most common commercial arrangement in project collaboration is a contractual agreement that confirms the cost, time, resource expectations of each party against the project goals. The collaboration in PFI is translated into a formal Project Agreement (PA) between the Authority (Public) and SPV (private) parties as to the purpose of their collaboration and the sharing of responsibilities, resources, risks and benefits. The formal written agreement is for a defined period of time.

Different factors affect the performance of collaboration in projects. These factors are related either to: the project's environment; to the partners involved; to the collaboration process; to the project development process; to the governance methods used to organise and manage the project (Préfontaine et al, 2000).
The critical success factors for collaboration are given in Table 1.

Table 1: Critical Success Factors for Collaboration
(Adapted from Préfontaine et al, *2000*)

COLLABORATION CRITICAL SUCCESS FACTORS (CSF)	**EXPLANATION**
CSF 1: Political, Social, Economic and Cultural Environment	These are factors associated with the macro-environment and they are significant in identifying the institutional, industrial and technological frameworks. They provide the opportunity to more efficiently identify those macro environmental factors that enable or inhibit collaboration for public service delivery.
CSF 2: Institutional, Business and Technological Environment	This dimension deals with the more immediate environment of the collaboration project associated with the institutional environment or regulatory framework, the project's sector of activity or industry and the specific features of the technologies used.
CSF 3: Partners' Objectives and Characteristics	This dimension establishes the basis for compatibility and complementarities of various partners by closely examining the objectives, motivations and characteristics of each.
CSF 4: The Collaboration Process	This dimension develops in stages that each requires the presence of specific conditions to ensure success. At each stage, the collaboration process evolves in such a way as to ensure a negotiation-decision-action-evaluation process that takes into account the degree of project completion and the evaluation of relationships among partners.
CSF 5: Models of Collaboration	The specific features of the implemented collaboration model. It is defined by its mode of governance (which determines the power at this dimension, it is important to identify the power structure), by the very nature of the collaboration in terms of sharing responsibilities and benefits among partners and by the organizational methods or measures used for co-operative management.

PFI is a collaborative venture and it reflects the UK government's preference for the form of collaborative working with the private sector (Akbiyikli, 2005). In the UK the collaboration is via partnering.

2.2 Partnering

Partnering was first applied in the UK in the North Sea oil and gas industries in the early 1990s. Major industry players such as BP were driven to this new model in an attempt to achieve profitability from what would have been otherwise uneconomic oilfields. The new approach proved successful in achieving significant cost savings in platform construction for the employers and in creating increased profits for the participating partners (Baird and Bennett, 2001).

Partnering is a difficult concept to define. It has to do with human relationships and interactions, with stakeholders' interests, with the balance of power (McGeorge and Palmer, 2002). Barlow *et al.* (1997) conclude that partnering is best considered as a set of *collaborative processes*. Processes which emphasize the importance of common goals and raise such questions as how such goals are agreed upon, at what level are they specified and how are they articulated? It can mean different things to different people and there are numerous definitions of partnering which are currently in use.
The one offered by Egan (1998) defines partnering as follows:

> *'Partnering involves two or more organisations working together to improve performance through agreeing mutual objectives, devising a way for resolving disputes and committing themselves to continuous improvement, measuring progress and sharing the gains'*.

The definition offered by Bennett and Jayes (1995) emphasizes effectiveness, culture and relationships based on trust and understanding:

> *'Partnering is a management approach used by two or more organizations to achieve specific business objectives by maximizing the effectiveness of each participant's resources. The approach is based on mutual objectives, an agreed method of problem resolution, and active search for continuous measurable improvements'.*

The concept of partnering can be confusing as to what it is and what it is supposed to achieve. As noted in McGeorge and Palmer (2002):

> *'Partnering is more than a set of goals and procedures; it is a state of mind, a philosophy. Partnering represents commitment of respect, trust, co-operation, and excellence for all stakeholders in both partners' organisations'*.

A partnering relationship is not a soft option. It requires significant input, both of time and effort if the benefits are to be delivered (HM Treasury, 1992).

From these different definitions, partnering is a concept which provides a framework for the establishment of mutual objectives among the parties and stakeholders in a construction activity and this framework enthuses trust, cooperation and teamwork into a project process, which enables the combined effort of the project parties to focus upon procurement and project objectives fostering a collaborative bond to everyone's benefit.
Successive UK construction industry review reports; (Latham, 1994; Technology Foresight Report, 1995; Egan, 1998; NAO, 2001) emphasised the importance of partnering arrangements in order to facilitate team working across contractual boundaries. Latham (1994) set the agenda by stating that improvement begins with clients and particularly with government committing itself to become a best practice client and promoting excellence in design. Technology Foresight Report (1995) stated that the vision for construction is one, which sustains high levels of productivity, profitability and responsibility. Egan (1998) underlined that the UK construction industry is underachieving, has low profitability and invests too little capital in training, research and development and listed five key drivers of change, namely: committed leadership; focus on the customer; integrated processes and teams; a quality driven agenda; and commitment to people.

The NAO (2001) stated that, if established reliably, partnering should provide the public sector with greater assurance that value for money is being achieved due to the appointment of contractors competitively; clearly measurable targets for improving construction quality, delivery times and achieving cost reductions; and, commitment from both parties (public and whole Supply Chain) for continuous improvement and collaborative working.

In short the conclusion is that the partnering concept lies on four main dimensions, which are: Good relations, HOT (Honesty, Openness, Trust), Integrity and Co-operation. These issues are important partnering and collaboration features of PFIs. The main dimensions of a partnering concept are shown in Fig.1.

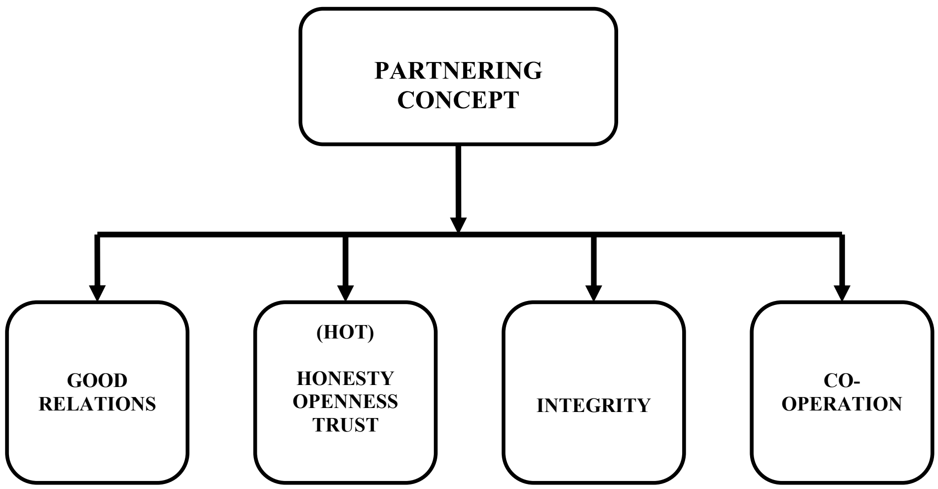

Fig.1: Main Dimensions of Partnering Concept (Akbiyikli, 2005)

According to Bennett and Jayes (1998) the defining features of successful partnering are:

1. Mutually agreed objectives and goals;
2. Inter – organisational trust;
3. Mechanism for problem resolution;
4. Continuous improvement related to benchmarking;
5. Proactive management of relationships.

Crowley and Karim (1995) proposed the key characteristics and the associated attributes for partnering organisations. Attributes to some key characteristics of partnering is shown in Table 2.

Table 2: Attributes to some Key Characteristics of Partnering
(Adapted from Crowley and Karim, 1995)

KEY CHARACTERISTIC	ASSOCIATED ATTRIBUTE
Mutual Trust	Developing confidence Encouraging open communication Exchanging ideas Sharing resources
Long-term commitment	Constant improvement of technology and methods Reinforcing of the mutuality of the parties
Aversion to Litigation	Producing feeling of camaraderie among parties
Shared vision	Setting common project objectives and goals
Win-win attitude	Neither party win due to the other's loss
Freedom of speech and openness	Parties being encouraged to identify and address problems
Innovation	Open exchange of views and ideas solving day-to-day problems
Equity	The needs, concerns and objectives of each party being cooperatively addressed
Shared risk	The uncertainties of project life being jointly shared

According to McGeorge & Palmer (2002) there are two different categories of partnering: project partnering and strategic partnering. Project partnering can be stepping stone to strategic partnering. *Strategic partnering* is sometimes referred to as *" multi-project partnering"* or less frequently as *"second-level partnering"* and *"project partnering"* as *"single project partnering"* or *"first-level partnering"*.

Project partnering has become increasingly established as a non-adversarial and performance enhancing approach to contracting. In the case of PFI the project and strategic versions merge because of the long time-scale of the project concession.

Fundamentally the PFI partnering process is about team building, which is why the function of internal partnering is so important in achieving a successful outcome. The processes of partnering must be seen as a means to an end and must not be seen as an end in itself.
The PFI partnering process attempts to establish working relationships amongst the stakeholders through a mutually developed, formal strategy of commitment and communication. It attempts to create an environment where trust and teamwork prevent disputes, to foster a cooperative bond to everyone's benefit, and facilitate the completion of a successful project. PFI Partnering requires a process of change. Partnering is the key to the holistic approach, which must first be brought to the project and then incorporated into the whole team performance.

In general the partnering process falls into three phases: the pre-project stage, the implementation stage and the completion/feedback stage details of which are excluded from this paper.

If the PFI option appears to deliver lower costs over the life-time of the project than the PSC, the preferred bidder and the public sector work together to prepare the full business case (FBC). "Officially" in a PFI project the partnering between parties starts at this stage of the procurement process (Akbiyikli, 2005). In "reality" it must start much earlier.

There is conformity over the general concept of partnering as a co-operative relationship between business partners formed in order to improve performance in the delivery of projects but there is considerable variation of definition. The detailed analysis of the case study PFI road projects (A92, NSDR and A55) indicated that partnering has to be practiced and learnt over a series of PFI projects.

2.3 Governance

The concept of Governance has become important in the discipline of public administration, business administration and in the related areas. The popularity of this concept needs to be conceptualised in multi-level and multi-actor contexts. This concerns the classical public government and also the relationship of collaborative alliances of public-private organisations. Governance can be defined as, *'the process whereby an organisation or society steers itself.'* (Rosenau, 1995). Broadly speaking, governance consists of the systems of rules, norms, processes and institutions through which power and decision-making are exercised. According to the World Bank (1994) good governance is thought to have four components:

1. Representative legitimacy;
2. Accountability;
3. Competence and appropriateness;
4. Respect for due process.

The authors consider items 1 and 2 as particularly significant components since they raise special concern for the parties in a PFI project. Items 3 and 4 are fundamental to all forms of procurement, and as such have been excluded from detailed analysis with this paper.

The area of legitimate representation in public – private partnerships raises both *normative* and *operational* issues. The normative issues are very important since there are many parties in a PFI project: central or local government authorities, lenders, sponsors, banks, insurance companies, Special Purpose Vehicle (SPV) shareholders and diverse subcontractors. The normative issues determine whose, of the above said parties', interests should be represented and whose should not.

The accountability concept is concerned with being held responsible for one's actions. Both the public and private sectors have well established mechanisms of accountability. In the private sector, the project management team is accountable to the company's shareholders. In the public sector, administrative structures report to political structures that are ultimately accountable through the contestability of political power.

However, the accountability in public-private partnering may be less straightforward, partly because accountability is dependent upon the clear specification of objectives, activities, roles and responsibilities. It will be more easily achieved through formal partnering where accountability roles are spelt out. In a PFI concession contract between the public sector (Granting Authority) and private sector (Special Purpose Vehicle), both parties are losing their sharp boundaries; and both the public and private organisations are becoming more and more interrelated, losing control upward and downward. The aim of this is to create an organisational condition that supports product and process innovation; and in PFI the way the product is achieved is a novated procurement form. In this novated procurement the SPV will be required to be a party so that it undertakes to enter into, and be bound by, any assumption of its rights and obligations by a third-party purchaser as appointee of the debt funders (Fox and Tott, 1999). Such an assumption will be effected by means of a novation of the relevant project document. A novation is an agreement by which all parties to a contract agree that a third party is to stand in the place of one of the original parties (ibid). The role of the public sector in the provision of infrastructure has changed significantly since the implementation of PFI procurement policy in the UK, and this will continue. PFI has required a considerable change in public sector working practices. Through PFI, government has become attracted to the clarity of roles and responsibilities that contracting can provide.

The ultimate Governance goal is to establish collaboration and partnering to achieve value for money and transfer of risk to the party that is able to manage it. In order to achieve this goal the partnering governance arrangement must have the following features at the strategic management level (ACCA, 2002):

1. Mechanism for dealing with coordinating, managing and controlling objectives and strategy;
2. A partnering structure that is supportive of the goal and anticipates potential conflicts between parties;
3. A transparent system;
4. Mechanisms to steer the private sector (governing role); placing at the heart of the governance structure the governing body which must have a public responsibility mindset that consists in controlling, overseeing and safeguarding public principles and interests.

As of April 2003, 569 PFI contracts had been signed in the UK, 418 of which were operational. A considerable number of projects were construction and property related, including hospitals, prisons, roads, schools and office accommodation (OGC, 2003 a and b). Given the scale of PFI, it is imperative that both the public and private sector should look to manage PFI better, by (CBI, 1996):

- Refining policy and processes;
- Adapting culturally;
- Acquiring new skills.

The NAO report (2001) on successful PFI pointed out the key issues which awarding authorities needed to bear in mind when developing and managing relationships with the private sector. The research, based on analysis of 121 PFI projects let prior to 2000, revealed that PFI projects should be approached in the spirit of partnership, in terms of business understanding and establishing a common vision of working together. The NAO highlighted in the report that the PFI process poses a key project management challenge. In the same report it is also pointed out that, in order to manage a long-term PFI contract effectively, granting authorities need to have staff equipped in skills which include:

- Thorough understanding of the project;
- Familiarity with the contractual terms and how they are supposed to operate;
- Good communication skills;
- Good relationships skills.

3. PFI in Roads

Public infrastructure represents the physical assets and their related actions that serve the economic and social needs of the public. The quality and efficiency of the infrastructure affects the quality of life, the health of the social system, and the continuity of economic and

business activity. A nation's strength is reflected in its infrastructure assets and good public infrastructure facilitates a higher quality of life (Ergün et al, 2004). Clarification of the relationship between public infrastructure and economic development is provided by the World Bank study (Queiroz and Guatam, 1992). It shows a very strong association between economic development, in terms of per capita gross national product (GNP), and road infrastructure. Road transport is important in economic activity and a good road system gives a nation a competitive advantage in moving goods efficiently and economically.
Public infrastructure has been defined in different ways, for example:

> *"Infrastructure is services and facilities that support day to day economic activity. Infrastructure includes roads, electricity, telephone service, and public transportation. Infrastructure has traditionally been provided and maintained by the government. However, some nations are currently experimenting with privatisation of some elements of infrastructure"* (ICONS Glossary, 2004).

In order to stimulate infrastructure investment, public authorities seek to involve the private sector in the creation of new infrastructures. The private sector invests, constructs and maintains the constructed asset and provides the services required by the public sector.
Current World Bank estimates point to financing needs of about 7% of GDP (Gross Domestic Product) for all developing countries – for both new investment and maintenance (O&M) expenditures – and as much as 9% of low-income countries' GDP Some 70% of all infrastructure investments were publicly financed over the 1990s, with an additional 8% funded by official development aid, and calls on the public sector have increased as private investment has declined. At the same time, the scope for private participation in infrastructure remains substantial, to be achieved by leveraging the mobilisation of additional private capital per unit of available public sector resources. During the 1990s some 22% of spending on infrastructure was private.

In the UK, the government has introduced the private finance initiative (PFI) in order to promote the construction of new infrastructure and roads. The participation of the private sector in road projects has led to the creation of a new organisational structure to realise the project.

4. Research Methodology

Risk Management (RM);Critical Success Factors (CSFs); Whole Life Cycle Costing (WLCC); Competitive Advantage (CA) have been identified as essential requirements to enable the appraisal of the value of a PFI road project over the concession period which facilitates the determination of the best value design solution, provision of a functional road and long-term budgetary forecasts (Akbiyikli, 2005). These areas, as a part of a PhD research, have been analysed and frameworks have been proposed that represent and structure these issues. The frameworks have been validated by the project respondents of the case studies.

5. Dis-functions between Public Sector and Private Sector Organisational Structures

Separately in traditional contracting both public and private sectors have completely different raison d'etre organisations and objectives. It has to be kept in mind that values, beliefs, guiding principles, customs and success measures are different between these two sectors.

The public sector is structured, bureaucratic and organised. On the contrary the private sector is flexible, spontaneous and entrepreneurial. These parameters create a dis-function in policies, procedures, practices and politics of the organisations in a project organisation. In traditional contracting this dis-function also creates dis-location of the organisations.
The case study results indicated a dis-function between the organisational structures of the public sector and the private sector. A dis-location was also noted between the operational collaboration at the site level. A section from interviews on the A92 PFI road project between Dundee and Arbroath is given below.

> **Rifat**: *"Mr. JR, after studying the organisation charts and your comments about partnership in the project I thought about the PFI's partnering philosophy (honesty-openness-trust) and collaboration and I propose you two governance structures for discussion. One of them is a "generic organisational structure for the public sector" in dealing with a PFI project; and the other is "a project collaboration organisational structure at operational level". The first organisational structure is internal for the Council and the other one is for the project site level. At the site level teams that cut across public and private organisations should be formed into a structure creating a team-based design in order to solve day-to-day problems and deliver service. I think this can contribute to a step forward to partnering between Council and private sector. I would like to hear your opinion and suggestion."*
>
> **JR**: *"My immediate reaction to these proposals is positive. The first one concerns our own Council's structure in future PFI projects. Currently we are heavily depending on external consultants as it is also indicated in your proposal. They are very costly. I feel that we must have in-house skills and training in order to be better project managers in future PFI projects. We have different skills in our organisation. We know traditional contracting. Change must come from the top.*
>
> *The other proposal for the site level can be implemented easily. This project based governance committee will open up new ways of working in partnering in all stages of the project. I believe that this organisational structure will promote less conflicts, increased skills and collaboration across the Council and private sector partners at site".* (Interview, A92 case study, 13.05.2004).

Below is given a conclusion paragraph from the Workshop held in Rugby with the Morgan Est (SPV and Construction Contractor) managers on 01.10.2004 for the validation of the case study findings.

> *"Finally RA explained to the managers a proposal for a project collaboration structure at site (operational) level; and explained the need for such an organisational structure to decrease the "them" and "us" attitude at sites. This structure would have a "team-based design" as a necessity of PFI's partnering philosophy; telling them that the same proposal was also explained to Council's site representative in the A92 project. RA explained that this team-based organisation, which was called as "project governance committee" was designed to solve problems and deliver service which demanded certain traits and skills of the people in the committee from both sides.*
> *The managers fully supported such a team-building ("committee") concept at project level composed of representatives from public and private sectors working in partnering and encouraging the work in a relationship of trust and mutual support to common project goals".*

Fig. 2 is proposed to promote and increase the understanding, co-operation and skills within the public sector organisations for PFI deals and their project management. The idea behind the proposal of Fig. 3 to the parties is that partnership is an “ideal” to be reached between public and private contracting parties in PFI and has implications for monitoring and HOT (Honesty-Openness-Trust) relationships. The proposal which is *ad hoc* (project dependent temporary organisations) and is meant to increase the integration of the two contracting parties towards common project objectives and increase the collaborative efforts in pursuit of shared goals. The concept of *adhocracy* refers to the opposite of bureaucracy, or the absence of hierarchy. All members of the organisation have the authority to make decisions and to take actions affecting the future of the organisation. Such adhocracies are team based and temporary in nature. They are typically staffed by professionals with a high level of expertise and flexibility for adaptation and problem solving with minimal supervision. Influence in an adhocracy is through professional expertise rather than positional authority. The operative adhocracy is concerned with innovation and problem solving directly for the client (Minzberg, 1979).

The proposal establishes a relationship between the private sector (supply side) and the public sector (demand side) of the project for joint action; forcing them to work together in a mutually beneficial relationship creating a collaborative advantage. In order to get this advantage the parties must create a “project organisation” that is not public or private sector organisational structure. The proposed project organisational structure was meant to be “a vehicle” or “an instrument” for the contracting parties to work in co-operation for their mutual benefit in delivery of both works and service and to achieve continuous performance improvement. This proposal is an attempt to create a basis for longer term relationship both in structural linkages and goals of the two separate organisations by moving members outside their traditional areas and tight links to new systems and operations having great interdependency with sharing power for mutual benefits and gains.

The co-located and integrated team proposal is meant to mutually strive for best value and innovative solutions in the whole life of the project; to remove waste and inefficiency and move away from adversarial approaches. This approach will promote improvements in time, cost, quality and certainty and develop a learning culture within and between the public and private sector parties in the project.

The generic organisational structure of PFI road project and the project collaboration structure are described in the next section.

6. Proposal of Generic Organisational Structures

A generic organisational structure for a Granting Authority in a PFI project is shown in Fig.2 and a project collaboration structure at operational level in a PFI project is shown in Fig. 3.

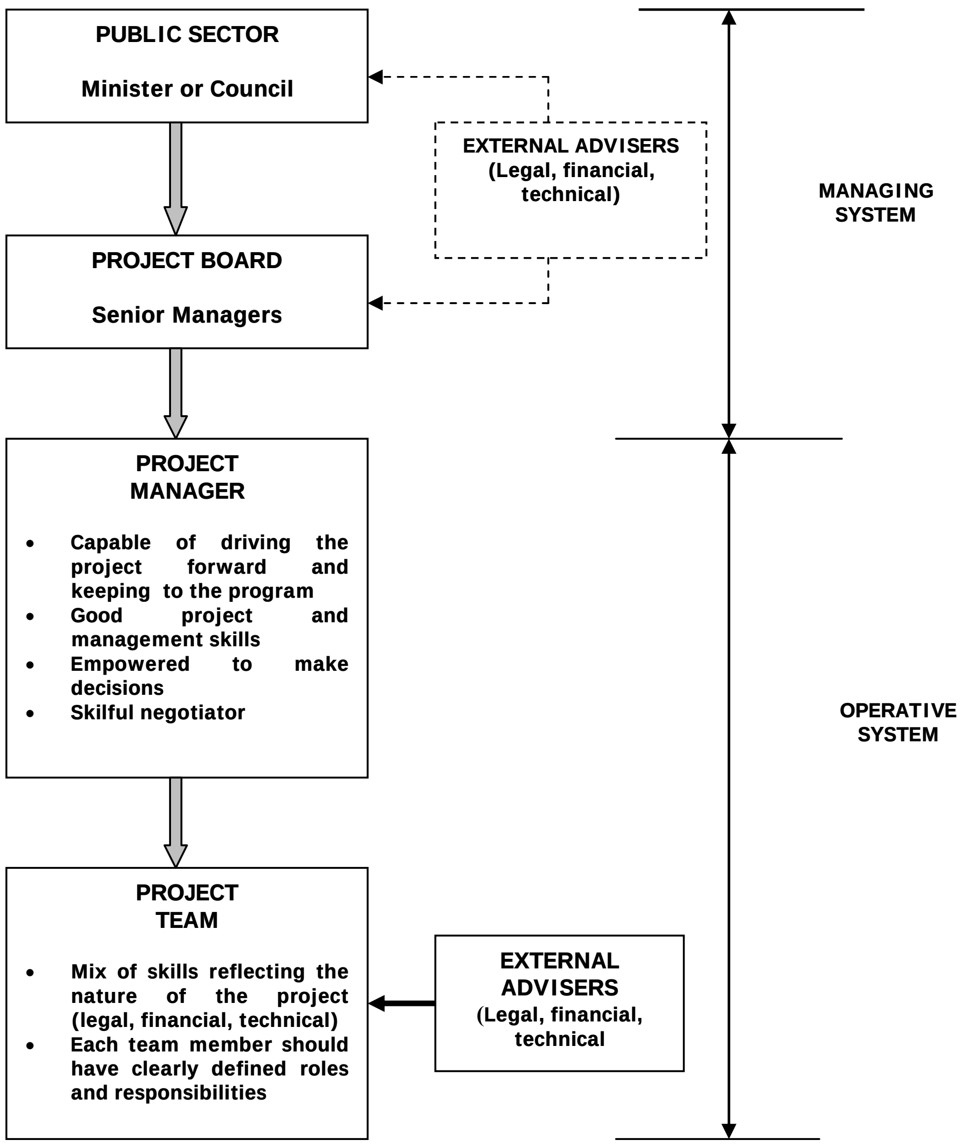

Fig. 2: A Generic Organisational Structure for Public Sector in a PFI Project
(Akbiyikli, 2005)

This is a proposal after discussions with the Public sector and the SPV representatives in case study projects (Akbiyikli (2005). The public sector in any PFI project including roads has to work hard in order to foster a constructive long-term relationship with the private sector provider. The Public sector's project management structures must be appropriate to the needs of the public sector and must fit the existing public sector decision-making structures. After discussions with the above mentioned stakeholders the researcher concluded that the public organisational structure for PFI road project must be such that:

- It will have mechanisms to deal with coordinating, managing and controlling the project objectives (VFM and risk transfer);
- It will have a structure that creates a transparent system;
- It will have mechanism to steer the private sector which must have a public responsibility and accountability mindset that consists in controlling and protecting public interests;

- Keep continuity in experienced personnel;
- This structure is thought to be involved in determining the viability and scope of the project, in activities leading to the contract and in contract management;
- The structure is thought to exist throughout the PFI Procurement Process;
- Necessary training has to be given to the staff in the organisation;
- Advice is needed both (primarily) in-house and external consultants in legal, financial and commercial skills;
- Main idea behind the organisational structure is hands-off monitoring philosophy – "Getting better VFM from the PFI".

Beliefs and guiding principles, customs, strategies and success measures are different in public and private sectors. The public sector is structured, bureaucratic and organised and the private sector is flexible, spontaneous and entrepreneurial. The aim of the proposal is to develop a PFI project based core team between public and private parties to develop an organisational framework that is capable of setting the direction, coordinating operational activities and problem solving within the PFI project and opens up new ways of working. This project based organisational structure is proposed as a necessity after discussions with the stakeholders in the case study projects and the aim was to create an organisational condition that supports product and process innovation and eliminate arbitration (Akbiyikli,2005).

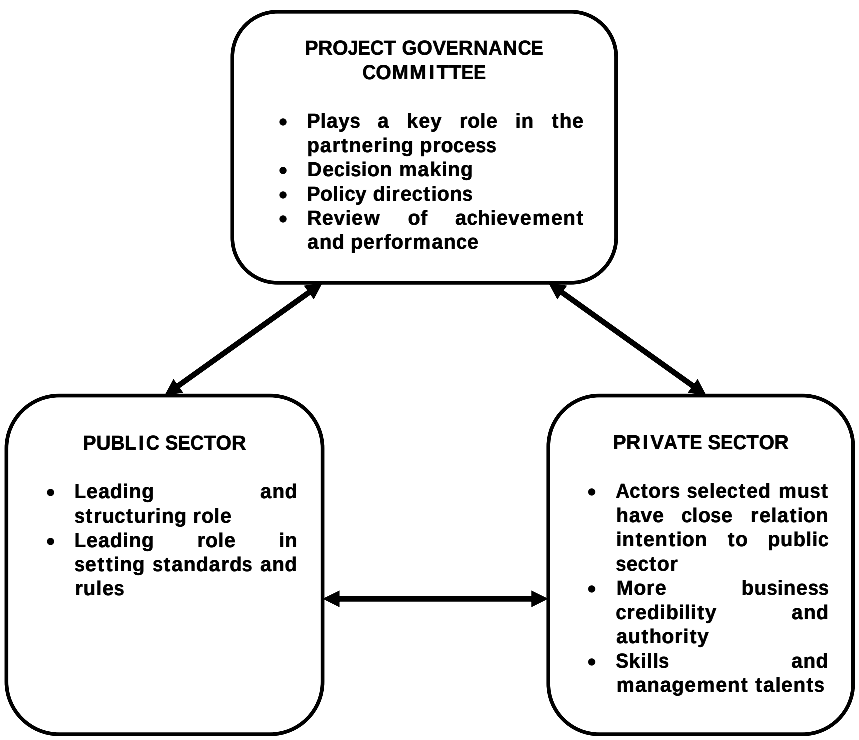

Fig. 3: A Project Collaboration Structure at Operational Level of a PFI Project (Akbiyikli, 2005)

At the operational level (construction and concession periods) the need for a fast response to PFI project environmental changes requires an organisational design that is not inhibited by a public structure designed for more stable conditions. Teams that cut across public and private organisations should be formed into a structure creating a team-based design. The team has to solve problems and deliver service. Because of the holistic approach to the PFI project – that is, design, build, finance, and operate – the teams can consist of the appropriate expertise to handle the project at each stage of its life-cycle.

7. Conclusions

This paper detailed the PFI as a collaborative venture and as a form of business partnering creating synergy and ensuring a common purpose across organizational boundaries of the public and private sectors. The paper considered PFI as a creative process and product needing a long-term operational and managerial relationship between the public and private sector parties with an overall aim to work in collaboration and partnering. In this respect the paper detailed the concepts of collaboration, partnering and governance.

Team-working on PFI projects and an effective governance structure is crucial since the service delivery focused nature and the longevity of the PFI projects require effective co-ordination and integration of the stakeholders from both public and private sectors. The paper argued that the PFI partnering process is fundamentally about team building across organizational boundaries requiring a process of change which has to be incorporated into the whole team performance throughout the whole life-cycle of the project.

Based on case study research the paper proposed two organizational structures for PFI road projects; one for the public sector to promote and increase the understanding, co-operation and skills within the public sector organizations for PFI deals and the other, which is "*ad hoc*", is meant to increase the integration of the contracting parties in a PFI project towards common project objectives and increase the collaborative efforts in pursuit of shared goals and to achieve continuous performance improvement at project level.

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A Value For Money (VFM) Framework Proposal For PFI Road Projects

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Abstract: In PFI procurement the question of VFM has been given the utmost attention together with risk and risk management. VFM is considered to be a controversial issue in PFI projects. The VFM has to be explained with and built on a set of performance criteria to deliver service. VFM is built on economy, efficiency and effectiveness (Butt & Palmer, 1985). The PFI approach offers the prospect of delivering the services required by public sector clients in a way that provides superior Value for Money than conventional procurement, because the PFI approach can give scope for innovation in how services are delivered, better management of the risk associated with projects, more effective exploitation of opportunities, and better management. The Public Sector Comparator (PSC) provides a quantitative analysis to support a qualitative judgement of the best procurement option, taking into account the risks of each procurement approach as a means of informing a wider VFM assessment. The PSC at present is focused only on the narrower benefits and disbenefits of future project options. The UK government believes that a rigorous economic assessment is important to ensure that the right procurement option is chosen on the basis of VFM and it believes that the PSC continues to have an important role. The VFM exercise focuses on this.

The VFM in this paper is undertaken as a holistic approach, it is multidimensional and builds on the economy, efficiency and effectiveness and considers Robustness, Affordability and Risk Transfer as the main features. These features will be detailed in the text. There is a clear need for the public sector to have an objective VFM appraisal for assessing PFI throughout the whole life cycle of the road projects. VFM exercises focus on outputs, Whole life-cycle costs, identifying risks and allocating these to the party best able to manage them. It provides a rigorous framework to ensure that the Public Sector gets the best value for the investment in the priority project.

The paper will propose a framework for VFM: how economy, efficiency and effectiveness apply in road PFI projects and their relation to other parameters that are interrelated and necessary for the public sector in the WLCC environmental supra system.

Keywords: Affordability, PFI, PSC, Road Projects, Risk Robustness, Transfer,VFM, WLCC.

1. Introduction

Achieving Value for Money (VFM), which is an aggregation of issues such as quality, price, technical merit, aesthetics and functional characteristics, cost effectiveness, etc., is a statutory requirement for the UK public sector. Hence achieving VFM is of vital importance in the successful delivery of a PFI road project. In PFI the UK government has put in place, procedures to ensure that approval is given only to PFI projects that are likely to deliver VFM to the public sector throughout the whole life cycle of the project. These procedures require the business case of any project that includes all the costs, benefits, risks and risk transfer and affordability of both traditional and PFI options using Discounted Net Present Value (DNPV) cash-flow analysis. Awarding contracts on the basis of the lowest price tendered for construction works is rarely VFM; long-term value over the life of the asset is a much more reliable indicator. It is the relationship between long-term costs and the benefit achieved by the public sector that represents VFM.

According to ACCA (2004) VFM is the key rationalizing motif for partnering; and its meaning in the context of PFI is more based on economy as reflected in the use of discounted cash flows over the life-time of the project. Akbiyikli (2005) found a slightly different result from two case study road PFI projects in the UK concluding that VFM was not based mainly on economic parameters when the local public sector authorities decided on the PFI option- even though the PFI bid were higher than the PSC in both cases. An extract from the fieldwork clarifies this argument:

Rifat: "It was only the price you judged when you chose the bidders. Do you agree with that?"
Respondent: "In principle, yes! But, there is a big difference between the PSC and Preferred Bidder's price. £10 million is a lot of money!"
Rifat: "…How do you see PFI and value for money to the Council?"
Respondent: "Principally the Council will get the objectives set and the quality requested in the Output Specification. Although there is £10 m difference between the PSC and the Preferred Bidder's price (£53 m), I see the PFI deal as "political value for money" for the A92 Upgrading Project".

2. Literature Review

PFI differs from privatisation in that the public sector retains a substantial role in PFI projects, either as the main purchaser of services or as an essential enabler of the project. It differs from contracting out in that the private sector provides the capital asset as well as the services. The PFI differs from other PPPs in that the private sector contractor also arranges finance for the project (Allen, 2001 and 2003).
In PFI procurement the question of VFM has been given the utmost attention together with risk and risk management. VFM has to be explained with and built on a set of performance criteria to deliver service. VFM is built on economy, efficiency and effectiveness (Butt & Palmer, 1985). *Economy* is related to the cost and quality of resources, *efficiency* is the ratio of output gained for the amount of resources used, and *effectiveness* is the extent to which the actual results matched the desired results.
Rutter & Potter (2003) gave a concise definition of those three performance criteria concerning asset procurement as:

"Economy reflects the quality and cost of resources obtained through the procurement process at the stages throughout useful life of an asset. Efficiency reflects the management of the delivery and operation of the asset throughout its useful life. Effectiveness reflects the level of performance achieved throughout the useful life of the asset".

Different publications gave different definitions of Value For Money, for example:
The definition given by the National Audit Act 1983 in HM Treasury Taskforce-Fourth Report (2000) is:

"The economy, efficiency and effectiveness with which a body has used its resources in discharging its functions".

The definition of Johannisse and Coenen (2000) is:

"a qualitatively better product for the same money or the same quality with less money".

The definition of the SPFM-Scottish Public Finance Manual (2004) is:

"the optimum combination of whole-life cost and quality (or fitness for purpose) to meet the user's requirements and …. is crucial to the wider objective of delivering high quality, cost effective public services".

Value For Money according to ACCA (2002) is the virtual synergy created by and a comparison made between Best and Final Offer (BAFO) and the Public Sector Comparator (PSC). *"Value For Money is an issue that should have continuity throughout the project life-cycle and the assessment of the risk must continue to the end of concession period".*

The definition of the OGC (2003) has similarities with the above definition:

"Value for Money is an issue and a process which spans the complete life cycle from initial inception to the end of the useful life of the asset or completion of the contract. Value for Money gains are improvements in the user's requirements".

The PFI approach offers the prospect of delivering the services required by public sector clients in a way that provides superior Value for Money than conventional procurement. This according to the House of Commons-Public Accounts Committee-Twenty-Third Report (1999) is because the PFI approach can give scope for:

- *Innovation in how services are delivered:* Because the client specifies what is required not how it is to be delivered, the supplier has scope to innovate. The public sector client must not unnecessarily restrict suppliers' scope of innovation, by prescribing in excessive detail how services are to be delivered. For the higher cost of private sector finance to be offset by bringing in private sector expertise, the public sector must be open to innovative ideas offered by the private sector. Private sector bidders need to be given as much freedom as possible to determine the best way to provide the services required.
- *Better management of the risks associated with projects:* The principle in the PFI is that risks should be allocated to whichever party is best able to manage them. Appropriate allocation of risk between the parties is critical to the achievement of

Value for Money in PFI contracts. Inappropriate risk transfer and risk creation is likely to reduce Value For Money as the party concerned will seek to mitigate the impact of the risks concerned. A proper understanding of where risks lie is also crucial.

- *More effective exploitation of opportunities:* With PFI, the private sector supplier's ability to exploit commercial opportunities can be harnessed to benefit the taxpayer also. Value For Money is not likely to be achieved if the procurement process has not been competitive. Competition is a fundamental requirement for PFI deals.
- *Better management.* The PFI can be a method of finding the most effective management team for a particular service.

The PFI literature has mostly focused on examining VFM at the contract negotiation stage (PricewaterhouseCoopers, 1999; Mayston, 1999; Froud and Shaoul, 2001; ACCA, 2002). These studies have criticised the financial appraisal of VFM, including uncertainty involved in predicting future cash flows, the subjectivity involved in risk transfer processes and the discount rate used in appraisal. Edwards and Shaoul (2004) examined the *ex post facto* VFM and accountability issues in the context of road PFI contracts, which they argue are under researched.

Treasury Guidance 'The Green Book' (HM Treasury, 2003) and 'Partnerships for Prosperity' (HM Treasury Taskforce, 1997) provide guidance on PFI appraisal and how VFM is achieved through PFI contracting. An important issue in evaluating VFM in PFI contract bids is the comparative cost of doing the project within the public sector. This is known as the Public Sector Comparator (PSC). The HM Treasury Taskforce (1997) states that "VFM will need to be demonstrated by comparison of private sector PFI bids with a detailed Public Sector Comparator (PSC)".

The PSC (for a reference project) is the "purportedly neutral benchmark" of the most efficient form of public sector delivery (English and Guthrie, 2003). *The Green Book* (HM Treasury, 2003) explains that the PSC is a discounted cash flow analysis of the costs to the public sector of providing the public service. Risks kept by the public sector are added to these costs to obtain the "risk adjusted PSC" which is then compared with PFI bids. The difference is called VFM. According to the Treasury Taskforce Technical Note No.5 (HM Treasury Taskforce, 1999) on *How to construct a Public Sector Comparator* the PSC may be defined as:

> *"A hypothetical risk-adjusted costing, by the public sector as a supplier, to an output specification produced as a part of PFI procurement". It:*
>
> - *Is expressed in net present value (NPV) terms;*
> - *Is based on the recent actual public sector method of providing that defined output (including any reasonably foreseeable efficiencies the public sector could make);*
> - *Takes full account of the risks which would be encountered by that style of procurement.*

An output specification defines what the client wants to procure, and what the supplier is expected to provide but it does not generate or describe the costs (including risks) of conventional public sector procurement. It is the costs of meeting the output specification that critically defines the PSC (HM Treasury Taskforce, 1999).

According to Pollit (2000) cross-sectoral comparisons pose three issues:

- Interest rates used in the private sector are higher than in the public sector because the private sector accounts for risk while the public sector does not – this tends to inflate the financial cost of the private sector even though the cost to society may be the same;
- Private contractors will have to pay tax on profits which cannot be recovered by the private sector which inflates their bids relative to the public sector;
- No accurate PSC may exist for big projects and thus the system may be biased towards PFI solutions in the funding of capital projects.

The purpose of the PSC is to provide a benchmark against which to form a judgement on the VFM of PFI bids. This exercise is distinct from the process of establishing what level of service charges is actually affordable to the client. There is no reason to presume that good VFM will be affordable or that an affordable project will represent good VFM (ibid).
In *"PFI: Meeting the investment challenge"* it is noted that the PSC provides a quantitative analysis to support a qualitative judgement of the best procurement option, taking into account the risks of each procurement approach as a means of informing a wider VFM assessment. The PSC at present is focused only on the narrower benefits and disbenefits of future project options and is often done at a stage where it is not possible to take sufficient account of the wider factors around pursuing a PFI procurement programme, such as pre-contract costs (HM Treasury, 2003).

The UK government believes that a rigorous economic assessment is important to ensure that the right procurement option is chosen on the basis of VFM and it believes that the PSC continues to have an important role, but as the second stage in a three stage VFM process (ibid).

One crucial aspect of PFI is the appropriate division of tasks and risks. The goal is to share tasks and risks so that each party in this process does what it is best at and the sharing of tasks and risks is then enshrined in the PFI contract. The division of these tasks and risks affects the certainty of the end product and the delivery of the services conforming to the requirements and the output specification of the public sector. But more importantly it is a prime element of achieving VFM.

PFI procurement is a long period of collaboration between public and private sectors. This collaboration is based on clearly established criteria and constraints for which the private sector partner can be held to account. Not paying until the service has been made available or delivered as per specification, gives the private sector partner the maximum possible incentive to deliver the service on time and as well as possible (Johannisse and Coenen, 2000).

The combination of an integrated approach involving a long-term collaborative arrangement, careful division of tasks and risks, an output oriented contract, scope optimisation, public procurement and a payment mechanism based on the quality of the service delivered, is a guarantee of better value for money and is what distinguishes PFI from other forms of public private collaboration (ibid).

The objective of the investment criteria in the public sector, in the last decade, through private financing, has been to achieve value for money for the taxpayer. According to Heald (1997) VFM in PFI schemes depends on any gains in efficiency through private sector involvement more than compensating for higher finance costs. To Heald's view Hall (1998) says that, it is difficult to obtain clear evidence on this, since many PFI projects are large-scale one-off projects for which it is very difficult to calculate an accurate and uncontroversial Public Sector Comparator (PSC). But, relating the concept of VFM to concepts of efficiency and effectiveness in ways that are rarely made precise, draws auditing deep into the tensions not only between those public auditors who envisage their role as objective technicians and those aspiring to be policy analysts, but also between both groups and policy makers (Heald, 2003). PFI is the policy instrument with which PPPs are associated and Heald (2003) points out that the analysis of VFM has incentives embedded within it which bias it in favour of private provision. Supporting this approach Coghill (2003) notes that those incentives range from informal encouragement by Government Ministers operating in a culture which appears to be committed to a strong role for the private sector to methodological features that distort the distribution of costs and benefits in favour of PFI and PPPs. Furthermore, Coghill (2003) says that accountability is the key area in which private provision can impact both positively and negatively. Insisting that accountability is crucial to maintaining the responsiveness of government to the needs of the citizens and it gives citizens evidence of the government's performance in ensuring the delivery of goods and services effectively, economically and efficiently; requesting financial commitments stretching over the concession period to be handled transparently to test the public sector accountability in front of the citizens.

One of the major arguments put forward as the advantage of PFI, is the improved form of government contracting, which under the right circumstances could yield even greater efficiency savings and value for money (Kee and Forrer, 2002). Several publications in the UK have been issued in the 1990s citing varying cost savings and increases in quality generated by projects following the PFI procurement path. In 1998, the UK House of Commons, Public Accounts Committee in their Forty-Seventh Report and the UK National Audit Office Report reported that the first four design-build-finance-operate (DBFO) roads contracts were likely to generate net quantifiable savings of approximately 13% for the public sector (House of Commons - Forty-Seventh Report, 1998; NAO, 1998). In a report ordered by the Treasury Taskforce, the consultant firm Arthur Andersen, together with Enterprise LSE examined 29 private finance projects (projects representing about a third of those PFI projects that were operational at the time of the research) to reveal an average net present cost saving of 17% (HM Treasury Taskforce, 2000b; OGC, 2000). Arthur Andersen and Enterprise LSE identified six key drivers of value for money in PFI:

1. Risk transfer from public sector to private sector including construction and operation costs, technological change, and the long-term fit between a facility and its public purpose;
2. The long-term nature of contracts enables the private investment to be recovered over a reasonably long period and leads to lower costs to government for public services;
3. The use of an output-based service specification. PFI is based on delivery of a certain level of service, the output desired, rather than on the inputs used to provide the service ;
4. Competition in the bidding process lowers the cost of capital and services over the long term;
5. Performance measurement and incentives are developed and used as the basis for holding the PFI provider accountable for results and can be used to create financial incentives for superior performance; and

6. Private sector management skills increase operating efficiencies including economies of scale and the delivery of the services requiring skills that are non-core to government.

This report has been criticised (Pollock and Vickers, 2000). Pollock and Vickers questioned the Andersen/LSE findings that on average a PFI is 17% cheaper than the PSC. They argue that this calculation is an average of the 29 Full Business Cases (FBC) analysed by Andersen/LSE. However, they claim that more than half the total project savings came from one project and with two other projects account for 80 per cent of the total savings. Pollock and Vickers claim that, once these three projects are removed, the average saving is 6%. Furthermore, in their view, the FBCs are a "poor source of information" about the value for money of projects.

The above mentioned literature is generally in agreement with the UK government's claim that PFI projects offer better value for money. In its 2000 study, 'The role of cost saving and innovation in PFI projects', the Construction Industry Council (CIC) identified the role of innovation within construction based projects. It stated that cost savings could be accrued from the use of innovative working procedures and new technologies. The results show an overall project saving in the region of 5-10% of which the highest average savings could be found from the construction phase. The savings on construction costs were also estimated to be 5-10% (CIC, 2000).

This reduction in cost and /or improvement would have to come from either the transfer of risks or from improvements in the average unit of productivity. VFM accrues from the private sector being allowed the opportunity to be more innovative, in the sense of cost saving and product enhancement, than is likely to be found in traditional form of procurement.

Most of the above perceived cost savings for the public sector are derived from the evaluation of transfer of risks discussed previously from the public to private sector. 10% of the cost savings cited in the Andersen/LSE report were derived in this manner (CIC, 2000). Indeed, more than a third of the 29 projects examined depended entirely on risk transfer to achieve Value For Money (Reeves, 2001). For the public sector client the value of risk transfer lies mainly in the reduction of variation, i.e. increased predictability of the individual project outcome and in the possibility of obtaining an earlier certainty of the outturn project costs and values (CIC, 2000).

PFI in the UK is the mechanism through which the public sector can secure improved VFM in partnering with the private sector (HM Treasury Taskforce, 1997). PPPs [PFIs] have been linked to a form of 'network' between government and the private sector (Jackson and Stainsby, 2000). Casson has linked transaction costs and trust to provide insights into the formation of intra- and inter-firm networks (Casson, 1997). Networks, partnerships and alliances depend on co-operation and inter-dependency, leading, ideally, to mutual interest, shared goals and shared norms (Klijn and Koppenjan, 2000).These forms of contracting, lie between pure markets and hierarchies and over time can result as mutual interest and shared goals and norms and more projects based mutual dependencies are developed.

3. Research Methodology

This paper is based upon two detailed case studies of major UK PFI Road Projects. The findings have been triangulated against a previously published PFI road project case study (Eaton & O'Connor, 2002a, b). The case study was selected as the most appropriate holistic mechanism for data collection. (Akbiyikli, 2005)

The PFI research framework for a typical PFI project as proposed by Akbiyikli (2005) is shown in Fig.1.

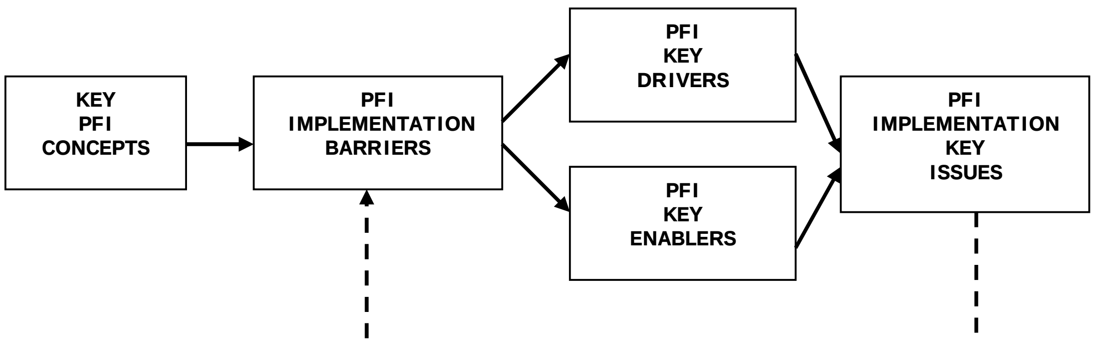

Fig.1: Research Framework for a PFI Project

The key PFI concepts and key implementation issues are an integral part of the above framework. Those PFI concepts, barriers, drivers, enablers, and issues are derived from a critical analysis of the literature review. The key PFI concepts, implementation barriers, key drivers, key enablers and key implementation issues are listed below.

The Key PFI Concepts are:

1. Purchase services not assets;
2. Value for Money (VFM);
3. Optimal Risk Transfer to the Private Sector;
4. Whole-life-cycle costing (WLCC);
5. Incorporate Private Sector know-how and expertise;
6. Alternative techniques requirement.

The PFI implementation barriers are:

1. Size of the PFI project;
2. Information needed to operate effectively;
3. Up-front capital requirements;
4. No perfect competition;
5. Long and costly bidding process;
6. Public sector policy constraints.

The PFI key drivers are:

1. Need for better infrastructure;
2. Demand in public sector services;
3. Search for efficiency and creativity in public sector and in construction procurement:
4. Financial need for infrastructure and road projects.

The PFI Key enablers of a project are:

1. Political framework and political will;
2. Legal frameworks;
3. Social (public) acceptance;
4. Quality practitioners;
5. Experience both in public and private sectors.

The PFI Key implementation issues are:

1. Critical Success Factors (CSFs);
2. Whole-life Cycle Costs (WLCC);
3. Competitive Advantage (CA);
4. Optimal Risk Transfer and Risk Management;
5. Value for Money (VFM).

From the in-depth literature review four parameters emerged as central to determining a “Holistic Road PFI Conceptual Framework”. These are: Critical Success Factors (CSFs), Whole Life-Cycle Cost (WLCC) Parameters, Risk Management (RM) Parameters and Competitive Advantage (CA) Parameters. These four parameters are confined and constrained by the requirement to obtain VFM for the Public Sponsor from the PFI project.
In constructing this framework a phenomenological (interpretive) approach is followed.
Interpretive research generally attempts to understand phenomena through the meanings that people assign to them. Interpretive researchers start out with the assumption that access to reality (given or socially constructed) is only possible through social constructions such as

language, consciousness and shared meanings. The philosophical base of interpretive research is *hermeneutics* (making sense of a written text) and *phenomenology* (Boland, 1985). Interpretive research does not predefine *dependent* and *independent variables*, but focuses on the full complexity of human sense making as the situation emerges (Kaplan and Maxwell, 1994). It provides a process of inquiry that encourages the immersion of the researcher in the problem domain. The research approach is intended for the purpose of sense making (Weick, 1995) rather than as a prescriptive guide to action. It is this emphasis on inductive learning that makes the method especially applicable to problems concerned with understanding emergent practice with a complex evolving context.

The research is concerned broadly with exploring and making sense of both the evolving context associated with integrated procurement and emergent practice of PFI Road Projects.

The term phenomenology is derived from the Greek words *phenomenon* and *logos*, and signifies *'the activity of giving an account, giving logos, of various phenomena, of various ways in which things can appear'* (Sokolowski, 2000, p.13). A phenomenological approach is a descriptive study of phenomena and is a meaning - making approach. A phenomenon is an observable fact, event, occurrence or circumstance and phenomenology defines the wholeness of the process. It is the description of the groups of successive and simultaneous processes in the PFI deal; and in an effort to understand the relationship and/or distinction between process and result; between the content of intentionality and the context of the intentional process.

A phenomenological (interpretive) approach uses qualitative approaches to inductively and holistically understand human experience in context specific settings. This approach tries to understand and explain a phenomenon, rather than search for external causes or fundamental laws (Esterby-Smith, 1991; Remenyi et al, 1998).
The goal of PFI road project research under the phenomenological approach is the development of wholeness through explanatory methods rather than through creation of generalisations (Akbiyikli, 2005).

Based on the methodological approaches as defined above the authors' set out to explore and answer the following research question:

> *"Has PFI proved to deliver better service and value for money in public procurement in road projects?"*

To answer the generic research question the following section presents the detailed research aim and objectives for this paper.

The aim of this research was to: *Determine a Holistic Road PFI Conceptual Framework (HRPCF) in the UK*. PFI projects are changing the way that infrastructure projects are delivered. The delivery of the service via the creation of an infrastructure solution is also changing the way project objectives are realised. The long-term duration of the service provision is altering and increasing the parameters by which projects are judged as successful or otherwise. The research identified the parameters that are particularly relevant to PFI infrastructure road delivery.

VFM is a relative concept and in this research means the lowest risk adjusted cost to the Public Sector of satisfying the specified Output Specification. *Ceteris paribus* (all things being equal) the option with the lowest Net Present Cost (NPC) theoretically should be preferred. As explained in the introduction in the case study research the Public Sector Comparator (PSC) was much lower than the Preferred Bidder's Capital Expenditure (CAPEX); meaning that the private sector's final offer is higher than the public sector's best estimate as to the Whole Life-Cycle Cost of delivery for the project via a traditional procurement method. The VFM Framework for PFI projects represents a sound methodology for analysis the full range of project procurement options to determine the VFM for infrastructure projects.

The VFM in this research is undertaken as a holistic approach and builds on the Economy, Efficiency and Effectiveness and considers Affordability, Risk Transfer and Robustness as the main features. Affordability for the Public Sponsor is the ability to access funds and that the expenditure of the available funds provides an adequate return when compared with other investment alternatives. The "Risk Transfer" refers to the balance achieved within the agreements between all of the parties in relation to accepting the financial consequences should a risk occur; and a risk should be allocated to the party best able to manage and control the risk. The "Robustness" of the Project arrangements refers to the congruence of the individual aims with the main project objectives. The project arrangements should be equitable between all parties, such that all parties should have the ability to complete a particular project without the necessity for 'step-in'. Thus no party conceives the agreement as 'unfair'. All parties should feel that they have not been disadvantaged by the arrangements. A satisfactory Robustness arrangement would be one that all parties would be prepared to execute for subsequent projects.

4. VFM Framework for Road Projects

The Procurement and Value for Money (VFM) Process Framework for the A92 road project is detailed below in Fig.2.

CONCEPTION

- Council started investigations to construct a dual carriageway between Dundee and Arbroath (1984)
- "Challenge Funding Document"gave possibility for a PFI project (1996)

FEASIBILITY
PUBLIC ENQUIRY
BUSINESS CASE

- Council brought external advisors to work with the project – Preliminary Assessment (July, 1998)
  - ► External advisors assessed the priority of the project based on affordability and Value for Money
  - ► Initial qualified estimates are generated on policy, economic, environmental and financial aspects
  - ► The Council developed a Public Sector Comparator (PSC) Model which represented the Council's best estimate as to the Whole Life-Cycle Cost of delivery for the road project via a traditional procurement route. PSC is the benchmark against which the Value for Money assessment is made
  - ► The Council undertook significant studies to identify quantify and transfer the risks within the project
  - ► The Business Case analysis is done by using Value Analysis and Sensitivity Analysis
- Planning Permission (Dec, 1999)
- Public Enquiry (April, 2001)

PROCUREMENT

- The Council issued Tender Documents and sent to four Bidders (February, 2002)
- Return of Tenders (August, 2002)
- The Council decided the Best and Final Offer (BAFO) in Sept. 2002 and declared the Preferred Bidder in October, 2002 and undersigned the Project Agreement

Fig.2 Procurement and VFM Process Framework for A92 PFI Road Project

The key issues for the Council in the Procurement and Value for Money Process Framework were:

- There was a clear need for the road project;
- The procurement itself was handled well;
- A notional PSC was calculated;
- Risk allocation was considered from an early stage in the process;
- The Project Agreement (PA) has in place mechanisms to protect Value for Money (VFM) in the future (Benchmarking, Market-testing and Step-in-rights);
- The Service will seek to share in the benefits of any future refinancing;
- The Payment Mechanism has been developed and risks were transferred before Project Agreement signature;

The proposed VFM framework for PFI road projects studied is shown in Fig.3.

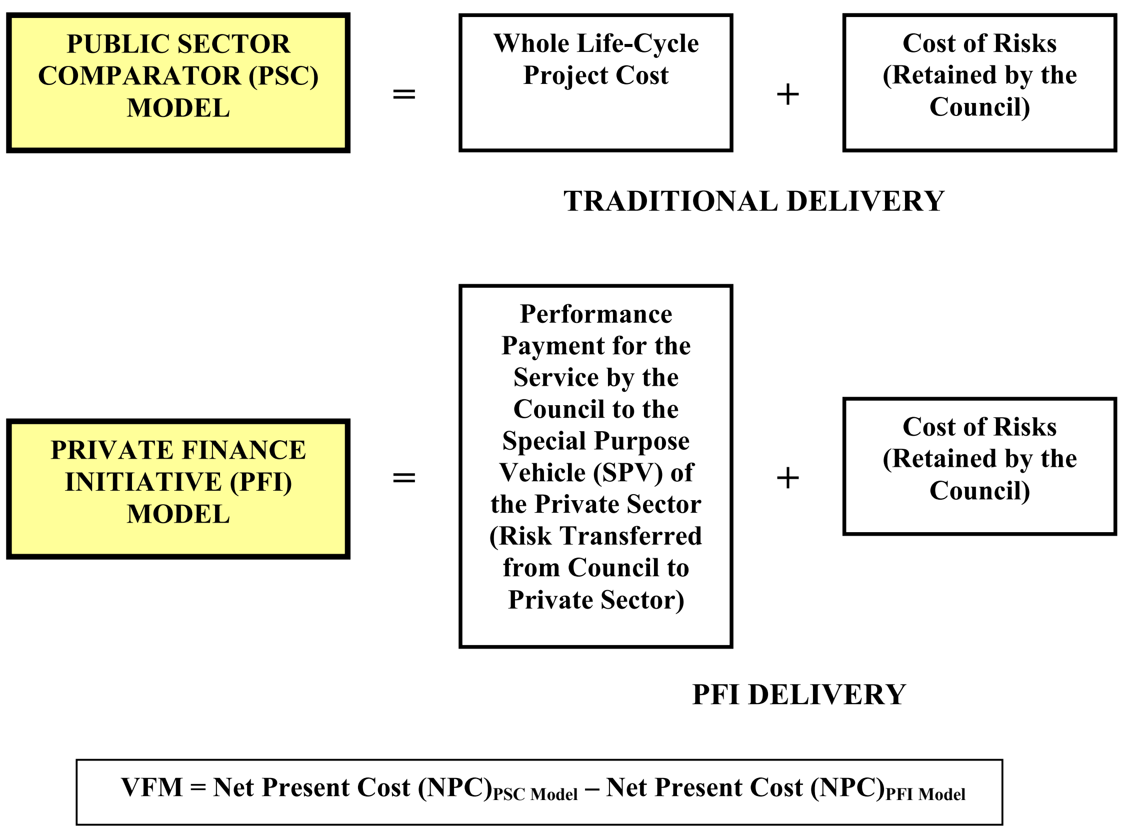

Fig.3 Value for Money (VFM) Framework for PFI road projects

Value for Money is not only the cost implication but an aggregation of issues such as quality, price, technical merit, aesthetics and functional characteristics, running costs, cost effectiveness, technical assistance, delivery date, etc. There is a clear need for the public sector to have an objective VFM appraisal for assessing PFI throughout the whole life cycle of the road projects.

The Value for Money exercise has to be carried out throughout the Concession Contract Period and the Project Agreement (PA) for the A92 road project required the SPV to carry out a review of Operations in the Concession period on each of the 5^{th}, 10^{th}, 15^{th}, 20^{th} and 25^{th} anniversaries of the Permit of Use Date (the "VFM Review Date").

The VFM Review shall consider and report on:

1. any material innovations in technology which have come to the attention of the SPV and which could enhance the Operations; and
2. jointly with the Council, the O&M Requirements in order to assess whether any alteration in the O&M Requirements would represent increased VFM for both Parties.

The VFM Review Report submitted by the SPV shall include:

1. the methodology of the review;
2. any material innovations in technology or material efficiencies in best working practices relevant to the delivery of the Operations which represent VFM; and
3. any proposed changes to the O&M Requirements.

VFM Review and Internal Rate of Return (IRR) Clawback provisions have been included on 5 yearly cycles after PTU (Permit to Use) Date to:

1. secure continuous assessment of whether improved VFM could be achieved by innovation;
2. to recover 50% of "super profits" gained by the SPV subject to there being no double-counting with Refinancing and also subject to reconciliation of any super-profit recovery with under performance over the life of the project. The Threshold Equity IRR (Internal Rate of Return on equity invested) figure above which super-profits are shared was negotiated to 22.5%.

The proposed framework for VFM exhibits clearly how economy, efficiency and effectiveness apply in road PFI projects as shown in Fig.4.

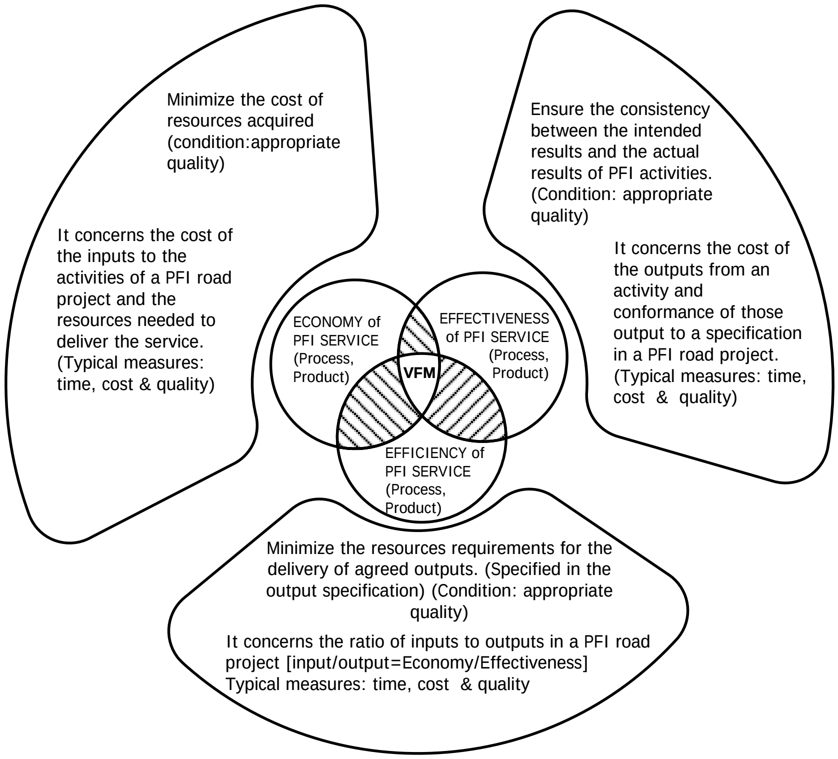

Fig.4 Value for Money (VFM) and the interrelated parameters

5. CONCLUSIONS

Awarding contracts on the basis of the lowest price tendered for construction works is rarely VFM; long-term value over the life of the asset is a much more reliable indicator. It is the relationship between long-term costs and the benefit achieved by the public sector that represents VFM. For the Public Sector Sponsor demonstrating VFM is a statutory legal obligation. Hence achieving VFM is of vital importance in the successful delivery of a PFI road project.

In the NSDR PFI road project the Construction Contractor worked closely with the Client at all stages (Tender, BAFO and Financial Close) to manage costs within their budget. All cost increases (eligible changes) were discussed with the Client and value engineered before execution. Capital expenditure and maintenance costs were considered throughout the various bidding stages in order to arrive at an effective whole life costing for the 40+10 years residual life of the project. An agreement was also in place that detailed the share for Client and SPV of savings made through value engineering. It is this understanding which resulted in a cost reduction of £6.53m due to innovative and sustainable whole life solutions to the project.

In both road projects (A92 between Dundee and Arbroath and NSDR in Newport) the SPV felt that they had the ownership of the problems and the associated risk was theirs. Furthermore, the SPV knew that the PFI contract was lump-sum and there was no additional capital beyond the agreement and, they could not ignore or delegate problems but they had to solve them. The Client and SPV chose a collaborative problem solving approach instead of claims and this attitude created more transparency between the contracting parties. They felt that collaboration provided benefits. The SPV together with its sub-contractors (Construction

Sub-Contractor, Designer, and Operation and Maintenance Sub-Contractor) created forward looking solutions - looking long into the concession period while designing and constructing. Since no payments were permitted as per the Project Agreement, by the Client, before the service became available the SPV, Construction Sub-Contractor and Designer all felt responsible for monitoring events and tracking procedures and expediting critical path operations earlier which delivered better quality and better service throughout the concession period of the projects.

The PFI procurement encouraged early start-up and “no service - no payment” which led to early completion solutions which led to innovative solutions that reduced the construction schedules and provided better and more reliable, conformant and durable solutions.

The Construction Sub-Contractor’s and the Designer’s team integrated at the earliest stages of the tender and construction process (and later with the Clients’ team during the execution of the works). The integration of the supply chain benefited the SPV by reducing bid failure risk at tender stage, by creating realistic constructible design and realistic work programs and cost savings through innovations increased the quality of the constructed asset.

In the case studies the internal quality monitoring was excessive with regard to long-term maintenance and service guarantees. The SPV understood that the quality of the constructed road was ensured and constructed better than a traditional road contract because of the 40 years concession (operation and maintenance liability) period. Value for Money evaluation in the case studies took into consideration both the technical, financial and economic parameters and also the non-financial parameters. The target according to the informants was to achieve a high quality and fit for purpose road to the satisfaction of the end users. Both projects award criteria, according to the public sector informants, satisfied a combination of both financial and non-financial factors which covered the Whole life cycle cost (WLCC) of the PFI contracts and areas such as deliverability, service quality, innovation, organizational culture, risk management, team-working and environmental issues. The award criteria in both projects contributed to improve the competitiveness of the bidders benefiting to the public sector investment and economy. All these financial and non-financial features in aggregation including a competitive tender process and a genuine risk transfer and performance related reward created VFM for the local authorities in both PFI road projects.

The PFI incentive in both projects added to the combination of WLCC and quality in meeting the user’s requirements, cost effectiveness throughout the project-life cycle, innovation in how services are to be delivered and the effectiveness in exploiting opportunities creating transparency, accountability and sustainable development.

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Whole-Life Cycle Costing (WLCC) Framework Proposal for PFI Road Projects

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Abstract: The introduction of PFI has forced the private/public sectors to consider the longer term implications of asset design. The PFI procurement philosophy requires greater integration of the design, operation and maintenance management processes to ensure that the long-term public sector requirements are satisfied.
PFI road projects require the successful consortia (SPV) to take full responsibility for designing, building, financing, operating, maintenance and replacement costs over the whole life of the concession period.

WLCC is concerned with optimising VFM in the ownership of physical assets by taking into consideration all the cost factors relating to the asset during its operational life. Optimising the trade-off between those cost factors will give the minimum WLCC of the asset.
WLCC seeks to optimise the cost of acquiring, owning and operating physical assets over their useful lives by attempting to identify and quantify all the significant costs involved in that life, using the Net Present Value (NPV) technique. The NPV method is also used in the analysis of whether a PFI project can achieve better VFM than a traditional procurement approach.

In DBFO roads, the Highway Agency in the UK compares the NPV of the projected payment under the DBFO contract over the period of the contract life (over 30 years) with the NPV of the costs of a traditionally procured Public Sector Comparator (PSC) over the same period. The calculation of costs of the PSC also takes into consideration the risks borne by the Highway Agency under the conventional procurement (HM Treasury Taskforce, 1999). This comparison is done for the selection of the Preferred Bidder in a PFI project.
The WLCC in this paper is undertaken as a holistic approach (that conceptualises the reality as an undivided whole) and considers VFM, Robustness, Affordability and Risk Transfer as

the main features. Each of these features and their relationships will be examined and a WLCC framework for PFI Road Project will be proposed.

Keywords: Affordability, NPV, Risk Transfer, Robustness, VFM, WLCC.

1. Introduction

Whole-Life Cycle Cost **(**WLCC) is concerned with optimising VFM in the ownership of physical assets by taking into consideration all the cost factors relating to the asset during its operational life. Optimising the trade-off between those cost factors will give the minimum WLCC of the asset.

The WLCC is a financial appraisal technique that normally uses Discounted Cash Flow (DCF) analysis to calculate future costs at today's prices and the results are presented in terms of Net Present Value (NPV).

According to Woodward (1997), it is important that management should realize the source and magnitude of life cycle costs so that effective action can subsequently be taken to control them. This approach to decision-making encourages a long-term outlook to the investment decision-making process rather than attempting to save money in the short-term by buying the assets simply with lower initial acquisition and capital costs.

A definition of life-cycle cost given by White and Ostwald (1976) is:

> *"The life-cycle cost of an item is the sum of all funds expended in support of the item from its conception and fabrication through its operation to the end of its useful life".*

WLCC seeks to optimise the cost of acquiring, owning and operating physical assets over their useful lives by attempting to identify and quantify all the significant costs involved in that life, using the Net Present Value (NPV) technique. WLCC which is synonymous with Life Cycle Cost (LCC) is concerned with quantifying different options so as to ensure the adoption of the optimum asset configuration (Woodward and Demirag, 1989).

According to Flanagan and Norman (1983) the objectives of LCC identified by the Royal Institution of Chartered Surveyors are:

- To enable investment options to be more effectively evaluated;
- To consider the impact of all costs rather than only initial costs;
- To assist in the effective management of completed buildings and projects;
- To facilitate choice between competing alternatives.

The LCC approach identifies all the future costs and benefits and reduces them to their present value by the use of discounting techniques through which the economic worth of a project or series of project options can be assessed.

The WLCC tries to convert all of the various life-cycle assessment (LCA) impacts to a monetary value and hence permit the calculation of a NPV of all effective costs. The main elements of WLLC are:

- Initial capital costs;
- Life of the asset;
- Discount rate;
- Operational and maintenance cost;
- Disposal cost.

In PFI projects, tenders are evaluated against various criteria in different assessment areas (Blackwell, 2000). General evaluation criteria may include:

- Innovation;
- Compatibility with operational approach;
- Deliverability;
- Flexibility;
- Risk transfer.

The NPV method is used in the examination of the relevant financial aspects of PFI projects. Tender evaluation is focused on the overall cost of services (i.e. the overall NPV of a tender's unitary charge) over the contract life or the whole life-cycle of a PFI project. The NPV of the residual value of the asset of a PFI project is also assessed if the asset reverts to the client at the end of the contract period. The NPV method is also used in the analysis of whether a PFI project can achieve better VFM than a traditional procurement approach.
In DBFO roads, the Highway Agency in the UK compares the NPV of the projected payment under the DBFO contract over the period of the contract life (over 30 years) with the NPV of the costs of a traditionally procured Public Sector Comparator (PSC) over the same period. The calculation of costs of the PSC also takes into consideration the risks borne by the Highway Agency under the conventional procurement (HM Treasury Taskforce, 1999).
The above comparison is done for the selection of the Preferred Bidder in a PFI project.
The relevant European Community procurement law requires transparency of the award criteria for the appointment of the preferred bidder (winner) and the award of the contract. The following are common criteria that a bidder should satisfy to be selected as the preferred bidder and subsequently awarded the contract (HM Treasury Taskforce, 1999):

- Meeting the Output Specification;
- Achieving Whole-life Value For Money;
- Acceptance of key contract terms and required transfer of risks;
- Confirmation of access to finance;
- Affordable unitary charge;
- Creation of a cohesive consortium.

2. Literature Review

Whole-life Cycle Costing (WLCC) is an investment appraisal tool which considers the value of a construction project over the selected assessment period. It facilitates the determination of the best value design solution; the provision of a functional and easily managed and flexible asset and long-term budgetary forecasts are calculated facilitating the generation of a sinking fund to cover whole-life cycle costing throughout the life of the facility (EFCA, 2003).
There are a number of definitions for whole life costing, but one currently adopted by the CRISP Performance Theme Group is:

> "the systematic consideration of all relevant costs and revenues associated with the acquisition and ownership of the asset" (CRISP, 1999).

Kelly et al, (2004 p.311) defines whole life costing as:

> "a technique for economic evaluation which accounts for all relevant costs during the investor's time horizon, adjusting for the time value of money and a methodology for predicting present and future costs for the purpose of comparing options and/or determining the most probable future facilities management cost of a facility".

For construction the WLCC= ∫ (capital or procurement costs + recurring or occupancy costs). The capital costs are: initial construction + interest + fees and the recurring costs are: rent + rates + cleaning + maintenance, repair, replacement/renewal + energy and utilities + dismantling and disposal + security and management over the life of the asset.
These final costs are shown at present day value for comparison purposes involving the use of discount rates. This establishes the amount which needs to be invested today in order to maintain the asset over its life.
There are emerging drivers for the take up of whole life cycle costing. Initiatives within the industry, such as Latham Report (1994) and the Egan Report (1998), have set the construction industry targets for cost savings which have to be set in the context of whole life cycle costing.
A whole life cycle costing approach encourages decision-making that takes account of durability, future running costs, and maintenance requirements. The WLCC therefore is a tool for encouraging the design of assets that are more compatible with the concept of sustainable construction.

An integrated approach to design, construction, operation and maintenance with input from constructors and their suppliers can improve sustainability, design quality, increase buildability, drive out waste, reduce maintenance requirements and reduce whole-life costs. The key issue is that the WLCC focus should start from the business case by increasing the value in the operational aspect while keeping the maintenance as low as possible. Time and effort spent in the design stage will save significant amounts of money later.

According to The Royal Academy of Engineering (1998) the relationship between Capital Cost: Cost in Use: Business Costs is 1: 5: 200 meaning that to operate and maintain an asset costs 5 times the capital costs over the life of the asset and the cost to the business, including salaries and staff productivity, occupying the asset is 200 times the capital cost.
WLCC is about understanding the balance between Capital Costs and Costs in Use (life-cycle costs) to deliver performance or service level required for an asset (WLCF, 2004).

Another important issue in relation to PFI road projects is the performance of the constructed asset. Performance means "quality of function/output along with constant process improvement" (Best & De Valence, 1999, p.200). The performance criteria, in order to avoid the misinterpretations of quality, are structured, objective and comprehensive in the Payment Schedules of the road projects. The Unitary Charges in the case study projects for the research undertaken has taken into consideration both the physical performance (such as maintenance, durability and environmental impact) and functional performance (driving comfort, safety and easy access).

The introduction of PFI has forced the private/public sectors to consider the longer term implications of asset design. The PFI procurement philosophy requires greater integration of the design, operation and maintenance management processes to ensure that the long-term public sector requirements are satisfied.

PFI road projects require the successful consortia (SPV) to take full responsibility for designing, building, financing, operating, maintenance and replacement costs over the whole life of the concession period.

The WLCC in the case study research is undertaken as a holistic approach (that conceptualises the reality as an undivided whole) and considers VFM, Robustness, Affordability and Risk Transfer as the main features.

3. Research and WLCC Framework

This paper is based upon two detailed case studies of major UK PFI Road Projects; A92 Upgrading between Dundee and Arbroath and Newport Southern Distributor Road (NSDR). The findings have been triangulated against a previously published PFI road project case study (Eaton & O'Connor, 2002a, b). The case study was selected as the most appropriate holistic mechanism for data collection (Akbiyikli, 2005).
This section critically examines and proposes the WLCC Framework required for achieving a successful PFI road project.

The WLCC Framework is a tool used to achieve the "Project Life-Cycle Costs" CSF for a PFI road project since it include all first costs (actual asset costs and all the costs associated with construction and completion of the asset) and future costs (all costs associated with operating and maintenance of the asset over its anticipated service life). It has a major impact on the financial model balance.
WLCC is one of the major areas of risk and uncertainty in the PFI process. Reliable data, according to the information from a SPV respondent in the road projects, does not exist but it is building up an experience data base for road projects. According to the same SPV respondent the Councils have taken WLCC as a feature in deciding the option appraisal in favour of PFI procurement in the road projects. The supporting argument to this was the financial model for the whole life cycle of the road projects. The Lenders also requested in their due diligence review a WLCC approach for the projects from the private sector.
The respondent from the SPV side expressed clearly the need for an agreed whole life framework within which the supply and demand sides must work. The private sector was not quite clear how the Council calculated its WLCC integrating it into the PSC in comparison with their Best and Final Offer (BAFO) for the whole life of the road projects.
When evaluating the WLCC four parameters emerged:

- VFM;
- Robustness;
- Risk Transfer;
- Affordability.

Each of these parameters and their relationships to WLCC are now examined.
There is a close relation between Value for Money (VFM) and WLCC. VFM is the optimum combination of WLCC and quality to meet the user's requirements (OGC, 2003). VFM is achieved by meeting the needs of the end-users with a higher quality project at lower whole-life costs. Awarding contracts on the basis of lowest price tendered for construction works is rarely VFM; long-term value over the life of the asset is a much more reliable indicator. It is the relationship between long-term costs and the benefit achieved by public sector that represents VFM (ibid). For the Public Sector Sponsor demonstrating VFM is a statutory legal

obligation. Hence achieving VFM is of vital importance in the successful delivery of a PFI road project.

A respondent from SPV said: *"We concentrated together with the Client on WLCC since our first meeting with them and continued till we became the Preferred Bidder. We did this consciously knowing the relationship with construction, operation and maintenance costs and the benefits that the Client would get at the end from the NSDR project. We and the Client were convinced of the whole value of the project"* (Respondent, 01.10.2004)
Another respondent from the SPV said: *"in the NSDR project the WLCC Model has been revised a couple of times in collaboration with the Lenders and the SPV's own financial and cost advisers in order to remodel all the associated costs with the anticipated road project life"* (Respondent, 01.10.2004).

There is proportionality between VFM and quality parameters. VFM is maximized, at least in part, by maximizing the quality parameters (level of services provided, performance of services, fitness for purpose. minimize environmental impact, extended useful life, etc.) (Best and De Valence,1999 p.17).

Value for Money (VFM) reveals the economic efficiency from the Public Sector Sponsor's side. VFM can be expressed as: VFM= Public Benefit (PB) / Public Cost (PC) and always has to be VFM>1.

The Public Sector Sponsor's aim is: "to procure a service that is acceptable Value for Money $(VFM)_{accept}$ subject to affordability".

Affordability is a measure of the ability to meet the Public Sector Sponsor's annual expenditure (the Unitary Charge Payment) that is paid to the SPV on a yearly basis. What the Public Sector Sponsor wants is a project from the Private Sector's side that is below its affordability. Affordability can be altered by the stakeholders and is expressed as:

Affordability =∫ (VFM, Robustness, Risk Transfer).

The Public Sector Sponsor seeks to make the SPV pursue its WLCC aim by using different mechanisms:
1. Risk transfer;
2. Output-based Specification;
3. Performance Payment;
4. Task integration;
5. Long-term contract;
6. Variable Concession Periods;
7. Competition and Innovation.

These mechanisms generate incentives and opportunities for the SPV to minimise its Whole Life Cycle Costing $(WLCC)_{SPV}$ which may translate into better VFM.

The WLCC and affordability are the governing parameters of VFM and the entire PFI Bid is based on the evaluation of the WLCC of the project. The aim of the Public Sector Sponsor is to lower it to a minimum.

The SPV in NSDR road project always used function-based solutions to achieve cost improvements without sacrificing the required performance. The value management done in both road projects focused on the elimination of redundant performance; that is, the avoidance of expenditure on any item of construction that does not add value to the project or which makes the output of the project achieve more than its required function as a road or as a bridge. Both case study projects, having the same construction contractor both in the SPV and in actual works execution, were good examples for the function-based value management approach.

A WLCC Framework for PFI Road Project is proposed in Fig.1 below.

The proposed framework contains the interrelationships between risk, value and function. Within this framework the supply (private) and demand (public) sides are working and interrelating; and efficiency, effectiveness, innovation and certainty in the framework is measured relative to the Public Sector's Output Specification.

The WLCC parameters are innovative and have different outputs for the private and public sectors. The SPV has payment as the output of the cycle which comprises an availability element and a shadow-toll element. The payment, reflecting the SPV's bankability and the payment mechanism are closely related to the performance of the constructed road since they incorporate the interrelations between risk, quality and function.

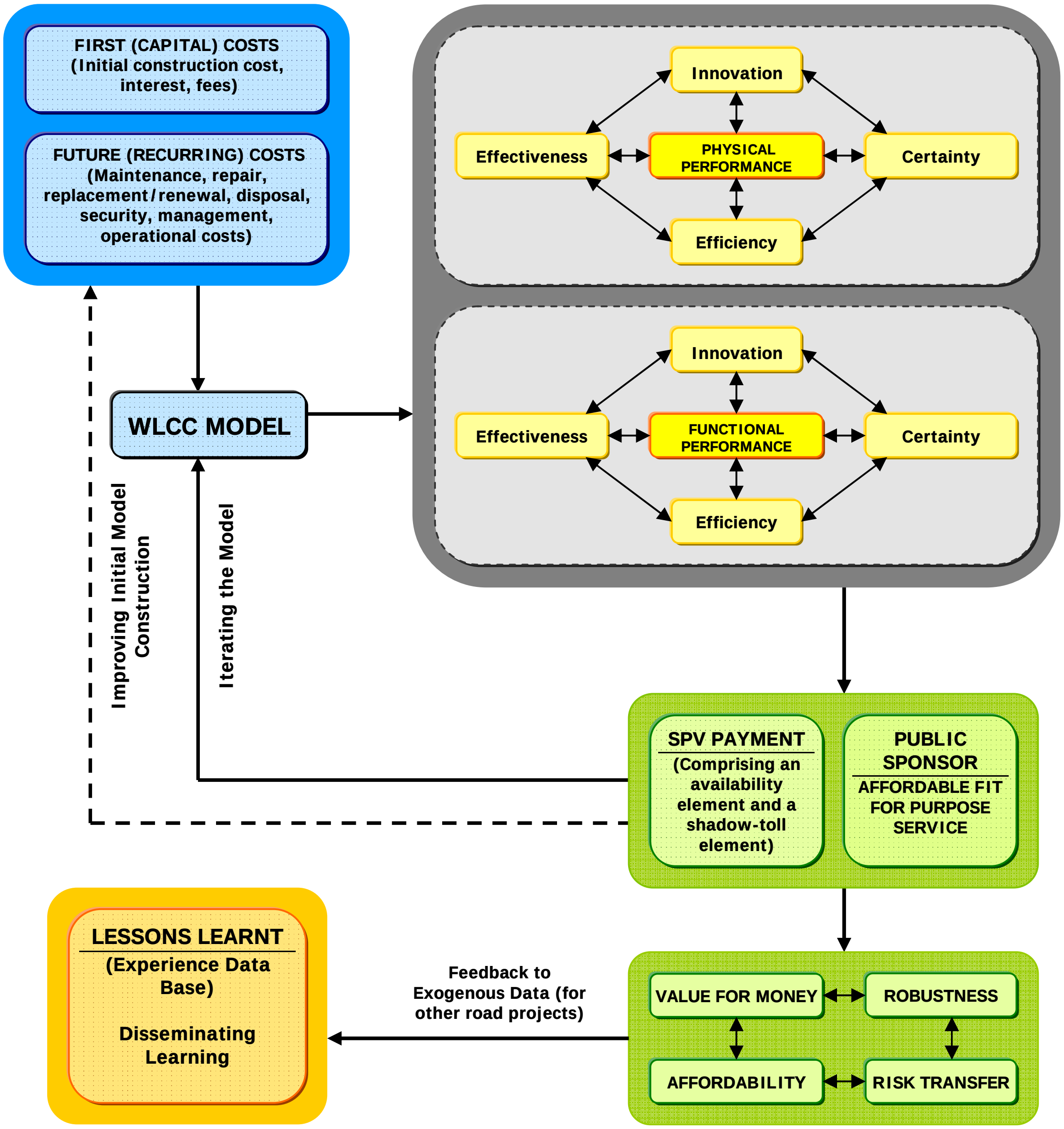

Fig. 1: WLCC Framework for PFI Road Projects (Akbiyikli, 2005)

The Public Sponsor has "Affordability" and "Value for Money" as the output of the cycle. Affordability for the Public Sponsor is the ability to access to funds and that the expenditure of the available funds provides an adequate return when compared with other investment alternatives.

The "Risk Transfer" refers to the balance achieved within the agreements between all of the parties in relation to accepting the financial consequences should a risk occur; and a risk should be allocated to the party best able to manage and control the risk.
The "Robustness" of the Project arrangements refers to the concurrence of the individual aims with the main project objectives. The project arrangements should be equitable between all parties, such that all parties should have the ability to complete a particular project without the necessity for 'step-in'. Thus no party conceives the agreement as 'unfair'. All parties should feel that they have not been disadvantaged by the arrangements. A satisfactory

Robustness arrangement would be one that all parties would be prepared to execute for subsequent projects.

The main philosophy behind the WLCC framework for PFI Roads in this study is:
An integrated approach to design, construction, operation and maintenance with input from constructors and their supply-chain to improve sustainability, design quality, increase buildability, drive out waste (lean construction) and reduce maintenance requirements.

A generic definition of WLCC for PFI road projects is proposed as follows:

"WLCC is a proactive, iterative, continuous and systematic approach which maximises the physical and functional value of a road project by managing its development from Business Case to Disposal according to the value requirement of the Public Sponsor". (Akbiyikli, 2005).

The facilitators of the WLCC process are the Public Sponsor and the SPV and its supply-chain.

Accurate WLCC increases the opportunity for efficiency and effectiveness improvements and can improve the availability of the PFI road during the concession period. It is therefore critical that sufficient attention is given to achieving accurate project whole life-cycle costs. Both the public and private sector can improve their strategic decision-making by improving the accuracy of their WLCC analysis in future PFI road projects.

4. Conclusions

The research case study analysis has identified among other issues the following:

- The PFI road projects required that capital expenditure and maintenance costs were considered throughout the bidding stages in order to arrive an effective Whole Life-Cycle Costing;
- In the PFI road projects the competitive and negotiation processes which benefits the Public Sector, required the Contractors to be innovative and cost conscious. The Private Sector benefited through long-term cash-flow and managing its supply chain with improved integrated solutions, and the introduction of cost efficiencies and WLCC analysis in design and sustainable solutions;
- The Financial Model which considered the Whole Life-Cycle Costing foresaw guaranteed expected service delivery and maintenance costs which are cardinal issues for affordability of the public sector. The Public Sector caps its final service costs at predetermined and agreed levels through the Project Agreement between Public and Private Sectors;
- The PFI gave the opportunity to the Public Sponsor to make the Special Purpose Vehicle (SPV) to minimize its WLCC which may translate into better service and better VFM;
- The WLCC and the PFI Contractual Framework ensured SPV ownership and thus a Zero Defect target at all levels of the supply chain. The WLCC, the necessity of the PFI's long-term service provision and the requirement of Zero Defect Target have resulted in an improved efficiency provision to the Public Sponsor and end user;
- The WLCC framework required the Contractors to be innovative and cost conscious; forced the SPV to introduce improved integrated solutions and project development

methodologies; and forced the Private Sector in general to think PFI's sustainability rationale, namely to minimize life cycle costs, to reduce source and waste, increase constructed asset efficiency and create safe road network.

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Modelling of Construction Project Management Effectiveness by Applying Neural Networks

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Abstract: The paper presents modelling of construction project management effectiveness from the perspective of construction management organization. Construction projects performance data from construction management companies in Lithuania and the United States of America was collected and used for model development. Construction project management effectiveness model (CPMEM) was established by using artificial neural networks (ANNs). Twelve key determinants factors were determined, that could increase opportunity to improve organizational performance through more effective project management. Construction project management effectiveness model and its application algorithm are recommended as a decision-support tool for competitive bidding to evaluate management risk of a construction project. The model allows construction project managers to focus on the key project management effectiveness factors, reduce the level of construction management risk and provide substantial savings for construction management company.

Keywords: Construction Project Management, Neural Networks.

1. Introduction

Construction projects are delivered under conditions of risk in the competitive market environment. There are external risks (economic, political, financial and environmental) and internal risks based on project management issues, i.e. projects manager's and his team competency, experience, strategic and tactic decisions made during construction project delivery. The opportunity to improve organizational performance through more effective project management could provide substantial savings for construction management company.

Traditionally, construction project management effectiveness is defined as the degree to which project goals and expectations are met. It should be viewed from respective perspectives of different project participants and the goals related to a variety of elements, including technical, financial, social and professional issues. Criteria are needed to compare the goal level against the performance level. The criteria are the set of principles or standards by which judgment is made (Lim et al. 1999). While effectiveness is measured in terms of goal attainment, there is ambiguity in determining whether a project is success or failure.

Project management effectiveness depends on the certain factors of project management system. The literature review revealed a substantial volume of work on measuring or identifying the factors or conditions contributing to the effectiveness of construction projects.

There are three main trends of previous research on construction project success factors:

- key factors identification for construction project success (Ashley et al., 1987; Pinto at al., 1988; Jaselskis et al., 1991; Sanvido et al., 1992; Chua et al., 1997; Chua et al., 1999; Millet, 1999);
- identification of key success factors for a particular group of construction projects, e.g. BOT, design-build (Mohsini et al., 1992; Tiong, 1996; Molenaar et al., 2001; Chan et al., 2001, Zhang, 2005; Shen et al., 2005);
- analysis of a particular factor impact on construction project success (Faniran et al., 1998; Angelides, 1999; Cheng et al., 2000; Back et al., 2000; Mitropoulos et al., 2000; Bower et al., 2002; Ford, 2002, Jan et al., 2002).

Some writers were attempting to develop predictive models while others focused on generating a list of practices. Predictive models developed to identify the key factors and to measure their impact on overall project success were using regression and correlation techniques, factor analysis, Monte-Carlo simulation, experts and multicriteria decision-making support methods. Essentially in these approaches the functional relationships between the input factors and project outcome is assumed and tested against the data. The relationships are modified and retested until the models that best fit the data are found.

When developing construction project management effectiveness model (CPMEM) referred to here, the writers attempted to cull the best aspects of artificial neural networks (ANN) methodology. The neural network approach does not require an a priori assumption of the functional relationship. Artificial neural networks are very useful because of their functional mapping properties and the ability to learn from examples. Multilayer neural networks have been shown to have a certain "universal" approximation property. Networks have been compared with many other functional approximation systems and found to be competitive in terms of accuracy (Haykin, 1999). This and the ability to learn from examples allow modelling the complex construction project management system where behavioural rules are not known in detail and are difficult to analyse correctly.

2. Modelling of Construction Project Management Effectiveness by Applying Neural Networks

The foundation of the artificial neural networks (ANNs) paradigm was laid in the 1950s, and ANNs have gained significant attention in the past decade because of the development of more powerful hardware and neural algorithms (Haykin 1999). Artificial neural networks have been studied and explored by many researchers where they have been used, applied, and manipulated in almost every field. As in civil engineering and management applications, neural networks have been employed in different studies. Some of these studies cover the mathematical modelling of non-linear structural materials, damage detection, non-destructive analysis, earthquake classification, dynamical system modelling, system identifications, and structural control of linear and non-linear systems, construction productivity modelling, construction technology evaluation, cost estimation, organisational effectiveness modelling and others (Adeli et al., 1998; Lu et al., 2000; Sinha et al., 2000).

Among the numerous artificial neural networks that have been proposed, backpropagation networks have been extremely popular for their unique learning capability. 80% of practical ANN applications used the backpropagation neural networks (Haykin 1999). The authors of the paper applied backpropagation neural networks methodology to create the model of construction project management effectiveness.

Modelling of construction project management effectiveness by applying backpropagation neural networks consists of the following stages:

- selection of the variables of the construction project management effectiveness neural network model (CPMEM);
- selection and preparation of training data for the CPMEM;
- designing and training the construction project management effectiveness neural network;
- evaluation of the importance of a particular input factor to the CPMEM output by applying sensitivity analysis technique;
- identification of the key construction project management effectiveness factors and modification of the CPMEM;
- determining the validation range of the CPMEM practical applications.

The construction project management effectiveness neural network model had been developed using *NEURAL NETWORKS TOOLBOX* by *MATLAB*. Preparation of the training data and statistical computations had been performed by applying *Microsoft Excel.*

2.1 Questionnaire Survey and Data Analysis

A questionnaire was developed to collect data from past projects to be used in developing a predictive model. The framework for the list of construction management effectiveness factors covering areas related to project manager, project team, project planning, organisation and control was selected from the research conducted by Jaselskis and Ashley (1991). However, the actuality of each construction management factor was retested by interviewing construction management practitioners and the approach was modified according to the interviewers' opinion. Construction project management effectiveness factors described in Table 1 served as the independent input variables of the CPMEM.

Construction cost variation criterion was used to measure construction project management effectiveness. The output variable of that model - construction project cost variation Q - was calculated by equation:

$$Q = \frac{PI - FI}{PI} \cdot 100\% \qquad (1)$$

where PI - estimated construction project cost; FI - actual construction project cost.
The present study is based on a set of data obtained in a questionnaire survey on construction project management effectiveness factors from construction management organizations in Lithuania and the USA. Personal contact was the major communication tool used to get organizations participated in the study. The interviewees were construction and project managers. Twelve Lithuanian companies participated in the research and presented information on 32 completed construction projects. The average size for the projects is 4.3 million Litas (1.6 million USD) and the mean duration is 7 months. Twenty seven US construction management companies presented information on 54 completed construction projects with the average size of 30.1 million USD and the mean duration of 14 months. Statistical analysis calculations proved that random project samples obtained from two countries belong to the same statistical population. Then the whole data set of 86 projects was divided into two subsets: training and testing. The neural network model was trained with 76

project samples and retested with 10 project samples. The testing subset represented 10 different construction companies and all 5 construction cost variation classes.

Table 1: Construction project management effectiveness factors

Category	Project management factor	*Measure*	*Priority*
Project manager (PM)	PM meetings	Number /month	7
	PM time devoted	Hours/day	16
	PM site visits	Number/month	2
	PM subordinates	Number	10
	PM levels to craftsmen	Number	8
	PM education level	Years	11
	PM construction experience	Years	27
	PM project management experience	Years	15
	PM scope experience	Number of projects	12
	PM technical experience	Number of projects	13
	PM scope experience other than as PM	Number of projects	9
	PM technical experience other than as PM	Number of projects	14
Project team	Team turnover	Percent per year	26
	Monetary incentives	% of total construction cost	1
Planning	Design complete at construction start	Percent	21
	Activities in execution plan	Number	19
	Budget contingency	Percent	18
	Independent constructability analysis	% of total construction cost	5
	Modularization	% of total construction cost	4
Organization and control	Progress inspection	Number/month	23
	Quality inspection	Number/month	22
	Safety inspection	Number/month	17
	Control system budget	% of total construction cost	3
	Design control meetings	Number/month	20
	Construction control meetings	Number/month	24
	Schedule updates	Number/month	6
	Budget updates	Number/month	25

A neural network works best when all its inputs and outputs vary within the range 0 and 1. Thus all the data were classified and massaged before using them in a neural network. The input data - project management factors - were classified into six groups and the output data - the percentage of the construction cost variation in loss or profit - were classified into five groups (Table 2).

Table 2: Classification of project cost variation

Range of predicted project cost variation Q	Class description	Predicted neural network output
Q > +10%	Very good	00001
+3% < Q ≤ +10%	Good	00010
–3% ≤ Q ≤ +3%	Average	00100
–10% ≤ Q < –3%	Poor	01000
Q< –10%	Very poor	10000

2.2. Designing and Training of Neural Network Model

The neural network chosen in the present study is multilayered with neurons in all layers fully connected in the feedforward manner (Fig. 1). Sigmoid function is used as an activation function. The number of neurons in the input and output layer was decided by the number of input and output variables of the construction project management effectiveness neural network. Thus, the input layer had 27 neurons and the output layer had 5 neurons, representing five classes of the construction cost variation. One hidden layer is chosen in which the number of neurons is decided during the training process by trial and error.

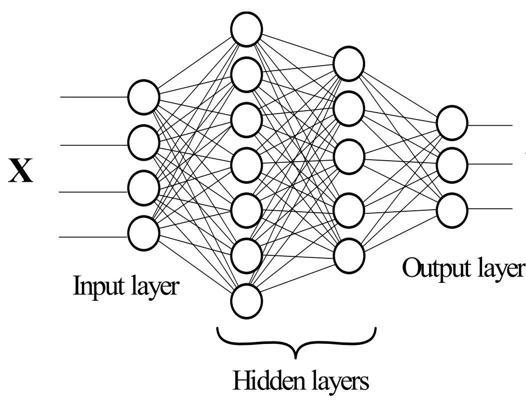

Fig 1. Architecture of a typical artificial neural network

The neural network was trained to solve the classification task by applying resilient backpropagation learning algorithm. The network performance in this study was measured by the modified regularisation error function:

$$E_{MSEREG} = \gamma E_{MSE} + (1-\gamma) E_{MSW} \qquad (2)$$

where γ is the performance ratio in a range [0;1]; E_{MSE} – the mean of the sum of squares of the network errors; $E_{MSE} = \frac{1}{n}\sum_{j=1}^{n} w_j^2$ - the mean of the sum of squares of the network weights and thresholds.

During iterative training a *leave-one-out cross-validation* technique was applied. *Cross-validation* refers to the process of assessing the predictive accuracy of a model in a *cross-*

validation sample relative to its predictive accuracy in the *learning samples* from which the model was developed. Each sample is sequentially removed from the training set and the model is trained on the (*N*-1) remaining samples. The excluded sample becomes the validation set. While the learning set was used to adjust the network weights, the validation sample maintains an independent check that the neural network is learning to generalize (Fig.2)

The interpretation of the network output is based on the Bayesian posterior probability: the construction project cost variation belongs to the class represented by the output layer neuron of the highest output value.

Classification error was calculated by equation:

$$CE_{RMS} = \sqrt{\frac{1}{q}\sum_{p}\left(T_p - P_p\right)^2}\,, \tag{3}$$

where T_p – actual class of project cost variation; P_p– class of project cost variation predicted by neural network; p – construction project index; q – number of examples for testing.

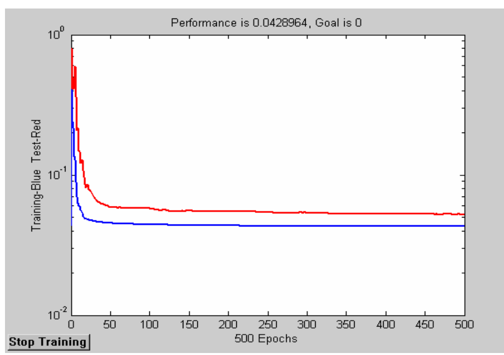

Fig. 2. Neural network error for learning and validation samples

Relative classification error was calculated by equation:

$$CE_{RS} = \frac{q-n}{q}100\%\,, \tag{4}$$

where q- number of examples for testing; n – number of correctly by neural network predicted project cost variation classes for testing samples.

The network's weights and thresholds must be set so as to minimize the prediction error made by the network. Once the number of layers, and number of units in input and output layers has been selected in the beginning, the number of hidden layer units was decided during the network training by calculating the prediction error on the test samples.

All construction management effectiveness factors were incorporated into the model at the first stage of model development. The initial network model comprised 27 neurons in the input layer with 9 neurons in the hidden layer and 5 neurons in the output layer. However, experimentation with an initial model that included all 27 variables resulted in a model with poor performance, thus indicating that including all variables makes the model less sensitive to each of them. In order to understand the importance of a particular input to the network output, a sensitivity analysis technique was applied. A sensitivity analysis technique indicates which input variables are considered most important by the particular neural network. Sensitivity analysis can give important insights into the usefulness of individual variables. It often identifies variables that can be safely ignored in subsequent analyses, and key variables that must always be retained.

2.3 Determination of Key Construction Project Management Effectiveness Factors

Sensitivity analysis was performed by measuring the network output, when each output-input was set (one at a time) to its minimum and then its maximum values. The amount of change in the network output represents the network's sensitivity to a respective input. Thus the priority of the construction management factors to the construction project management effectiveness was evaluated (Table 1). The insignificant factors were trimmed from the network at the stage of model development. This was done gradually by eliminating the least important factors, respectively to the results of sensitivity analysis. During this process 12 key determining construction management effectiveness factors were identified for further model development (Table 3).

Table 3: Key factors of construction management effectiveness

Category	Factors	Influence
Project manager (PM)	PM meetings	Positive
	PM site visits	Positive
	PM subordinates	Negative
	PM education level	Positive
	PM scope experience	Positive
	PM scope experience other than PM	Positive
Project team	Monetary incentives	Positive
Planning	Independent constructability analysis	Negative
	Modularisation	Positive
Organisation and control	Independent control system budget	Negative
	Schedule updates	Positive

Sensitivity analysis confirmed that the initially selected four categories are significant aspects of the cost performance. The selected twelve factors include seven for project manager category, one for project team, two for planning and two for organization and control category. Three key factors, i.e. PM subordinates, independent constructability analysis, and control system budget, showed negative influence on the CPMEM output. These factors appear to be associated with project complexity and risk. The higher project complexity and the higher level of risk degree means the higher values of these three factors: there are more employees and subcontractors supervised by PM, the cost of independent constructability analysis as well as control budget is respectively higher. Nine key factors showed positive influence on the CPMEM output. The higher values of these factors allow improving the construction project management effectiveness.

2.4 Model Validation and Testing

Many experiments with various network architectures were performed during training in order to arrive at the best-trained network. Based on the classification error, the final neural network model was built with 12 neurons in the input layer, 4 neurons in hidden layer and 5 neurons in the output layer (Table 6).

The performance in terms of generalization and prediction qualities of neural network depends significantly on the training data (training patterns) and the domain this data covers. The established CPMEM represents the input-output functional relationships reflected by the specific characteristics of the training data set. Then the model was validated by ten project samples, two for each class. All testing samples were classified correctly. Thus, the results are valid within this particular range of training data. However, the analogical model can be developed by applying training data of any group of construction projects or construction management organizations.

Table 6: Testing results of neural network model

Number of neurons in the layers	Number of iterations	E_{MSEREG}	CE_{RMS}	CE_{RS}
13/8/5	826	0.0304	0	0
13/12/5	951	0.0284	0	0
12/2/5	1251	0.1203	0.89	20
12/3/5	851	0.0965	0.89	20
12/4/5	1151	0.0957	0.45	10
12/4/5	1276	0.0953	0	0
12/4/5	1476	0.0944	0	0
12/6/5	1351	0.0848	0.32	10
12/7/5	851	0.0753	0.32	10
12/9/5	1051	0.0547	0	0
11/5/5	801	0.1364	0.89	20
11/6/5	751	0.1342	0.63	20
11/9/5	1251	0.1333	0.63	20
10/4/5	676	0.2157	1	40

3. Decision–Support Tool for Competitive Bidding

The construction industry has been presented with a number of analytical and numerical models for the calculation of the probability of winning and optimization of bid markups. The traditional bidding models of Friedman (1956) and Gates (1967) are based on the bidding history of a firm's competitors. Shaffer and Michaeu (1971), Benjamin (1972), Griffis (1992), Ahmad and Minkarah (1998) and Christodoulou (2004) introduced more quantitative and qualitative factors in the development of the expanded mathematical bidding models. However analytical models simplify the problem to one of consisting only two internal project parameters (cost estimate and bid markup) and focusing on the external factors: the level of competition, status of economy, the firm's need for work, etc.

Authors of the paper established the construction project management effectiveness model and developed the application algorithm of that model for competitive bidding process (Fig.3). CPMEM for competitive bidding process captures all the other objective and subjective internal company's and project factors that govern bid decisions.

The range of potential construction project cost variation can be evaluated by applying CPMEM on the specific project, project team and construction company as follows (Fig 3):

- The first stage's target is to obtain the maximum of existing information about the main features of the project.
- The second stage entails a detail study of the project, suggesting possible changes for the project, estimating costs and defining target bid markup.
- In the third stage the project management team is formed to deal with the project planning, management and delivery. In that stage the intended project management effectiveness factors should be evaluated.
- In the fourth stage the project's construction cost variation is predicted by applying CPMEM. This step is very useful to identify hidden project management risks.
- In the fifth stage the initial total bid price is adjusted according to the CPMEM results.
- The sixth stage entails a search and analysis of historical information about similar internal and external projects. The obtained information about the potential competitors and their strengths and weaknesses should be measured. Then the adjusted bid price should be evaluated in comparison with forecasted prices of competitive bidders.
- Finally, the decision if everything goes forward or if the project requires serious reconsideration should be made. If the project management system considered to be changed, the potential project management factors (e.g. different project planning or control strategy, different project team size or qualification, organizational structure, etc.) should be re-evaluated. The analysers should go back to the third stage and repeat the process until the selected criterion is satisfied. If the project management system considered not to be changed, the decision about the participation in the bidding process should be made.

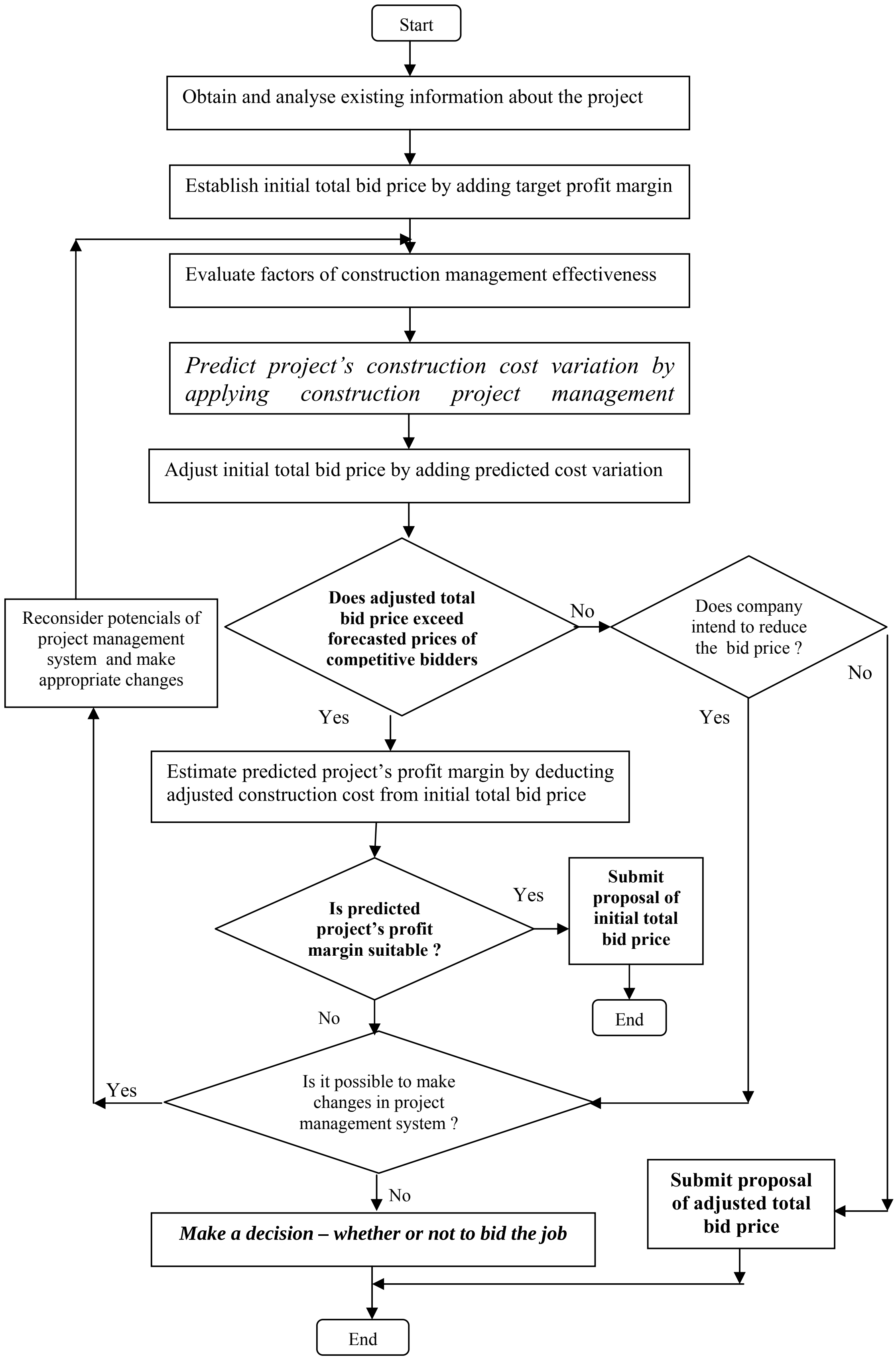

Fig. 3. Construction project management effectiveness prediction algorithm

Case study: The request for bidding proposal was issued by the private company to manage the construction of industrial project of 20 million USD on a fixed price contract basis. Construction company X prepared bidding material for that project. Company's X estimated total bid price was 20.7 million USD, 10 % profit margin was included. According to the market analysis the competitive bids might fall into the range of 20-21 million USD. What would be the company's X bidding decision?

Solution: The estimated construction cost was 18.82 million USD. The predicted cost variation was calculated within the range of –3 % and +3 % by applying CPMEM construction projects management effectiveness neural network model. If the worst happened, the construction cost would increase by 3 % up to 19.38 million USD and the markup would reduce to 6.8%. If the target markup for that project procurement was 10%, the company should re-estimate the bid price up to 21.32 million USD. Though, that price would not be competitive.

The managers decided to replace two members of the project team by more qualified professionals and not to hire outside consultants, i.e. re-evaluated the CPMEM factors of project team monetary incentives and independent constructability analysis. By applying CPMEM model for the second time, the predicted cost variation was calculated within the range of +3% and +10%. In that case there was a possibility of at least 3% construction cost reduction, i.e. 0.56 million USD (18.82*0.03=0.56). Thus, adjusted bid price was calculated at 20.08 million USD [(18.82-0.56)*1.1] =20.08.

X company must make a decision – whether to submit the bid price of 20.08 million USD, which seems competitive enough, or keep trying to reduce it by strengthening the other aspects of project management system, thus resources can be deployed even more effectively.

By applying CPMEM the construction project management effectiveness neural network model, managers of construction company can indicate how much importance each factor has for a particular project outcome, find the best possible arrangement of construction management effectiveness factors and examine the construction cost variation tendencies. Civil engineers and managers are uniquely positioned to take use of the opportunities offered by the new paradigm.

4. Conclusions

The paper presents new methodology for modelling of construction project management effectiveness by applying artificial neural networks. The approach of artificial neural networks allows the construction projects management effectiveness model to be built and to determine the key determinants from a host of possible management factors that affect project effectiveness in terms of construction cost variation.

Survey questionnaire was created and distributed to construction management companies in Lithuania and the US. Collected data of projects' performance has been used to build the neural network model. Twelve key determinants factors that influence project management effectiveness were identified covering areas related to the project manager, project team, project planning, organization and control.

The established neural network model can be used as a decision-support tool for competitive bidding process to evaluate management risk of a construction project and predict construction cost variation. The model allows the construction project managers to focus on the key success factors and reduce the level of construction risk. The model can serve as a framework for further development of construction management decision support systems.

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Promoting Innovative thinking within Construction

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Abstract: There has been a realisation within the UK construction industry that the promotion of innovation and innovative thinking across the supply chain can offer, the clients and service providers, key benefits in terms of adaptability, financial growth and improved service delivery. This paper attempts to highlight the benefits of innovation and how organisations can promote innovation and innovative thinking within their own organisation and within their supply chain. It presents one case study based on the measures taken by a leading service provider to promote innovation and innovative thinking with an aim to improve processes and service delivery across the supply chain.

Keywords: Innovation, Learning, Supply Chain

1. Introduction

Recent changes in the UK economy and shifts in business practices brought about by mergers and alliances, partnering, private finance initiatives (PFI) and prime contracting, have increased the importance of innovation within the construction industry. Construction organisations need to innovate in order to adapt continuously to complex and changing conditions. The recent reports (Egan, 1998), and viewpoints from the construction research and innovation strategy panel (nCRISP), and the movement for innovation (M4I) have all helped to improve awareness of the importance of innovation within the sector. Egan (1998), for example, stressed the importance of innovation within the industry, and proposed that service and product improvement and company profitability can only be achieved through innovation. Other benefits include improved leadership, customer focus, integrated processes and teams, quality and commitment to people (Khalfan and McDermott, 2006).

In spite of this growing realization, establishment of systems and processes to promote innovation and innovative thinking within construction organisations is still at embryonic stage. This paper presents one case study showing why and how a leading service provider established the process to promote innovation and innovative thinking. The case study offers learning opportunities to other construction organisations seeking to establish processes to promote innovation and innovative thinking across the supply chain.

2. Construction Innovation

Egbu (2001a, b) defined innovation as 'successful exploitation of an idea, where the idea is new to the unit of adoption'. Slaughter (1998) attempted to account for the project based nature of the construction industry while defining innovation as 'the actual use of a nontrivial change and improvement in a process, product, or system that is novel to the institution developing the change'. From construction perspective, the definition given by Ling (2003) could be considered the most comprehensive within the construction industry context. He defined innovation as an implementation of a new idea to a construction project with the intention of deriving additional benefits although there might be some associated risks and uncertainties. The new idea may refer to new design, technology, material component or construction method used in a project (Asad *et al.* 2005). Innovation can take many forms, it can be radical, in response to crises or pressure from the external environment, or can also be incremental where step-by-step changes are more common (Egbu, 2004). From construction industry perspective, innovation can be broadly classified as either 'Organisational innovation' or 'Technical innovation'. 'Organisational innovation' may result by the introduction of changes to the organisational structure, introduction of advanced management techniques, and implementation of new corporate strategic orientations (Anderson and Manseau, 1999). 'Technical innovation' can take form of either 'product' or 'process' innovation. Product innovation refers to where the new product is the outcome. Process innovation denotes innovation where the process by which a product is developed is exposed to new ideas and, therefore, leads to new and often more sophisticated methods of production (Egbu, 2004). The implication is that an idea goes through a process, from its generation to its exploitation and it can therefore be understood in stages or sequences (Egbu, 2004).

3. Importance of Innovation for Construction Organisations

It is widely accepted that promotion of innovation and innovative thinking is a pre-requisite to any competitive advantage. Innovation provides benefit to an individual, an organisation or wider society (West and Farr, 1990) and is directly linked to the economic development of any country (Seaden et al, 2003). Moreover, innovation can lead to the successful development and introduction of new products, processes and/or services, technical and/ or organisational change; and successful exploitation of new ideas (Dodgson et al, 2002; Gann, 2004).

From a construction industry perspective it is widely believed that due to the continuously changing conditions, construction innovation may become a fourth performance dimension in the future in addition added to the traditional dimensions of cost, quality and time (Newton, 1999). Innovative thinking has become essential for construction organisations because of increasing pressures from clients to improve quality, reduce costs and speed up construction processes (Gann, 2000). Innovation can also result in increased organisational commitment and higher organisational motivation (Dulaimi et al, 2003). Considering this fact it is important for construction organisations to innovate in order to take advantage of changes in market economy, build long-term relationships with clients, increase organisational motivation and make improvements to the systems and processes.

4. Innovation Management in Construction Organisations

Implementing innovative processes, whether related to new product development or enhanced project delivery, may result in failure of all the hard work without any motivation and efforts from the people actually responsible to carry out those processes. It is very true for the construction industry which is generally considered as slow to adopt new management techniques and information and communication technology. Mitropoulos and Tatum (1999) found that innovation could be only successful if the goal of the innovation is to manage or incorporate technological change, searching for alternatives, evaluating them and justifying the cost implications of the process. Considering this there are range of internal and external drivers which influence innovation within the industry:

- Clients (Barlow, 2000; Gann and Slater, 2000; Kumaraswamy and Dulaimi, 2001; Nam and Tatum, 1997; Seaden and Manseau, 2001). They can act as a catalyst to foster innovation by exerting pressure on the supply chain partners to improve overall performance and by helping them to devise strategies to cope with unforeseen changes (Gann and Slater, 2000), by demanding high standards of work (Barlow, 2000), and by identifying specific novel requirements for a project (Seaden and Manseau, 2001).
- The procurement method (Tatum 1989; Dulaimi et al 2002; Walker et al 2003). Dulaimi et al (2002) emphasized the importance of design-build contracts and their research work found that the design-build method would enable companies to increase their innovation, compared to deign-bid-build, which may result in enhanced supply chain fragmentation. Walker et al, (2003) have emphasized on the presence of a well–integrated team/supply chain as a mean to use procurement as a driver for innovation.
- Attitudes and processes (Blayse and Manley, 2004). It is important for construction firms and individuals to have attitudes and processes, which are conducive to innovation (Blayse and Manley, 2004). Research has shown that enhancing construction innovation requires stronger inter-organisational co-operation (Miozzo and Dewick, 2004), supportive organisational policies and priorities (Tatum, 1989), 'no blame' culture (Dulaimi et al, 2002), professional working together to find new ways to improve performance (Gann, 2000) and effective leadership (Nam and Tatum, 1997).

It has been suggested that management of innovation can take form of integrative, appropriate and contingency approach:

4.1. Integrative Approach

Integrative approach considers management of innovation by focussing on interdisciplinary and multifunctional resources. Tidd *et al*. (2001) suggests that it is not sufficient to focus on a single dimension of innovation: technological, market, and organisational change interact. Better management of research and development may improve the efficiency or productivity of technological innovation, but is unlikely to contribute to product effectiveness, and therefore cannot guarantee commercial or financial success. Even the most expensive and sophisticated market research will fail to identify the potential for radically new products and services. Flat organisational structures and streamlined business processes may improve efficiency of delivering today's products and services, but will not identify or deliver innovative products and services, and may become redundant due to technological or market change.

4.2. Appropriate approach

The appropriate approach stresses on a need to consider different viewpoints of stakeholders in the industry, and to take account of their different drivers. By considering these issues, and planning for the particular project, it is more likely that innovation can be successful. There is no general business case for innovation and each idea must be explored on its own merits. However, it is useful to understand why other innovations have brought benefit in order to learn from them (Cripps 2003).

4.3. Contingency Approach

Contingency approach talks about dealing with different kinds of innovation with particular solutions that different organisations have found to work well under different contingencies. In general most firms will work on a portfolio of innovations, some of which represent incremental developments and improvements on existing and proven products and processes, whilst others will focus on more radical change. One of the key skills in effective innovation management is balancing the composition of this portfolio and matching it to the firm's competencies and capabilities in technology and markets (Tidd *et al*. 2001).

Innovation management is about learning to find the most appropriate solution to the problem of consistently managing this process, and doing so in the ways best suited to the particular circumstances in which the organisation finds itself. Successful innovation depends on being able to look widely and ahead and develop strategic approaches based on an understanding of the knowledge aspects (Tidd *et al*. 2001). The case study discussed below helps to demonstrate that how innovation and innovative thinking has helped to improve processes and service delivery across supply chain.

5. Case Study

The case study is done with a construction support service joint venture and is aimed to reveal how the joint venture made efforts to promote innovation and used it as a tool to improve service delivery. The organisation presented in the case study is a strategic alliance of two support service organisations aimed to bring excellence to the development of integrated services for the Highway Agency in the UK and its customers by ensuring safe, reliable and efficient road environments. The case study explores the factors, which are put in place to promote innovation that acted as drivers for the organisation to promote noinnovation processes.

5.1. Key Driver for the establishment of Innovation Regime

The role of the Highway agency (client) and the new procurement route played an important role in the establishment of the innovation process. The client in line with Egan report (1998, 2002) developed a new procurement approach, which was aimed at delivering best value through partnering, early contractor involvement, openness and collaboration rather than priced-based competition. Innovation became encapsulated within the contract with specific references to its management that went beyond the standard intellectual property clauses that are generally used in contracts of this type.

52. Innovation Process

Figure 1 shows the process flowchart of the AmeyMouchel innovation process. In order to develop a culture of innovative thinking all employees are encouraged to raise innovative ideas through watchman forms (standard way adopted within the company for recording and progressing observations raised by people about the network issues). If the idea is considered suitable then it is passed for validation to innovation group comprising of company and client representatives who holds monthly meeting to validate whether or not idea is innovative. Once decided that the idea is innovative then a sponsor is appointed who reviews the idea and prepares an outline implementation plan. This also includes assessing of the resource requirements, potential benefits and overall value for money aspects of the idea raised.

If the idea has a potential benefit and requires fewer resources then the sponsor assists the responsible person for immediate implementation of the idea. On the other hand if idea is beneficial but costs higher and requires more resources then the sponsor allocated along with the originator/responsible Manager prepares and submits business case to Innovation Forum.

The Innovation Forum comprises of company (two) and client (two) representatives and independent experts (two) plus a facilitator & dedicated secretariat. This forum assesses the practical application and cost-value benefit aspects of the business case. Once approved the idea is submitted for approval to the Network Board meeting (this mirrors private sector company Board meetings), which comprises of company and client senior management and holds the meeting on quarterly basis. The Network board assess the overall benefits and financial implications to the Commission. If approved the idea is added to continuous improvement programme and immediate measures are taken for the implementation of the idea.

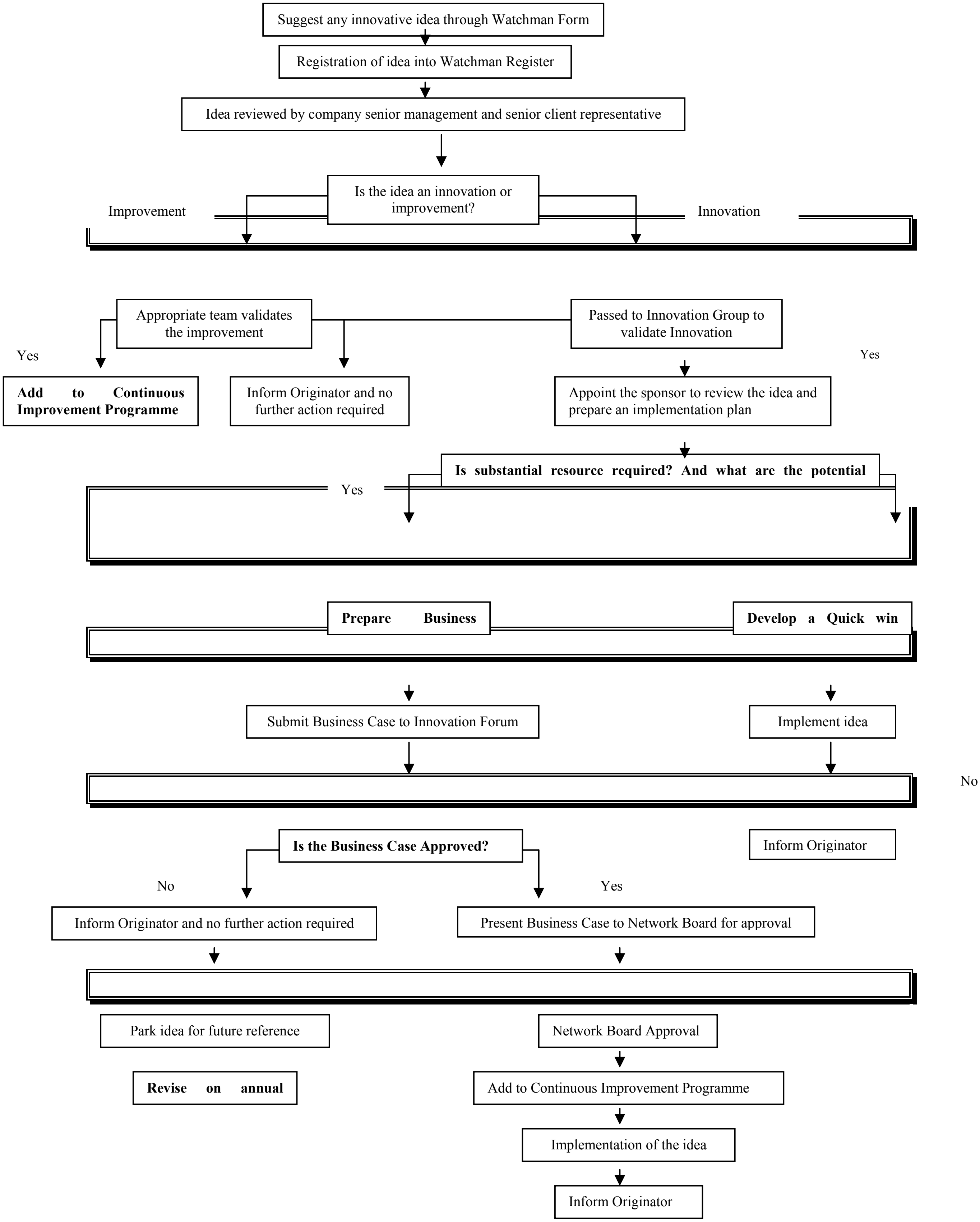

Figure 1: Innovation Process

5.3. Innovation Process in Practice

To promote innovative thinking various notice board messages, newsletter and intranet articles were published to improve awareness among employees' about the process. Innovation clinics for both innovators and sponsors during lunch breaks were introduced to improve further awareness. This has all resulted in improved awareness and people are raising innovative ideas in a range of disciplines including suggestions related to improvements to the existing maintenance regime, quality, health and safety and environment.

Innovation process has started to show useful benefits for the organisation, client and supply chain. So far various people have put approximately two hundred ideas forward. The ideas raised have helped to improve existing processes (see Table 1 for examples). Every effort has been made to keep the originator of the idea informed about the progress during the entire process. Two annual awards functions have been held to reward best innovations and to recognise originator contributions. The client is involved at all levels of the decision making process, which has not only resulted in quick processing of the decisions but has also promoted collaborative culture and establishment of mutual trust and relationships between the client and joint venture. As part of the cycle of continuous improvement the process is reviewed regularly and a report given to the Network Board with recommendations for improvement plus an outline programme of activities for the next year.

5.4. Discussion

This case study reveals the role which the client and procurement route play in promoting innovation within construction. The findings are consistent with previous research (see Tatum 1989; Barlow, 2000; Nam and Tatum, 1997; Gann and Slater, 2000; Kumaraswamy and Dulaimi, 2001; Seaden and Manseau, 2001; Dulaimi et al 2002; Walker et al 2003). Additionally it also suggests that contractor-client co-operation can act as a catalyst to promote innovative thinking and collaborative culture. The benefits demonstrated through the case study are consistent with previous research findings (Rothwell and Gardiner, 1985; Dodgson et al, 2002; Gann, 2004), namely that innovation can lead to the successful exploitation of new ideas and can be used to introduce small-scale organisational changes. The innovative process in the joint venture has resulted in the improvement of existing processes and development of innovative solutions to different problems along with successful exploitation of ideas including suggestions related to improvements to the existing maintenance regime, quality, health and safety and environment.

The findings suggest that reducing bureaucratic hurdles, feedback to the originators about the progress of the idea, identification of owners who can take the process forward and by rewarding people who have originated the idea, can facilitate management of the process and encourage people to raise innovative ideas. The company has also taken measures to establish a sustainable process by closely monitoring the situation so that objectives are met and that the methodology for capturing innovations is continuously improved. Similarly as the process is still at embryonic stage it is essential to evaluate the material benefits gained because of this process and benchmark it against the best practices (Asad *et al.*, 2005).

Table 1: Examples of Innovative Ideas put forward

Idea	Quick Win Y/N	Business Case Y/N	Alignment with Client Aims			Area of Operations Improved			Overall Benefits
			Informed Travellers	Safer Roads	Reliable Journeys	Quality	Env	H & S	
CAT 1 marker Flags	Y	N			✔	✔		✔	Faster rectification of defects
Suzy Safety	Y	N	✔	✔				✔	Children educated in dangers during construction
Major Incident Text messaging	Y	N		✔	✔	✔	✔	✔	Faster deployment of resources & reduced incident times
ISU Communications Vehicle	N	Y	✔	✔	✔	✔	✔	✔	Reduced incident times
Depot Green Award	Y	N					✔		Improved environmental condition & awareness
Folding Road Closure sign	Y	N	✔						Reduction in disruption & more satisfied road users
Cathodic Protection	N	Y			✔	✔			Reduced costs & disruption
Emergency spill kits	N	Y		✔	✔		✔	✔	Faster deployment, reduced impact & reduced incident times

6. Conclusions

This paper attempted to highlight through literature, the benefits of innovation and how organisations can promote innovation and innovative thinking within their own organisation and within their supply chain. It presented one case study based on the measures taken by a leading service provider to promote innovation and innovative thinking with an aim to improve processes and service delivery across the supply chain. The findings from the case study indicated that the role of client and innovative procurement route can help to promote the culture of innovation. Management of innovation can also be improved by reducing bureaucratic hurdles, feedback to the originators about the progress of the idea, identification of owners who can take the process forward and by rewarding those who have originated the idea. Although the company's innovation process is at an embryonic stage of development and needs to be benchmarked against best practices from other organisations, it still provides useful insight into how other support service providers can establish 'innovation process' within their organisations to make improvements to their existing systems and process. It clearly demonstrates how the right conditions necessary for innovation to flourish can be fostered within a contemporary construction organisation.

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Multicriteria awards of construction contracts: do Swedish administrative courts support or hinder sustainability

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Abstract: In recent Swedish local government practice, lowest bid has increasingly been replaced as an award criterion for construction contracts by multicriteria approaches, including ecological criteria. An earlier interview survey of municipal procurement officials in Sweden has shown that there is a widespread opinion that reliance on multiple criteria, not least those related to ecological sustainability, causes a risk when awarding construction contracts. Officials appear to exaggerate the volume of award decisions that are contested and are believed to give rise to excessive cost and delays for local authorities. In fact, the number of court cases related to ecological criteria is small in Sweden. The purpose of this investigation is to analyse how court practice influences the local development of ecological criteria for awarding construction contracts. Theories of how the legal system interacts with decision making in local government are applied to this problem. Court decisions from 2003 through 2005 and relating to all of Sweden are analysed in order to answer questions as how ecological sustainability is argued and taken into consideration in administrative court practice. Findings indicate how and under what circumstances sustainability reasoning used by local procurement officials in their award decisions stand in the courts. Furthermore, general feedback effects on local contract award practice are discussed.

Keywords: Construction Procurement, Contract Award, Court Practice, Ecological Sustainability, Multiple Criteria

1. Introduction

In recent Swedish local government practice, lowest bid has increasingly been replaced as an award criterion for construction contracts by multicriteria approaches, including ecological criteria (Waara and Bröchner, 2006). An interview survey of municipal procurement officials in Sweden shows that there is a widespread opinion that reliance on multiple criteria, not least those related to ecological sustainability, causes a risk of legal complications when awarding construction contracts (Carlsson and Waara, 2006). In current practice, ecological award criteria are usually expressed in relation to the existence of an environmental management system within the tendering firm or in more vague terms, such as ‘environmental aspects’.

The issue of how courts react to protests regarding award decisions in best-value procurement is receiving wider attention (Shane et al., 2006). There is a possibility that court practice, or perceptions of court practice, introduces an obstacle to the development of ecological criteria for the selection of construction contractors. A broad international overview of appeal procedures for public procurement has been published by the OECD (2000).

Just as it is difficult to reach consensus on defining sustainability in general, there is a variety of approaches to defining environmental sustainability, in particular so that these definitions can be used as criteria in public procurement (Marron, 1997). Nevertheless, it is a challenge for courts to contribute to the development of a more precise understanding of sustainability and criteria for sustainability as legal concepts.

Sustainability considered as a legal concept is an example of a goal-oriented norm, bringing some form of uncertainty into the legal framework and at the same time highlighting the importance of possibilities to appeal. Therefore, an important question is whether courts reduce this uncertainty significantly for procurement officers and for those who submit tenders for contracts.

The purpose of the present investigation is to analyse how court practice influences the local development of ecological criteria for awarding construction contracts.

After a short description of the Swedish appeal system for contract award decisions, the methodology is explained. The question of legal application in a context of markets and local politics is outlined, as well as the relationship between Swedish procurement law and EC directives. Empirical findings from interviews and a database of court cases are presented and discussed.

2. The Swedish appeal system

In Sweden, the National Board for Public Procurement (NOU) supervises the observation of the Public Procurement Act, the GATT agreement and the procurement agreement under the WTO. The Board disseminates information and gives general advice and comments on how the procurement regulations shall be interpreted. Suppliers may appeal to a County Administrative Court if, during an ongoing procedure of procurement, they consider that they have been harmed or risk harm (see Fig. 1). Decisions made by a County Administrative Court can in their turn be appealed to Administrative Courts of Appeal. On the other hand, when an award procedure has been concluded, suppliers who consider that they have been harmed can claim damages in a District Court. Also, when suppliers consider that they have been treated wrongly, they can appeal to the EC Commission or to the National Board, which reviews cases of general interest, but lacks sanctions. An earlier overview by Herlitz (1966/67) of the Swedish appeal system for administrative decisions is still valid as an introduction.

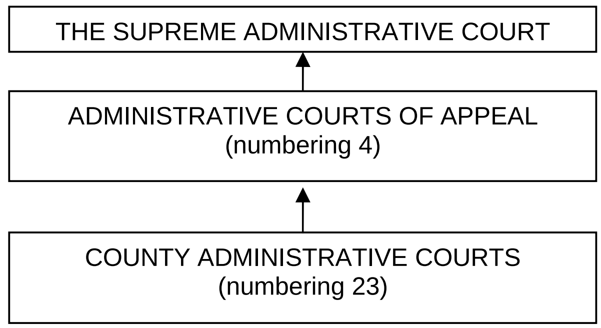

Fig. 1. The Swedish appeal system for ongoing procurement

From the 1980s and onwards the possibilities to appeal decisions made by public authorities, especially in local government, have increased. At least in theory, this has led to a new role for the administrative courts in terms of influencing public administration. The two main politically stated motives have been first, to strengthen the situation for the individual in relation to the state and the municipalities and secondly, institutionalising a system for convergence in the exercise of public authority, in order to compensate for the increasing use of soft law and the introduction of a more goal oriented style of legal decision-making. The need for institutions to provide convergence has grown as the reliance on goal oriented framework law has increased in many fields of administration.

However, the strength of courts as institutions that support administrative convergence should not be exaggerated. A useful classification recognizes three categories of legal norms: (i) material - defining what to do, (ii) procedural - defining how to do it and (iii) norms giving power to act and make decisions. Socio-legal research in the sector of welfare administration (Åström and Werner, 2002) has pointed to the fact that courts often avoid taking position in a material conflict, but rather twist the case into a question of procedural matters.

3. Methods

The methodology relied on here includes interviews with local procurement officials and an analysis of judgements from County Administrative Courts from 2003 to 2005.

Eight Swedish municipalities (Eskilstuna, Göteborg, Malmö, Sandviken, Stockholm, Uppsala, Varberg, Växjö) and two county councils (Västra Götaland, Västerbotten) have been selected based on 2000-2002 calls for tenders. A total of 25 procurement officials have participated in semi-structured interviews, and documents describing their models have been analysed.

For the judgements a commercial database, Allego, has been used. This database includes all judgements from every County Administrative Court from 2003 and onwards. The presentation of court practice given here is based on a preliminary assessment and interpretation of this material.

4. Market, local politics and legal application

Public procurement performed by local government involves many sectors of society. The overall responsibility lies with the elected representatives. Civil servants with various professional backgrounds actually manage the process of procurement, and courts have the last word if a contract award decision is appealed. Swedish procurement legislation underlines a requirement for public clients to use businesslike ("affärsmässiga") principles, thus going further than the European directives in ensuring fair competition between private contractors.

Hence, it is easy to identify that every single case of procurement involves four different forms of rationality, namely local politics, professionalism, business and adjudication process. It is to be expected that politicians, professionals and businessmen act in order to fulfil goals that they have defined themselves, while judges are supposed to make decisions according to norms that are defined by others. Thus politicians, professionals and businessmen engage in a form of decision making that is goal-oriented, while judges decide according to a form of decision making that is norm-oriented and which characterises the administration of justice in a legal positivist tradition, typical of Scandinavia and most of Europe.

5. EC directives and convergence of legal systems

From a Swedish viewpoint, it is increasingly obvious that the development in public procurement and its specific effects on both public sector management and private sector responses (in terms of behaviour and strategies of firms) is a question of merging two normative systems, the national and the one of the European Union.

Why should first instance verdicts in a statutory law country acquire some of the force of precedents in a common law system? This can probably be explained by considering the new sources of uncertainty that the implementation of EC directives has created in Sweden (Bernitz, 2001). It is a break with Swedish legal tradition and has complicated life for laymen who earlier were more able to gain an understanding of the legal issues raised by public procurement. Also, it should be kept in mind that municipal procurement, regardless of the contract sum, was not regulated through Swedish procurement legislation until recently. Earlier, there was a widely used set of principles issued by the Swedish Association of Local Authorities (cf. survey findings in Sweden, 1971).

Today, in contrast with Swedish Acts that are outside the scope of directives, there are no adequate, Swedish-style *travaux préparatoires*; no authoritative commentary to the Act; no central government authority that is empowered to issue guidelines for public procurement, although the National Board for Public Procurement partly fills this need through its web site and its conferences on procurement issues. Neither is there a centralized court or administrative body for handling appeals, but these are dealt with at the district or regional court level, leading to diversity in legal practice. Furthermore, the fundamental principles of public procurement are not to be found in the Act itself, but belong to the *acquis communitaire* in the underlying treaties.

Under such circumstances, it is reasonable that practitioners turn to court practice for guidance in procurement. This tendency is strengthened by the greatly increased ease of access to first instance verdicts by means of databases of legal cases, such as the Allego database used here. According to information from the Allego database managers, larger law firms, local governments and larger contractors are the primary users of their services at present. There are between 200 and 300 subscribers to the database, meaning that there probably are some 700 individuals who have access to the judgements found there. Allego also publish a paper containing, among other topics, comments on important cases from the courts. There has been considerable interest among subscribers for these comments. In other words, there is a widespread interest in what is going on in courts. However, it is too early to say whether this ease of access contributes to administrative convergence in local procurement. The importance of access to first instance verdicts is obvious since few cases from the County Administrative courts are appealed to the Administrative Courts of Appeal and it is only exceptionally that the Supreme Administrative Court takes up procurement cases.

In its annual report for 2005, the National Board for Public Procurement presents statistics of all cases on public procurement in the County Courts from 2000 to 2005. There has been a substantial increase in the number of judgements, from 108 in 2000 to 1213 in 2005. The Board estimates that about 30 percent of the cases are approved. In 2005, 345 cases were appealed to the Administrative Courts of Appeal, but only a minority of these cases were permitted for review. This means that the County Courts have an important task in shaping a more precise understanding of the content of the legal norms.

There is no statistical information of how many public contract awards that are made annually. A Swedish law committee (Sweden, 2001, p 437) estimated the total number of public procurement procedures to 200,000 annually, but this figure includes simplified procurement with contract sums below the directive threshold value. In relation to this estimate, it is obvious that cases brought to the County Courts are less than one percent.

6. Empirical findings

As there were no previously available statistics or estimates of the number of cases related to public procurement of construction, the first step when working with the Allego database was to identify and separate these cases. It was found that between 80 and 100 cases per year were brought to the County Courts. Many of these appeals were rejected, which means that about 20 to 25 cases every year are approved, the verdict implying that the procurement process should be corrected or remade. Interviews with procurement officials have shown a fear that appeals could cause severe delays. Surveying the court cases show that in half of the appealed cases, the court decision is made less than one month from the date of award. Only in about one quarter of the cases the delay is more than two months.

As mentioned before, we may distinguish between three categories of legal norms: material, procedural, and norms giving power to act and make decisions. From the database, it is possible to establish that most cases are about procedural matters, while fewer are about material questions as to the interpretation of the concept of sustainability or what should be acceptable practice for achieving sustainability in the appealed case. It appears that contentious issues are more related to the use of multiple criteria in general than specifically those that concern ecological sustainability. Although there are cases where the applicant complains that sustainability has not been correctly defined and assessed, but these issues are often reformulated into a procedural matter by the court. It can therefore be said that courts avoid taking ecological sustainability, as such, seriously into account.

There might be various reasons for Country Administrative Courts to avoid entering into details of how criteria such as sustainability shall be evaluated. In one case the court has declared that normally, the procurement agency has the best capability to evaluate how different bids fulfil stated requirements, and the main task for the court is then to establish whether irrelevant considerations have influenced the decision (Länsrätten i Södermanlands län 2696-03E). In another case (Länsrätten i Stockholms län 9921-05E) the court clearly settles that the reasons or motives behind a local assessment of how different tenders fulfil sustainability requirements, do not have to be exhaustive.

7. Conclusions

The investigation of court cases has revealed that the fear felt by many local government officials that a construction contract award will end in court is exaggerated. Also, the risk of construction project delays seems to be weakly founded. It is obvious that courts avoid making judgements of what promotes sustainability. They simply do not make decisions on material matters in the context of public procurement of construction contracts.

One reason for this is probably the strong legal positivist tradition of Swedish courts to look at matters in terms of right or wrong, and not making evaluations in relation to legally defined goals on their own, without having strong support in *travaux préparatoires*. The outcome is that courts fail to give practitioners the guidance that they actually are asking for. Neither does legal practice contribute to a gradually more precise and convergent interpretation of material legal norms.

The examination of the court judgements also points to the question of how those appealing public procurement decisions experience the legitimacy of courts, as a material question often is found to be transformed into a procedural one. At the same time, there are cases appealed on procedural grounds and judged in a rigorous way as such.

The effect of courts in practice is primarily to consider whether the award decision has been procedurally correct and not to examine the fulfilment of the legally defined goals of sustainability, as expressed in national preparatory works and EC documents. The role of the courts in relation to public procurement is thus another than in the context of welfare law and also physical planning law, as these two are more obvious examples of goal oriented frame laws, where the courts are intended to make legal objectives gradually more precise. In other words, there is a focus on procedural matters rather than normative when the courts are faced with appeals in procurement cases.

However, one effect of court decisions seems to be a higher level of uncertainty among procurers and bidders. What matters to local government officials appears to be the possibility of costly delays in construction projects and not only the prospect of having an award decision overturned. It may thus be that tenderers' ease of access to legal remedies is more important than procurement law in itself. Judges in County Administrative Courts do not enjoy the support of traditional legal preparatory works, and also lack experience in making decisions grounded in evaluations of how to promote fulfilment of legally defined goals such as ecological sustainability.

Finally, investigating court judgements on the first level of court hierarchy has revealed that courts do not directly hinder taking ecological sustainability into consideration in public procurement of construction, but the perception of court practice seems to be an obstacle to the development of local practice. On the other hand courts do not support the progress away from lowest price (as the only contract award criterion) towards a more multifaceted and ecological way of thinking. Court judgements do not, or only imperfectly, mirror the growth of advanced local practice in accordance with EC Buying Green principles (European Commission, 2004) or what can be found in a recent official law committee report on public procurement (Sweden, 2005), a report that stresses the importance of encouraging procurement officials to give priority to ecological sustainability. The legal sources reflect a challenge that so far has not been taken up by the County Administrative courts.

Acknowledgment

Support for this investigation through a grant from the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning is gratefully acknowledged.

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Towards A Human Resources Management Approach In Supply Chain Management

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Abstract: Supply chain management (SCM) has grown as a discipline since the field attracted attention in the 1980s. However, it is observed that effective implementation of SCM is limited because the current focus is too task-based and information-centric. The concept is often conflated, in practice, with subcontractor management, where numerical flexibility is pertinent. At the same time, consideration of human resources management (HRM) in SCM has been limited. Strategic fit within supply chains tends to emphasise task-based numerical flexibility, rather than genuine consideration and development of human resources. On the other hand, HRM has, until recently, rarely taken into account inter-organisational characteristics that typify the construction industry. Therefore, this research intends to plug the gap by examining the use of human resources in construction supply chains, with a view of developing good practice for HRM in construction SCM. To achieve this, a two-phase research methodology comprising a scoping phase and case study phase will be ensued.

Keywords: Human Resources Management, Inter-Organisational, Literature, Project Environments, Supply Chain Management

1. Introduction

The field of supply chain management (SCM) has gained much popularity over the last three decades. SCM has come of age, with commentators suggesting it has developed from mere physical management of materials and logistics to understanding demand chains to more recent notions of value chains. Notwithstanding its various perspectives, effective SCM is understood to enhance organisational efficiency, effectiveness and competitiveness through improving customer and end user satisfaction. Despite much interest, the existing understanding of SCM is limited in terms of exploring the role of human resource management (HRM). To date, the emphasis of HRM in supply chains has been limited to a secondary function. This paper is a position paper, advocating the need to develop a more proactive approach in utilising human resources as a generator of value in supply chains, especially in project-based environments pertinent to the construction industry. As such, the paper puts forward a methodology for bridging the gap to examine the use of HRM in construction supply chains. The paper is organised as follows. Firstly, an overview of the extant literature of supply chain management which argues for the need to consider greater emphasis of HRM issues is presented. Thereafter, the aim and objectives of the ongoing research are outlined. Finally, the research methodology is discussed.

2. The evolution of supply chain management

Supply chain management (SCM) has grown as a discipline since the field attracted attention in the 1980s. SCM has developed from purely physical management of materials and logistics to understanding demand chains to more recent notions of value chains (Walters, 2004). Notwithstanding various perspectives of SCM, there is consensus in the literature that effective SCM enhances organisational performance and competitiveness through the management of operations across organisational boundaries (Giannakis *et al.*, 2004).

The emphasis of SCM has changed over the last three decades. The extant literature indicates that early focus of SCM lie within the movement of materials and components (Jones and Riley, 1987); with some commentators suggesting SCM is an extension of vertical integration (see Stonebraker and Liao, 2006). SCM has also been analysed from the marketing perspective, with academics and practitioners stressing the importance of business-to-business relationships within supply chains (Christopher, 1992). Concomitantly, the importance of customer satisfaction and the role of SCM in delivering value to customers and end-users have been addressed (Harland, 1996). In order to deliver customer value, Christopher (2004) asserts that businesses need to concentrate on developing their core competencies (Prahalad and Hamel, 1990). Subsequently, firms have begun developing their knowledge base (Teece, 1998) and engaging with the organisational learning agenda (e.g. Bessant *et al.*, 2003), often with information and communication technologies (ICT) as enabling tools (van Hoek, 2001).

However, the role of HRM in effective SCM, especially across firm boundaries, has not gathered much attention thus far. By HRM, we consider practices such as recruitment and selection, retention, training and development, rewards and incentives, employee involvement and participation etc. (see e.g. Ulrich, 1997). Where HRM is addressed, it is usually portrayed as a secondary, support function. For instance, Porter (1998), in his well-known value-chain model, explicitly highlights HRM as a secondary function. Croom *et al.* (2000) reviewed the SCM literature and noted that HRM is mainly confined to rewards and incentivisation, with "only one work that highlights the links between organisational competence and individual competence, and none relating to the links between individual and organisational competence required for good supply chain management (p. 73)" (see also Scarbrough, 1998). Winfield and Hay (1997) and Dyer and Nobeoka (2000) undertook research on Toyota and examined the impacts of supply chain development on employee relations. Thus, previous empirical studies discuss HRM only as consequences of SCM, rather than the consideration of HRM as a driver for effective SCM.

Indeed, HRM is rarely examined in the way decisions are made in SCM. For example, Goffin *et al.* (2006), in a recent exploratory study, noted that while the literature extols the need for integration in the supply chain, the reality is that consideration of supplier competence is far from ideal (Scarbrough, 1998). Power (2005) purported that the adoption of strategic thinking across the supply chain is challenging since "this is easier said than done within a stand-alone organisation, let alone across a diverse and dispersed group of trading partners (p. 252)". Even the literature on supplier development (Krause and Scannell, 2002) aimed at integrating supply chains has focussed on aligning business processes across multiple organisations, albeit with little emphasis on HRM.

There is scope for exploring the role of HRM in driving effective SCM in construction, and how greater alignment and integration of HRM practices can be achieved for the benefit of effective SCM. The next section looks in greater detail at the specific SCM literature relevant to construction and puts forward an argument that construction provides a unique context for exploring the role of HRM, within an inter-organisational setting, in supply chains.

3. Supply chain management in construction

Much SCM research has hitherto centred upon manufacturing and retail industries (Tan, 2001). Indeed, the adoption of SCM in construction has lagged behind these industries. Akintoye *et al.* (2000), for example, surveyed the top 100 contractors in the UK and found that although there is some awareness of the concept of SCM, its adoption is still in its infancy. More recently, Briscoe and Dainty (2005), through case study research, suggested that the structural characteristics of the industry (one-off projects, geographically dispersed and high fragmentation) hamper the full realisation of supply chain integration. This echoes with observations made by several commentators, including Dubois and Gadde (2000) and Akintoye *et al.* (2000).

Indeed the exploitation of the benefits of effective SCM is not fully realised in the construction literature. Studies abound on the use of construction SCM for waste minimisation (see Proverbs and Holt, 2000; Vrijhoef and Koskela, 2000), often hinging on lean manufacturing philosophies (see Jones and Saad, 1998). Still, several dissenters have voiced their views against the mere transference of such principles from manufacturing without recognising the nuances of construction (see Green, 1999; Bresnen and Marshall, 2001), resulting in recent calls for more thorough, holistic understanding of SCM application in construction (see Akintoye et al., 2000; Saad *et al.*, 2002; Briscoe and Dainty, 2005).

There is also another perspective of SCM that has been examined in the construction literature – that of supply chain relations. For instance, Dubois and Gadde (2000) investigated the issues of partnering and networking with construction suppliers and found that effective supply networking was, in reality, absent because of the dominant focus of project efficiency and competitive procurement methods. Work has also been undertaken on improving and standardising the design and construction process to integrate the variety of project stakeholders (Cooper *et al.*, 2004), as well as to improve trust in construction (see Wood *et al.*, 2002). Other notable work that touches upon relationships is the investigation into the issue of knowledge management, in particular the ability to locate knowledge held in people's heads (Kamara *et al.*, 2002; Tan *et al.*, 2004). However, all these studies have focussed largely on activity at the managerial level, with little reference as to how this might be applicable to human resources at the grassroots. Indeed, Saad *et al.* (2002) found that SCM in construction is only confined to the clients, consultants and contractors, with very little cascading lower down the supply chain in reality. Briscoe and Dainty (2005) also examined construction SCM from a client-driven perspective (see also Vrijhoef and de Ridder, 2005).

The role of HRM is largely unexplored in the construction SCM literature, especially in terms of how HRM can be utilised to integrate and align business processes across organisational boundaries. Yet, recent construction literature points to the importance of people in construction. Green (1999) talked about the human costs of lean production, whilst the Egan (1998) report fuelled the Respect for People agenda (Movement for Innovation, 2000). In fact, Loosemore *et al.* (2003) called for more proactive, strategic approach to HRM when managing construction projects. Arguably, given the construction sector's reliance on people to deliver projects (Clarke, 2006), and its temporary multi-organisational nature, it is important to explore the role of HRM in construction SCM.

4. Research gaps

O'Brien *et al.* (2002) observe "there needs to be development of shared understandings of epistemologies and ontologies (p. 141)" in the adoption of effective SCM in construction. Indeed, there are calls for deeper, more holistic understanding of SCM from an inter-organisational perspective. Harland (1996), for example, observed that SCM research has largely concentrated on dyadic (one-to-one) relationships, possibly due to restrictions of access. Fawcett and Magnan (2002) maintained that while the literature has promulgated an inter-organisational view of supply chains, their multi-methods study found the reality of extensive supply chain integration and collaboration between organisations to be less prevalent. In associated fields of organisational learning and knowledge management, there are also calls for more empirical studies that delve into the inter-organisational dynamics, particularly within supply chains (Holmqvist, 2003). Interestingly, Truss (2004) recently observed that the study of HRM has hitherto adopted an intra-organisational perspective (see e.g. Ulrich, 1997; Hadley *et al.*, 2005) as she developed a framework for managing human resources across firm boundaries in a franchise setting.

It is argued that construction provides a unique opportunity for developing a deeper inter-organisational understanding of SCM, and the role HRM can play across organisational boundaries. This is because the *modus operandi* of construction is typified by temporary multi-organisations. This structural characteristic of the construction sector also provides scope for investigating what Lamming (1993) calls the study of supply chain relationships as "quasi-firm" (see also Eccles, 1981). Harland *et al.* (2004) suggest that "the management of lean supply chains may require [the view of supply chain relationships] as a "quasi-firm" with its own organisational structure and goals, communication mechanisms and culture (p. 214)". Indeed, the study of construction supply chains is also timely in the UK given current demand with events/initiatives like Olympics 2012 and the level of public spending in terms of healthcare (Procure21, LIFT), schools (Building Schools for the Future), and housing (affordable housing, and Decent Homes Initiative). Furthermore, with advances in procurement strategies that encourage collaborative working, particularly between the public and private sectors (Hall *et al.*, 2000; Hughes *et al.*, 2006), the study of construction supply chains is ever pertinent.

5. Research outcomes

Given the dearth of research examining the role of HRM in construction supply chains and the need for deeper, more holistic understanding of how best to utilise human resources in an inter-organisational context, the key aim of the ongoing research is "to develop a more proactive approach in human resource management for managing construction supply chains". To achieve the aim the following objectives will need to be met:

- To establish the "as is" and "desired" approach in human resources management for managing construction supply chains within a construction project setting;
- To investigate the HRM factors that contribute to the efficacy of construction supply chain management at the project-level;
- To investigate the shifting emphases of HRM throughout the construction project life cycle;
- To develop and test a prototype approach of HRM for effective construction supply chain management at the project-level that considers both systematic (procedural) and systemic (cultural) issues, and;
- To disseminate good practice of HRM in managing construction supply chains effectively.

The research is intended to benefit both the academic and industrial community. For the academic community, the project will result in the development of new models of supply chain management that will integrate human resource management practices. The work will also extend the current understanding, both theoretically and empirically, of the inter-organisational dynamics surrounding construction supply chains (as "quasi-firms"). For industrial practitioners, the methodology adopted will enable participants to reflect on their organisational practices. The resultant guidelines will provide practitioners with insights into how best to utilise their human resources for effective supply chain management.

6. Research methodology

Due to the exploratory nature of the research, the research methodology adopts an interpretative framework largely comprising the conduct of case studies (Yin, 1994) that consists of interviews with a range of stakeholders and documentary evidence where available. The research is split into two phases: a scoping phase and case study phase. An overview of the research methodology is illustrated in Figure 1 below.

6.1 Phase 1: Scoping phase

Phase 1 – Scoping phase – consists of a desktop study and the conducting of preliminary interviews. The purpose of this phase is to exhaustively identify the key HRM issues in construction supply chains, as well as to help refine the research questions. The desktop study is aimed at systematically reviewing the literature in accordance with the guidance provided by Tranfield *et al.* (2003). The subject areas to be covered include human resource management practices and supply chain management, with special emphasis on construction project-based environments. The review will also consider the impacts of construction procurement, since the adoption of any organisational practice in construction will depend on the choice of procurement strategy. Following the systematic review, scoping interviews will be conducted with senior managers in the first instance of stakeholder organisations within a typical construction project, i.e. client, design team, contractor, subcontractor and supplier. The scoping interviews are intended to elicit the senior managers' views on how HRM is practised at that point in time. This will enable the construction of an "as-is" model of HRM in construction SCM. The scoping interviews will also explore the issues – drivers and barriers – to adoption of HRM practices in construction supply chains.

6.2 Phase 2: Case study phase

Following the scoping work undertaken in Phase 1, the findings will enable the development of case study methodology in the second phase. The case study phase is further broken into two rounds. The 'first round' case studies include data collection from six case study projects: two case studies from construction projects undergoing early design stage; two case studies from projects undergoing tender stage, and two case studies from projects undergoing construction to handover stage. The purpose of the case studies is to first verify the findings obtained in the scoping phase, and more importantly, to examine systematic (procedural) and systemic (cultural) issues surrounding the implementation of HRM in construction supply chains in greater detail. The range of case studies and the stages of the construction project life cycle will provide both temporal and longitudinal insights into the opportunities in the design and construction process where HRM practices can be appropriately adopted for effective SCM. Unlike the scoping interviews, it is likely that interviews will be conducted with senior managers, line managers and a range of employees. Furthermore, documentary evidence (e.g. organisational archives, project records), where available, will be examined.

The 'second round' case studies will involve repeating one case study from each of the stages selected in the first round. The purpose is to track any potential changes in the dynamics as a result of progressing through the project life cycle, as well as to explore opportunities for intervention. The ultimate aim is to test and verify the good practice of utilising human resources in construction supply chains before final dissemination. It is anticipated that interviews will be undertaken in a similar fashion to the 'first round' case studies, although the questions are likely to be directed at understanding the changes that took place since the first interview. As such, it is hoped that more depth in relation to longitudinal insights of the adoption of HRM practices in construction supply chains will be sought.

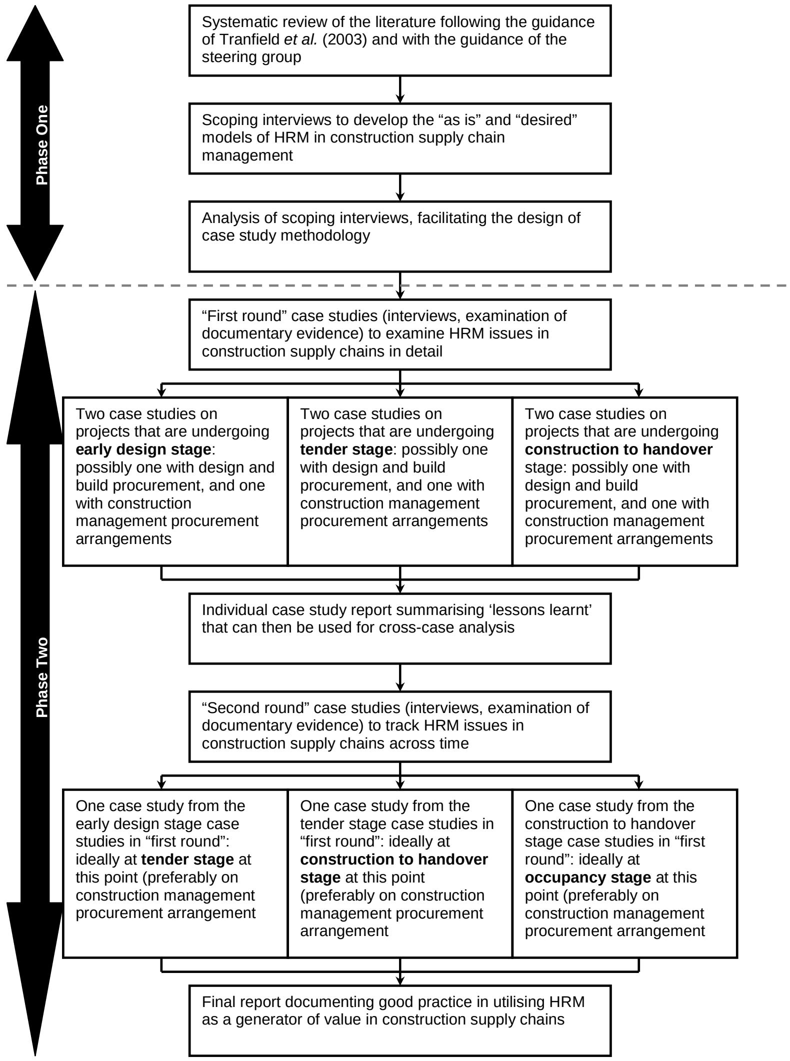

Fig. 1. Research methodology to develop a HRM approach in construction SCM

7. Conclusions

In conclusion, this paper has reviewed the extant literature on supply chain management and found a lack of research aimed at understanding the role of human resource management in the effective management of supply chains. Alongside this gap, there are also calls for the consideration of HRM across organisational boundaries. The embryonic research described here attempts to plug these gaps with a two-phase research methodology. The first phase comprises a series of exploratory interviews conducted with senior managers in stakeholder organisations (client, contractor, subcontractors and suppliers) within the supply chain of a typical project in the Northeast of England. This is to capture the perceptions of exploitation of HRM in managing construction supply chains and to elicit from the participants areas of consideration for enhancing the use of HRM in managing construction supply chains for delivering project success. Therefore, the first phase will contrast "as-is" and "desired" models of HRM in construction supply chain management The second phase involves the conduct of six case studies that will enable the research team to delve deeper into the issues identified during the exploratory phase and to advance a model of HRM in construction supply chain management. The "as is" and "desired" models established in Phase 1 will be instrumental during the case studies to explain the practical drivers and barriers (on both systematic and systemic issues) to affording a more proactive approach of HRM in construction supply chains. The six case studies will be drawn from different stages of typical construction projects – two from early design stage, two from tender stage, and two from construction to handover stage. Furthermore, one prospective case study from each stage will be repeated so that the research team can learn from the issues relating to changes across time. Taken together, Phases 1 and 2 will provide a robust methodology that will contribute to the development of a more proactive approach in HRM for the managing of construction supply chains.

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Relationship Management in the Australian Construction Industry - a Grounded Study

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Abstract: The significance of a link between organisational culture and organisational performance has long been recognised in both mainstream management literature as well as in the construction management literature. Within the construction research domain, the impact of culture and organisation on project performance is becoming an increasingly important topic for the establishment of sound partnering or alliancing, or to what has been referred to increasingly in recent years as relational contracting, in the overall approach to project management. However, studies of the efficacy of alliancing or partnering have so far produced mixed results.

The present study concerns two public sector organisations in Australia, where the interrelationships between organisational culture and structure, commitment and national culture were investigated. The methodology was triangulated; with a detailed questionnaire survey undertaken with both organisations, and with subsequent interviews and case studies carried out for validation. Multivariate statistical techniques were utilised to investigate complex relationships between variables.

This paper reports the perceptions of professional personnel in the public sector organisations, and some mismatches found between organisational structuring and organisational culture. Key issues affecting project performance, and the set of project team characteristics enhancing the development of a collaborative project culture, were found to include continuous commitment from all levels, right mix of people, formal and informal communication, continuous facilitation, education and training in the universities, institutions and industry. The combined outcomes of the research provided a framework of fundamental elements for successful relationship management application.

Keywords: Australia, Organisational Culture and Structure, Procurement System, Relationship Management

1 Introduction

Relationship based approaches are seen as the way forward for the construction industry towards cooperative and collaborative working and true teamwork. Business systems and strategies need to be redefined and move from a short-term project to project culture to a more strategic, long-term perspective (Walker, Hampson and Peters 2000). Numerous reports have been produced in recent years, such as the Tang Report on 'Construct for Excellence: Report of the Construction Industry Review Committee', the Hong Kong Housing Authority report on 'Quality Housing: Partnering for Change', 'Building for Growth' by Australia NatBACC and the Egan report on 'Rethinking Construction'; all indicate the way forward for the construction industry. These reports advocate a move away from adversarial relationships and towards the use of relationship management approaches. However, such approaches require a culture change, a change of mindset.

The problem addressed in this research is the implementation of relationship management through a range of Government projects in Queensland, Australia with a focus on changing attitudes and perceptions of staff of the client (Queensland government). However, the efficacy of alliancing or partnering has thus far not been proven and projects have produced mixed results. This research aims to shed light on the practices and pre-requisites for relationship type contracts to be successful (see for example Bresnen and Marshall 2000a,b,c) and to understand how the interrelationships between national culture, organisational structure, organisation culture and levels of commitment affect an organisation's performance.

2 Research Methodology

Questionnaires, interviews and case studies were conducted in this research in order to validate the results. Both qualitative and quantitative approaches have different strengths and logics, and are best used to address different questions and purposes (Maxwell 1996). The qualitative approach derives primarily from its inductive approach and its emphasis on words rather than numbers. It focuses on specific situations or people. By involving inductive, theory-generating, subjective and non-positivist processes (Lee 1999), the qualitative approach seeks to gain insights and to understand people's perceptions of 'the world', as individuals and as groups (Fellows and Liu 1997).

The research methodology is a grounded, triangulated approach. By using independently collected data, it was possible to verify the thinking of key individuals in the organisations as to the strengths and weaknesses of the systems currently in place. The objective of this research is to investigate the impact of the various cultural variables on project performance, which then allows patterns, in which alliancing contracts work, and other patterns where traditional contracts work, to be defined. The research was carried out by investigating the organisational structure, culture and commitment in two public sector organisations in Queensland, Australia. Key issues affecting project performance were also identified. In order to do so, an audit was performed to find out where the organisations currently stand and questionnaires, interviews and case studies were conducted in order to validate the results. Hence, the results presented here distil the key research issues and findings that came from this research project.

3 Organisational Culture

Task culture is found to be more preferable by the professionals in both public sector organisations. Handy (1985) describes task culture as being best suited to groups, project teams or task forces which are formed for a specific purpose, which very much describes the job nature in the public sector organisations. Individuals in the organisations belong to his/her own project team for each project and are highly likely to work with a different team of people in each project.

Task culture can be found where the market is competitive, the product life is short, and speed of reaction is important. In this instance this fits well with the public sector organisations as the participants generally works as a team, particularly a project team. The individuals form a team, a project team, for specific purpose. The success of the project is judged by results and work relationships within team are emphasised. However, when the results were analysed further it was found that the perceived culture existed within the public sector organisations was a role culture.

Role culture is often found where economies of scale are more important than flexibility or where technical expertise and depth of specialisation are more important than product innovation or product cost. In this context it is apparent in bureaucracy, heavy reliance on procedures and formal authority. The public sector organisations still exist when projects (e.g. schools, residential blocks, hospitals, highway up-grade, road and bridge construction) have finished. Professionals from the public sector organisations would not expect to be abandoned after each project completion.

4 Commitment

The same group of professionals were questioned at the same time on the concept of commitment, using Allen and Meyer's (1990) Affective, Continuance and Normative Commitment Scales. Affective commitment (emotional attachment to the organisation) was found to be a little stronger than continuance commitment (costs of leaving the organisation outweigh the opportunity costs of staying) and normative commitment (acceptance of the organisation's set of values). However, all scores are rather 'middling', indicating a 'non-committal' level of commitment. For the implementation of relationship management to be successful, it is essential for a high degree of support and commitment to the organisation's values, with the benefits and philosophy of relationship management filtered to all levels. This proposition is confirmed by follow-up interviews and case studies.

5 Organisational Structure

Organisational assessment from Van de Ven and Ferry (1980) was used to explore the type of structure prevalent in the public sector organisations and relate this to the nature of the tasks being undertaken by the organisation, with a view to identifying mismatches. The same group of professionals was again questioned, together with a follow-up survey sent to another group of professionals (here-in-after Other Units), who had work relationship with the respondent(s) in the past six months, as identified in the main questionnaire survey.

Van de Ven and Ferry (1980) suggested that organisational units that undertake work at high levels of difficulty and variability adopt what they termed a developmental group mode of structure. Table 1 presents the hypothesised patterns of their three design modes in complex organisations.

Table 1: Hypothesised Patterns of Systematized, Discretionary and Developmental Modes of Structure in Complex Organisations (extracted from Van de Ven and Ferry, 1980, p. 368-9)

	Systematized Impersonal Mode	**Discretionary Personal Mode**	**Developmental Group Mode**
Difficulty & Variability of Tasks, Problems, Issues Encountered by subsystem –	**Low**	**Medium**	**High**
Salient Dimensions of Managerial Subsystem			
1. Organizational Referent	Central information systems	Hierarchy & staff	Coordination committees
2. Coordination and Control by:	Rules, plans, schedules	Exceptions to hierarchy	Mutual group adjustments
3. Resource & Information Flows among Organizational Levels, Units, & Positions:			
a. Direction	Diffuse	Vertical	Horizontal
b. Amount	High	Medium	Low
c. Standardization & Codification	High	Medium	Low
4. Perceived Interdependence among Components	Low	Medium	High
5. Frequency of conflict among Components	Low	Medium	High

A developmental group mode is aimed at creating a programme for handling tasks, problems or issues that have not been encountered before, and/or are sufficiently difficult or complex, which require further work for solutions. It is also suggested that a developmental programme/mode of structure consists of (1) general goals or ends to be achieved in a specified amount of time, leaving unspecified the precise means to achieve them, and (2) a set of norms and expectations regarding the nature of behaviour and interactions among group members. The characteristics mentioned above seem to fit in with both public sector organisations' missions very well. One of the major roles of the organisations is to be part of the project team in a construction project, including being able to react to unforeseeable events that occur during the project, whether these events have natural or man-made causes. It is also common not to have the project thoroughly strategically planned and specified at the outset, particularly when dealing with complex 'multi-clients', as often happens with the organisations. Based on the facts and characteristics described above, a developmental group mode of structure is seen as being the most appropriate structure mode for both public sector organisations.

Based on the results generated from the survey, a similar table was developed to test the hypothesised pattern suggested by Van de Ven and Ferry and the shaded columns in Table 1 represent the findings. Although both organisations were initially expected to follow the logic of developmental group mode of structure, the logic of systematised mode is more closely followed. This again reflects the results from Handy's instrument.

Both public sector organisations have had long relationships with the other parties. The fact that the degree of relationship awareness was rated higher by both groups of Other Units than the organisations might suggest the organisations have overlooked the other parties' knowledge or understanding of the organisations' goals; or perhaps the organisations find the other parties do not truly understand the organisations' objectives and goals. Either way, the public sector organisations should look into their client/contractor management for better understanding of each party's business and goals. Relationship management is about opening up communication and working with goals aligned. There will not be common goals and objectives in a project if members do not openly communicate and discuss each other's objectives for consensus.

When disagreements arise, the most frequently used resolution method was an open exchange of information about the conflict or problem and a working through of differences to reach a mutually agreeable solution. This is confirmed by follow-up interviews with respondents that Australian professionals prefer confronting issues when disagreements arise. A conclusion can be drawn from the findings so far – the Australian culture is very well suited to relationship management. Professionals are not afraid of confronting issues. Instead, this open exchange of information is accepted and very welcome in the construction industry. Open communication is a crucial element in relationship management

The most frequently used communication method by the professionals is telephone calls, followed by face-to-face talks. The quality of communication is found to be average (based on the degree of difficulty of getting in touch and getting ideas across to other party). It is interesting to note that although both public sector organisations and Other Units find it relatively easy to get in touch with the other party, the degree of difficulty in getting in touch and getting ideas across is rated higher by Other Units. This is confirmed by one of the follow up-interviews, an interviewee pointed out face-to-face talks or meetings were an issue between project teams - due to the distance between parties, physical meetings were not feasible and telephone conferences were used instead. With today's technology, one suggestion to achieve some of the benefits of face-to-face talks or meetings is to use video conferencing or Netmeeting© via the internet. Although physical presence is still not possible, these technologies do allow behaviour or body language of the other party to be observed.

Survey findings point out that the higher the degree of difficulty in getting ideas across to Other Units, the more the performance of the organisations is hindered by Other Units and visa versa. This is purely a consequence of the nature of construction in that all works are inter-related. Quality of information flow has always been crucial in the project team. This is again confirmed by the positive correlation between difficulty in getting ideas across and frequency of dispute, suggesting a poor quality of communication often leads to a higher frequency of dispute, reinforcing the relationship between quality of communication and work performance. All of these issues have surfaced as anecdotal evidence in case studies.

Positive correlations are also found between the extent of commitment by both parties, the degree of productive relationship and the relationship satisfaction level, suggesting these variables are interrelated. High commitment from both parties would result in a more productive relationship. During the follow-up interviews, one comment which appeared from time to time is that a high level of commitment from all parties is needed in order for the relationship and the project to be successful. All unsuccessful relationship management/partnering projects have one common theme – lack of commitment from all levels. The significant influence of commitment by project parties on a productive relationship is verified in this survey by the organisations.

Positive correlations are also found with equality of transactions and the extent of a productive and satisfactory relationship. Also, a positive correlation is found between equality of transactions and personal acquaintance, implying the better both parties know each other on a personal basis, the higher the degree of transaction equality. It was pointed out by various interviewees that personal relationships are very important for successful partnering/relational contracting. Parties became more cooperative, problems are discussed rather than disputed, there is positive problem solving rather than confrontation, and there is sharing of information which leads to reduction of risks and unreasonable claims. The observation was reflected by the positive correlation between consensus and resource dependence. The power of informal relations as identified earlier in the survey result is verified.

6 Culture

The Value Survey Model by Hofstede (1980) was used to calculate the cultural values of individual participants. Australian professionals scored low on Hofstede's power distance index, indicating the low acceptance of a hierarchical or unequal distribution of power in organisations. A medium score is perceived in Hofstede's uncertainty avoidance index, suggesting Australian professionals are semi-comfortable with uncertain or unknown circumstances, and would create formal rules and procedures to deal with those situations. The degree of individualism was found high in the same sample, suggesting people would look after themselves and their direct family in preference to seeing themselves belonging to the larger group (organisation), which takes care of their interests in exchange for loyalty. Finally, Australian professionals scored low on Hofstede's masculinity index, implying people tend to sympathise with the underdog, rather than admire the achiever; interpersonal relations, gender equality and interdependence are emphasised.

Both public sector organisations professionals rate personal time, desirable living area and cooperation with team members very important for an ideal job. Cooperation with team members is a fundamental requirement for relationship management. Good working relationship in the project team is one of the main philosophies in relationship management. Australian professionals rated contribution to company's success utmost importance for an ideal job (the most important criteria), yet working in a successful company and the size of the organisation is considered to be not so important or desirable. These results actually indicate a strong linkage with the high score on the affective commitment dimension. Australian professionals have a strong emotional attachment to the organisation, and they also find contributing to the company's success highly important in a job. It appears that Australian professionals and their organisations have a common and positive goal alignment to the company success. In any successful project, it is not uncommon to find 'goal alignment in the project team' as one of the major criteria. Likewise, relationship management might not be implemented as effectively if project team members at all levels have no common goal.

Respondents reported that they do not often feel stress at work. Also, the majority disagree that a large corporation is a more desirable place to work than a small company. These all match well with what Hofstede suggested would be found in an organisation with a low masculinity index. With reference to earlier survey results using Handy's instrument, task culture is preferred by those in the organisation. It is also interesting to note that although

Australian professionals find formal procedures are necessary for project management success, at the same time, they also agree formal procedures may need to be disregarded to ensure successful project completion. According to questionnaire responses and in subsequent interviews, both formal procedures and informal arrangements are considered necessary for the successful management of a project. The majority's view was that relationship management is more successful in projects when it has been made formal in contract documents. This finding gives an excellent example of the importance of embedding informal arrangements in formal mechanisms and again verifies the mismatch between the perceived role culture and the preferred task culture, where Australian professionals are restrained by rules and procedures, with a lack of flexibility.

7 Different Issues at Different Levels

Subsequent interviews and case studies show that at the inspector/foreman level, the issue in the relationship is getting the job done. At the engineer level, the issue is quality and claims, and keeping the job moving. However, the engineers are not empowered to make final decisions such as claim issues, and are sandwiched between inspectors/foremen and superintendent/project manager. The main focus for the individuals is actually the quality of work life and, similarly to inspectors/foreman, getting the job done. At the superintendent (representative)/project manager level, the major issue is performance measures and claims, and contract administration. Lastly, at the principal/director level, the major issue is strategy and claims management. It can be seen that the relationships within the project team are focused on very different issues at these four different levels. The benefits of relationship management need to be recognised at all levels for it to be applied effectively. On the other hand, the relationship management process needs to be set up in a way that would benefit the project team.

8 Role of Facilitator

The role of facilitator is crucial in the relationship management process. However, the cost of employing an external facilitator is also very high, which subsequently affects the frequency of the facilitator's involvement in the process. Most participants felt that the facilitator should be a neutral party to the project but there are situations where one or other party has supplied a facilitator and the process has been successful. Either employing a third party as a facilitator or a contractor supplying his/her own facilitator are scenarios which can work successfully.

9 Education and Training

During interviews, it became apparent that the endorsement of the relationship management arrangement depends mostly on the client body. Clients must be educated to recognise the benefits of relationship management. They must be weaned away from the practice of letting projects to the lowest tender submission. They must have the right attitude towards relationship management; and must acknowledge that the contractor is entitled to a reasonable profit. The perception of relationship management as a one-off approach was also observed. Relationship management should not be seen as a one-off approach which can be switched on and off as necessary. It is in fact an overriding philosophy and a sea-change in the industry's culture, leading to changed attitudes and collaborative, proactive project management. There is a need to promote the concept of relationship management as ‘business as usual’ and effectively drag the industry into a new era. This is an education and training issue that needs to be addressed at trades and tertiary/professional levels; and needs to be driven by the involvement of the construction industry groups – clients, contractors’ and suppliers’ associations, professional institutions and consultants associations.

10 Conclusions

This research has investigated the impact of the various cultural variables on project performance. The basic concepts and variables relating to cooperation, collaboration, organisational issues and performance were examined through questionnaire survey and follow-up interviews with survey respondents. Cultural barriers to change exist at both management and operation levels. There was a mismatch in both departments between the organisational culture as perceived by the professionals and the organisational structure that was being implemented. Professionals in the departments preferred working in a task culture, but in fact they were working in a role culture. Matrix organisation is particularly suitable to construction project environment (Bresnen 1990, Rowlinson 2001), and such an organisation will only work effectively with a task culture. In the Hong Kong study conducted by Rowlinson, the mismatch between the actual organisation culture and organisation structure is one of the factors that created barriers against implementing changes in the department (Rowlinson 2001).

Relationship management suits the Australian culture very well. Professionals were not afraid to express their ideas or disagreements. Direct confrontation between individuals was accepted and preferred for collaboration as well as conflict resolution. Australian professionals have strong individualist attitudes; open discussion of matters is preferred, which has an implication for decision-making styles and problem-solving techniques. Further support for this argument is the finding that being consulted by one’s direct supervisor is very important. Australian professionals are not afraid to express disagreements with their supervisors. However, uncertainty avoidance was an issue that might impact the efficiency of implementing relational contracting. Ineffective rules and procedures might be imposed to satisfy people’s emotional need for formal structure. This study has demonstrated Australian professionals prefer a flat organisation structure and have a strong desire for decentralisation, yet also a medium level of formality. Professionals from both public sector organisations were actually working in a role culture and systematised structure mode. Although having roles clearly specified assists the relationships between parties, excessive formalisation, rules and procedures do not necessarily contribute to relationship productivity and might in fact have a negative effect on the decision-making process. Decision-making processes were prolonged due to extensive layers of procedures that affected work efficiency. The importance on having both formal and informal mechanisms in place was highlighted in the study.

Findings showed that should one’s level of commitment increase, the other party’s commitment level would also increase significantly. Strong support and commitment from project parties is crucial for project success and implementation of changes. Also, findings showed that the more the parties are satisfied with their relationships, the more productive their relationships would be; and both levels of relationship satisfaction and productivity would increase with the degree of personal acquaintance. Australian professionals strongly agreed personal relationships are important in managing projects. The importance of personal relationship in the project process is agreed by the respondents and shown in statistical analysis.

Low to medium levels of commitment were found in the professionals. Commitment to the goals and objectives of an organisation is crucial in facilitating successful implementation of relational contracting. As noted earlier, one party's commitment levels have a significant effect on the others'. It is suggested the degree of match and mismatch between organisation culture and structure has an impact on the staff's commitment levels.

The advantages and importance of face-to-face and continuous open communication were identified in both the survey and interviews. However, finding time for communication seemed to be a major problem. This is clearly an issue the organisations need to investigate. The effect of communication quality and frequency on parties' relationships was clearly shown in this study, and the professionals clearly stated better communication is needed. This is obviously an issue both organisations should address promptly.

Relationship management should not be seen as a one-off approach which can be switched on and off as one wishes. It is an overriding philosophy and sea-change in the industry culture. Concepts of relationship management should be promoted as 'business as usual'. Relationship management needs to be constantly maintained and facilitated to retain effectiveness. Relationship management maintenance and review process should be set up before a project begins. Facilitation is needed to enable open, blame-free communication and this facilitation must be ongoing throughout the life of a project. The role of facilitator in achieving a relational contracting culture is highlighted in this research.

Project parties need to be familiar with relationship management principles and relationship management in practice for effective integrations. This brings us to the last conclusion of this research, that education and training is an imperative element for achieving effective relationship management application. Relationship management culture must be championed in organisations through in-house workshops. Relationship management culture and correct principles should be embedded in people's mindset at an early stage. This research suggests the relationship management concept should be promoted through continuous training and education in universities and institutions.

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Developing and Implementing a Performance Measurement System for Benchmarking in Construction Companies through Collaborative Process

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Abstract: This paper describes the preliminary results of a research project in which a performance measurement system for benchmarking in the construction industry was devised and implemented, through a collaborative process. The aim of this paper is to describe the collaborative process, which was carried out with a group of construction companies and also to analyse the changes obtained by some of these companies from the perspective of their learning focus, which refers to the learning was concentrated on improvements in work procedures (incremental changes), the identification of new insights or knowledge (adaptive changes) or changes in existing principles (innovative changes); and the skill development focus, which assess weather the learning was achieved by the individual, a group of people or included the organisational as a whole. This study was developed using action research as research strategy. The findings indicated that Benchmarking Club had the role of inductor of the learning process, encouraging the transfer and adaptation of knowledge to the companies' local conditions. From one hand, the results showed that the learning focus limited from incremental to adaptive changes, not achieving innovative changes, on the other hand, the collaborative process can enable the achievement of organisational learning instead only individual or group learning.

Keywords: Benchmarking, Knowledge Transfer, Organizational Learning, Performance Measurement

1. Introduction

Despite its importance, performance measurement has not been widely implemented in construction companies. As a result, information on the performance of the construction industry as a whole tends to be scarce. This is related to a great extent to the attitude and lack of training of managers (Formoso and Lantelme, 2000). Moreover, some construction companies have too many measures, most of them linked to supporting rather than critical process, which are the key processes that the company has to control (Costa and Formoso, 2004). This tends to make it difficult for the company staff to understand what should be the priorities and also to define the key indicators that should be used for comparison with other companies (Schiemann and Lingle, 1999). The effective implementation of performance measurement systems is not simply a matter of selecting the right measures. It also implies a much deeper change in the decision-making processes and the learning approaches adopted in the organisation (Formoso and Lantelme, 2000).

Aiming to break some of these barriers for the implementation of a performance measurement process in the construction companies routine, the benchmarking process can be used as a strategy not only for data comparison, but also for knowledge sharing and acquisition, being a key step to promote organisational learning (Garvin, 1993; Dibella et al., 1996 and Drew, 1997).

Traditional concept of benchmarking refers to a continuous, systematic process of evaluation the products, services and work procedures of organisations that are recognized as representing best practices for the purpose of organisational improvement (Spendolini, 1992). This traditional concept emphasises a competitive benchmarking, which is conceived as a measure to assist the gaining of superiority over others. Thus, the main relationship is competition or rivalry, the actions used to be unilaterally and voluntary, and also the metaphor is the reference point or standard (Wolfram Cox et al., 1997).

However, the benchmarking process has been developed not only using a traditional competitive approach, but also using a collaborative approach (Wolfram Cox et al., 1997). Collaborative benchmarking refers to a group of firms, which share knowledge in a particular activity, all hoping to improve based upon what they learn (Boxwell, 1994). The aim of a collaborative benchmarking is learning with others rather than gaining position over them, the dominant relationship is joint collaboration and partnership rather than competition, and there is discussion among members, considering the factors which affect the group as a whole (Wolfram Cox et al., 1997).

In the construction industry, there have been several initiatives in different countries, such as USA, UK and Chile that resulted in Benchmarking Clubs (Constructing Excellence, 2004; Grillo and Garcia, 2003). These can be defined as forums for individuals to learn from best practices, while creating a local support network for continuous improvement (Constructing Excellence, 2004). In general, those initiatives involve a set of similar companies that compare results and share practices. However, in none of the existing initiatives, the knowledge transfer and the knowledge creation have been properly investigated in the benchmarking process.

The process of understanding the practices and its application in a local context depends on how the transfer of knowledge happens (Lillrank, 1995). The same author suggests that practices can be more effectively transported across different contexts and cultures if they were first translated into abstract ideas. However, the level of abstraction is affected by the complexity of the system or idea itself. For Lillrank (1995), complexity refers to the number and types of social interfaces, as well as the tacit nature of the knowledge embedded in management practices (Lillrank, 1995). Large elements of tacit knowledge in a business process add significantly to the difficulties of doing benchmarking (Drew, 1997).

Therefore, the knowledge gap identified in the performance measurement and benchmarking area is the need to motivate knowledge creation and organisational learning in companies participating in the benchmarking process, mainly, concerning the transfer and internalisation of the knowledge acquired during this process. In this study, organisational learning is related to individual and organisation performance improvements (DiBella et al., 1996) and involves both cognitive and behavioural changes with the organisation (Tsang, 1997). According to Sweringa and Wierdsma (1995) and Argyris and Schön (1995), the learning process happens through cycles. The single loop refers to improvements in work procedures, the double-loop refers to the identification of new insights or knowledge and the triple-loop refers changes in existing principles (Sweringa and Wierdsma, 1995). For Argyris and Schön (1995), the single-loop learning involves incremental changes within an existing framework and the double-loop involves transformative changes and the testing of underlying assumption.

This paper describes the preliminary results of a research project in which a performance measurement system for benchmarking in the construction industry was devised and implemented. This initiative started in April 2004 aiming to create an environment for encouraging learning among the group of construction companies. It consists of a collaborative process between several construction companies, which form a benchmarking club. The aim of this paper is to describe the inter-organisational collaborative process and also to analyse the changes obtained by the companies from the perspective of their learning focus and skill development focus. This study is part of a PhD research project, which aims to develop a model to do a collaborative benchmarking process among construction companies aiming to create knowledge and organisational learning.

2. Research Method

This study involved the development of an action research empirical study, involving a group of 20 construction companies from the State of Rio Grande do Sul, Brazil, most of them from the residential, commercial and industrial building markets. This paper focused in the first two cycles of the benchmarking club: (1) the development and implementation of the Performance Measurement System (PMS) for Benchmarking; and (2) the sharing of good practices and results of indicators among companies (Figure 1).

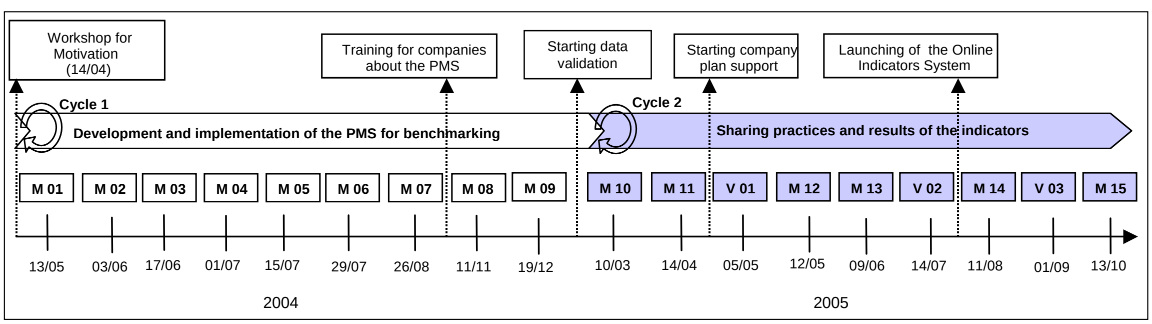

Fig. 1 –Development of the Benchmarking Club

The first cycle aimed to define the set of measures for benchmarking and to motivate the companies to implement this system. Moreover, the creation of the benchmarking club aimed to promote to the companies an environment for sharing. Firstly, a workshop was organised aiming to present the research proposal to the local construction companies and also to encourage some of them to participate in the research. After that 18 construction companies decided to participate in the research. Seven meetings involving both representatives of the companies and members of the research team were carried out to define the set of measures. In each meeting a sub-set of measures was discussed, including their objectives, formulae, and data collection as well as analysis procedures. The final version of the set of measures was defined in the end of August 2004. After that, a training course was provided for the companies' staff involved in the implementation of performance measurement. In October 2004, the companies started the implementation process, and two more meetings were carried out aiming to discuss this implementation.

The second cycle operated from March to October 2005. It aimed to establish a sharing learning environment, motivating the knowledge transfer. In this cycle, fourteen construction companies participated. Twelve of these companies also participated in the first cycle. The companies shared results and practices in the Benchmarking Club, through monthly meetings. Three of them were carried out in the construction sites of member companies. In these meetings, some themes were discussed, such as health and safety, layout and logistic of construction sites, cost management, as well as good practices in the implementation of the performance measurement system for benchmarking. There was always an attempt to link the practices discussed to the benchmarking measures.

In both cycles, a facilitator, the main author of this paper, led these meetings and visits. The main data used to analyse this part of the research came from the reports, which were written in the end of each meeting, describing the main discussions and the decisions taken. Moreover, in the second cycle, the meetings were recorded, aiming to observe the behaviour of the group. And also, at the beginning of the meetings, handouts with questions were provided to be answered by the audience during the meeting.

Moreover, a project website was developed in which data could be directly input by the members companies and they could access project reports and graphs which were based on the existing database. Besides, those companies could also access in this web site all documents developed during the meetings of the benchmarking club, such as procedures, reports, presentations and pictures of the construction sites. Finally, a validation procedure was implemented in order to assess the consistency of the data sent by the companies.

Also, further data was collected in companies during these two cycles, aiming to identify the evolution in the implementation of the measures and managerial practices, as well as to identify weather the companies created knowledge and developed a learning process due to the participation in the benchmarking club. The main sources of evidence were interviews, measurement reports, meetings for data analysis in companies, the database of the project, and a structured questionnaire.

Four of the construction companies, which participated in the two cycles, were selected to be analysed concerning their learning achievement. Three of these four companies (Company 07, Company 11, Company 13) were chosen because they had progressed a great deal in terms of implementation of the PMS regarding to their initial stage at the beginning of the research. The Company 03 was selected because despite the engagement of their members, they had several difficulties to transfer knowledge to the organisation. The other companies were analysed according other construct, which are not the focus of the present paper. Table 1 presents the main characteristics of the four companies involved in this analysis.

This paper presents some preliminary analysis concerning two aspects: (a) **the collaborative process among the companies**, which refers to analysis of the actions and behaviours observed in the meetings, and (b) **the changes inside the companies**, which was analysed concerning the **learning focus**, which refers to learning was concentrated on improvements in work procedures (incremental changes), the identification of new insights or knowledge (adaptive changes) or changes in existing principles (innovative changes); and the **skill development focus**, which assess weather the learning was achieved by the individual, a group of people or included the organisation as a whole. Table 2 presents the constructs, the variables and sources of evidence used in this analysis.

Table 1 - Characterisation of the companies

Company	Main Activities	Main Characteristics	People directed involved in study
03	Development and construction of residential buildings for higher-middle class in Porto Alegre-Brazil	Middle size company. All labour subcontracted. Performance measurement system started in 2003, and it has not been linked to the critical process.	Planning Manager Project Manager Budget Manager
13	Development and construction of commercial and industrial buildings for private clients in Porto Alegre-Brazil	Small company. Most labour subcontracted. ISO 9001 certification Performance measurement system started in 2003, due to the quality management system.	Top manager Trainee in Civil Engineering Coordinator of Quality
07	Development and construction of residential buildings for higher-middle class in Porto Alegre-Brazil	Middle size company. Most labour is subcontracted. ISO 9001 certification. Received several Quality Awards. Performance measurement system started in 2002,due to the quality management system.	Production Manager
11	Development of residential building projects for higher-middle class in Greater Porto Alegre-Brazil	Small company. All own labour. ISO 9001 certification Performance measurement system started in 2003, due to the quality management system.	Trainee in Civil Engineering Coordinator of Quality

Table 2 – Constructs, variables and sources of evidence

Constructs	Variables	Sources of evidence
Collaborative process among companies	- Practices and measures which were discussed - Sharing of experiences and practices - Engagement of the members	- Research observation concerning the intensity of the exchange of practices and experiences. - Presentations of the members in the meetings - Oral reports of the use of information - Entrance of new participants in the meetings - Participation of the members (active or passive) - Members observation regarding to the effectiveness of the benchmarking club
Learning focus and skill development focus	- Changes in the structure of the measurement system - Changes in the application/development of the managerial practices - Changes in the members behaviours - Barriers to implement the changes in the PMS and the practices	- Research observation regarding to the use of the information which were available in the meetings by the companies - Oral reports of the use of information - Members observation regarding to the review and implementation of the performance measurement system and managerial practices - Measures data collected by the members of the club.

3. Results

3.1 The Collaborative Process in the Benchmarking Club

The benchmarking club was composed in the first cycle by top and middle level managers from small and medium construction companies, and in the second cycle by lower and middle level managers of these companies. The club had monthly meetings, which favoured the development of mutual respect and trust. The difference in the participant members in the two cycles is related to the aim of each different cycle. In the first one, the aim was the development of PMS, which involved strategic decisions. In the second cycle, the aim was the sharing of practices and results related to the PMS, which were more operational activities. One aspect of this benchmarking club is that the members were engineers or architects and they also had similar experiences, working at residential, commercial or industrial building markets.

The development of the PMS for benchmarking in the first cycle was the main problem and common interest for the members of the companies. One positive result of this first cycle was the participatory process that has taken place in the definition of the PMS. Through the meetings, the companies participated in decisions concerning the choice and definition of measures, including the negotiation of data collection criteria. The representatives of the companies involved understood well the set of measures and they were aware of the relevance of each measure. As a result, they created together a system, which was the expression of what they would like to measure and compare. In this first cycle, the companies started the sharing process of ideas and practices, because for the definition of each measure, the members showed their experiences and opinions about the subject discussed. Moreover, the sharing of practices started the learning process among the participants related to the use of measures.

After the definition of these measures, the club was maintained, but the purpose was widened. In the second cycle the initial problem was the implementation of the measures aiming to compare results and practices. However, due to the different types of measures that were selected, the companies had different specific interests related to the best practices. Therefore, in each meeting a theme was discussed.

In the second cycle, three milestone were identified in the club, which characterised different levels of development, as following: (a) the familiarity of the club; (b) the development of the club: (c) the dropping of the club. In the first three meetings, which were related to the familiarity of the club, the members were not very active, and they also had some difficulties to talk openly about the problems of the companies. Along the three meetings, a gradual engagement of the members was observed.

The second milestone was associated to the development of the club, and a better engagement of most members was observed, mainly because they showed that they were improving their PMS and also, they were trying to implement new practices observed in the previous meetings. An important aspect was observed concerning the different levels of maturity in performance measurement of the participating companies, which influenced the sharing of ideas and practices, promoting unbalanced sharing of information. By contrast, in the first cycle of the benchmarking club, this difference was not very important because the discussion was about the definition of the measures at a theoretical level, and most of members had similar experience and technical knowledge to discuss it. Due to these differences, there was a need to identify some strategies to keep the top companies motivated in participating in the club, and also some strategies to stimulate the companies, which had more difficulties to implement the measurement process to speed up their measurement system development. For example, an individual support for the implementation of performance measurement was offered to these developing companies.

The third milestone can be related to the perceptible drop in the members' engagement in the club. According to the data collected in the companies by meetings and interviews, one of the reasons is that despite the connection between the best practices and measures, so many themes to be discussed were not satisfactory. The companies did not have enough time to understand and abstract all practices discussed and also to transfer them to their internal context. Furthermore, based on the interviews and the researcher observation, some other reasons could be linked to this drop, such as: the little engagement of some top managers, the participation of only one member for company, the differences in the maturity of the PMS of some companies and, finally, the lack of active participation of some members of the club.

During the second cycle of the benchmarking club some interviews were carried out aiming to identify the impacts of the club in the companies. From the point of view of the interviewees, the Benchmarking Club was very important because it promoted a consolidation, adaptation as well as a development of their own PMS, including a more effective implementation of practices related to performance measurement. Moreover, the members listed several benefits in participating of this club, which included: identification of their problems and better view of their performance; acquisition of new knowledge by observing and participating of other experiences and other practices; the possibility of comparing performance; culture of performance measurement; interaction with other companies; as well as qualification of managers for measurement and implementation of new practices.

3.2 Use of Measures and Practices for Promoting Changes

In the analysis of four companies, the results showed different types of organisational learning and changes due to their participation in the benchmarking club. Also, the companies had different barriers to do the benchmarking process and to promote changes based on the knowledge acquired.

It was possible to identify that the learning focus of the participants in the benchmarking club are related to incremental or adaptive changes in their own performance measurement system, and also some incremental changes within existing practices related to the measurement process due to the information discussed in benchmarking club.

Incremental changes were more evident in Company 03 and Company 13, because the focus was the revising and improving of several indicators and the setting of routine procedures. So far, there were still some basic problems of implementation to be solved, such as little use of measures to strategic, middle and low level decision-making; centralisation of data collection, processing and analysis; and ineffective communication of results. The lack of the implementation of these measurement practices suggests that the changes achieved were related to improvements in work procedures, what express single loop learning. Single loop learning means that the organisation seeks solving problems according to the companies' own values and norms (Argyris and Schön, 1995). The changes promoted are at the improvements level, and the questions related to the changes refer to "how", instead of waiting to know the real reason (Sweringa and Wierdsma, 1995).

Company 07 and Company 11 used the previous structure as bureaucratic task, aiming mainly to achieve the requirements of the ISO quality certification. During the process, Company 07 and 11 sought to ask themselves about "why the old structure was not working properly", and thus, they discussed new principles to select and implement the measures. These changes were encouraged through observation and sharing of experience in the benchmarking club. The members interpreted the information meaning, and they sought to find ways to apply the knowledge in their realities. They also used their previous experiences both from the point of the person and the company. So, it was observed the knowledge transfer, the understanding of this knowledge and its application according to the organisational structure and culture a well as their managerial systems.

Therefore, Companies 07 and Company 11 developed and implemented new methodologies for performance measurement. Through the process of implementing the PMS, individual and group cycles of knowledge creation were observed in both companies. They achieved higher loops of learning, adapting knowledge according to the exist principles due to the experience of the club. The changes achieved were related to the identification of new knowledge and insights, which mean double loop learning.

From the point of view of the practices discussed in the second cycle of the club, the companies had improvements in their production procedures. For example, all companies improved their construction sites, mainly by using the results of the Site Construction Best Practices Indicator. Furthermore, all companies implemented boards showing the results of the production indicators aiming to communicate information and also to increase the engagement of the subcontractors.

The companies were simply copying the managerial practices observed in the meetings and visits to the construction site. In reality, this kind of operational practices do not require a higher level of abstraction, because they are very concrete and real. Also the companies are already familiar with such experiences. Therefore, these types of practice discussed and observed during the second cycle were different from the practices concerning the measurement process, which required more strategic thinking. Consequently, this confirms what Lillrank (1995) states that the level of abstraction depends on the type of the knowledge transfer, and it will influence the achievement of different learning focus.

Different ontological levels of learning in the skill development focus were observed. In Company 03 and Company 13, there was an indication of individual learning. But, so far, there is not enough evidence of group learning or organisational learning. Each member individually learned about PMS, encouraged by the benchmarking club, and also they were engaged in promoting routine improvements in their PMS and managerial practices. However, these managers did not develop general capabilities required to share knowledge effectively, such as low and middle leadership and communication of ideas.

The results of Company 11 indicated that the representative of the club had an important role in the process of transferring knowledge. This representative, individually, sought to understand and apply the knowledge acquired, promoting the first cycle of knowledge adaptation at individual level. At the moment that that knowledge made sense for him, he shared the knowledge acquired as well as the knowledge already applied for the managerial production team. This group, in turn, created and adapted new knowledge and also applied it, thus promoting the second cycle of knowledge adaptation at managerial production team level. A similar case happened with Company 07, but they achieved one more cycle of knowledge adaptation, thus disseminating the new methodology developed for the company as a whole.

Therefore, it was observed the conversion of isolated experiences of the individual concerning measures and practices into an experience in which the managerial production team is using, in the case of Company 11, and the companies as a whole is using, in the case of Company 07. The main evidence is concerning the internalisation of the PMS in company routine and the actions, which were taken to improve the process based on the results of the indicators.

Figure 2 presents a matrix of learning level in the four companies. The horizon dimension refers to the skill development focus (individual, in a group and organisational) and the vertical dimension is the learning focus (incremental changes, adaptive changes and innovative changes).

Companies 03 and Company 13 only achieved the first step of the learning process, because the knowledge acquired were the domain of the representatives of the benchmarking club and the changes promoted limited to incremental routine improvements. Company 11 achieved a second step of the learning process, promoting adaptive changes and transferring the experience for a group. Finally, Company 07 also achieved adaptive changes, but they promoted changes in the organisation as a whole, showing the best result in this study. Unfortunately, none of the companies achieved innovative changes, which was one of the propositions of the research.

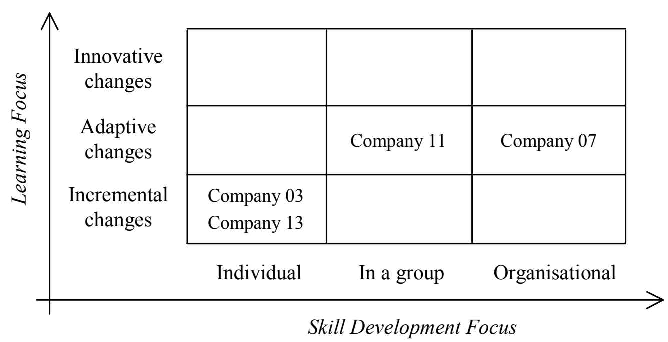

Figure 2 –Learning level achieved in the collaborative process

Two positive aspects in knowledge transfer from the individual to the organisation were identified. The first aspect was the effective involvement of the managers (representatives of the benchmarking club), because they had the role to lead the implementation, taking action and promoting an effective communication of ideas to other managers Therefore, the low and middle managerial leadership was a critical aspect in the benchmarking process because it involved the personal capability to absorb the knowledge available in the club and transfer it to the organisation. The top managers also had a key role in the knowledge transfer, because they had the responsibility to approve the changes proposed, and also because they should provide the adequate resources to allow the project run effectively, thus encouraging the involvement of people at different level.

4. Conclusions

The preliminary analysis of the results showed that the club encouraged a collaborative benchmarking process, which aimed mutual learning. The club had the role of the inductor of this learning process with others, motivating the transfer and the adaptation of the knowledge acquired in the club to the companies' environment. Through the formation of the Benchmarking Club as well as the exchange of practices, the companies found a favourable environment to incorporate and internalise the use of performance measures, focusing in the use of the measures in their routine.

One of the success factors is the existence of a common problem among the companies, which they desired to discuss and to solve it. In the case of the present study, the common problem was the design and the implementation of a PMS for benchmarking. Moreover, the company realised a mutual gain in their participation, and the members realised that they had a role to lead the process of knowledge transfer in the companies.

This kind of approach motivated the members to transfer the explicit knowledge acquired to their local context. This explicit knowledge was adapted and internalised according to the companies needs. However, the conversion of knowledge is both a technical and a social process. Consequently, the path and the scope in which this knowledge moves throughout the organisation depended on the importance of the process for the company, the involvement of the members, but mainly, the extent to which the company is willing to promote changes. Moreover, for the consolidation of the knowledge transfer, the companies still need to develop internal mechanisms to facilitate the communication of the new knowledge, motivating the understanding and further application. Also, the companies should identify the individual and organisational capabilities need to learn and to create knowledge.

This paper presented a preliminary analysis, being necessary further analysis aiming to have a real understanding about the knowledge creation process in the companies, which participated of the benchmarking club.

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Conceptual Challenges to Studying the Implementation of Policy Innovations in Public Sector Construction Procurement

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Abstract: This paper reports on a PhD study in the field of public sector construction procurement that addresses the shortfall of academic research into changing procurement policies. The PhD research specifically focuses on the implementation of policy innovations in public sector construction procurement. The aim of the paper is not to present an in-depth analysis of particular policy innovations or interim research findings, but to present a discussion of key conceptual and methodological design issues that are central to studying the implementation of policy innovations in public procurement. The paper argues that research questions that focus on both the process of innovation and contextual factors that influence implementation are necessary to holistically examine the implementation of policy innovations, and that the case study is the most suitable research strategy to pursue the research purpose. Design of case studies to investigate the implementation of policy innovations in public procurement is not straightforward and several of the conceptual challenges that had to be overcome in this research are shared in this paper. The issues highlighted in this paper serve to improve the conceptual rigour of research investigating the implementation of policy innovations in public procurement and also increase the likelihood that such research can contribute a deep understanding of policy innovation implementation for the benefit of both public procurement theory and practice.

Keywords: Conceptual Paper, Implementation, Innovation Process, Policy Innovation, Public Procurement

1. Introduction

Public sector construction procurement in the UK has been subject to several major changes over the last two decades. One change has seen successive governments develop a more strategic approach to public procurement by emphasising the need for partnership relations with key suppliers (Erridge and Greer, 2002). More recently, public procurement in the UK, as across the globe, has also been seen to move towards a greater policy role (IRSPP2, 2005). However, despite these strategic shifts in public procurement, and despite considerable effort from government entities and procurement practitioners to improve procurement practices, public procurement has been a neglected area of academic research (Thai, 2001).

This paper reports on a PhD study that is being undertaken to partially address the shortfall of research in the area of public sector construction procurement and the lack of academic investigation into changing procurement policies. The PhD research specifically focuses on the implementation of policy innovations in public sector construction procurement. This paper presents a research strategy that has been designed to investigate the process of implementing policy innovations in procurement. It is not the purpose of this paper to provide an in-depth analysis of particular policy innovations, but instead the paper presents a wider discussion of conceptual and methodological design issues that are central to studying the implementation of policy innovations in public procurement.

The next section of the paper discusses in more detail the overall aim of the research to investigate the implementation of policy innovations in public construction procurement. This section is followed by a discussion of the two major research questions used in this study. A complimentary relationship between the two research questions is revealed. In the subsequent section of the paper the nature and characteristics of these research questions are shown to influence the choice of the case study as the research strategy used in this study. In Section 5 of the paper key conceptual challenges that were faced in the design of case studies are shared.

2. Research Purpose

A policy innovation in this research is characterised by the following statements:

- A policy innovation must be an implemented policy, process or practice;
- A policy innovation must be new to the unit of adoption within which it is introduced (e.g. project team or public sector client);
- A policy innovation must be more substantial than routine or trivial policy change;
- A policy innovation must be aimed at producing benefit for individuals, projects, organisations, or wider society.

In order to realise the expected benefits of policy innovations in procurement the innovations must be successfully implemented. However, implementation of innovations is not straightforward and many organisations often fail to realise the expected benefits of the innovations they adopt. Indeed, organisational researchers have increasingly identified implementation failure, not innovation failure, as the cause of many organisations inability to achieve the intended benefits of the innovations they adopt (Klein and Sorra, 1996).

The broad purpose of this research therefore is to consider the *implementation* of policy innovations in public procurement. This subject is of relevance to procurement practitioners who want to know how to implement effectively and successfully put innovative ideas and policy initiatives into practice. The value of research on implementation is enhanced by notable research gaps. Firstly, the current innovation literature offers little practical guidance to those who want to influence innovation in organisations (Meyer and Goes, 1988; Wolfe, 1994). Secondly, although innovation implementation has been argued to be the crucial innovation stage that researchers should seek to explain for a long time, the lack of research studying implementation has been persistently criticised (Downs and Mohr, 1976; Meyer and Goes, 1988; Tornatzky and Klein, 1982; Nord and Tucker, 1987; Wolfe, 1994; Klein and Sorra, 1996; Clayton, 1997). Adoption has traditionally been the central event investigated in innovation studies (Wolfe, 1994), often at the expense of the crucial implementation activities that are argued to have much more to do with innovation success (Tornatzky et al., 1983).

3. Research Questions

The two primary research questions chosen for this study aim to extend understanding of how policy innovations can be successfully implemented in the context of public procurement. The questions concern the process of implementing policy innovations in public procurement and the contextual influences that enable or constrain the implementation of policy innovations:

1. What processes do public sector clients go through in implementing policy innovations in public procurement?

2. What factors influence the implementation of policy innovations, at which points in the procurement process, and in what manner?

The first research question is related to the process of innovation and seeks to identify temporal events and sequences of activities that are crucial to the successful management and implementation of policy innovations. This question reflects a growing interest in innovation processes and the need to understand how and why events unfold over time as individuals, groups, and organisations innovate (Van de Ven and Poole, 2002). Such process questions have been labelled fundamental to gaining an appreciation of dynamic organisational life and to developing and testing theories of organisational innovation (Van de Ven and Huber, 1990). However, some researchers have identified that despite a high level of theoretical interest in the process of innovation there have been a scarcity of empirical studies on the subject (e.g. King, 1990; Van den Ven and Poole, 2002). Empirical research into the innovation process is necessary in this study because the implementation of policy innovations is a process and the innovation context of public procurement is also a process-based activity.

The second research question concerns influences on the implementation of policy innovations. This question is related to determinants of innovation research and similar research questions have been posed in many previous research studies in order to identify factors that have positive or negative on innovations (e.g. Kimberly and Evanisko, 1981; Meyer and Goes, 1988). However, it is unusual for the research studies that investigate factors influencing innovation to pay attention to the process of innovation. This has resulted in weaknesses being identified in a great proportion of determinants of innovation research (King, 1990; Clayton, 1997). Failure to focus on the innovation process when investigating influences on innovation limits the value of innovation determinants research because of the so-called ‘innovation-dilemma’ (Zaltman et al., 1973). The notion of the innovation-dilemma suggests that the positive or negative influence of determinants on innovation is dependent upon the stage of the innovation process being considered. And this means that the same factor that might facilitate innovation at one stage of the innovation process could inhibit innovation at another stage. For example, organisational complexity might have a positive influence on innovation at the adoption stage and a negative influence at the implementation stage of innovation development, or alternatively centralisation of organisations might negatively influence adoption but positively influence implementation of innovations later in the innovation process.

The existence of the innovation-dilemma means that undertaking research into factors influencing innovation without due consideration to process would on its own be inadequate.

When the innovation process is ignored, or there is ambiguity or inconsistency concerning innovation stages, the potential risk for obtaining contradictory research results is high (Wolfe, 1994). To address this issue it is therefore necessary to identify influences on innovation as the innovation process unfolds. This requires the integration of process and determinants of innovation approaches. Given this argument it is possible to see a complimentary relationship between the two primary research questions proposed in this study. Answers to both questions are required to understand the implementation of policy innovations in public procurement. Identification of innovation implementation processes in response to the first question would be of little use to practitioners without answering the second research question. Similarly attempting to understand the influence of different contextual factors on innovations would be futile without considering the innovation process.

4. Research Approach

This following section demonstrates the alignment of the working research methodology with the research purpose and research questions established above. An interpretive philosophical perspective was considered most appropriate to investigate the dynamic nature of policy innovation implementation in the complex social context of public procurement. It has been argued that scholars studying change and innovation processes in complex social environments face inherent difficulties in researching usually imperceptible aspects of social reality and explaining the "dynamics of deep structures" (Poole and Van de Ven, 2004). An interpretive orientation is suitable because complex and uncertain innovation processes that occur in complex social settings are best understood from the point of view of the actors involved (Van de Ven and Rogers, 1988).

The interpretative approach of this research requires a research strategy that enables in-depth study of the implementation of policy innovations from the frame of reference of the social actors involved, as the procurement process unfolds. The case study was chosen as an appropriate research strategy to achieve this. Numerous scholars have maintained support for the use of case studies to further the field of innovation research and the generation of new theory and propositions (Tornatzky et al., 1983; Nord and Tucker, 1987; Van de Ven and Rogers, 1988; Van de Ven et al., 1989; Rogers, 1995). Indeed several case studies have been celebrated for making major contributions to the innovation knowledge base (e.g. Burns and Stalker, 1961; Yin, 1981; Pettigrew, 1985; Leonard-Barton, 1988).

The rationale for adopting the case study approach to investigate the implementation of policy innovations in this study is further enhanced by both the implementation focus and process focus of this research. The scarcity of accumulated knowledge about innovation implementation has encouraged several researchers to argue that in-depth studies of individual cases are the most appropriate method to begin knowledge building (Gross et al.1971; Nelson and Yates, 1978; Yin, 1981; Nord and Tucker, 1987). Meanwhile, from an alternative perspective the process nature of innovation has encouraged other researchers to promote the suitability of case studies to study innovation ahead of other methods like cross-sectional studies, which have been criticised for their lack of attention to process aspects (Becker and Whisler, 1967; King; 1990; Rogers, 1995; Clayton, 1997).

Yin (2003) proposes three conditions to distinguish if the case study is a suitable research strategy: when 'how' or 'why' questions are being posed; when the investigator has little control over events; and when the focus is on a contemporary phenomenon that is not easily distinguishable from its context. All of Yin's (2003) conditions apply to this study and thus validate the selection of the case study as an appropriate research strategy. The first research question addressing the innovation processes that clients go through in implementing a policy innovation in procurement is a 'how' type question. In the case studies of public procurement under investigation the investigator has no control over events and the case studies focus on current live procurement processes and not completed construction projects.

5. Challenges Faced in Case Study Design

Following selection of the case study as a suitable research strategy, design of the case studies is required. The development of research designs is a difficult part of doing case studies (Yin, 2003). In this study the complexity of investigating the contemporary phenomenon of policy innovation implementation as the procurement process unfolds, created many challenges for designing rigorous and conceptually sound case studies. This section of paper discusses some of the major conceptual and methodological challenges that have impacted on the design of the case studies in this research.

5.1 Undertake Research Before the Outcomes of Innovation are Known

A great deal of innovation research is based upon retrospective case histories that were conducted after the outcomes of an innovation were known. However, it is widely recognised that prior knowledge of the success or failure of an innovation invariably biases a study's findings (Van de Ven, 1987). It is therefore recommended to initiate studies before the outcomes of an innovation are known and to observe the innovation process as it unfolds. This approach maximises the probability of discovering short-lived factors and changes that exert important influences on successful innovations (Van de Ven and Poole, 2002). But, in addition, conducting real-time observations of the innovation process before innovation outcomes are known can also present the opportunity to learn from unsuccessful innovations and innovations that were not implemented.

Access to contemporary procurement case studies where the outcomes of the implementation of policy innovations are unknown necessitates good relations with public sector clients. To gain access to public procurement cases in order to successfully conduct this study it was important to place the research within the frame of reference of procurement practitioners. If practitioners perceive little potential use of a study's finings there is little to motivate them to provide access and information to an investigator (Van de Ven, 1987). Because the nature of this study had strong relevance to public procurement practice access to relevant case studies was relatively straightforward. Indeed longitudinal access to a series of contemporary procurement case studies was granted and this was important to successfully address the next conceptual challenge to be discussed.

5.2 Follow the Whole Procurement Process as it Unfolds

In the discussion on the two primary research questions chosen for this study the importance of following innovation processes, and identifying different influences on policy innovations as the procurement process unfolds, was argued. Longitudinal study of the procurement process can help to bring about a much greater understanding of the process of implementing policy innovations in procurement and also identify the influence of different contextual factors throughout the implementation process. An approach such as this corresponds with Pettigrew et al.'s (2001) observation that *"theoretically sound and practically useful research on change should explore the contexts, content and process of change together with their interconnections over time"* (p.698). Studying the whole procurement process allows the innovation implementation process to fully reveal itself and enables changes to a policy innovation that occur during a procurement process to be identified.

To investigate the implementation of policy innovations as the procurement process unfolds a variety of research techniques were used. The research techniques included interviews and questionnaires with key actors, document analysis of key procurement documentation, and observation. Observation proved to be a very useful technique for tracking policy innovation implementation in this research because it provided intimate first-hand insights from the frame of reference of public procurement practitioners. Although the use of observation as a research technique does involve considerable commitment and resources from an investigator's viewpoint the benefits of proximity in time and place to key people, events and processes are expected to strongly increase likelihood of collecting accurate data.

5.3 Research Multiple Perspectives

The importance of multi-level and multi-perspective investigation of innovation and change has been increasingly recognised (King, 1990; Pettigrew, 1990; Pettigrew et al., 2001). However, existing innovation studies have tended to focus on distinct levels of analysis. A review of innovation research (King, 1990) was for example able to categorise most innovation research by its focus on either the individual, group or organisation levels of analysis. Previous innovation research has also been argued to possess a managerial bias in its data collection samples (King and Anderson, 1990). Research that just examines innovation from the perspective of managers in the organisation that is implementing the innovation risks developing a purely 'top-down' view of innovation (King and Anderson, 1990). In the context of this study the need for multi-perspectives means that it is imperative to examine policy innovations from the perspectives of all those involved in the procurement process and not just those initiating and implementing the innovation on the client-side.

Obtaining a multiplicity of perspectives on policy innovations might illustrate differing perceptions of the implementation process and alternative views on the value of certain policy innovations. An innovation might not always be desirable for all parties involved. A major criticism of much innovation research is the assumption implicit in many studies that innovation is always desirable and beneficial. Kimberly (1981) has labelled this 'pro-innovation bias'. Because innovation can have a wide range of consequences, some anticipated and intended, but some unintended and some which have conflicting effects on different stakeholders, it is crucial that innovations are examined from multiple perspectives.

5.4 Investigate the Characteristics of Innovations

Analysing the type and the attributes of the innovations studied is important because the nature of the innovation has a profound effect on its implementation. Numerous different types and attributes of innovations have been suggested. For example, innovations have been distinguished by their complexity, relative advantage, radicalness, and pervasiveness.

However, although various means of categorising organisational innovations have been identified, most research in the past has regarded innovation as a unitary phenomenon and few empirical studies have actually investigated the characteristics of the innovations studied (King, 1990; Wolfe, 1994). Innovation researchers received great criticism for giving only minimal attention to the types and characteristics of innovations investigated because it is argued to hamper both comparison of empirical findings and theoretical development (Downs and Mohr, 1976; Beyer and Trice, 1978; Meyer and Goes, 1988; Henderson and Clark, 1990; King, 1990; Wolfe, 1994). To address this conceptual challenge investigation of the characteristics of the policy innovations studied in this research is necessary.

6. Summary

This paper has reported on a PhD study in the field of public sector construction procurement that is addressing the shortfall of academic investigation into changing procurement policies. The PhD research specifically focuses on the implementation of policy innovations in public sector construction procurement. The aim of the paper was not to present an in-depth analysis of particular policy innovations or interim research findings, but to present a discussion of key conceptual and methodological design issues that are central to studying the implementation of policy innovations in public procurement.

It is important to specifically investigate the implementation of policy innovations because of the crucial influence that implementation activities can have on overall innovation success. The two main research questions adopted in this study focus on the process of innovation implementation and the contextual factors that influence implementation in order to acquire insights into how policy innovations can be successfully implemented in public procurement. The two research questions are argued to be complimentary and provide a clear focus for empirical research that is currently being conducted through use of the case study strategy. However, despite the guidance of the research questions there have been several conceptual challenges faced during the design of case studies on the implementation of policy innovations that needed to be shared in this paper. These challenges focused on: undertaking research before the outcomes of innovations are known; following the implementation of policy innovations throughout the whole procurement process; taking multiple perspectives into account in innovation research; and investigating the characteristics of the policy innovations being studied. The issues highlighted here, as for all of the issues highlighted in the paper, serve to improve the conceptual rigour of research investigating the implementation of policy innovations in public procurement and increase the likelihood that such research can contribute a deep understanding of policy innovation implementation in public procurement for the benefit of both theory and practice.

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Development of Key Performance Indicators For Housing Market Renewal New Build

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Abstract: This paper presents a case study on the development of Key Performance Indicators by a Housing Market Renewal (HMR) Pathfinder. The pathfinder organisation has formed partnerships with local authorities and private sector housing developers to renew and regenerate housing markets in a sub-region of the North West of England. Within the context of these partnerships, Key Performance Indicators (KPIs) were identified as being crucial to evaluating the performance and success of construction projects and programmes to be delivered by supply chain partners. Concentrating on new build housing, this paper presents the approach of the pathfinder organisation to performance measurement and details the KPIs selected for measurement. A discussion of the approach taken by the pathfinder organisation is included in the paper and a distinction between KPIs that were *adopted*, *adapted* and *generated* is made. The paper concludes with potential areas of future research that includes comparison between the approaches of different HMR Pathfinders to assist learning and diffusion of good practices.

Keywords: Housing Market Renewal, Key Performance Indicators, Public Construction, Public Procurement.

1. The Context of KPIs in Housing Market Renewal Construction

Elevate East Lancashire, the Housing Market Renewal (HMR) pathfinder is intervening in the built environment in several ways, including demolition and clearance of unfit housing, repair and facelift of some existing housing, and building of new housing. These different built environment interventions require the local authorities obtaining HMR funding to agree contracts and form partnerships with several construction companies and housing developers. Elevate identified Key Performance Indicators (KPIs) as being crucial to evaluating the performance and success of the HMR funded construction projects and programmes to be delivered by supply chain partners. Based upon the case study method this paper presents Elevate's approach to KPIs and performance measurement for new build housing procured by several of the Elevate Local Authorities. The case study is presented from the viewpoint of practitioners in the pathfinder organisation.

2. Elevate's Approach to KPIs and Performance Measurement

Elevate desired to introduce a system of KPIs in order to measure performance of a number of issues that were perceived to be critical to the success of the housing market renewal new build programme, including housing design, build quality and impact on the environment. Measurement of such critical issues would allow Elevate to communicate priorities to supply chain partners and share key outcome indicators from funding bodies including Department for Communities and Local Government (DCLG), Housing Corporation and English Partnerships, with supply chain partners.

However, Elevate did not want the KPI system to just measure performance against targets, but also wanted to ensure that the KPI system followed good performance measurement practice by incorporating benchmarking and continuous improvement principles. The KPI system was therefore complemented by what was termed as a performance measurement process that would enable the benchmarking of project performance at different points in time and against data from other projects. Such benchmarking would enable the identification of areas where improvement is required and also demonstrate the achievement of continuous improvement.

A performance measurement group, that comprised representatives from Elevate, Local Authorities and private sector developers, was established in order to carry out the benchmarking and continuous improvement processes. The performance measurement group ensured that key individuals bought into the KPI system and continuous improvement processes. However, guaranteeing buy-in from the Local Authorities and private sector partners was not something that the pathfinder strongly worried about because of another key facet of the KPI system, its incentivisation.

The incentivisation of the KPI system was designed so that performance on the KPIs that were most important for the client would be linked to either a proportion of housing developer return, or overage on the land sold by the Local Authorities to developers. In practice this would mean that for developers to get their full return and complete share of the overage negotiated during the procurement process, they would have to achieve the target set for each individual incentivised KPI. Linking KPIs to return and overage ensured that developers would be focused on achieving the performance levels desired by the client. The incentivisation system also meant that ensuring actual measurement of the KPIs, which can be problematical in some projects, would not be in this case.

Incentivisation of the KPIs also meant that KPIs and measures would have to be carefully selected. Only simple, transparent and reliable measures were considered suitable. Each KPI had to be approved by all relevant partners and only realistic and achievable KPI targets could be set. To ensure that performance measurement did not become too resource consuming, a limit on the number of KPIs was set and partners were only required to provide data on issues that they had major control over.

3. Case Study KPIs

The KPIs at Elevate were divided into five categories A-E. The section that follows presents an overview of each category and the respective KPIs.

Category A (Table 1) included the most important KPIs that were incorporated as a contract term and poor performance would result in a contract breach resulting in defined remedies, failure to comply could result in forfeiture. Only 3 KPIs were considered for this category.

Table 1: Category A KPIs

KPI	**Overview**
EcoHomes	The environmental rating for new homes, covering energy, transport, pollution, materials, water, land use and ecology, health and wellbeing, and development management. All new units produced should be to a minimum 'very good' standard.
Design	Recognising that good design is fundamental to the delivery of safe and attractive places to live. Secured by Design and Building for Life standards were adopted to measure the quality of design against national standards.
Implementation of Phase Milestones	To ensure that the business plans agreed for each development phase are implemented by developers to the satisfaction of the client, key milestones have to be achieved on time. These milestones include supporting Local Authorities in the relocation of displaced residents and delivering the agreed number of units to be built and agreed tenure mixes.

Category B (Table 2) comprises factors that are very important to the Pathfinder/Local Authority client and accordingly positive performance on KPIs included here is rewarded. KPIs in Category A (above) will be combined with the KPIs in Category B, and together they will be linked to the incentivised proportion of developer's return. There are 5 KPIs in Category B so therefore, with the addition of the 3 Category A KPIs there are 8 KPIs that would impact on a developer's return.

Table 2: Category B KPIs

KPI	**Overview**
Local Labour	Participation of local labour in the project is vital to support the wider participation goals of the programme. Developers must make realistic attempts to use local labour and Elevate is funds a 'Constructing the Future' programme which includes a construction agency, in order to ensure labour supply and support the targeting of hard to reach groups.
Local Suppliers	Participation of local suppliers in the programme is vital to support the wider economic regeneration goals of market renewal in East Lancashire. Elevate has undertaken an audit of construction suppliers in East Lancashire to help developers identify capacity in the sub-region.
Quality	Good quality homes must be built. A defect free dwelling is important for the reputations of Burnley, Elevate and the developers. Developers are measured on defects at handover and quality and speed of correction using standard Constructing Excellence measures.
Good Constructor Practices	Developers will be working in local communities during the programme and as such good management of construction activities is expected in order to retain the support of residents. Considerate Constructors is the best practice standard that performance is measured against.

In Category C (Table 3) the KPIs are of a slightly lower priority to those in A and B, but nevertheless important to the client and incentivised accordingly by being linked to 50% of the developer's overage. There are 4 KPIs that measure developer performance in this category. There is also one KPI that measures the performance of the client.

Table 3: Category C KPIs

KPI	**Overview**
Predictability of Construction	This measures actual construction costs and delivery times against pre-construction budgets and programme timescales. Based on standard Constructing Excellence Predictability KPIs these measures are used to focus developers on agreed budgets and deadlines, and over the long term demonstrate continuous improvement of the business plan.
Training	Training opportunities and vocational qualifications improve the career prospects of construction operatives from the local area. Targets are set for the number of apprenticeships created and construction skills qualifications attained. A breakdown of the percentage of opportunities taken up by hard to reach groups, including BME communities and women, is also measured.
Health and Safety	This measures the health and safety training of site operatives and the number of site accidents and warnings. The targets set for developers include subcontractor employees.
Good Developer Practices	Two distinct measures are used here. Firstly a community engagement measure that considers proactive community activities undertaken by developers against a best practice checklist. Secondly, an end user satisfaction measure that considers the satisfaction of end users with the overall customer service and change management process offered by developers.
Developer Satisfaction	Here certain measures that developers wanted to measure client performance against are included. These include Compulsory Purchase Order progress and client decision making speed.

In Category D (Table 4) the KPIs were not incentivised. Although termed KPIs, the issues included here are measured by short survey as opposed to a series of distinct indicators. These KPIs relate to factors that were the collective responsibility of the partnership between client and developer partner, and not just the responsibility of the private sector partner.

Table 4: Category D KPIs

KPI	**Overview**
Community Satisfaction	This measures the local community's attitude towards the HMR intervention and covers issues such as safety and security and community wellbeing.
Partnering Relationships	This measures the satisfaction of all partners with each other vis-à-vis support, preservation of partnership principles and quick and effective dispute resolution.
Supply Chain Satisfaction	Measures supply chain issues relevant to wider public sector procurement policies including supplier and subcontractor satisfaction, and participation of voluntary and social enterprises.
Sustainable Development	Measures performance on a number of key sustainable indicators like sustainable use of water and energy resources. The indicators consider the construction process and the performance of the final end product.

In Category E (Table 5) the KPIs represent measures of long term outcomes desirable for the client. These KPIs measure the success of the above performance issues and offer a potential warning bell system that may indicate if a review of strategy is required to achieve better results.

Table 5: Category E KPIs

KPI	**Overview**
Land Registry Property Prices	As a measure of intervention success in revitalising the housing market this KPI uses data from the Land Registry Agency to track property prices and market turnaround.
Demographic Change	Demographic statistics will help to monitor population changes in the intervention areas over time.
Local Health Statistics	Local health statistics will help to monitor health changes in the intervention areas over time.
Crime Statistics	Crime statistics will help to monitor crime levels in the intervention areas over time.

4. Discussion of the Elevate Approach

Elevate's KPIs were assembled from a mixture of sources, including *adopted*, *adapted* and bespoke *generated* KPIs. Adopted KPIs came from Constructing Excellence (CE) and the DCLG (formerly ODPM). The CE KPIs have become well established within the construction sector since the Egan report (DETR, 1998) recommended the development of standard KPIs to be collected nationally. The original group of national construction KPIs produced by a partnership of the Construction Best Practice Program (CBPP), the

Construction Industry Board (CIB), and the Department Of Trade and Industry (DTI), have been expanded by CE and now comprise six distinct groups: All Construction (economic); Respect for People; Environmental; Consultants; Construction Products; and Mechanical and Engineering (Constructing Excellence, 2006a).

Elevate were most interested in the All Construction KPIs (Constructing Excellence, 2006b), sometimes known as the Headline KPIs. From CE's ten headline KPIs, Elevate opted to use Cost Predictability and Time Predictability, Quality, and Health and Safety Accident rates as formal KPIs. Elsewhere several CE Environmental KPIs (Constructing Excellence, 2006c) were used by Elevate to measure Sustainable Development in Category D of the Elevate framework. Other CE KPIs on the likes of Respect for People and Consultants were not adopted. The majority of the CE KPIs were therefore found to be inappropriate measures of the critical success factors required to measure the performance of new build housing construction in the context of housing market renewal. Elevate were therefore required to go beyond selection of just standard CE KPIs in order to establish a framework of KPIs that would encompass every important issue requiring measurement.

The DCLG presented Elevate with a further source of potential measures that could be adopted as KPIs. The DCLG indicators were particularly focused on determining performance on issues critical to the long-term impacts of market intervention. The KPIs in Category E, relating to property prices, demographic, health and crime statistics were derived from DCLG's holistic priorities for market renewal and sustainable communities. Measurement of such issues would be a first for the housing developers in partnership with the Elevate Local Authorities. But Elevate strongly believed that it was important that long-term indicators of success derived from funding sources like the DCLG were shared with supply chain partners to keep attention focused on the wider issue of market renewal and not just the short-term objective of building new homes. Although being measured on such indicators represented a completely new approach for the housing developers involved, they did readily accept the KPIs in Category E. Elevate were able to encourage the quick acceptance of these KPIs by stressing that they were measuring the long-term success of the client-developer partnership and not just developer performance. From the developers viewpoint the long-term measures were agreeable because they were very aware of the policy context surrounding market renewal following submission of tenders to several different HMR pathfinders, and also because there were no incentives or penalties attached to the actual performance levels of the KPIs.

In the Elevate case there were several KPIs that were adapted measures from best practice schemes, including the EcoHomes, Design, and Good Constructor Practices KPIs. The EcoHomes measurement is a requirement for DCLG, Housing Corporation and English Partnership funding, and was converted into a KPI by using the score out of 100 awarded to schemes after completion. Performance on the EcoHomes KPI was targeted to ensure that developers did not just manage to achieve the required 'Very Good' standard, but achieved the award comfortably. For the Design KPI, CABE's Building for Life measure and the UK Police's Secured by Design initiative, were adapted. To receive a proportion of the incentivised return on these KPIs the developers had to work towards the Building for Life 'Silver' standard and for Secured by Design, accreditation. The Good Constructor Practices KPI, utilised the Considerate Constructors best practice scheme as the measurement of performance. The score awarded by external auditors against the Considerate Constructor code of practice would be converted into a performance level on this KPI.

The final source of KPIs comprises bespoke KPIs that were generated by Elevate to measure specific issues critical to success that could not be measured by KPIs either adopted or adapted from elsewhere. In Category A of the KPI framework, the Implementation of Phase Milestones KPI was developed by the client to ensure that constructor partners completed, within set time parameters, the key milestones agreed in the developed programme. However, this measure was subject to lengthy negotiation between client and developers before any agreement could be made because developers argued that a large number of the key milestones originally proposed by the client were not under their complete control. Local Labour, Local Suppliers and Training were all other bespoke KPIs that were developed to measure performance on one of Elevate's key strategic objectives: obtaining social and economic community benefits from construction expenditure in the sub-region. The three distinct KPIs demonstrate the significance of community benefits to Elevate. To help ensure that developers could deliver good performance on these issues the client funded a construction agency to work with local agencies to supply local labour and trainees. Additional bespoke KPIs were, Good Developer Practices, measuring the performance of developers on community engagement and end user/resident customer service, and the Developer Satisfaction KPI. The Developer Satisfaction KPI measured client performance against indicators suggested by the developers themselves but with the approval of the client.

During the period of negotiation between client and developers on the measures to be used for the KPIs, representatives of developers proposed that the KPIs and the targets set should be fixed for the duration of the partnerships. Developers revealed the fact that they desired the KPIs to be fixed was because of the incentivisation that would be linked to the KPI performance. The Pathfinder/Local Authority client however rejected this suggestion from developers, arguing that such an approach would offer no flexibility if new priorities emerged or current measures were found to be inadequate. Removing the incentivisation of the KPIs was also not an option for the client, who believed that if KPIs were not tied to developer return delivering good performance on the issues would be difficult, and even ensuring that the KPIs were measured a potential challenge. In order to assist developer acceptance of the KPIs at the beginning of the partnership, Elevate therefore proposed a system of continuous target adjustment. Recognising that the KPI framework comprised performance issues new to developers, and that desired performance levels could not be guaranteed as soon as development work began, Elevate intended for targets to start off low at the beginning of the partnership and gradually increase overtime. Developers appreciated such realistic expectations from the client regarding performance levels, and subsequently the KPIs and initial target levels were agreed.

5. Summary

This paper has presented a case study on the development of Key Performance Indicators by a Housing Market Renewal (HMR) Pathfinder. The approach of the pathfinder organisation to performance measurement and KPIs was presented. Analysis of the case study KPIs revealed that they were assembled from a mixture of sources, including *adopted*, *adapted* and bespoke *generated* KPIs. Adopted KPIs came from both Constructing Excellence and DCLG. Adapted KPIs were developed from best practice schemes that include EcoHomes, Building for Life and Considerate Constructors. Bespoke generated KPIs included Implementation of Phase Milestones and community benefit measures on Local Labour, Local Suppliers and Training, which could not be measured by existing measures developed elsewhere.

The case study illustrated that Elevate did not believe that KPIs from any single source would sufficiently encompass all of the critical issues that they wished to measure. The complexity of renewing housing markets meant that the KPI system introduced by Elevate would require private sector construction partners to be measured on holistic issues influencing overall market regeneration and not just construction performance. This theme has also emerged following preliminary discussions with other pathfinder organisations engaged in market renewal and other public agencies engaged in large-scale regeneration projects.

A best practice workshop chaired by Elevate, with representation from all of the HMR pathfinders nationally, for instance, revealed that consistent across the different cases was the perception that the national construction KPIs championed by Constructing Excellence were not broad enough to incorporate the wider regeneration activities crucial to contemporary public sector intervention in failing housing markets. This is one potential area for future research. Further comparison between different pathfinders and major regeneration clients could assist mutual learning and diffusion of good practices. Comparing the experiences of different pathfinders could identify similar KPIs collected elsewhere, and provide the basis for the benchmarking of performance between clients that have had to generate their own similar KPIs seperately to measure the crucial regeneration activities that are not covered by existing schemes or measures.

Acknowledgement
The authors wish to acknowledge the support of Elevate East Lancashire in completion of this research.

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Findings of tailoring the procurement system for a school based on the Living Building Concept

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Abstract: In the Netherlands, school concepts and educational structures tend to change a lot. And even when policies remain stable, school boards may want to reorganize their processes. As a result, the housing needs change quicker than the school building can accommodate. The Living Building Concept (LBC) provides guidelines for dealing with these changes. This paper presents the case of a school board that wants to apply the LBC to the development of a new school building in the city of Veenendaal in the Netherlands, because of the potential benefits of the LBC. This is the first time the LBC is applied in real life, so the theoretical concept had to be developed and elaborated on an operational level. The procurement system had to be tailored to the specific needs of the board, the LBC and existing restrictions. The project is on a tight programme with budget constraints, limiting the theoretical freedom of applying the LBC. During the process of tailoring the procurement system difficulties were encountered, which had to be solved quickly. The time schedule required a pragmatic approach which led to an interesting development process; the discussions focused very quickly on relevant content as well as multi-criteria decision theory. One of the innovative elements is incorporating several scenarios in the selection procedure for which suppliers will have to make a plan and a price. In the paper the final procurement system is presented, including some of the configuration possibilities that were developed. Conclusions about the acceptation and feasibility in terms of legal and financial aspects of the system are drawn.

Keywords: Key Performance Indicators, Living Building Concept, Scenario based procurement, Value Procurement, Whole Life Cycle Costing.

1. Introduction

At present, lowest price selection is the dominant procurement strategy in the public sector of the Dutch construction industry. This procurement system has several drawbacks and the resulting excessive price competition regime has detrimental effects as well.
Adopting a differentiation strategy is according to business administration and marketing experts, a common solution for suppliers in a market with escalating price competition. This option is barred in the public sector of the Dutch construction industry due to tender regulations, or moreover the way in which these regulations are interpreted and used by public clients.
Whilst there are examples of successful implementation, several outcomes of public tenders based on Most Economically Advantageous Tender (MEAT) have resulted in successful legal

claims by suppliers that were not awarded the contract. These claims have been successful because of flaws in the selection procedure concerning transparency, objectivity and proportionality. However, there are also examples of successful implementations. Hence the focus of this research on sound and accepted value quantification methods and evaluation systems.

2. Theory behind the Value-Price system

2.1 Procurement space

A model which has been found suitable for mapping selection mechanisms is the model of the procurement space, see figure 1.

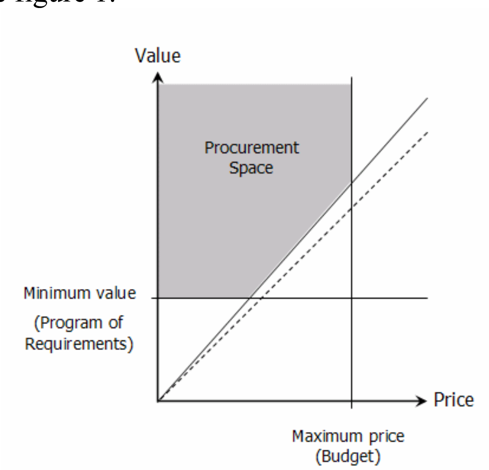

Fig. 1 Model of the procurement space (De Ridder & Vrijhoef 2006)

The procurement space is limited by a certain minimal desired value, an available budget which determines the maximal acceptable price and a certain value to price ratio, which represents the "value for money" notion. The grey area in figures 1 and 2 corresponds with the procurement space; proposals located in this space are suitable. Proposals which are located outside the procurement space are not suitable. Available selection strategies are mapped into the graph, see figure 2.

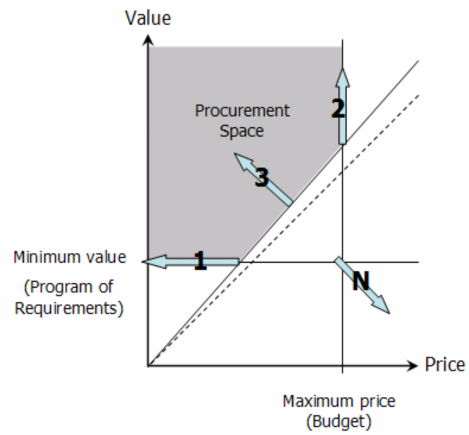

Fig. 2 Proposal selection strategies available to public clients (Dreschler 2006)

Explanation of proposal selection strategies available to public clients:
1: Minimize price at a given quality (value) level
2: Maximize value at a given budget
3: Maximize value/price ratio within boundaries
N: represents the tendency to deliver less value for more money, due to optimistic or opportunistic planning and unforeseen events.

Selection strategy #1 favours Porters (1980) costs leadership strategy, #2 corresponds with a design competition. #3 Corresponds with the selection based on the Most Economically Advantageous Tender (MEAT). By chance, the model resembles the "strategic clock" defined by Johnson and Scholes (1993), a model which presents eight competitive strategy options.

At present, selection strategy #1 is dominant in the public sector of the Dutch construction industry. In theory, selection strategy #3 offers new possibilities, because specific advantages of the production system can be used. That is the reason why large public clients in the Dutch construction industry are in a transitional phase, trying to enable selection strategy #3. Tender regulations allow for it, but this criterion turns out to be difficult to implement.

2.2 Contractor selection

The boundary of the procurement space as described in section 2.1 is represented in figures 3 and 4 by a solid line. Having defined the supply space, each competitor is able to submit his specific proposal. Each proposal consists of a system (built object) provided with associated system specifications. The set system specifications represent the value of the system. In this way it is easy for the client to select a supplier. The first check is whether the system specifications exceed the minimum requirements. The second check is to establish the value price ratio, which is reflected by the angle alpha in figure 3. The supplier with highest alpha (the best value to price ratio) wins the contract.

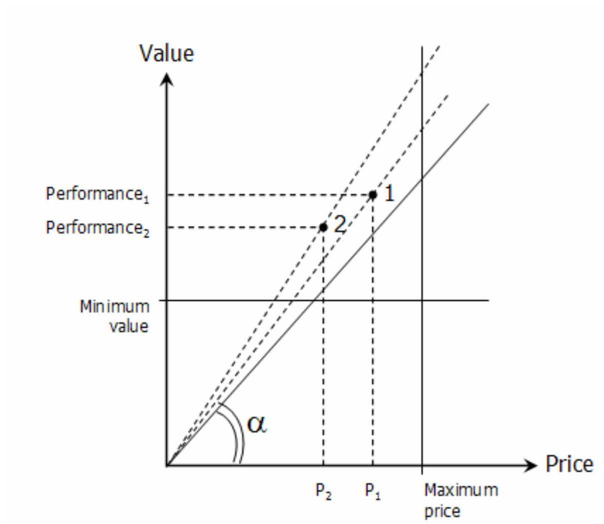

Fig. 3. Selection between two supply strategies (De Ridder & Vrijhoef 2006)

2.3 Performance contracting

The contract is based on a value- price relation. The actual value is an important variable and will be measured during the contractual period. With the relation between value and price agreed upon at the start of the project, the price changes automatically after a limited deviation of the actual required value related to the initially defined value. Larger deviations require a revision of the contract. In extreme situations such revisions can also be used to start a new tender procedure in order to collect new biddings.

Measuring value can be relatively easy. The supplier must give the key indicators for the value of the building such as floor space, electric power capacities, energy consumption and indoor climate. Also other indicators may be considered such as time of completion as early completion of building leading to earlier occupation may have financial and non-financial benefits. These indicators are used for establishing the initially required value in the basic scenario. The actual required value after a change of scenario must be established with the same algorithm and compared to the initially required value.

The ultimate goal is to find the best solution for clients and other stakeholders, as well as for the contractor and suppliers. This implies finding the best value for the client and stakeholders at minimum costs for the contractor and suppliers. This maximises the benefit; value minus costs (De Ridder et al. 2002). Client and supplier share the benefit by agreeing a right price in the middle. The goal specificity is influenced by value specificity and the client's requirements. Higher levels of value specificity and observing life cycle value rather than project delivery improve the final project outcome and the starting point for the rest of the life cycle of the built service (Leung & Liu 2003). In order to specify all stakeholders' values and project priorities, value engineering must be a structural component of the procurement process. Analogously to the procurement process, the value engineering must be performance based, not price based. This implies measuring and rewarding performance delivery, minimizing adversarial relationships and collaborative decision making leading to a provision of best client value (Kashiwagi & Khiyara 2002).

The main principle is to measure the delivered value and to establish the corresponding price. This relation is not only valid in the initial design made by the supplier but also in the adjacent area (contract scope) (Figure 4). This area is proposed to be 20 % deviation from the initial design in both the value dimension as well as the price dimension. The value can be measured by the actual set of system specifications at the highest possible abstraction level thus representing the behaviour of the system.

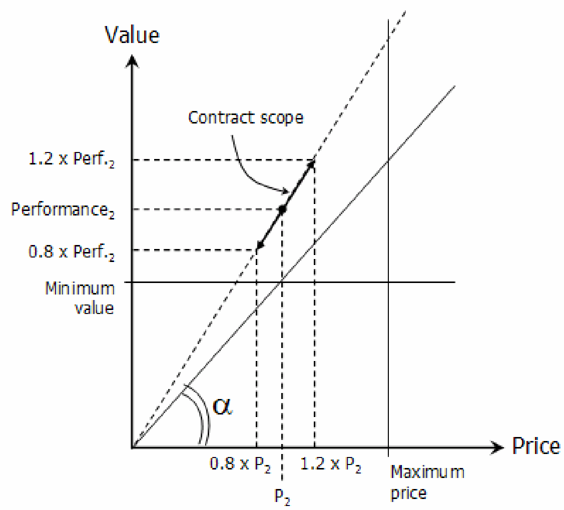

Fig. 4. Performance measurement after contractor selection (De Ridder & Vrijhoef 2006)

2.4 Definition of value

Based on the findings of a previous paper (Dreschler & De Ridder, 2006) value is defined as "quality as perceived by the customer, expressed in monetary terms". This is still a very broad definition because the outcome of a valuation will depend on how the following matters are defined:

- Who or which group of people is the customer?
- How will conflicts of interest be resolved when the customer is a group?
- How will quality be expressed in monetary terms?
- To which extent will effects be considered?
- When does the valuation take place; ex ante, ex post or during consumption?
    - In the case of ex ante: how is the expectation composed?
    - In the case of ex post: which performance criteria should be used?

The definition of value is kept broad intentionally in order to illustrate:

- That the chosen system boundary will determine the outcome of the valuation;
- Subjectivity; the outcome of the valuation depends on the definition of the customer

Quality as perceived by the customer can be transparently objectified by establishing a number of performance criteria and a mechanism for combining the results on these performance criteria; in other words a preference formula (see section 4).

3. Case description

A school board wanted to apply the LBC to the development of a new school building in the city of Veenendaal, because of the potential benefits of the LBC. The procurement system had to be tailored to the specific needs of the board, the LBC and existing restrictions. Already some boundary conditions were in place, including budget, time schedule, location, an architectural design, a Table of Requirements and decisions concerning project approach. As these had to be respected, the conceptual freedom of implementing the LBC and Value-Price based selection was limited. Nonetheless there remained enough latitude to break free from a lowest price based selection strategy.
Elaborating and developing the theoretical LBC on an operational level concept was quite a challenge, because it was the first time it was applied in real life and the time schedule and budget were tight.

Programme
Important milestones in the project:

- Publicize an invitation and selection criteria: halfway March 2006
- Notify the result of the selection (qualified suppliers) and publicize Pre-bid criteria: beginning of June 2006
- Notify the result of the pre-bid (the three best suppliers/tenders) and Bid criteria: end of August 2006
- Selection of best supplier/tender: beginning of September
- Start construction: beginning of October 2006
- Delivery of school: August 2008

Available client budget
About 20 M€.

Contract type
The contract resembles a DBMO contract because besides construction, (some) design, maintenance and operation are included. The length is 30 years, of which the first 2 years span construction. After 12 years a market consultation will take place, introducing the possibility to change the maintaining and operating party.

4. Development of the selection formula

In the early stages of the project (end 2005) the client expressed his views of his most important criteria. Besides aesthetics and maintainability, the adaptability and flexibility turned out to be crucial. The chance that the lay out needed to be changed somewhere in the near future was very high, so contractors that would be able to demonstrate how to cope with these changes would be preferred.

In order to implement the LBC (Value-Price based selection) a performance evaluation system had to be developed which had to meet the juridical criteria of measurability, objectivity, transparency and proportionality.

Whilst procurement systems always have to comply with legislation, for this project this was even more so. Because it is a pilot project for a new way of working it attracted much interest and mistakes could not be afforded. The chance that suppliers that do not get the assignment will sue is fairly high. Recently some Dutch public clients using innovative public tendering procedures have successfully been sued, so extra care would have to be taken to meet the legal criteria. This is illustrated by the following revision history of the selection formula, which was developed over a three month period:

Month 1

Selection will be based on:

- Price for delivery of base level performance (described in a traditional Table of Requirements)
- Aesthetics (bonus, established by an expert panel containing client representatives)
- Unity price for exploitation
- Unity price for change scenario's

How these criteria would be combined was to be resolved in this early stage. The division roughly corresponds with an ancient yet still applicable division (Vitruvius, 20 BC) of quality: a structure must exhibit the three qualities of *firmitas*, *utilitas* and *venustas*, which means it must be strong or durable, useful, and beautiful.
Possibilities for value creation by suppliers being co financers or exploiting the building (i.e. rent out space in evening hours) were dropped because the school board wanted to keep control and because of uncertainty about local regulations.

Beginning of Month 2

The elements had been elaborated as follows:

CP_{Basis} =	Discounted price for complying to the Table of Requirements.
$CP_{\Delta Energy}$ =	Discounted price for savings in energy consumption (reference usage needed) during the life cycle.
$CP_{Maintenance\ 10\text{-}30}$ =	Discounted price for the long term maintenance. Short term maintenance up to year 10 is assumed to be included in the basis.
$CP_{Scen.}$ =	Discounted price for several scenarios. Based on the probability a scenario will occur it is given a weighting factor, the weighed discounted scenario prices are the summed.
$V_{Aesthetic}$ =	Aesthetic value, expressed in points. 100 Points is maximum, 80 points is minimum.
$V_{Availability}$ =	Availability of the building, expressed in points. 100 is the base score and based on hindrance caused by reconstruction activities points will be subtracted.

These elements were grouped into two value price ratios:

$$\text{Preference score} = \frac{V_{Aesthetic}}{CP_{Basis} - CP_{\Delta Energy} + CP_{Maintenance\ 10\text{-}30}} + 0,2\frac{V_{Availability}}{CP_{Scen.}}$$

The first ratio's was deemed to be five times more important than the second. Working with ratios was believed to have some advantages:

- Good representation of the chain of thought involving possible trade-offs; a higher value or a lower price will lead to a higher preference score.

- It was thought to be an elegant way of combining the differing dimensions of value (points) and price (euros) without the need for "artificially" transforming one dimension into the other.
- No need to establish (many) weighting factors.

The form of using ratios was later dropped because of some drawbacks:

- Weighting factors are introduced implicitly in the way value is defined
- According to regulations, qualitative and quantitative evaluation needs to be done in different stages.
- Mixing points and euros was difficult to explain to other people involved in setting up the procurement system.

The end of month 2

The previous version of the selection formula did not seem appropriate because the dimensions of the ratios were not exactly the same. Even though the dimension is points per Euro for both ratios, and the maximum score for both value elements is 100 points, the value elements do not seem comparable. In order to overcome this problem, the ratios were standardized, see section 5. Each ratio was brought back to a scale from 0 to 1, in which a score of 1 is the highest scoring tender. This procedure is also known as normalization. This lead to the following preference formula:

$$0,1 * \left| \frac{V_{Aesthetic}}{CP_{Basis}} \right| + 0,5 * \left| \frac{S_{Energy}}{CP_{Basis}} \right| + 0,3 * \left| \frac{S_{Maintenance\ 10\text{-}30}}{CP_{Basis}} \right| + 0,1 * \left| \frac{V_{Availability}}{CP_{Scen.}} \right|$$

The vertical lines are used to indicate that the ratio is standardized. So in this case, the best proposal will score 1. New elements in the formula are S_{Enery} which represents energy savings compared to a reference usage and $S_{Maintenance\ 10\text{-}30}$ which represents maintenance cost savings compared to a reference level.

The mentioned weighting factors were not final, but a first proposal. The client had to establish the final weighting factors, being supported by advice based on simulation with realistic cases. In this case the weighting factors needed retuning, because suppliers with 100 k€ energy savings enjoyed the preference over suppliers with a 200 k€ lower base price, ceteris paribus.

Month 3 (final pre-bid selection formula)

In order to solve the problem of finding the right weighting factors, after intensive brainstorming sessions every element of the preference score formula was expressed in euros:

Preference Score = $P_{Basis} + P_{Maintenance} + P_{Scenarios} - S_{Energy} - C_{Wishes}$

The three suppliers with the lowest score would go on to the bid phase.

The determination of the first three factors is quite straightforward, albeit that using prices for scenarios is unconventional. Energy savings were taken into account according to table 1.

Table 1: The incorporation of energy savings in the preference score

EPC	**Preference score correction (in 100 k€)**
1,4 (upper limit)	0
1,3	3
1,2	6
1,1	9
1,0	12
0,9	15
0,8 and lower	18

EPC stand for Energy Performance Coefficient and is calculated according to established standards. A lower EPC means a better score.
The factor C_{Wishes} stands for a correction on the preference score as a result of how suppliers deal with client wishes. 26 Optional items have been formulated. For each item the suppliers can describe how they will deal with it in their offer. Based on this description, points will be awarded. The maximum score is 395 points, which will lead to an improvement in the preference score formula of 2 M€.

These optional wishes differ from traditional requirements because suppliers can choose to fulfil a wish in order to get a higher preference score, thus opening up the possibility for the supplier of asking a higher price and still be able to be selected. Or alternatively choosing the option to not fulfil some wishes but provide the client with a very competitive price.
The formula was used in order to select three pre-bids.

5. Normalization routines

According to Multi Criteria Evaluation literature (Voogd, 1982, van der Heijden 1990) several techniques for standardizing criteria in order to make them comparable exist.

The "rough" evaluation-score is indicated by E. E(i,j) then is the evaluation-score of alternative i (i=1,…,I) on criterion j (j=1,…, J). The standardised evaluation-score is indicated by e(i,j).

Below, three standardisation procedures are described, on the level of a criterion. It is assumed that a higher evaluation-score corresponds with a higher performance.

Standardisation routine 1: Highest performance scores 1, the lowest 0

$$e(i) = \frac{E(i) - \text{minimal } E(i)}{\text{maximal } E(i) - \text{minimal } E(i)}$$

Standardisation routine 2: Percentage of the sum of the performances

$$e(i) = \frac{E(i)}{\text{sum of al } E(i)}$$

Standardisation routine 3: Percentage of the best performance

$$e(i) = \frac{E(i)}{\text{maximal } E(i)}$$

More standardisation routines could be formulated, i.e. the performance compared to the average performance, but then the scale would no longer be [0,1]. Even more sophisticated standardisation routines exist, which weren't elaborated in the project because they need to stay understandable for all parties involved.

The choice for a standardization routine has influence on the weighting of the criterion, so numerical simulation with realistic assumptions is important. It appeared that using percentage differences will lead to more just outcomes.

The very often used difference method (routine number 1) will give the lowest performance a score of 0, while the performance can be for instance 97% of the best performer. Thus using the difference method will disproportionably favour the best performer, which cannot entirely be solved by tuning the weighting factors. This is an important pitfall to avoid if you want to prevent successful lawsuits.

5.1 Techniques for the "aiming" of criteria

During the development of the selection process criteria were encountered which were better as they became lower, for instance the EPC. Sometimes these criteria needed to be aimed, for which several techniques exist:

- Inversion: to divide 1 by the criterion reverses the outcome: the lower the criterion, the higher the score. This will lead to problems when the criterion can become zero or negative and leads to proportionality problems as well.
- Subtracting performance from a reference level. Difficulties:
    - how to establish the reference level
    - the establishment of the reference level influences the weighting factors
- Transform the criterion from an quantity into a difference (for instance from total energy cost to savings).

These kinds of criteria can also be standardized using the aforementioned standardization techniques, but this posed a problem when the criteria were used in a ratio.

5.2 Other multi criteria analysis related considerations

Globally four options are available for configuring performance criteria:

1. a fixed reward for complying to a fixed product description (no performance variation possible)
2. option 1. extended with a bonus for higher performance (budget has to allow for it)
3. option 1. extended with a penalty for lower performance (the possibility for a lower performance has to be available)
4. option 1. with possibilities for bonuses as well as penalties

Basic assumption of these four options is a performance-reward coupling is in place, other than the trivial coupling zero performance equals zero reward.

Care has to be taken that alternatives are not ranked ordinal when a cardinal ranking is possible, because this can lead to proportionality problems. The outcome of a tender procedure was successfully sued because it gave 85 points to the tender with the lowest price, 80 points to number two, etc. This was ruled to be not proportional. This leads to the conclusion that it is better to have an evaluation procedure which can produce a preference score using only one tender, than having a procedure in which tenders have to be compared to each other in order to establish a preference.

6. Conclusions

Many choices and approaches for formulating a preference formula exist. For the sake of clarity only few of the developed versions have been displayed in this paper. Every configuration option has its specific advantages and pitfalls. Formulating a preference formula that does not leave any room for juridical procedures poses a challenge. The following legal criteria have to be respected.

- Transparency: The way the preference is determined should be known in advance.
- Measurability: Discussion exists about this criterion. Physical attributes can easily be measured, but architectural quality for instance is essentially a subjective characteristic. This is resolved by objectifying the criterion: break it down into sub aspects, explain how these sub aspects will be judged and how this will lead to an end value. This should be done by an expert panel, which can include field experts, but should always include the client. In this way the numbers behind the decimal point are subjective, but the number before the decimal point is more or less objective.
- Proportionality: This criterion is especially applicable for determining the maximum turnover size of reference projects that allowed to be demanded. For instance demanding a relevant turnover twice the project budget is not proportional. Also the pitfall mentioned in section 5 is part of this criterion.
- Objectivity: Discussions with jurists about objective versus objectified exist, see also the measurability item. For the reason of risk avoidance legal advisors tend to be only satisfied with criteria that can be measured such as a physical property. They are afraid the measuring method that is developed when a criterion is objectified will successfully be sued, because it is not generally accepted. This can be dealt with by stating that the measuring method doesn't need to be generally accepted. It is enough when the client and the end users that the client represents accept the method. In the case of public clients, the discussion then quickly shifts towards the definition of the system boundary; which parties should be represented by client and how should this be done? These discussions

are often concluded by stating that the client has been given a mandate to make these decisions, so the opinion of the client can be used. It is not necessarily objective, but it is the best subjective opinion there is. Another reply can be that even with the measurement of physical properties concern about the measuring method still exists.

An observation during the development of the formula was that the outcome of the preference selection formula became awkward if no value was attached to delivering the minimum required quality. The influence of for instance the value of availability during reconstruction activities became much too important. Monetizing the selection preference formula solved this problem.

Overlooking all the problems and risks involved when using the different multi criteria techniques leads to the conclusion that expressing preferences in monetary terms is the best option. This is a big advantage because it is easier to understand and enables a higher acceptance. It also saves a lot of time for all parties involved because such units are easier to work with.

A problem of expressing preferences in monetary terms is that it easily generates the idea that it is still about the lowest price. As shown in sections 1 and 2 of this paper that is not true; the proposed system corresponds with selection strategy #3 rather than selection strategy #1.

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UK PFI Model of Procurement: Improvements Based Upon Current Practice In UK Schools and Hospitals.

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Abstract: This paper summarises the current UK practice of the PPP (Public Private Partnership approaches to the PFI (Private Finance Initiative) within schools and hospitals. It emphasises the operational aspects of the project post-construction. It does this by comparing the FM (Facilities Management) of schools and hospitals in both PFI and Non-PFI forms of procurement.

A SLEEPT (Social, Legal, Economic, Environmental, Political, Technological) analytical approach is combined with a ‘cultural compass’ to identify significant incongruence between PPP and non-PPP models for both schools and hospitals.

The most significant findings are that PPP schools and hospitals models are more consonant with each other than between Non-PPP and PPP schools or hospitals.

The movements around the compass for particular aspects of the PPP school and hospital models are very noticeable. It makes the development of a ‘generic’ and ‘internationalised’ PPP school or hospital approach almost impossible to achieve. This review suggests that the appropriate approach is that of a ‘modified individual’ approach.

Key Words: Education, Healthcare, PFI, PPP.

1. Introduction

The objective of this paper is to examine the suitability of UK PPP (Public Private Partnership) models used in projects in UK secondary schools and hospitals for implementation into other school and health projects. The premise of this paper being that the PPP approach is isomorphic with the characteristics of the individual UK PFI (Private Finance Initiative) project and its PPP ‘drivers’. Isomorphism is considered in the mathematical sense of a one-to-one correspondence between the characteristics of the individual hospital or school and its PPP performance.

This paper evaluates this mathematical isomorphism and attempts to establish the criteria for biological isomorphism – the similarity of form between different generations. Therefore to be an effective PPP model the biological and mathematical isomorphism must be aligned and be congruent with the drivers and local characteristics of each individual hospital or school project.

Since PFI projects are for an extended period of time (typically 20-30 years duration) the operational aspects – or Facility Management – are the crucial factor in assessing the appropriateness of the PPP model for schools and hospitals.

The effectiveness of any particular PPP model cannot be guaranteed under conditions of differing organisational cultures. Therefore the question to be answered for school or hospital projects is to what degree are these PPP models isomorphic with their own particular types of characteristic. The corollary is therefore what changes are likely to be required to the Non-PPP and PPP models to achieve greater compatibility with a particular school or health project characteristic.

The evaluation of these characteristics is by the use of a 'cultural compass' approach (Eaton et al, 2005) which is briefly explained later in this paper.

1.1 FM Imperatives in UK Schools and Hospitals

In FM procurement the school or hospital defines *what* the services will be and then for Non-PPP schools and hospitals the school (and/or the LEA- Local Education Authority) or the hospital (and/or NHS Trust National Health Service) determines *how* those services will be provided, whilst in a PPP school or hospital the private sector determines *how* those services will be provided. This form of PPP gives more certainty of the end product since its solution lies in an *output oriented approach*. This means that the school or hospital establishes the result it wishes to have and the parameters and constraints within which those results are to be delivered, but within those parameters and constraints it leaves it to the private contractors to determine the best way of achieving those results. Therefore the appreciation of the similarities and differences between the two PPP models will assist in minimising the potential difficulties of applying FM within differing cultural and social 'systems'

The derivation of these FM imperatives is examined in detail in a separate paper. (Eaton et al, 2006)

1.2 Theoretical Imperatives of PPP

The derivation of the concepts, drivers and characteristics of PPP is defined in Eaton & Akbiyikli (2005).

A brief synoptic review is presented below:

Key concepts of PPP:

- Governments purchase services not assets;
- Seek Value for Money for the Government Authority;
- Provide extensive Governmental Risk Transfer and improved Risk Management;
- Incorporate private sector know-how and expertise;
- Increase the incorporation of Innovation;
- Provide Whole life-cycle costing for the entire Project life-cycle.

Key drivers of PPP:

- A national need for better facilities and infrastructure;
- Increasing demand for public sector services;
- Governmental search for efficiency and creativity;
- A search for Innovation;
- Governmental Financial necessity;
- Desire to introduce competition in traditional Government services.

Key PPP characteristics:

- Capital investment from Private Sector;
- Output specification for Services;
- Defined Operation and Service content;
- Charges for defined quality of Service availability;
- Risk transfer to the managing party best able to control the specific risk.

Key enablers of PPP (SLEEPT):

- **Social** - Public acceptance of private sector involvement
- **Legal** framework – standardised documentation;
- **Economic** – Access to significant Private Sector Borrowing;
- **Environmental** – Clearly defined Sustainability and Impact criteria;
- **Political** framework - International, National and Local will or commitment;
- **Technological** – Access and availability of Quality PPP practitioners and experienced project sponsors.

In PPP procurement the public sector defines *what* the services will be and the private sector determines *how* those services will be provided. According to Akbiyikli and Eaton (2004) the PPP's philosophy is: *'A government policy to tackle financial problems in service provision and to integrate management skills to increase efficiency, effectiveness and quality and to exploit new opportunities.'*

2. Research Methodology

This study is a developmental study. It aims to identify the key features in each of the school and hospital environments so that necessary and sufficient consideration can be given at the initial concept phase of a PPP to attempt to minimise the intra-cultural conflict.

A holistic cultural perspective is presented based upon a 'cultural compass' approach (Lessem & Neubauer, 1994). The concepts of opposing linear scales; for example the Masculinity-Femininity and High Power Distance Index (PDI) – Low PDI (Hofstede, 1980) and multi function attributes (Hampden Turner & Trompenaars, 1993) have informed the creation of the cardinal compass points. [See Eaton et al 2005]

A sleept methodology (social, legal, economic, environmental, political, technological) analytical approach is utilised within this research for the analysis of components. The sleept mnemonic has been developed by crmr: the centre for risk management research at the university of salford as a tool for separately identifying 'drivers' of a process or object. It is based on the segregation of activity into six component parts both endogenous and exogenous of the unit of appraisal. No attempt is made to analyse the quantum of interdependency and co-dependency of the sleept components. The control position on the compass for each individual component incorporates a holistic qualitative composite of the other five components.

However, the cardinal points have been created specifically to represent the SLEEPT features specific to PPP in schools and hospitals. They were derived from analysis of 4 detailed case studies. The proposed specific features have the potential to be further developed, however for the purposes of this research they provide an adequate representation of the distinctive characteristics of the school/hospital cultures for application within the PPP model.

The cardinal points as created have as a definition of 'cardinality' placed the Non-PPP school and hospital as the Western cardinal point for all features. This essentially means that there is zero variance of the application of Non-PPP model for the Non-PPP school and Non-PPP hospital. As a consequence this would mean that if the PPP model was 'ideally suited' for introduction into a new school or hospital, the figure would show the same 'profile', that is a horizontal line on the 0 scale of the y axis, and no variance.

For the purposes of the 'cultural compass' the Non-PPP will always be the West point of the assessment. This introduces the assumption that there is no variance between the application of the Non-PPP case study and its counterparts within the UK. The authors recognise this as an assumption. However the premise is that there is no theoretical inconsistency in the application of the Non-PPP model within all Non-PPP schools and hospitals in the UK. The difficulties are practical post-hoc difficulties. This study is not intended to identify these post-hoc difficulties. It is to be used to ameliorate the conceptual and pre-inception inconsistencies.

The control position on the cultural compass indicates a presumed preference to a particular style of 'management', i.e., a Non-PPP model which has been the typical school or hospital model for many years. A cardinal points approach has been introduced. This introduces 8 potential alternative control models as variants of PPP. Even with this approach significant variation still existed within the model. Detailed disaggregation of the cultural components was therefore undertaken. The control location for each parameter (component of FM) has been determined by examination of the available data set. (These details are not presented within this paper).

Therefore the starting premise within this paper, as indicated by Figure 1, and confirmed by the case studies, is that ‘generally’:

Non PPP Schools will be ‘West’ – having a control position at 0° on the y axis;

Non PPP Hospitals will be ‘West’ – having a control position at 0° on the y axis;

PPP Schools will have a North East position – having a control position of 135° on the y axis.

PPP Hospitals will have a North East position – having a control position of 135° on the y axis.

This demonstrates the flexibility provided by the ‘cultural compass’ model as presented within Figure 2 as it covers the two sample schools and the sample hospital trust.

The intra-cultural conflict identified by this approach would manifest itself in inconsistencies between the operational model in the new PPP and the older and more traditional operations in Non-PPP Schools and Hospitals. This would be visually demonstrated by large movements away from the y axis.

For example, a Non-PPP model assumes that FM within a school can be provided by a ‘Caretaker’ and local contractors. The PPP model assumes that FM will be provided by a national/international provider. Therefore applying this PPP concept to a school/hospital that does not have experience of operating with national FM contractors is creating a potential intra-cultural inconsistency. This would be visually represented as a large movement away from the zero point on the y axis.

This work is intended to identify these potential inconsistencies before conception in order that amelioration can be effected. These inconsistencies may cause difficulties for the school/hospital management team and the FM provider in terms of the structures, systems, strategies or behaviours of the people, required in the implementation of the PPP. This paper does not propose changes to the PPP procedures in the UK.

3. Research Analysis

There is always confusion about PPP (Public Private Partnership) and PFI (Private Finance Initiative). PFI is a Public Service delivery type of PPP where responsibility for providing public services like education, healthcare, transportation, sanitation, etc is transferred from the public to the private sector for a considerable period of time. (Akintoye et al., 2001). The PFI is therefore a generic classifier for all types of ‘construction PPP’. “The whole concept of [PPP] is a government policy to tackle financial problems in facility provision and integrate private management skills to increase efficiency, effectiveness and quality” (HM Treasury, 2000). PPP is therefore based upon a financial premise that was introduced by the UK Government in 1992. For a detailed introduction to the principles and concepts of PPP the reader is referred to previous work. For example, Akintoye et al, (2001), Eaton & Akbiyikli, (2005). The PPP has become an important part of UK Government’s investment programme with projects currently being signed at a rate of £3 - 4 billion per annum (Henderson Global Investors, 2003).The use of a PPP model is not restricted to the UK and it is increasingly being utilised across the world in countries such as Japan, Denmark, Canada, Australia, Greece, Portugal and South Africa. (Eaton & Akbiyikli, 2005,)

The introduction of PPP in UK education and healthcare development marked a dramatic shift from the general presumption against the use of private finance in social infrastructure projects which had previously existed in the UK (Hall, 1998). Private financing is the fastest growing method of financing the construction of assets needed for public services. In the short-term, PPP projects shift more risk onto private sector firms, but over the longer-term, PPP funding can help to reduce the impact of economic cycles by providing more stable cash-flows during the long concession period.

An initial examination of the research data as presented in Figure 1 indicated how unrepresentative a single UK model was. The vertical scale indicates the number of degree points (clockwise) away from the Non-PPP (Traditional Practice) position the PPP school or hospital is for a particular characteristic. Figure 1 indicates the variance from the Non-PPP control position (a horizontal line at 0 on the y axis) for the examined features of PPP. This suggests many potential intra-cultural inconsistencies when the new PPP model is introduced.

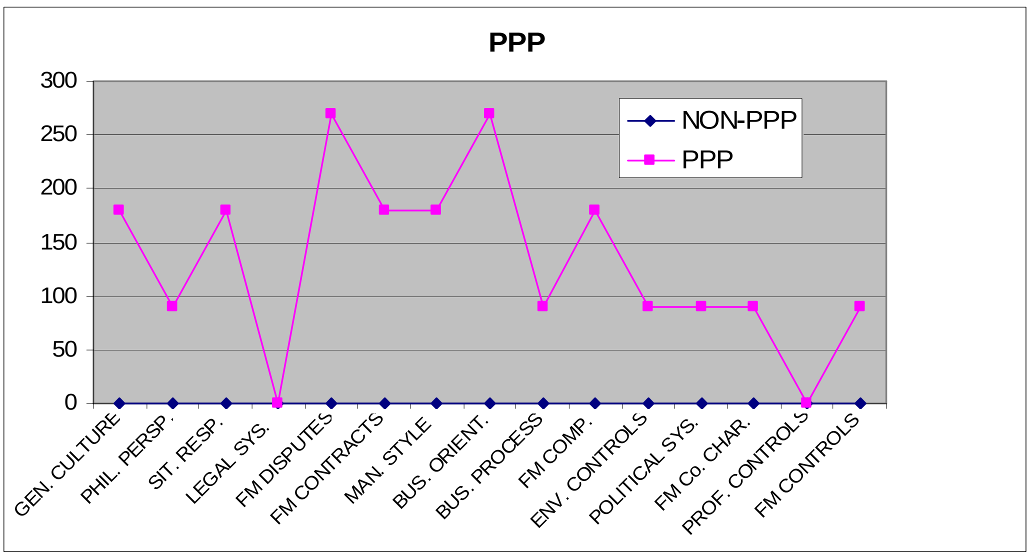

Figure 1 Generalised Comparison with the UK PPP and Non-PPP Schools and Hospitals.

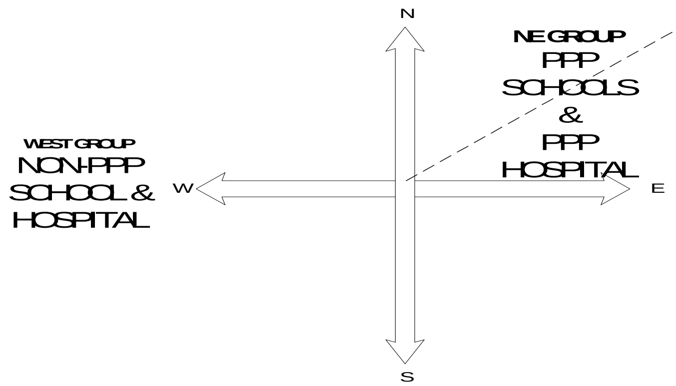

Fig. 2 Generalised FM Compass with Control Positions

Figure 2 indicates the 'best fit' aggregate position for the PPP school and the PPP hospital as defined by the case study data.

This 'control position' is then analysed by a series of component-by-component disaggregation. This indicates the compatibility of the control position for a particular feature. For example, how compatible the Non-PPP model is for PPP schools or hospitals when examining the features of the PPP legal system, or how compatible the PPP hospital model is when compared to PPP schools.

These individual component positions are then compared with the pre-defined control position. This gives a 'component-by-component' profile of variability, and hence the applicability of an FM model in PPP schools or hospitals. The variations in compatibility are demonstrated by movements away from the control position; indicated by positive and negative values on the y axis. Figure 1 indicates this variability between Non-PPP and PPP. The study did not find any significant variability between the PPP school and PPP hospital models.

3.1 Intra-Model Variability of Positions

3.1.1 The Non-PPP Model:

Perfect 'component-by-component' compatibility is demonstrated by the NON-PPP model. This is expected since the Non-PPP model is defined as the 'control' model. Figure 1 demonstrated this.

3.2 The PPP School and PPP Hospital Models

The control position for both of the PPP models was defined as 135° as shown in figures 1 and 2, this was the aggregated or average position. This PPP control position is then converted and is shown as the 0 scale point on the y axis of figure 3. This shows the disaggregated position, reflecting both positive and negative movements away from the control position for the ‘cultural features of FM’ examined in this research. All of the individual components vary from this converted aggregate position as shown in Fig 3.

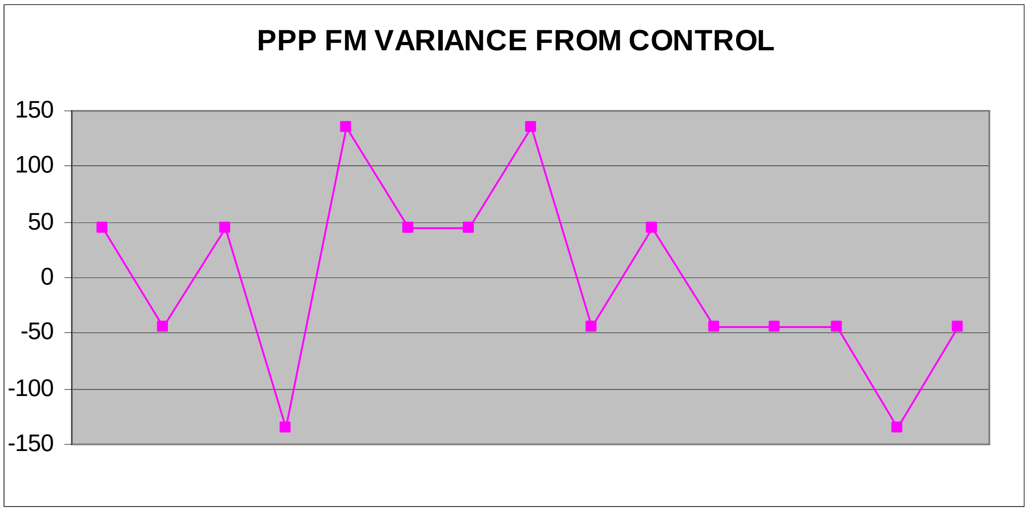

Fig. 3 Component-by-Component Analysis of PPP School FM

Having conducted the component-by-component and intra model variability, the analysis now moves to the analysis of the FM Imperatives and PPP Imperatives as realised by the case study schools and hospitals data.

3.3 PPP Imperatives in UK Schools and Hospitals

The PPP imperatives have been presented in the introduction of this paper. They are now analysed for realisation against both the PPP schools and hospitals. Table 1 presents the comparison. When a PPP imperative is achievable by the PPP school and / or hospital a brief note is made, in other instances not applicable is stated.

Table 1: Comparison of realisation of PPP Imperatives

Key concepts of PPP:	**PPP SCHOOL**	**PPP HOSPITAL**
Governments purchase services not assets;	LEA purchases services	Trust purchases services in 1 contract
Seek Value for Money for the Government Authority;	VFM at commencement of procurement process	VFM at commencement of procurement process
Provide extensive Governmental Risk Transfer and improved Risk Management;	Service costs transferred to private sector. LEA pays annual charge for services	Service costs transferred to private sector. Trust pays annual charge for services
Incorporate private sector know-how and expertise;	Implicit in PPP philosophy	Implicit in PPP philosophy
Increase the incorporation of Innovation;	No evidence	No evidence
Provide Whole life-cycle costing for the entire Project life-cycle.	Provider deemed to satisfy this criteria	Provider deemed to satisfy this criteria
Key drivers of PPP:		
A national need for better facilities and infrastructure;	Fully achieved	Fully achieved
Increasing demand for public sector services;	Could be met by revised PPP	Could be met by revised PPP
Governmental search for efficiency and creativity;	Provider seeking efficiency-efficiency failures do not affect School. No evidence of creativity.	Provider seeking efficiency-efficiency failures do not affect Hospital. No evidence of creativity.
A search for Innovation;	No evidence	No evidence
Governmental Financial necessity;	Agreed	Agreed
Desire to introduce competition in traditional Government services.	Competition at inception of PPP on whole package basis	Competition at inception of PPP on whole package basis
Key PPP characteristics:		
Capital investment from Private Sector;	Yes	Yes
Output specification for Services;	All services subject to performance output specification	All services subject to performance output specification
Defined Operation and Service content;	No ambiguity, but School did not have all Service specification documents	No ambiguity, but unresponsive to changing requirements
Charges for defined quality of Service availability;	Defined in Annual Unitary Fee	Defined in Annual Unitary Fee
Risk transfer to the	Generally provider	Generally provider

managing party best able to control the specific risk.	responsibility School Business Manager only becomes involved if there are problems with service quality	responsibility Trust Facilities Manager only becomes involved if there are problems with service quality
Key enablers of PPP (SLEEPT):		
Social - Public acceptance of private sector involvement	Emerging and socially contentious policy	Emerging and socially contentious policy
Legal framework – standardised documentation;	1st local PPP therefore bespoke documents. National trend to standardised docs.	National trend to standardised docs.
Economic – Access to significant Private Sector Borrowing;	Yes	Yes
Environmental – Clearly defined Sustainability and Impact criteria;	Detailed sustainability and impact assessments	Detailed sustainability and impact assessments
Political framework - International, National and Local will or commitment;	Emergent and politically contentious policy	Emergent and politically contentious policy
Technological – Access and availability of Quality PPP practitioners and experienced project sponsors.	School lacks implicit and explicit PPP knowledge. FM provider in 'better' position.	Trust implicit and explicit PPP knowledge resides with individuals. FM provider in 'better' position.

4. Conclusion

A paper such as this inevitably contains many features that are approximated or generalised. The key imperatives identified within this research and the PPP models can be elaborated to contain many more features. However the appreciation of cultural similarities and differences will have implications for the effective project delivery of future healthcare or education projects.

The appreciation of cultural similarities and differences between individual schools or hospitals and between PPP and Non-PPP schools or hospitals will have implications for effective project delivery of future PPP projects.

Mathematical isomorphism was found between the school and hospital PPP models but not between PPP and Non-PPP schools or hospitals. Biological isomorphism was not established and is unlikely to be established under current PPP procedures.

The movements around the compass for particular aspects of the PPP school and hospital models are very noticeable. It makes the development of a 'generic' and 'internationalised' PPP school or hospital approach almost impossible to achieve.

PPP school or hospital projects should be considered within the existing exogenous features of a local area. Merely implementing standardised PPP protocols without recognising these inherent differences will lead to potential operational failures. This paper offers an approach that can be generalised for adoption by schools and LEA's or hospitals and NHS Trusts considering the introduction of PPP as a procurement process. This review suggests that the appropriate approach is that of a 'modified individual' approach.

The most significant findings are that the examined PPP schools and hospitals models are more consonant with each other than between Non-PPP and PPP schools or hospitals.

The other significant feature is that in relation to the technological issues of PPP, the healthcare sector is better equipped than the education sector for managing their own involvement in the entire PPP process.

Another finding is that in both education and healthcare no evidence was found to support the PPP imperative that incorporation of innovation was being accomplished through the PPP mechanism.

There was also no evidence of the incorporation of creativity in either the healthcare or education PPP's examined.

The provision of greater flexibility emerged as a major issue in both hospitals and education PPP's. Whilst poor flexibility in healthcare has attracted much media attention, far less apparent was the same issue in education.

The research demonstrates that any school or hospital embarking upon a new PPP should carefully consider the 'model of PPP' it wishes to adopt and not simply impose the current national model. It should also recognise the inevitable conflicts that will arise between previous performance practices and those that will emerge from the PPP process.

Acknowledgements

The authors acknowledge the invaluable assistance of Mr Alan Smithies, Mr John Longden, Mr Philip Wood and Mr Peter Webster, the head teacher and business managers for the PPP and Non-PPP Schools, Mr Mike Gallagher the Director of Facilities for Blackpool, Fylde and Wyre NHS Hospital Trust respectively, used as case studies in this paper. The authors also acknowledge the cooperation of many unnamed colleagues at collaborating institutions for their assistance in determining FM 'locations' for the parameters defined by the 'cultural compass' presented within this paper.

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Intra-Market Analysis of Facilities Management in UK Schools and Hospital PPP's: Lessons Learned.

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Abstract: This paper summarises the current UK Facilities Management practice of PPP (Public Private Partnerships) in the form of PFI (Private Finance Initiative) in education and healthcare projects. It compares and contrasts the two sectors with the more traditional Non-PPP form of facilities management and presents empirical analysis from case study projects.

The analysis is structured to compare and contrast the attainment of the:

Key Concepts of Facilities Management;
Key Drivers of FM;
Key Characteristics of FM;
Key SLEEPT Enablers of FM.

This analytical approach based on case studies identifies significant incongruence between FM in PPP and non-PPP models for both schools and hospitals.

Operational flexibility and adaptability are key features for the continued development of projects in both sectors. Current experience gathered from this research suggests that the educational sector is achieving this more than the health sector.

Key Words: Education, Facilities Management, Healthcare, PFI, PPP.

1. Introduction

The objective of this paper is to examine the suitability of Facilities Management (FM) models in UK secondary schools and hospitals for implementation into other school and health projects. The premise of this paper being that the FM approach is isomorphic with the characteristics of the individual UK PFI project and consequently its FM 'drivers'. Therefore to be an effective FM model it must be aligned and congruent with these drivers and local characteristics. Isomorphism is considered in the mathematical sense of a one-to-one correspondence between the requirements of the individual hospital or school and its PPP performance.

This paper evaluates this mathematical isomorphism and attempts to establish the criteria for biological isomorphism – the similarity of form between subsequent generations of hospitals or schools. Therefore to be an effective model the biological and mathematical isomorphism must be aligned and be congruent with the drivers and local characteristics of each individual hospital or school.

Private financing is the fastest growing method of financing the construction of assets needed for public services. Indeed the introduction of PPP in UK education and healthcare development marked a dramatic shift from the general presumption against the use of private finance in social infrastructure projects which had previously existed in the UK (Hall, 1998). In the short-term, PPP projects shift more risk onto private sector firms, but over the longer-term, PPP funding can help to reduce the impact of economic cycles by providing more stable cash-flows during the long concession period. For the public sector this marks a dramatic shift from being a provider of services to becoming a consumer of specified service provision. This shift has significant organisational and cultural implications for how both the public and private sectors perform their duties.

Since PFI projects are for an extended period of time (typically 20-30 years duration) the operational aspects – or Facility Management – are the crucial factor in assessing the appropriateness of the PPP model for schools and hospitals in the delivery of these services.

The effectiveness of any FM model therefore cannot be guaranteed under conditions of differing organisational cultures. Therefore the question to be answered is to what degree are these FM models isomorphic with their own particular types of characteristic. The corollary is therefore what changes are likely to be required to the Non-PPP and PPP FM models to achieve greater compatibility with a particular school or health project.

1.1 FM Imperatives in UK Schools and Hospitals

A research project (Eaton & Akbiyikli, 2005) studied the essential requirements of the ‘generic PPP’ project. The following imperatives where established as being critical to the success of PPP. These imperatives are used in a comparison exercise which is detailed later in a series of tables in the section headed ‘Research Results’.

Key Concepts of FM:

- Creates high quality expectations from all services;
- Seeks Value for Money in service provision;
- Improves Risk Management;
- Incorporates whole life-cycle costing of service provision.

Key Drivers of FM:

- Maintain facilities and infrastructure in a condition to permit delivery of educational / healthcare mission;
- Permit increased and extended use of facilities and infrastructure;
- Search for efficiency and effectiveness;
- Financial stewardship of expenditure;
- Competition in separate FM services.

Key FM Characteristics:

- Restricted financial availability;
- Output specification for services;
- Defined Operation and Service content;
- Maximise quality of service availability.

Key Enablers of FM (SLEEPT):

- **Social** – General acceptance of alternative methods of service provision;
- **Legal** framework – standardised performance documentation and standards;
- **Economic** – Access to sufficient finance for FM;
- **Environmental** – Clearly defined Sustainability and Impact criteria;
- **Political** framework - National and Local commitment to FM;
- **Technological** – Access and availability of Quality FM practitioners and experienced FM managers.

In FM procurement the school or hospital defines *what* the services will be.

In Non-PPP schools and hospitals the school (and/or the LEA - Local Education Authority) or the hospital (and/or NHS Trust – National Health Service) determines *how* those services will be provided.

In a PPP school or hospital the private sector determines *how* those services will be provided. This form of FM gives more certainty of the end product since its solution lies in an *output oriented approach*. Within this approach the school or hospital firstly establishes the result it wishes to have and the parameters and constraints within which those results are to be delivered. Secondly within those parameters and constraints the client (school or hospital) leaves it to the private contractors to determine the best way of achieving those results.

Therefore the appreciation of the differences between the two FM models will assist in minimising the potential difficulties of applying FM within differing cultural and organisational 'systems'.

1.2 Theoretical Imperatives of PPP

PPP's have become an important part of UK Government's investment programme with projects currently being signed at a rate of £3 - 4 billion per annum (Henderson Global Investors, 2003).The use of a PPP model is not restricted to the UK and it is increasingly being utilised across the world in countries such as Japan, Denmark, Canada, Australia, Greece, Portugal and South Africa. (Eaton & Akbiyikli, 2005,)

The derivation of the concepts, drivers and characteristics of PPP is defined in Eaton & Akbiyikli (2005). According to Akbiyikli and Eaton (2004) the PPP's philosophy is: *'A government policy to tackle financial problems in service provision and to integrate management skills to increase efficiency, effectiveness and quality and to exploit new opportunities.'*

In PPP procurement the public sector defines *what* the services will be and the private sector determines *how* those services will be provided. When compared to the imperatives of FM there is very little difference. The most noticeable exclusion from FM is the incorporation of innovation.

2. Research Methodology

This study is a developmental study. The basis of this analysis was a series of separate case studies for PPP and Non-PPP hospitals and schools (4 Number). These case studies consisted of historical literature review, archival record analysis and a series of semi-structured interviews. These separate case studies have then been collated and analysed by a SLEEPT (-Social, Legal, Economic, Environmental, Political, Technological) methodology and 'cultural compass' approach (Eaton et al 2005).

The SLEEPT methodology has been developed by CRMR: The Centre for Risk Management Research at the University of Salford as a tool for separately identifying 'drivers' of a process or object. It is based on the segregation of activity into six component parts both endogenous and exogenous of the unit of appraisal. No attempt is made to analyse the quantum of interdependency and co-dependency of the SLEEPT components. A holistic cultural perspective was utilised based upon a 'cultural compass' approach (Lessem & Neubauer, 1994). The concepts of opposing linear scales; for example the Masculinity-Femininity and High Power Distance Index (PDI) – Low PDI (Hofstede, 1980) and multi function attributes (Hampden Turner & Trompenaars, 1993) have informed the creation of the cardinal compass points. (See Eaton et al 2005)

The purpose of this analysis was to identify the key features in each of the school and hospital environments so that necessary and sufficient consideration could be given at the initial concept phase of an FM to attempt to minimise the intra-cultural conflict. This intra-cultural conflict would manifest itself in inconsistencies between the FM model in PPP and Non-PPP Schools and Hospitals. For example, a Non-PPP FM model assumes that FM can be provided by a 'Caretaker' and local contractors. The PPP FM model assumes that FM will be provided by a national / international provider. Therefore applying this PPP FM concept to a school / hospital that does not have experience of operating with national FM contractors is creating a potential intra-cultural inconsistency.

This work is intended to identify these potential inconsistencies before conception in order that amelioration can be effected. These inconsistencies may cause difficulties for both the school / hospital management team and the FM provider, in terms of the structures; systems; strategies; or behaviours of the people; required in the implementation of the FM. This paper does not propose changes to the FM procedures in the UK.

3. Research Analysis

An initial analysis was conducted with the hypothesis that the PPP models of FM in either a hospital or a school was mathematically isomorphic with the pre-existing Non-PPP model of FM in either schools or hospitals. Isomorphism would have been indicated if the PPP models showed no variance from the Non-PPP models. Figure 1 showed that this was not the case. Figure 1 indicates the variance from the Non-PPP FM control position (a horizontal line at 0 on the y axis) for each of the examined features of FM. This suggests many potential intra-cultural inconsistencies when the FM model in PPP schools or hospitals is introduced. Detailed disaggregation of the cultural components was therefore undertaken. The control location for each parameter (component of FM) has been determined by examination of the available data set.

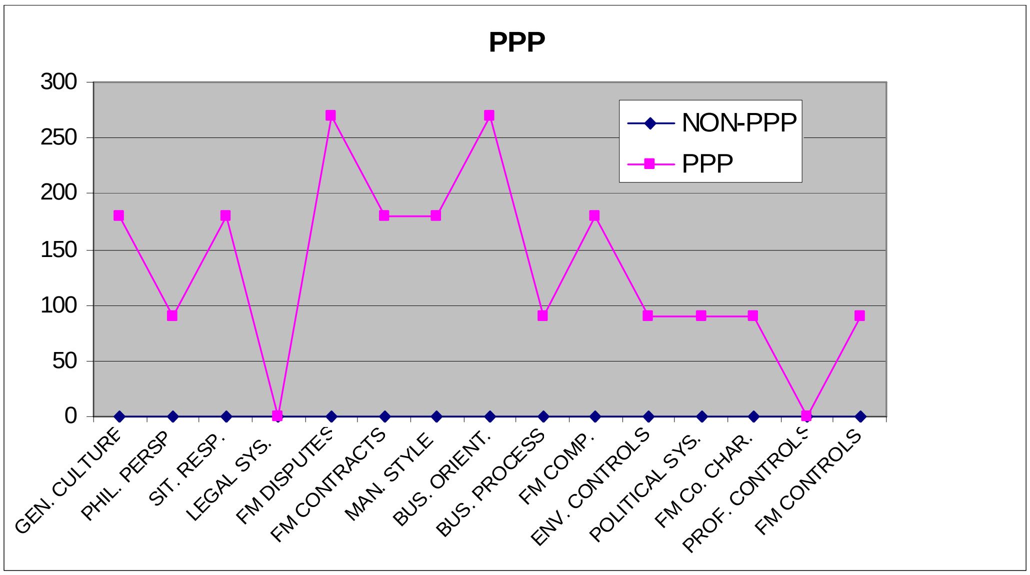

Figure 1 Generalised FM Comparison with the UK PPP and Non-PPP Schools and Hospitals.

Figure 2 indicates the 'best fit' aggregate 'cultural compass' position for the PPP School and the PPP Hospital as defined by the case study data.

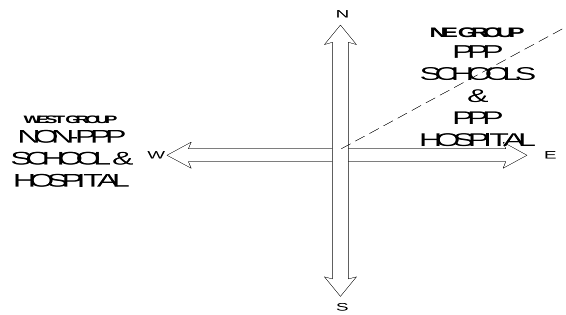

Fig. 2 Generalised FM 'Cultural Compass' with Control Positions

4 Research Results: FM Imperatives in UK Schools and Hospitals

The FM imperatives have been presented in the introduction to this paper. The realisation of those imperatives is now summarised in Tables 1-4.

Table 1: Comparison of realisation of Key Concepts of FM

Key Concepts of FM:	PPP SCHOOL	NON-PPP SCHOOL	PPP HOSPITAL	NON-PPP HOSPITAL
Creates high quality expectations from all services;	Achieves Safe, Caring, Happy and Purposeful Environment	Desirable but always constrained by budget limitations	To Performance Specification 100% outsourced	To mandatory guidelines with some discretion over timescales
Seeks Value for Money in service provision;	Premise of original PPP procurement	Usually only concerned with initial capital cost	Premise of original PPP procurement	Some VfM sought but other priorities intervene
Improves Risk Management;	No major change from Non-PPP	No major change from Non-PPP	No major change from Non-PPP although provider is more risk averse than Trust.	Trust is more risk accepting.
Incorporates whole life-cycle costing of service provision.	Yes	No	Yes	Attempts but lacks sufficient data and analytical resources

Lessons Learned: In the PPP school the high expectations of service quality are delivered. This is in direct opposition to the Non-PPP school where high service quality was deemed desirable but was never achievable given current budgetary constraints.

In the PPP hospital the service quality is delivered to the Performance Specification. If this is defined as the requisite national guideline then satisfactory quality can be achieved. However the rigidity of the national guidelines means that great care and attention is required to define and delimit different performance standards for differing circumstances. Many hospital facilities will have a number of different medical uses over its life cycle and the flexibility of use must be accompanied by the same flexibility in service provision This also requires that the unitary charge has a change mechanism for subsequent changes in the required service performance. The Non-PPP FM currently performs better than the PPP service in achieving this flexibility.

In achieving Value for Money (VfM) the PPP school and hospital both felt that the PPP was delivering. There was greater belief of this VfM in the school than in the hospital. The emphasis on Whole Life-Cycle costing within the PPP was believed to be the reason for this. The Non-PPP school had acute budget constraints which resulted in an almost total concentration on initial capital cost to the detriment of VfM. The Non-PPP hospital had a much larger budget and therefore had a greater opportunity to seek VfM. The Non-PPP hospital concluded that they where not as effective as the PPP hospital in achieving VfM.

In terms of improving Risk Management no evidence was found to suggest that risk management had improved under PPP. The PPP hospital reflected that the FM service provider was more bureaucratic than in the Non-PPP hospital and that this was reflected in the PPP hospital being more risk averse and consequently the FM provider was probably committing capital outlay at an earlier time than the Non-PPP would. In the Non-PPP school there was a recognition that their 'world-view' of risk management was perhaps too much associated with Health and Safety and therefore should become much broader in the future.

Whole Life-Cycle costing in both the PPP school and hospital was superior to the Non-PPP equivalent.

Table 2: Comparison of Key 'Drivers' of FM

Key Drivers of FM:	**PPP SCHOOL**	**NON-PPP SCHOOL**	**PPP HOSPITAL**	**NON-PPP HOSPITAL**
Maintain facilities and infrastructure in a condition to permit delivery of educational / health mission;	School not concerned with FM budget (except for potential pupil malicious damage claims from FM provider). FM is no different from [Non-PPP] provision. Facilities are all less than 3 years old	The budget is the most critical issue. Maintenance is always constrained and hence prioritised by availability of funds on an annual basis Reactive approach is typical. Facilities are of mixed ages	Trust not concerned with FM budget (except for potential malicious damage claims from FM provider). FM is no different from [Non-PPP] provision. Facilities are all less than 3 years old	Maintenance budget is a major issue. Mixture of proactive and reactive maintenance. Proactive is typically outsourced Facilities are of mixed ages up to 100 years old
Permit increased and extended use of facilities and infrastructure;	PPP has permitted extended hours and incorporates additional services, E.g. full time security as part of Full Extended School and Life-Long Learning Centre	School constrained by total budget Many proposed initiatives never materialise through lack of finance	PPP has permitted extended and additional services. The Trust advises that this is more a function of the age of facilities	Increased and extended use is defined by management team and budget normally follows from decision to change Budget cuts at a later stage create difficulties for FM team
Search for efficiency and effectiveness;	School Business Manager only becomes involved if there are problems with service quality	School Business Manager is heavily involved in all matters of FM Often this detracts from other ongoing activities	Director of Facilities (or delegated staff) only becomes involved if there are problems with service quality	FM staff heavily involved in day by day issues. Staff frequently overloaded by FM demands Outsource some aspects to consultants
Financial stewardship of	No school budget FM	A major aspect of Head teacher	No Hospital budget - FM	A major aspect of FM workload

expenditure;	provider to fully repair and maintain all facilities irrespective of budget	and Business manager activity	provider to fully repair and maintain all facilities irrespective of budget	
Competition in separate FM services.	All services outsourced under single operational contract of FM provider	Many services separately contracted out	All services outsourced under single operational contract of FM provider	Mixture of direct and contracted out service provision. Changes to TUPE makes for more equal competition

Lessons Learned: The FM provision is generally more efficient in the PPP than Non-PPP facilities; however difficulties arise over the Performance Specification and the monitoring of performance to specification. The biggest FM benefit was attributed to the age of the PPP facilities when compared to the much older Non-PPP stock. There was no evidence of increased effectiveness of FM in PPP hospitals, however in the Non-PPP school FM was severely constrained by budget limits. There was a small maintenance backlog in the non-PPP hospital (approximately 3% of annual budget) and a much larger maintenance backlog in the Non-PPP school (approximately 400-500% of annual budget). There was no maintenance backlog in the PPP facilities; however they are all less than 3 years old.

The introduction of the PPP facilities had permitted an increase and extension of the service provision. In both instances this was attributed directly to the age or design of the facility rather than to PPP.

The introduction of FM services in the PPP facilities permitted the school or hospital staff to concentrate on other matters than routine FM. In the Non-PPP hospital, since there was always a large workload no significant difference was noted. However, in the Non-PPP school a major portion of the Business Managers' time and a significant portion of the head teachers' activity were associated with FM.

The financial stewardship burden was dramatically reduced in both the PPP hospital and school.

In terms of competition for FM services the PPP school and hospital conceded that competition may have been reduced, due to the lack of major FM providers. The Non-PPP school and hospital could market test competition at a more regular interval than in the PPP facilities. All PPP and Non-PPP recognised that there was a trade-off in terms of competition. A feature that did emerge was the gradual 'squeezing-out' of local SME's (small and medium enterprises) in PPP facilities. In the PPP school a 'local' security company had been replaced by a 'national' company without reference to the school. The school felt that there was a potential loss of 'local implicit knowledge' that had not been recognised in evaluating the tenders.

Table 3: Comparison of Key Characteristics of FM

Key FM Characteristics	**PPP SCHOOL**	**NON-PPP SCHOOL**	**PPP HOSPITAL**	**NON-PPP HOSPITAL**
Restricted financial availability;	No capping for FM costs	Severely cash limited – never sufficient for all needs	No capping for FM costs	Cash limited but usually sufficient for all significant needs
Output specification for services;	All services subject to performance output specification	Ad hoc mixture of LEA and local performance specifications	All services subject to performance output specification	Typically detailed performance requirements available from national NHS sources
Defined Operation and Service content;	No ambiguity, but School did not have all Service specification documents	Potential ambiguity in performance assessment Has caused contractual disputes	No ambiguity.	Comparisons between separate blocks is difficult Local supervision is essential
Maximise quality of service availability.	Not maximised but conforms to Performance spec.	Not possible typically operates on a lowest practical specification	Not maximised but conforms to Performance spec.	Flexibility in provision to meet local condition requirements

Lessons Learned: For all FM characteristics the PPP facilities were deemed superior to the Non-PPP facilities with the exception of the maximise service quality characteristic in the Non-PPP hospital where service flexibility was deemed better than in the PPP as discussed previously.

Table 4: Comparison of Key Enablers of FM (SLEEPT)

Key Enablers of FM (SLEEPT):	PPP SCHOOL	NON-PPP SCHOOL	PPP HOSPITAL	NON-PPP HOSPITAL
Social – General acceptance of alternative methods of service provision;	School has no flexibility – this is transferred to FM provider	Great flexibility delegated to head teacher and governing body A relatively new provision	Hospital has no flexibility – this is transferred to FM provider	FM flexibility delegated to local FM team to respond to local conditions and needs
Legal framework – standardised performance docs. and standards;	1st local PPP therefore bespoke documents. National trend to standardised docs.	Recently subject to major changes in FM provision Service provision evolving and maturing on a local area basis	National trend to standardised docs.	Subject to national requirements with local regional variations
Economic – Access to sufficient finance for FM;	Always fully funded	NEVER fully funded Major maintenance backlog Some priority work is usually postponed	Always fully funded	Usually sufficient for major needs Requires annual prioritisation of needs There is a small maintenance backlog
Environmental – Clearly defined Sustainability and Impact criteria;	Detailed sustainability and impact assessments	Aspired to but not satisfactory	Detailed sustainability and impact assessments	Sustainability considered and local impact aspired to.
Political framework - National and Local commitment to FM;	Emergent and politically contentious policy	An emergent national FM policy.	Emergent and politically contentious policy	A well established and robust national framework
Technological – Access and availability of Quality FM practitioners and experienced FM managers.	FM management from experienced provider. Contractual expertise for FM expenditure	FM management from Business Manager – not a normal job criteria for the post. Present incumbent had experience from previous employment	FM management from experienced provider. Contractual expertise for FM expenditure	FM management by an experienced local team

Lessons Learned: The most significant issue to emerge from the SLEEPT enablers was the need for social flexibility in which both the non-PPP school and hospital were judged as superior to the PPP facilities. The PPP school and hospital managers felt that they were inhibited in how they could respond to changes in social responsibility because this flexibility had been transferred to the FM operator. It was only by chance that the PPP school had a “very flexible” FM provider who “worked with the School”. A more intransigent FM operator would have been a major obstacle for the PPP school. The inflexibility of service operations in the PPP Hospital has previously been referred to.

5. Conclusion

A paper such as this inevitably contains many features that are approximated or generalised. The features identified within this research and the FM models can be elaborated to contain many more features. However the appreciation of cultural similarities and differences will have implications for the effective project delivery of future FM projects.

There was no evidence of isomorphism (mathematical or biological) between the Non-PPP and PPP models for either the schools or hospitals.

There was some evidence of mathematical isomorphism between the Non-PPP hospital and Non-PPP school. (Biological isomorphism was not tested.)

There was significant evidence of mathematical isomorphism between the PPP hospital and the PPP school. (Biological isomorphism was not tested.)

The incongruence of particular aspects of the PPP school and hospital FM models when compared to the previous Non-PPP models is very noticeable. It makes the development of a 'generic' and 'internationalised' PPP school or hospital FM approach almost impossible to achieve. This review suggests that the appropriate approach is that of a 'modified individual' approach.

The appreciation of cultural similarities and differences between individual schools or hospitals and between PPP and Non-PPP schools or hospitals will have implications for effective project delivery of future FM projects. PPP school or hospital projects should be considered within the existing exogenous features of a local area. Merely implementing standardised PPP FM protocols without recognising these inherent differences will lead to project failures. This paper offers an approach that can be generalised for adoption by schools and LEA's or hospitals and NHS Trusts considering the introduction of PPP as a procurement process.

This paper represents a synoptic review of a major research work and a detailed analysis of the full implications cannot be presented within this paper. The models are not presented as prescriptive but as advisory to the modification of FM operational protocols. The concepts can be generalised to any school or hospital considering the introduction of a PPP procurement system. The research demonstrates that any school or hospital embarking upon a new PPP including FM should carefully consider the 'model of FM' it wishes to adopt and not simply impose a traditional or 'standardised' model.

Acknowledgements

The authors acknowledge the invaluable assistance of Mr Alan Smithies, Mr John Longden, Mr Philip Wood and Mr Peter Webster, the head teacher and business managers for the PPP and Non-PPP Schools, Mr Mike Gallagher the Director of Facilities for Blackpool, Fylde and Wyre NHS Hospital Trust respectively, used as case studies in this paper. The authors also acknowledge the cooperation of many unnamed colleagues at collaborating institutions for their assistance in determining FM 'locations' for the parameters defined by the 'cultural compass' presented within this paper.

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Multi-Project Resources Procurement in the Construction Industry

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Abstract: In this paper, supply policy and procurement of shared resources in some kinds of concurrent construction projects are investigated. This could be oriented to the problems of holding construction companies who involve in different projects concurrently and they have to supply limited resources to several projects as well as prevent delays to any project. Limits on transportation vehicles and storage facilities for potential construction materials and also the available resources (such as cash or manpower) are some of the examples which affect considerably on management of all projects over all. The research includes investigation of some real multi-storey buildings during their execution periods and surveying the history of the activities. It is shown that the common resource demand variation curve of the projects may be expanded or displaced to achieve an optimum distribution scheme. Of course, it may cause some delay to some projects, but it has minimum influence on whole execution period of all projects and its influence on procurement cost of the projects is considerable. These observations on investigation of some multistorey building which are built in Iran will be presented in this paper.

Keywords: Construction Management, Multi-Project, Resource Procurement, Resources Sharing, Supply Management

1. Introduction

In the construction industry, most of owners and contractors have usually large ongoing construction portfolios rather than one-off construction projects. Although, every project has its own resources requirements but the type and quantity of resources vary considerably during the projects implementation. In addition, some market incertitude increase the projects delay risk. Nevertheless, general project management literature is heavily biased towards the single project paradigm, with little written on the multi-project environment (Blisman, 2002; Levy, 1997). A single project paradigm does not accurately reflect the reality of many construction clients. Multi-projects have tended to be treated as monolithic projects (Reedy, 1983), even though unique problems, particularly regarding their management, have been identified by several authors (Abdullah and Vickridge, 1999; Loftus, 1999). In brief, there are enough differences between multi-projects and traditional projects to question the applicability of straight project management approaches.

The management of multi-projects is not simply an aggregate of single project efforts and as such requires unique approaches, techniques and tools. Use of common resources provides usually important constraints on the individual planning of these kinds of projects. Some of

these limitations are: storage capacity, transportation, specialized and non-specialized manpower and even cash resources. The main target of this research is to minimize the overall cost of these resources for a group of projects without any delay on a whole.
Although, use of common storage and transportation system may provide some delays or modifications to the individual project planning, but it leads to great saving in material delivery cost (Sarkar M.R., 2004). When the projects are planned concurrently, some cases are met at which the demand for special resource is increased where at other periods the demand is at its lowest. Non-uniformity in demand distribution causes some difficulty in supply of resources. It is possible to bring the resources consumption to a proper level by suitable distribution of demand within whole duration of the projects. This investigation shows considerable reduction in volume of the necessary resources and total projects' expenditure.

2. Problem description

Nowadays, the competition in construction industry is usually very strict and serious. Therefore, a methodology for optimal use of resources and for maximum reduction of any risk damages and delays could affect considerably projects delivery with competence. A construction project compounds of several activities each one requiring various kinds of resources and services during its execution. Ordinarily, the projects are scheduled using some software as like as MSF, PRIMAVERA, etc. which are based on activities precedence in essence. The activities of each project are distributed during a particular periods and each one demands some particular resources including construction materials and equipment. Although the quantity and quality of these resources are determined in advance but there is usually some flexibility to displace the activities leading to change in the periods of resource demands. Besides, the quantity and quality of some resources might be inconsistent to market delivery.

Encountering the resource restraints leads to some repeated modification and software performance improvement to consider the resource restrictions of single project. But, there are several reasons to merge the management of some projects in a higher level while each project has always its own management. Some of these reasons are as following:
(a) The quantity of required resources is not economically feasible at some time intervals.
(b) The quality of some services and resources delivery is not accessible with enough satisfaction.
(c) The market uncertainty and inflation affect considerably on the resource and service delivery of the projects as a whole.
(d) Resource and service delivery for the projects in busy urban areas oblige some storage and transport facilities which add some supplementary constraints to be attended.

Transport and storage capacity are some examples of very expensive and severe constraints that affect considerably on whole cost of construction portfolios. These constraints could be more restrictive for the projects undertaken in the busy areas of grand cities. In one side the demand of these kinds of resources is very different during the execution of each project and in the other side, the supply possibilities has usually unpredictable. The market based restraints also provide essential and harmful effects on project delivery. On-time material delivery for all the projects' activities requires a plan of procurement consistent to all the projects' scheduling. Because of the difference on peak time of material needs and uncertainty of market response to instant delivery, some storage capacity is required and it obliges some prediction and material reservation. This will be more important when market shows irregular infatuation and the initial prediction of costs is being violated. Predicted and unpredicted traffic obstacles provide additional needs to resource storage. This research investigates the cost and delay sensitivity of projects portfolios delivery in respect to the shared and unshared storage and transportation capacity that has important influence on multi-project delivery in holding construction companies.

The projects portfolios describes a collective group of construction projects carried out under the sponsorship and/or management of a particular organization, with no inference to the manner in which they are organized or managed. In general, it focuses on the benefits or strategic aims of an organization; provides common purpose between projects; involves a number of projects run within groups, and exhibit some form of interaction between projects. In fact, it is a framework for grouping existing projects or defining new projects, and for focusing all the activities required to achieve a set of major benefits. These projects are managed in a coordinated way, either to achieve a common goal, or to extract benefits which would otherwise not be realized if they were managed independently.

3. Methodology

A general literature review was undertaken to establish previous researches, identify definitions, terminology and general construction trends. The scarcity of resources on the subject within construction-related disciplines dictated that literature from other disciplines formed the major proportion of the review.
In this study, we investigated the actual project scheduling and management planning of three multi-storey buildings executed in some busy areas of Tehran. All these buildings had a unique owner but each one had its own project manager and subcontractor. These projects were scheduled using the MSP software and modified successively during the project implementation. Although, each project had its own special problems in resource procurement, but there were some common problems that could be resolved or delighted by the initiative proposed in this study. This research concentrates on the resources whose delivery is affected considerably by transport obstacles or the resources for which some storage facilities could provide sufficient ease on the resource procurement. Looking for these kinds of resource leads some deep study on the quality and quantity of resources used by each activity including the appropriate using time intervals.

In fact, at the beginning, each project was analyzed and scheduled ordinarily and independently using the MSF software. Independent planning of the projects provided initial guess of resource demand and their delivery deadlines. These schedules were modified several times during the project execution to coincide the actual resource availabilities.The procedure could be summarized at the following steps:

Step 1
Schedule separately all the projects under consideration using an ordinary technique as like as MSP or PRIMAVERA software. The activities on the critical lines and also the slack times of other activities for all the projects could be determined clearly.
Step 2
Define a time interval and divide the maximum expected period of the project execution. Estimate the resource demand for each activity of all the projects in different time intervals.
Step 3

Evaluate the influence of different resource scarcity on the delivery of every project. (Sensitivity Analysis)
Step 4
Recognize the most vulnerable resources and classify them based on the market stability, feasible resource quantity, transport obstacles, etc.
Step 5
Investigate the procurement possibilities of required resources and distinguish the most influenced ones by the transport and storage facilities.
Step 6
Estimate the quantity selected resources with enough precision accompanied by time intervals of their demands. It will serve as initial guess for global resource demand. In fact, the decision variables may be the quantity of selected resources during the corresponding intervals.
Step 7
Estimate the upper and lower bound on selected resources corresponding to the different time intervals using the scheduling diagrams of the concurrent projects. These bounds serve as technological constraints used in the optimization program.
Step 8
The capacity of the storages and transport facilities, in centralized management, could introduce other constraints to be defined and formulated in respect to the decision variables.
Step 9
Estimation and formulation of the direct and indirect cost of the storage and transport related to the resources provide objective function in the optimization program. All the mentioned cost refers to life cycle cost that includes all the related operational and capital costs.
Step 10
Use the appropriate optimization program to find the decision variables at a cost total minimal.

Considering the quantity of resource allocation to each project at each time interval as decision variables, the sensitivity analysis provides approximation to formulate the objective function that could be some kind of simulated life cycle cost. Forever, the technological and behavioural constraint could be estimated satisfactorily. Required transport and storage capacity in different intervals could be formulated as functions of the decision variables. The details of this formulation were described in (Sarkar 2004, Sarkar and Gholipour, 2003).
However, the optimization program applied to this problem provides the quantity of the selected resources for each project in each interval. Therefore, the total demand of each resource at each interval would be realized. Thus, the procurement plan for resource delivery to the centralized storage and transport facilities are well recognized against lack of any resource deficiency for the projects. In addition to huge save for total resource delivery at any interval, it provides any challenge and competence for centralized procurement of resources which usually forgive considerable benefits.

4. Sample projects to investigate multi-project procurement study

Three real multi-storey buildings were investigated. They are selected based on the following criteria to improve the clearance observations and justification of the comparison at most:

a) The selected projects are some real cases under construction in the same period to provide similar social and economical conditions.

b) The selected projects use similar kinds of materials and equipment and also use similar construction technology.
c) All the cases are located in high populated business area of Tehran.
d) The distance between the cases' sites are sufficiently far to present the transport effects.
Some other criteria also are considered which are described in (Sarkar,2004, Sarkar and Gholipour,2003)

Case one:
As the first sample a private five-storey residential building with steel structure was investigated. It was built in a populated area of Tehran. It included more than 195 activities which were classified to five groups of activities. The project was scheduled for 315 days. Owing to some unpredicted conditions the last schedule extended to a period of 387 days (Sarkar M. and Gholipour Y. 2003). The resource including; machinery, materials, cash, and human resource, actually used during the project implementation were estimated. It can be used in the multi- project planning thereafter. This kind of estimation guarantees the reliability of the comparison sufficiently.

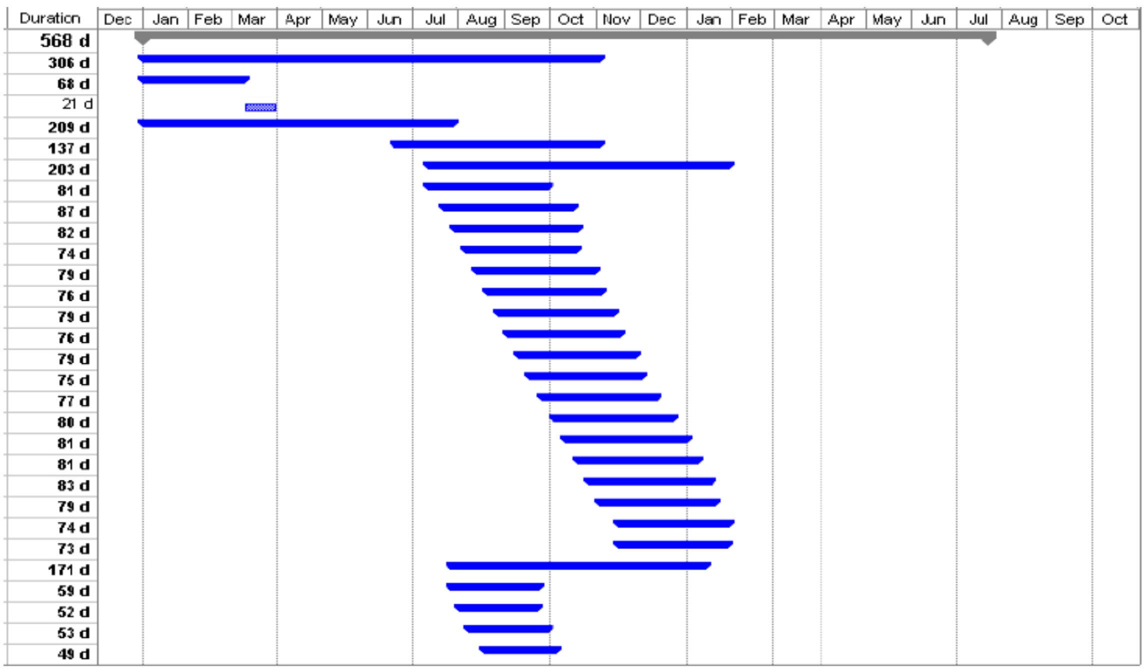

Figure 1: Schedule of sample project (1)

Case two:
The second project is a seven storeys residential building belonging to the same owner and constructed in another populated area of the city. This building with more than 7000 square meter area, had a steel structure with composite floors. As like as the previous project all activities and required resources of this project were realized and classified carefully.

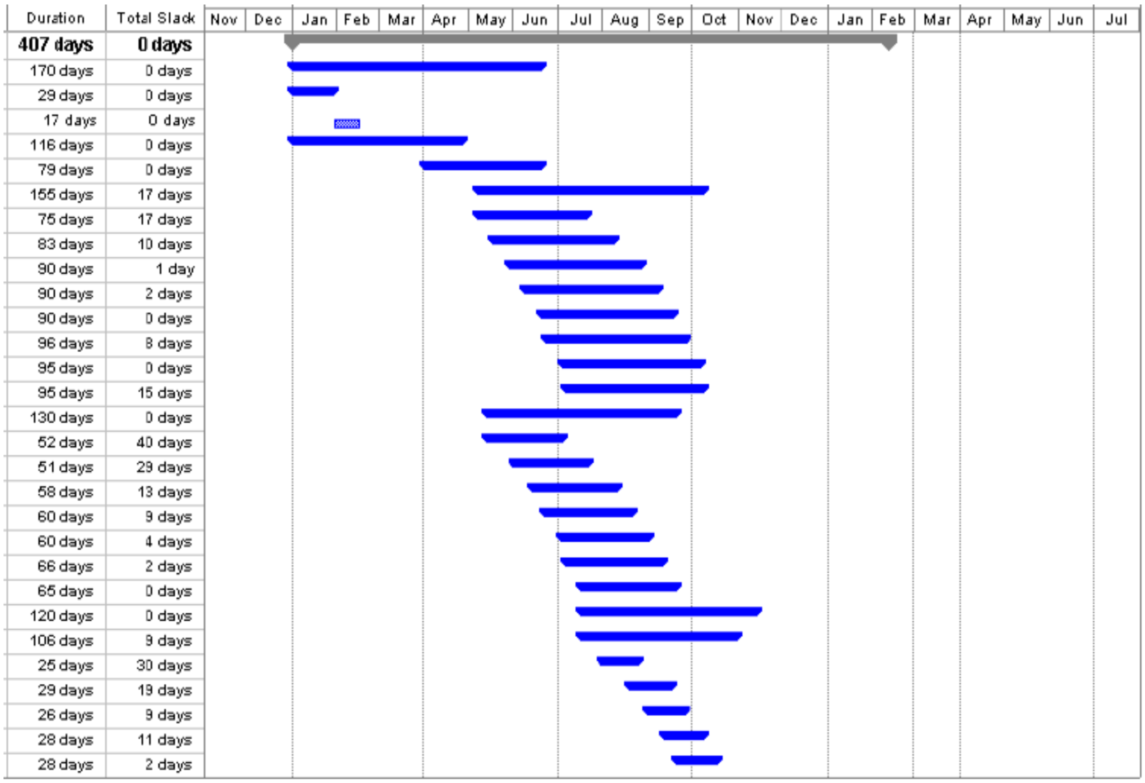

Figure 2: Schedule of sample project (2)

Case three:
The third project under investigation is a 17-storey residential building constructed in a different populated area of Tehran. It compounds of further activities. The construction period of this project was longer than the else. It belongs to the same owner too. The quantities of all resources used for each unit volume of the activities were estimated consistent to reality.

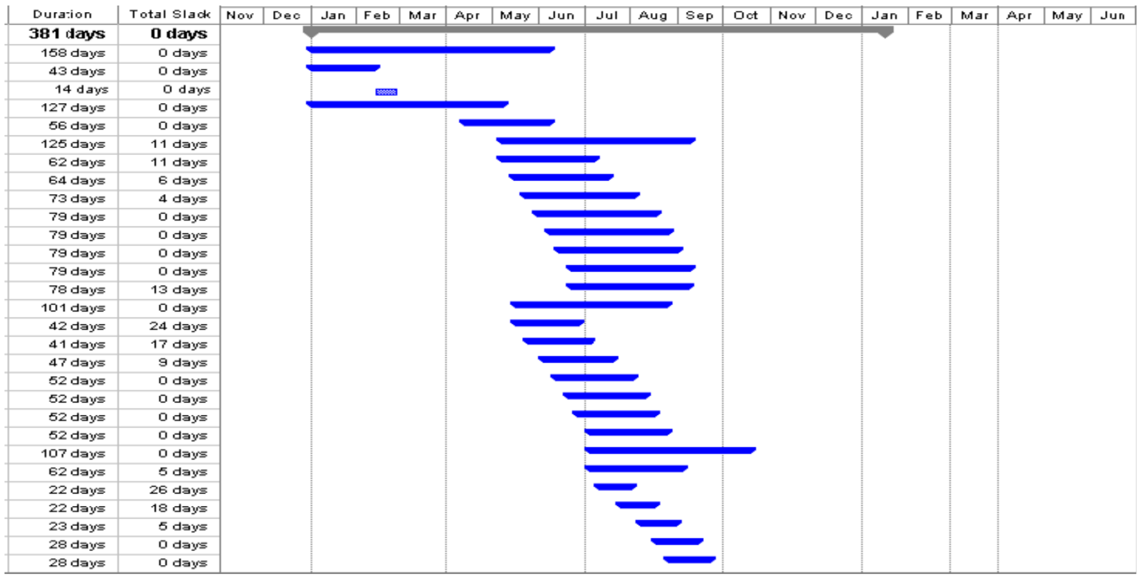

Figure 3: Schedule of sample project (3)

5. Investigation and Discussion

In this research we used the data from three constructed project for a real justification of the methodology. We use the scheduling plan of the projects developed before project beginning. Although, the rate of resource usage by the activities of the three projects differ slightly, but they provide reasonable estimation of resource needs successfully used for multi-project procurement planning. A systematic careful investigation of the schedules and resources demands of the three projects permit composition of demands at different time sections concluding the global demands of resources. At this stage it will be possible to estimate the upper and lower bound of the quantity of these resources at each section. In fact, these bounds play the role of constraints in an optimal program looking for the optimal procurement plan. Considering the storage and transport capacity and cost at different time section provides the other constraints and also the objective function of this optimization problem. Application of the methodology presented at this article provides a global plan of management for all the projects that could be seen in figure 4.

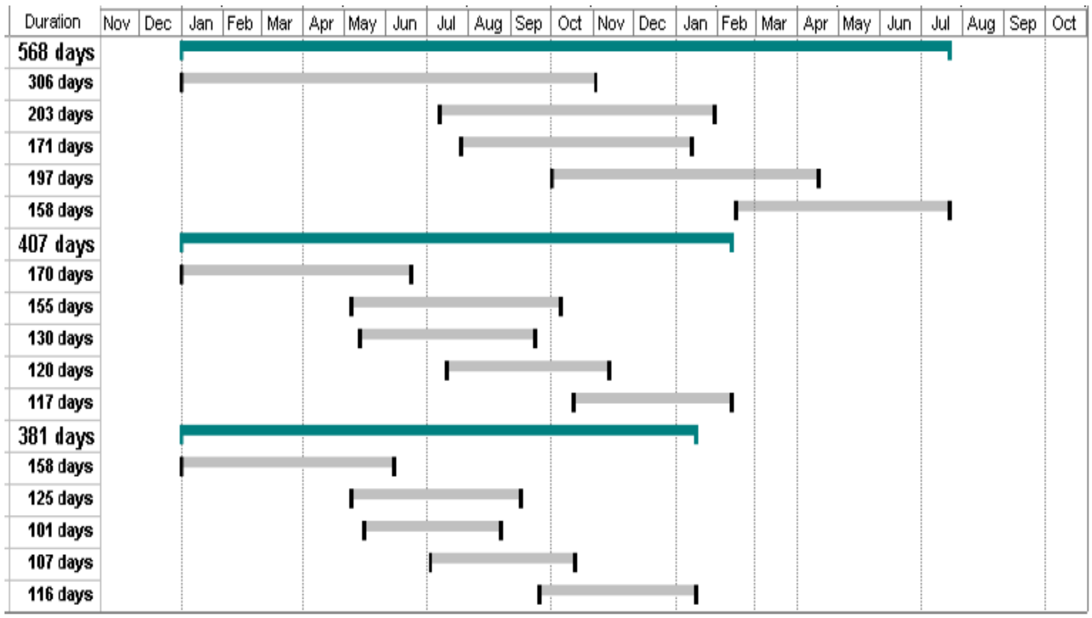

Figure 4: Concluded schedule of the three projects

Use of this methodology presents considerable save for global planning of three projects. This investigation shows that only five resources have considerable effect on the life cycle cost. The following figure shows that only a few number of resources are affected considerably by centralized storage and transport facilities. Therefore, it does not need to involve all resources in the centralized procurement. Investigation of the resources needs at different periods of the project execution shows considerable decrease in whole resource needs. It could be seen in figure 5.

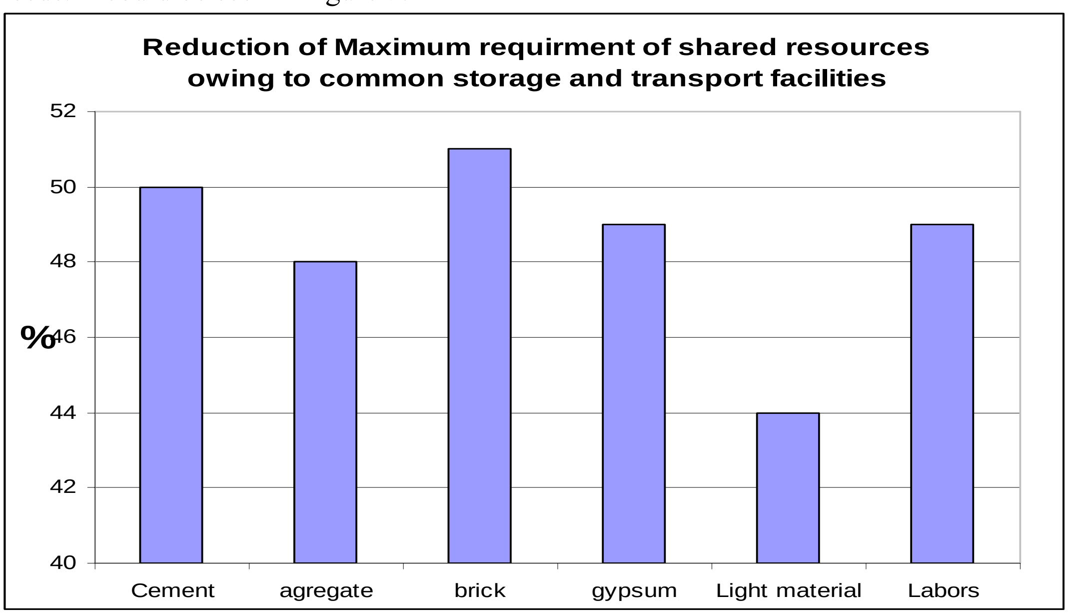

Figure 5: Decrease on resources demands after application of multi-project procurement

6. Conclusion

This procedure provides the required quantity of the selected resources to every project with satisfaction. Also, the total demand of all important resources at each time interval would be known for whole of projects under super management of the holding company. Consequently, the procurement plan for resource delivery to the centralized storage and the required transport facilities could be designed clearly.

This model provides great challenge and competence for procurement of resources in addition to huge save on the whole resource delivery at any interval, and also considerable benefits on whole multi-project delivery.

Owner and contractors can use the procedure of multi-project procurement to satisfy project activities requests with delay minimal. In fact, centralized management of the storage and transport facilities, even at small size, provide grand opportunity to prevent any deficiency on project delivery.

Although this procedure has focused on storage and transport affected resources, but it could be applied to other kinds of resources as like as cash request or skilled and unskilled labors requirement.

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The Future of Construction Procurement In The UK: A Shift To Service Provision

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Abstract: Procurement is a process and observable phenomenon entwined both culturally, politically and practically into the fabric and history of the construction industry. Historical reviews have highlighted recent changes in procurement systems which reflect the developments within the industry as a whole. This development is argued to be influenced mainly by a myriad of inter-connected contextual drivers and issues both internal and external to the industry. Ability to adapt to change via a comprehensive understanding of these inter-connected issues is a prerequisite for the industry to better meet the requirements of the society and deliver added value to the customers. This paper reports on research findings which identify procurement issues and trends from past construction reports and uses these issues as a foundation on which to build future scenarios in the area of construction procurement. Future scenarios constructed by experts in the area of construction procurement are also presented. The scenarios depict two polarised paradigms, namely 'free market' and 'intervention', which will largely determine the future state of the industry. The scenario of health care provision suggests a developmental shift from infrastructure production to service provision, and highlights the importance placed upon delivering end user value. Future work will validate these plausible scenarios and develop an interactive simulation tool based on system dynamics (SD) principles to assist practitioner's in their decision making.

Keywords: Competitiveness, Construction industry, Futures studies, Historical, procurement.

1. Introduction

Procurement is commonly defined as the process of acquiring new products or services (Bower, 2003). There are many ways in which this process can be conducted, and is influenced by a myriad of factors including social, political, technological and environmental. Understanding this process and factors within their context are critical due to the direct and indirect influence of procurement on the future competitiveness and well-being of the construction industry. These factors have caused changes in procurement practice in the past. In the late 1960s and 70s, purchasing and procurement were generally considered to be a service to production (Farmer, 1997). Essentially, procurement was positioned in a supporting role to the manufacturing or production activities of the firm, an administrative, rather than a strategic activity (Ansoff, 1970), and one which was purely transaction based, quantified and specified. Market changes and events in the 1970's, such as the 1973 oil crisis and the impact of Japanese manufacturing, began to show the weaknesses of the traditionally disparate systems of purchase, supply and procurement. This blurring of roles continued and was mirrored in the organisational changes away from highly structured and rigid company structures to more multi-functional and cross-disciplinary companies. Indeed, the government and several industry reports had already identified the problems of relying only on contractual obligations in order to coordinate work (HMSO, 1964). Many regard that contractually-based procurement practice has been largely responsible for the poor performance of the construction industry (e.g. Walker and Hampson, 2003).

In the last decade, procurement practices in construction have undergone a considerable transformation, partly due to a shift in the business environments in which the procurement systems operate. In the early to mid 1990's procurement experts and practitioners were involved mainly with debating the more strategic issues of the time such as privatisation, market liberalisation, and the role of culture and trust in negotiations, as well as the more traditional themes of procurement systems, contractual arrangements and forms of contract (McDermott, 1999). In the late 1990's some wider issues relating to procurement began to emerge, such as organisational learning and knowledge management, sustainable procurement and "developmentally orientated procurement systems" i.e. those procurement systems/strategies that are charged with delivering wider social or economic benefits, rather than just cost and time criteria (McDermott, 2006). Recent reports also acknowledge that the more 'softer' skills of persuasion and alignment are required by industry in order to best incorporate value creation and best practice in purchasing and procurement (FPA, 2003).

Today's clients and markets demand flexibility and innovation and consequently firms must be leaner, quicker and more proactive to keep their 'head above water' and in front of the competition. As a prime example, a holistic view of supply chain management is seen to provide the much needed competitive advantage. Procurement is no longer concentrating on operational activities, but on strategic objectives linked to the long-term survival and development of the organisations as a whole (Male, 2003). Using procurement as a 'competitive tool' brings many implications that have to be appropriately addressed before this tool can deliver the benefits promised. For instance, changing skill and attitudinal requirements penetrate organisations within the supply chain. To this end, clients have to be more active and sophisticated, whereas supply chain members have to adopt collaborative working attitudes. Appropriate incentives and rewards have to be fairly decided and given when the common project objectives are achieved. This, in turn, will heighten the motivation and satisfaction of everybody involved, hence enhancing the likelihood of delivering added value for the project. It seems that maximum benefits can only be achieved through a thorough understanding of all related issues/ factors and their complex interconnectivities. This is the crux of an ongoing project called *"Sustained competitiveness in the UK construction sector: a fresh perspective,"* or the *Big Ideas* for short, which is explained in the following section.

1.1 The Big Ideas: Project and Methodology

The Big Ideas is a large multidisciplinary collaborative research project aimed at developing possible future development scenarios for the UK construction industry over the next 20 years in order to support the industry in delivering the future requirements of society and industry. The central tenet is that a better understanding of the structure of underlying issues, events, barriers and trends through their causal relationships will enable the industry to address the persistent and deep-rooted problems that have hampered its performance for many decades. The overarching aim of the research is to develop multi-level strategic frameworks and policies for sustained competitiveness in the UK construction industry. This multi-level approach should address the full spectrum of firms within construction, including small subcontractors and suppliers which are often overlooked by the mainstream performance improvement agenda. The research is grounded on the real terrain in which these many firms operate through a thorough investigation of the current structural and cultural configurations of the industry.

The initial stages of this work involved reviewing the many construction futures reports which had been published in the last 8 years in the UK and internationally (Harty *et al*., 2006a). More than 300 separate issues were identified from this literature and content analysis was used to group these in high-level clusters of related issues (Soetanto *et al*., 2006). These issues were used as a basis for developing future scenarios, which can be used as a tool to explore plausible states and pathways to an envisioned future. From this literature analysis and review, procurement was identified as one of a series of important issues for the future (Harty *et al*., 2006a). Interviews with two procurement experts were conducted to capture their perceived future scenarios in their chosen disciplines. These interviews, lasting about two hours, yielded detailed maps of issues, drivers and barriers, together with an associated recorded verbal narrative of the maps. This data was then converted into pictorial Visio™ maps (depicting relationships between issues, events, barriers and outcomes) and an associated textural explanation of the scenarios. Further detailed description of the methodology is presented elsewhere (Harty *et al*., 2006b).

The first interview scenario concerned two paradigms of 'free market' and 'intervention' and their impacts upon the possible developmental pathway of the industry. This resonated closely with the second interview regarding the trend in the procurement of healthcare facilities. In reflection, the first indicates the general trend in construction procurement, whereas the second provides a specific example of how the trend is enacted in practice. A brief historical development of this subject is presented as follows.

The project has also undertaken further work in the area of procurement comparing recent procurement initiatives with both an analysis of the changes within the industry and the actual business path developments of a number of construction firms i.e. firms' responses to the procurement initiatives (Kao *et al*., 2006).

2. Healthcare Procurement Today

In May 2000, UK Ministers launched 'Sold on Health', jointly with Her Majesty's Treasury and the Public Services Productivity Panel (NHS Estates, 2000). The document set out a range of programmes to improve the NHS's planning, procurement, operation and eventual disposal of its estate (NHS, 2006a). These include NHS ProCure21 as a direct response to the government report 'Achieving Excellence' (OGC, 2006). ProCure21 was developed by NHS Estates with the main objective of promoting better capital procurement in the NHS by developing a partnering programme using pre-accredited supply chains engaged in a long-term framework agreement. The aim was to cut out waste and duplication of effort in the tendering process, but also to bring the best of the construction industry together to deliver better value for money and in the end better clinical facilities for patients (NHS, 2006a). It was intended that ProCure21 would negate the need for traditional adversarial procurement and tendering by using pre-agreed supply chains and long-term framework agreements managed by Principal Supply Chain Partners (PSCPs). Under NHS ProCure21, it was recommended that the PSCPs were involved in a project from the outset, to contribute to the planning and design phases, encouraging long term, collaborative working to achieve quality.

Two hundred and thirty projects are currently underway using ProCure21, with 54 completed (NHS, 2006b).

LIFT (Local Infrastructure Finance Trust) was announced in the NHS Plan in 2000 and involves private businesses taking over the ownership, financing and management of public sector infrastructure and services and tying the public sector into exclusive long-term contracts with private sector companies (Unison, 2003). The plan was for health and social care premises (e.g. GP's surgeries) to be built or refurbished and owned by new profit-making companies made up of public and private sector partners, with the private sector having a controlling interest. These would then be leased back to NHS bodies, GPs, local authorities, possibly voluntary sector and commercial organisations.

2.1 Healthcare Procurement Today and in the Future

The government's Sustainable Procurement Task Force was launched on 12 June 2006, charged with drawing up an action plan to bring about a step-change in sustainable public procurement so that the UK is among the leaders in the EU by 2009 (SPTF, 2006a). The Task Force recognised that this was important in moving the country towards a more sustainable economy, partly because the public sector's equivalent spend of 13% of GDP is capable of stimulating the market for more sustainable goods and services and partly because only with government leadership can the consumption patterns of business and consumers be shifted onto a more sustainable path (SPTF, 2006b). The Task Force presented a National Action Plan with six key recommendations for government, namely lead by example, set clear priorities, raise the bar, build capacity, remove barriers, and capture opportunities. The National Action Plan is intended to give government a clear direction on how to make real progress toward better, more sustainable procurement which will in turn allow it to move forward on sustainable development and set an example both to business and consumers in the UK and to other countries.

Organisations such as Building Futures have identified the future trends in the construction and healthcare industries in order to generate debate about their future paths. An example is the 2020 Vision research project, which identified the current social, economic and technological trends and how they might influence the design of healthcare environments over the next 20 years (Building Futures, 2001). They found that over the next 20 years the UK will experience:

1. very rapid developments in information and medical technology;
2. a demographic shift to an increasingly aged population;
3. citizens becoming more informed about healthcare choices and decisions;
4. modernization of the health and construction industries (including new forms of procurement);
5. new IT will change the location of different parts of the health service;
6. public access to health information will continue to grow rapidly; and
7. tele-medicine will bring care closer to the patient.

Other recent futures work has also looked at specific areas of the health sector, such as the 2029 report (IAF, 2005) which produced four alternative timelines for the future of biomedical R&D, together with recommendations for the future of healthcare provision.

3. A Shift to Service Provision

Many leading practitioners in UK construction are becoming aware of the increasing move away from product delivery towards the delivery of clients' needs through service provision. This shift from product delivery to service provision is already well established in aerospace, defence and manufacturing procurement. Several well known traditional construction contractors have in recent years re-listed themselves on the Stock Exchange as service companies, the main reason being the changing procurement policies in both the public and private sectors. This, coupled with the extensive market segmentation in construction means that the companies have to team up together in order to possess the necessary financial 'weight' to win these increasingly larger and larger contracts. Public Private Partnership (PPP) and Private Finance Initiative (PFI) schemes have been extensively used for public sector procurement in the UK such as hospitals, prisons and schools and has resulted in a significant degree of supply-side consolidation and re-positioning of firms. 'Prime contracting' and other types of serial contracting arrangements provide the basis for clients to evaluate competence on the basis of service provision, the idea being that this approach encourages cost reductions by improving the capacity for supply-side innovation and increased efficiency. Concerns do remain however, regarding perceived value-for-money and design quality within PFI/PPP. This is mainly due to concerns on how much actual innovation and collaboration these procurement routes encourage as it is suggested that much of the work within these consortia is still undertaken by disconnected teams and sub-contractors, and that the owner/operator/maintenance operation frequently find it difficult to influence the actual design decision-making process.

Hughes (2003) provides an insight into how the future of the industry might look if these trends in procurement and service provision continue:

> "*Integrated procurement systems became strategic alliances. Strategic alliances were formed in the name of partnership, mutual trust and collaborative working practices. Loosely based on limited networks of trading partners, they formed the basis for more formalized business relationships within groups of companies up and down the supply chain. Strategic alliances became mergers and acquisitions, increasing consolidation of the market into a few major conglomerates. These became so large that they were capable of funding PFI and PPP projects without the support of the banks, and selling completed schemes to pension funds provided them with the cash that they needed to invest in new ones. The consolidation of businesses affected the whole construction sector. As the trend toward leasing rather than buying gathered pace, most of the SMEs in the sector found that work dried up unless they joined in a strategic alliance. Eventually they were bought out or they simply went insolvent.*"

4. Two Alternative Future Scenarios for Construction Healthcare Procurement

As outlined earlier, 2 experts were interviewed to capture their perceived future scenarios for procurement, including the identification of the inter-linked issues, drivers and barriers. The first scenario concerned two paradigms for procurement of 'free market' and 'intervention' and the second outlined the possible trends in the procurement of healthcare facilities in practice.

4.1 Scenario: "Two Procurement Paradigms and Their Possible Outcomes" (see Figure 1)

The manner in which the procurement of services is planned and implemented, has a great impact on the future state of society. Two contrasting scenarios are viewed to exist and are driven by the extent of control or governance. They are 'free market' and 'interventions accepted'. In many ways, they resemble two opposite paradigms of economic governance, the 'capitalist' and 'socialist'. In reality, the market situation (such as in the UK) is often in-between these two extremes. The balance is influenced by many factors such as the political situation, leadership changes, and the international money market. Two possible future states are hypothesised to represent the 'good' and 'bad' outcomes. The 'good' outcome is seen to be an industry that emphasises continuous performance improvement in cost, speed, quality, safety, sustainability, pattern of employment, and community benefits. In contrast, the 'bad' outcome is an industry with poor time and cost performance, poor health and safety, and with no consideration for sustainability (social, economic and environment). 'Free market' and 'interventions accepted' tend to, but do not necessarily yield 'bad' and 'good' outcomes. A few exceptions may occur however, that lead to the other way around. The two scenarios are described as follows.

<u>Free market</u>
The driver for the 'free market' trend emerged in 1968, when the Labour party introduced their monetary policy, under pressure from the International Monetary Fund (IMF). This trend continued, reinforced by Thatcherism during the years of Conservative government. The principal reason for the privatisation of public sector is the increasing demand for better quality infrastructure that can not be met by the public purse, and therefore needs a shared funding from private investment. To one extreme, this could lead to the private sector providing 100% of the required investment. Within this regime, several emerging problems are seen to exist, including shortage of funding, cost being too expensive, and lack of management expertise. These will exaggerate the level of fragmentation (especially the client base) and the absence of aggregate procurement. This free market may result in a lack of long-term investment including no training and R&D, and a poor level of satisfaction. Overall, the sum of procurement decisions do not create an efficient construction sector, leading to a 'bad' outcome. However, properly managed privatisation may yield to aggregate procurement, achieved through an integrated programme of deliveries, which may yield a 'good' outcome.

<u>Acceptance of interventions</u>
Interventions can have a positive and/or negative impact. On the negative side, industry / government policy initiatives (e.g. legislation / planning) can lead to 'initiative overload'. The difficulty of changing existing culture can negate the implementation of these initiatives and create an attitude of ignorance. Also, intervention-laden procurement may stimulate the emergence of collusion and corruption. All these will divert the intention of intervention towards a 'bad' outcome. A positive exemplar of intervention on procurement is modern procurement, which considers wider criteria, more than traditional cost, speed and quality. Used properly, modern procurement systems can appoint design and construction teams based upon criteria that will create the behaviors that will lead to the industry that we desire. Modern procurement embraces principles of strategic procurement, prequalification criteria and invitation to negotiate, emphasising best value rather than lowest price competition. Recent research has commended the use of tools to capture stakeholder's values and criteria such as VALiD and DQI. This value-based procurement system will positively shape the market and the structure of the industry. Key players will concentrate on market

specialisation by type (e.g. health care) and region. They will be more effective and efficient, and engage designers, suppliers and subcontractors in real sense in their quest for best value. Modern / strategic procurement will mitigate against capacity issues where everyone is ‘playing the game properly’, leading to more work and a more predictable workload. This will deliver more for less and a better quality product at lower cost. The resultant outcome will be a superior industry, in terms of efficiency, employment, H&S, R&D, and more and better buildings for society.

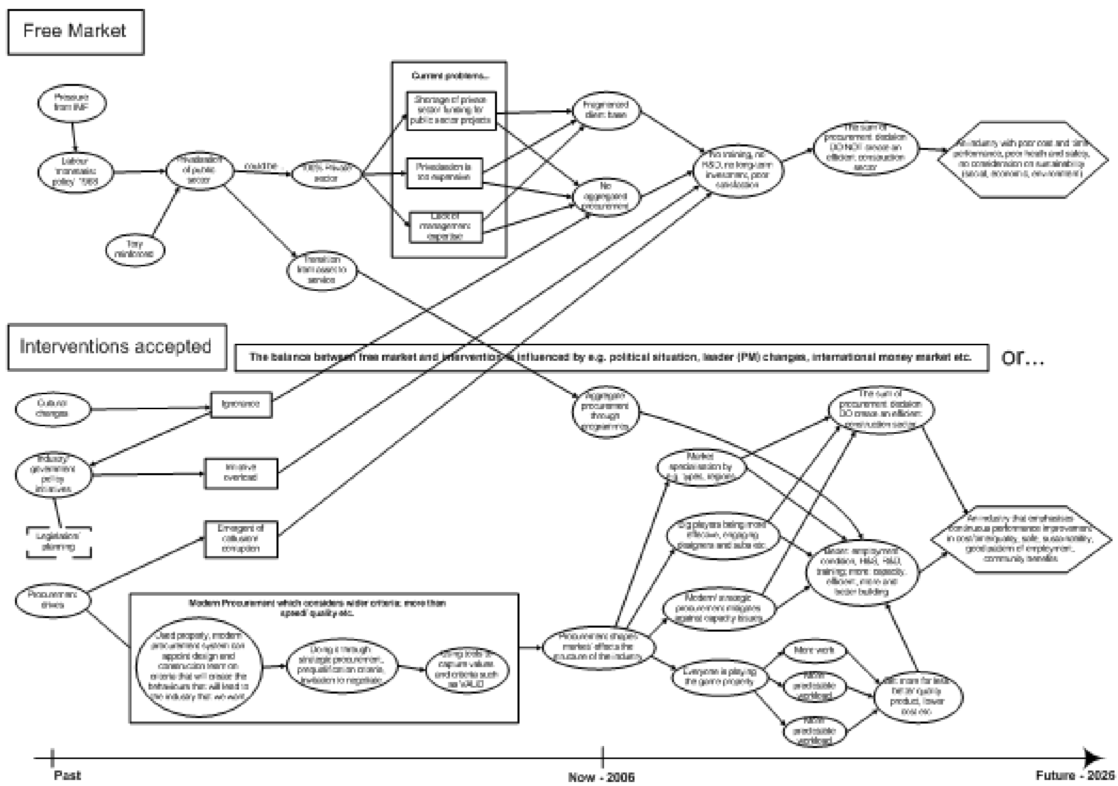

Figure 1 Two paradigms of ‘free market’ and ‘intervention’ and possible future outcomes

4.2 Scenario: "Trend of Commissioning Services" (see Figure 2)

The biggest driver in the healthcare business at the moment is the procurement of services, not facilities, which has an enormous impact on the supply chain. This trend is towards output rather than specification. For some, this is synonymous to 'backdoor privatisation' as if privatisation in the Thatcher era has emerged in a different guise. For the contracting business, this trend requires different skill sets to respond to tender. Contractors are being 'pushed down' the supply chain to service suppliers. This would also mean that they may wish or need to establish partnerships and/or joint ventures to obtain the necessary skills. They may also procure Doctors from abroad (e.g. Poland). By law, EU governments can not employ doctors from other countries, but private sectors are permitted to do so. This would also mean more overheads for the contractors and the Department of Health. Several potential barriers should also be considered by the potential contractors, such as establishing 'true partnership', the amount of risk to take, the allocation of risk to appropriate parties, and level of competition.

The pertinent question concerning this major shift is the quality of service provided, i.e. what happens to the standards? Government will set minimum standards for services and review the existing standards in the UK. In the future, comparison of standards will be undertaken against EU countries and others globally. These comparisons will stimulate innovations and enhance design, as well as competition. This trend opens up alternatives for the provision of services, such as the mixed use of buildings and the use of mobile facilities. Although these alternatives may provide flexibility and an economical solution, issues such as infection control do exist.

Overall, the trend towards providing services will dramatically change both health provision and care, but there are technical, social and cultural barriers that need to be overcome.

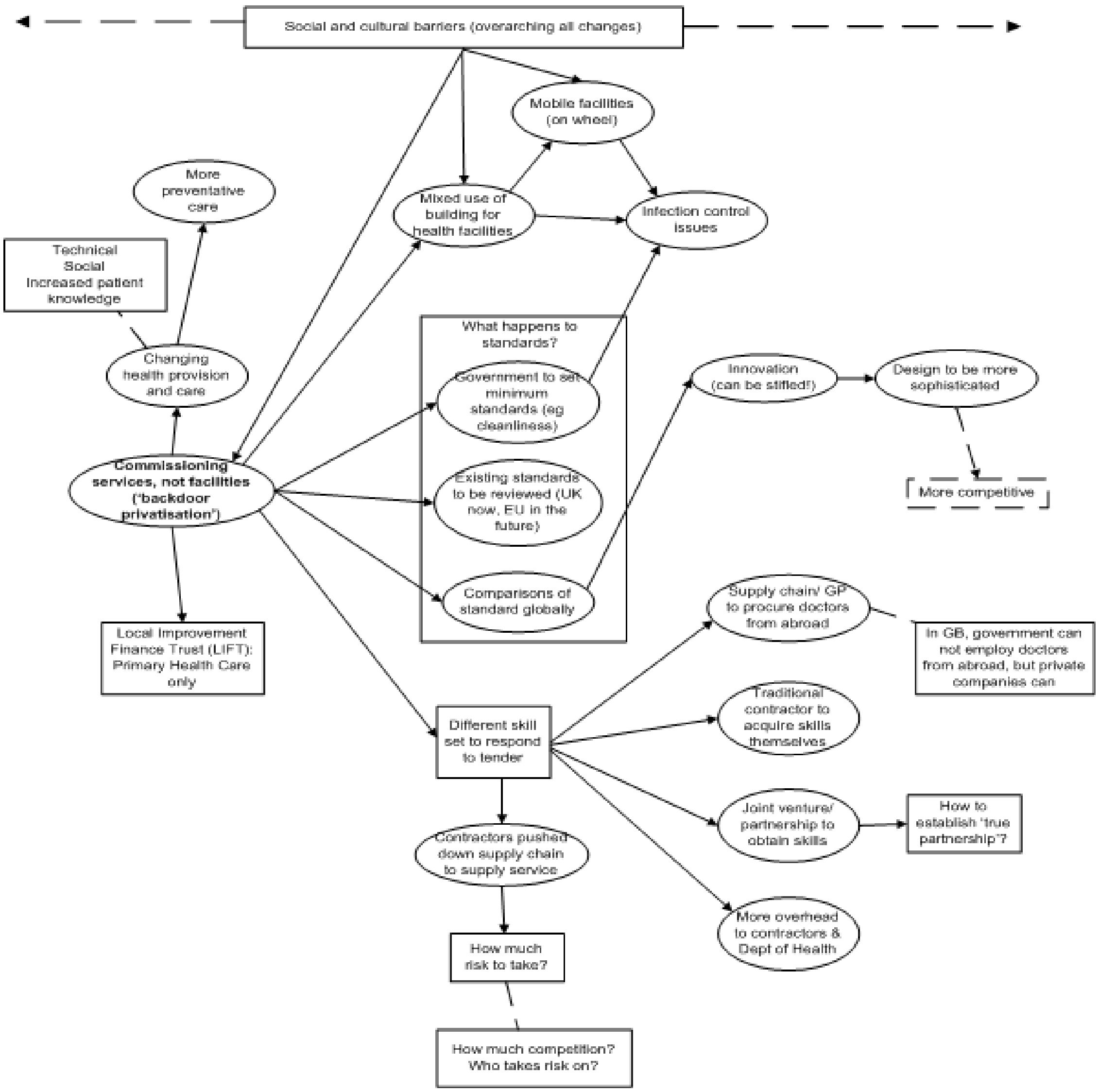

Figure 2 Trend of commissioning services in the healthcare sector and their implications

5. Modeling procurement

In order to understand the internal interconnectivities within the industry and the external interconnectivities between the industry and its environment and how these inter-relate, a methodology, called System Dynamics (SD), is employed to enable systemic interconnectivities to be modeled and analysed. SD has been selected as a modeling technique for this project, due to its capability to model systems with the purpose of improving behavioral understanding of the system. The construction industry and its wider environment are considered to be complex in terms of their components and inter-relationships. SD offers a technique that models these components and inter-relationships in a methodological rather than intuitive fashion. The early phases of SD modeling share similarities with case study methodology. Initially they both gather and organise information from the actual case. However, the case study leaves the information in a descriptive form whereas SD takes the information and simulates it to reveal the variety of dynamic behaviors that result from different policy choices. It is felt that the technique is appropriate for modeling construction as it is particularly adept at modeling complex entities.

In this project, the technique will be capable of modeling and simulating the trends and structural factors that are identified to produce scenarios. These scenarios will provide an insight into the construction industry's behavior to enable key policy makers to review existing policies and determine appropriate policies for future implementation. SD is also being used to help interpret the findings from the classical literature and construction company case studies that have been undertaken as part of the Big Ideas project, the results of which are published elsewhere (Fleming *et al*., 2006).

6. Conclusions

This paper has presented some background on the history and present status of construction procurement in the UK heathcare sector. Two future scenarios constructed by experts in the area of construction procurement have been presented which depict a general shift from infrastructure production to service provision, with one providing examples of two possible future markets, 'free market' and 'intervention'.

The purpose of these scenarios is not to predict which is going to happen, but to generate open debate amongst practitioners and policy makers so that plans can be put in place to ensure that the industry progresses towards the more 'desirable' future, whilst simultaneously being aware of the risks associated with the 'less-desirable' scenario. The scenarios are considered as stakeholder sensitive. When discussing possible future scenarios, it should also be remembered that one individual's 'desirable' outcome can often be another's 'undesirable'.

Future work will validate these plausible scenarios and develop an interactive simulation tool based on system dynamics (SD) principles to assist practitioner's in their decision making.

7. Acknowledgements

The *Sustained competitiveness in the UK construction sector: a fresh perspective*, or *the Big Ideas* for short, is a collaborative research project funded by the EPSRC and this support is gratefully acknowledged. The research team consists of Loughborough University, the University of Reading and the University of Salford. We are grateful to the input from these partners and to the experts that we interviewed as part of this paper.

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A New AE Design Delivery Model

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Abstract: The construction industry has identified the lack of performance of designers as a problematic issue in delivering construction. The industry has taken various approaches to address the problem, commonly focusing on the minimization of the designers' role and increasing the client's and general contractor's function. This paper proposes a different approach that transfers total control of the delivery of design to the designer. The new approach changes the designers' main objective from design creation, to the delivery of design. The delivery includes a methodology that forces the designers to use a leadership model which includes preplanning, quality control, performance measurements, and experience. The new model forces designers to be responsible for minimizing all design risks and seeks to minimize bureaucratic actions. The proposed research will also include the testing of the model in the actual delivery of design for the City of Miami Beach, Florida, USA. This paper will concentrate on the concepts being proposed.

Keywords: Design delivery, Designer performance, Designer quality control, Design risk minimization

1. Introduction

This paper reviews a dissertation work being done at Florida International University in conjunction with the Performance Based Studies Research Group (PBSRG) at Arizona State University on the optimization of performance of the delivery of design services. This work is another component of the research that has been ongoing for the past 12 years at PBSRG to improve the performance of the construction industry. This research work differs from traditional research in the following ways:

1. The research effort has identified the client and the client's delivery system as the major source of many of the problems in the construction industry. This hypothesis has been validated by 400+ tests over 12 years (PBSRG, 2006).
2. The basic research concepts are predicated on logic, and not traditional best practices. The basic concepts include: defining efficiency as minimizing the client's function; identifying management and partnering as signs of inefficiency; client driven direction and control are contrary to true quality control; preplanning forces accountability; and experts should be doing the work instead of fixing the work.
3. The theoretical basic research, prototype testing, and implementation is done simultaneously through hypothesis testing. This is rare for academic research which

operates in a linear fashion where the basic concepts are usually derived from subjective perceptions of experts, best practices, and the results of other research efforts.
4. Hypothesis testing and the scientific method are done quickly and repeated over many tests on real-time projects. A worldwide look at research in the construction industry identifies that this type of research is rare in the construction management/delivery research area.
5. The research hypothesis and preliminary results in certain areas do not agree with current industry best practices.
6. An objective of the research is simplicity over complexity. The developed model must be logical, more efficient and effective than current practices, and feasible to implement.

In understanding the need for the current research in design delivery, an examination of the construction/design industry yields the following characteristics (Butt & Clinton, 2005; EC&M, 2005; Shuster, 2005; Stuttel, 2005; ENR, 2004; ENR, 2003; HC&O, 2004; Parks, 2006; Sturts & Griffis, 2005; Carr & Beyor, 2005; Parks, 2006; FMI/CMAA, 2004; Roe, 2002)

1. Construction performance is decreasing.
2. Designers have been identified as one of the major sources of reduced performance in construction.
3. Designers are required to put together specifications/drawings for a contractor base that is continually deteriorating.
4. Clients have started to review and correct designer specifications and drawings.
5. Designer functions and fees have been reduced.
6. Designers are being forced into a commodity environment, relationships are more important, and it has become more important to get work than it is to do high performance work.
7. Seventy-percent of all respondents to the FMI/CMAA Fifth Annual survey said that they had experienced a decline in the quality of design drawings.

Congruent to the changing industry dynamics, designers have been placed into a position of minimizing risk through errors and omissions insurance and minimizing their accountability and liability (ENR, 2003). Designers are increasingly seeking to minimize internal decision making and move risk and decision making to the client/owner by continual partnering sessions. Consequently the design community has become gradually more reactive instead of proactive, thereby decreasing the need for preplanning and decreasing the designers' role in minimizing risk. Accordingly, client project managers have responded by becoming the lead and an expert on projects. This requires additional client overhead functions to manage the projects, perform coordination, schedule and track the design process, and provide reviews and directives to the design team on all aspects of the design.

The authors have identified this current trend in design delivery as inefficient, ineffective, and not sustainable. It goes against the basic concept of outsourcing and, by forcing one professional to review and correct the work of another professional, the accountability within the design process has been confused. The current drift in design delivery forces more management, review, and inspection: all sources of inefficiencies and poor performance (Deming, 1982).

The purpose of the paper is to review the hypothesis, methodology, basic theoretical concepts of a new design model/paradigm. Also the paper seeks to offer for evaluation the preliminary efforts of a dissertation research that will design, test, and implement a new design delivery model.

1.1 Problem Statement

Project managers representing the client have become increasingly accountable and responsible for the design of the project. Though they are not the designer, they are placed in a role of attempting to manage and control the design. This role has resulted in (FMI/CMAA, 2004):

1. Delayed designs
2. Faulty and inaccurate designs
3. Construction nonperformance (change orders, not on time, and not on budget.)
4. Client bureaucracy where procurement, project management, and regulatory branches do not cooperate.
5. Finger pointing that increases the adversarial positions of, not only the designers and contractors, but also the client's project managers, procurement agents, and regulatory reviewers.

1.2 Hypothesis

The authors hypothesize that a new design delivery model/paradigm where the designer is responsible for minimizing the risk of the design not being on time, the project not being on budget, and for meeting the quality expectations of the client will increase the performance of design and design delivery. In the new model, the designer will not only be responsible for minimizing their own technical risks, but also the risk of all participants who interface with the design. The new model will use performance measurements, a quality control model, and a risk minimization information system that will deliver the design on time, on budget, and meet the expectations of the client.

1.3 Methodology

The new model will be designed using the concepts of Information Measurement Theory (IMT) (Kashiwagi, 2003), the Performance Information Procurement System (PIPS) (Kashiwagi, 2004; Kashiwagi, 1999), and leadership/business principles that lead to efficiency and effective results. The theoretical model will then be presented to clients who use design services and they will be requested to fund and test the theoretical model. The validity and value of the new model will be determined by the owner satisfaction and the testing result of the model. A broad range of clients will also be surveyed to find their acceptability of the concepts. The determination of whether the new model is significantly different from existing practices will be determined by the designers' capability to quickly understand, apply, and deliver performing construction services within the system of the. The system will be measured for effectiveness, efficiency, compliance of AE's to the model, performance of the AE, client satisfaction of the AE services, AE understanding of the model, amount of change required from the status quo paradigm to the new paradigm, the difficulty of the transition based on AE perceptions, the number of times AE's need to redo requirements and the number of hours of education required.

1.4 Theoretical Foundation

After literature analysis and discussion with industry professionals, the authors identify the following issues as inhibitors of the current performance of AE design teams (Harness, 2001; ENR,2005; ENR 2003; Harness, 2001; Gransberg & Molenaar, 2004; Christodoulou et al, 2004; Perng et al, 2006; Chang, 2002; Kilian & Gibson, 2005; Conklin, 2005; Puddicombe, 2006; Lyer & Jha, 2006:

1. Lack of a definition of performance.
2. Lack of accountability and clear assignment of responsibility for the AE firm.
3. Selection mechanism and payment scheme of AE design firms.
4. Number of uncontrolled factors that the AE team must interface with.
5. The lack of clear preplanning and use of a risk minimization quality control plan.
6. The type of direction given by the client to the AE design team.
7. The use of low bid award contracts that add to the confusion of liability.
8. The lack of accountability of the client's representatives.
9. The lack of a measurement system to rate AE design teams.

These concepts will be further validated by a survey to a wide range of industry personnel.

2. Potential Sources of Problems of AE Design Delivery

Previous studies in the industry have identified the following constraints to performance within the current AE design delivery mechanism (Lapinski et al, 2006; Post, 2005; Butt & Clinton, 2005; EC&M, 2005; Shuster, 2005; Stuttel, 2005):

1. The current process is inefficient and ineffective.
2. The process is bureaucratic.
3. The client's organization/practices are bureaucratic.
4. Designers have no control over the process.
5. Too many individuals are involved in the delivery of design.
6. The problem is not technical, and it is being solved by technical/detail oriented people.
7. Designers are being asked to identify minimal standards with no information that differentiates performance.
8. The design will be used by low performing contractor craftspeople/subcontractors.

2.1 Development of the New AE Model/Paradigm

The new model will be developed using the following steps:

1. Identify a definition of performance.
2. Use a selection process that motivates the performance of the AE design firm in measurable terms.
3. Identify AE accountability by defining what the AE design firm can control and cannot control.

4. Identify the factors that the AE design firm cannot control as risk, thus forcing the designer to minimize the risk through their efforts.
5. Set up a measurement system for everything the AE design firm can control. Also set up a measurement system for everything the AE cannot control in terms of risk (cost, time, and expectation/quality.)
6. Identify a measurement/tracking system that can transfer risk/liability to participants who are interfacing with the designer.
7. Set up a preplanning/quality control phase where the AE design firm can preplan, identify risks and specify how they are going to minimize the risks.
8. Allow the AE design firm to direct themselves.
9. Minimize all direction from the client's representatives to the AE design firm.
10. Set up a model whereby the AE design firm identifies risk, identifies how they will minimize risk before the risk occurs, and identifies how the client will then take responsibility of the risk if the risk (which is out of the control of the designer) does occur.

3. Definition of Performance

The definition of performance is dictated by the client or buyer of the service (Deming, 1982). The definition of performance defined by the research clients (City of Miami Beach, US Army Medical Command, Baptist Health South Florida, University of Minnesota, City of Peoria, State of Washington, State of Missouri, Schering Plough) include:

1. Design is completed on time.
2. Design scope is within budget and constructible.
3. Design meets the expectations of the client.
4. Design is understandable by contractors.
5. Time spent by client's PM to manage and inspect the designer is minimized.
6. Risk to the client (cost, time, and not meeting expectation) is documented, minimized and understood by the AE design team.
7. Risk that cannot be minimized by the AE is communicated in a timely fashion to the client so that proper risk minimization actions can be taken by the client.
8. Design firm identifies the value that they bring to the client.

4. Designer Selection Process

The selection process proposed in the new design model has the following major differences from the traditional Qualification Based System (QBS) (QBS, 2006; ACEA, 2006):

1. Quantifiable past performance information (beyond resumes and references) on the design firm and key components, including individuals, is collected.
2. There is minimal client subjective decision making of the technical ability of the designer to deliver a high quality design.
3. The selection is based on a concise written description and interview on the project risk and schedule, along with differentiation between proposers in how the design will be delivered.
4. Only the selected best value design firm's past performance is verified.

5. The best value design firm's proposal becomes a key component of the designer's contract.
6. The best value design firm's and key individual's performance rating will be modified by their performance on the current project.

The selection uses the following information:

1. Performance/Satisfaction ratings given to the firm and key individuals by clients of completed projects.
2. Risk assessment plan statements, the ability of the firm and key individuals to identify, prioritize and minimize risk (items they do not control) on the project and to identify what they will do differently on the project in a short, concise, two page document.
3. Interview statements rating the design firm's key individuals and their ability to understand and communicate the new paradigm of taking control of the project, minimizing risk, and being technically qualified to design the required project on time, on budget, while meeting the quality expectations of the client.
4. Performance of the subcontractors (e.g. MEP).

The risk assessment plan and interview statements follow the selected best value design firm from the selection phase to the preplanning/quality control phase. The design firm is also regulated by the identification of potential risks by all competing design firms. The best value design firm must feel very comfortable in knowing how to minimize any risks identified by either the client or the other design firms. This process accomplishes the following:

1. Client does not have to be the expert in regulating the designer's performance.
2. Client can be assured that the designer perceives the major risks that others perceive.
3. Because the perceived risk is a part of the selection process, if any design firm perceives and knows how to minimize a risk, the winning designer must minimize the same risk.
4. The design firm's risk identification and value differential becomes their contract, putting the designers at risk to not only identify the risk but to minimize the risk.

The level of performance is formed by the competing best value designers and not subjectively decided by the client's project manager. The efficiency of this is derived through the client no longer having to direct the designer with incomplete information.

4.1 Delineation of What the AE Can Control

The ability to identify what the AE design firm can and cannot control is the theoretical concept that allows the design firm the ability to take control of a project, minimize risk, and be accountable for what they are technically qualified. When they identify what they do not control, they are also defining what they do control (technical expertise). This allows the design firm to set a baseline schedule, identify risks (elements that the design firm does not control), and define their method to minimize the risks. This concept is the most important theoretical contribution of the dissertation. The authors propose that the new design model would not be functional if this concept were absent. Without this understanding in the past:

1. The client would not allow the designer to use a legal document that identified what the designer had no control over.

2. The designer would not create a quality control plan to minimize risk that they did not control.
3. A baseline schedule could not be set by the designer.
4. Scheduled changes to a preset schedule would invalidate the participants' motivation to remain on the schedule causing the schedule to become ineffective.
5. No participant, including the design firm, would volunteer to be responsible for meeting the schedule.

Only one design firm moves into the preplanning/quality control phase. The prioritized best value design firm must consider the following:

1. Intent of the client's project.
2. Design firm's risk assessment plan and schedule submitted in the selection process.
3. Statements made in the selection process interview.
4. Risks identified by the competing design firms.
5. Any additional client concerns.

At this time the designer would be asked for a schedule. The schedule will include all risk events. If none of the risks are actualized due to risk minimization or project conditions, the designer is now accountable to complete the project on time. The designer must now develop a comprehensive list of potential risks, and how the risks will be minimized. The risks can include technical issues, but the majority of risks are non-technical items that the designer has no control over. This methodology/model does not minimize risk that is caused by the design firm's lack of competence or technical expertise. The design firm is responsible to be technically competent, as they were selected based on this competence. The design firm has errors and omissions insurance to cover technical errors. The selection phase also minimizes the risk of selecting a design firm that is not qualified.

The design firm must establish methods to minimize the identified risks. If the risk is minimized, the risk will have no effect to the project. If the risk occurs, the firm will not be responsible for the risk, but will continue to attempt to minimize the risk. By identifying all the risks that the design firm does not control, they, by default, identify what they do control. They can now be given control of the project even though they have no control over some of the factors.

5. Risk Management of the Design

The new design model proposes to do the following:

1. Measure the designer's success against the detailed schedule of the designer (factoring out uncontrollable risk.)
2. Identify the uncontrollable risk and then compel the designer to minimize the uncontrollable risk by practicing a quality control process.
3. Measure the performance of all participants who affect the performance of the design (time, their job description, and costs) creating a level of accountability.

The new model uses two Information Measurement Theory (IMT) concepts (Kashiwagi, 2004):

1. Minimize the flow of information to include only performance information.
2. Release control but make people responsible by preplanning/coordination with schedules, tasks, and point of responsibilities.

The authors propose that by not transferring control/responsibility to the designer, and expecting the designer to be responsible for both what they can and cannot control, a potential situation was created where the designers were able to evade all responsibility. This then resulted in the client managing the designer, which confused the responsibility/liability of the design. The natural result was then for designers to minimize their risk using errors and omissions insurance. The authors propose that client management, errors and omissions insurance, and the lack of a responsible party, result in inefficiency, confusion, and lower design performance.

5.1 New Design Model

The new design model assigns control/responsibility for the successful delivery of design solely to the designer. The new model includes the following components:

1. Performance measurements for the designers, which account for the quality of the design and their ability to minimize risk.
2. A selection process which includes past performance, risk identification documents, and interview, in order to determine the firm's ability to manage/control/minimize risk.
3. The selection process will also minimize the client's subjective decision making of the designers' technical capability by forcing designers to show differential in their ability to minimize risk and to deliver a high quality design.
4. A mechanism that holds designers accountable to minimizing risk and delivering a high quality design.
5. A Quality Control Plan (risks, minimization of risks, schedule) created by the designer.
6. Client's project manager (PM) becomes a Quality Assurance (QA) monitor and source of information. Client's PM minimizes any directing, coordinating, or reviews.
7. The Quality Control Plan becomes the designer's contract.
8. Risk management control document that identifies uncontrollable or unforeseen risks.
9. Designer documenting tool measuring the performance of any participant who is a potential source of risk to the delivery of the design.
10. A Quality Assurance report which enforces the Quality Control program of the designer.
11. A weekly report that passes information on uncontrollable or unforeseen risk which the designer is not responsible for and the measurement of potential risk.

5.2 Validity of the New Design Model

In addition to the normal methods of surveying experts to determine the feasibility and potential of the new design model, the dissertation will measure the validity in the following ways:

1. Come to agreement with a client who procures multiple design services, that the design model will improve design quality and delivery.
2. Contract with the client to run multiple tests.
3. Measure the performance of the tests using objective and subjective measurements.

4. Identify the delta difference between the existing model and the new process by comparing performance of both systems.
5. Identify if the new model is different by the reaction and perception of the designers.
6. Identify if the client, designers, and participants can modify their functions to successfully deliver using the new model.
7. Identify lessons learned to modify the new model for future testing.

5.3 Potential Value of New Model

The authors educated the City of Miami Beach (CMB), who agreed to partner in the research and test the proposed design model. The existing conditions were as follows:

1. Design of capital projects was not being delivered on time.
2. The CMB designer selection process was being executed very subjectively.
3. Design performance was not on time and resulted in poor construction performance.
4. CMB project managers were overburdened.
5. The Capital Improvement Program (CIP) was two years behind schedule.
6. The quality of the design packages was poor.
7. There was an ongoing feud between the CIP program and the regulatory Public Works (PW) branch due to the poor quality and confusion of design responsibility.

The authors quickly confirmed that the CMB problems were being experienced by other research clients (US Army Medical Command, Federal Aviation Administration, City of Peoria, AZ, University of Minnesota, State of Washington, State of Missouri, State of Wyoming, Schering Plough, Baptist Hospital South Florida, and General Dynamics.)

The City of Miami Beach agreed to participate in the research development to:

1. Develop the model.
2. Test the model.
3. Measure the effectiveness and efficiency of the model.
4. Implement the model into their project management structure if it is successful.

The theoretical model had an immediate impact on the City of Miami Beach design/construction delivery organizations. The CIP and PW branches which had been having coordination/cooperation difficulties agreed to work together on this effort. This was the first joint effort in ten years.

The University of Minnesota, the Baptist Health Hospital, and the US Army Medical Command are all waiting for the development of the new model. They have requested the testing/implementation of the model at their sites, at the earliest possible opportunity. None of them requested to wait for the completion of the beta testing. The nonperformance of the current system has encouraged the groups to absorb any risk involved with the implementation of the theoretical design model.

5.4 Education/Training on the New Design Model

The proposed design model is different from the existing QBS selection model and the current delivery of design with the traditional client project manager/management. It was immediately identified by the researchers that the model requires a change of culture among the industry. Although studying the cultural change was not a primary objective of the dissertation, it was identified that a simple, effective education package was required in the effort. This requirement both validated that the model was significantly different, that the model would require different thinking, and that the current model (regardless of the subjective perception by different parties in the industry) may be a part of the problem with the current nonperformance in the industry. This was manifested immediately upon testing with the prototype tests/design firms. In the initial testing of the model, the designers requested special training due to the following:

1. The design firm principals had difficulty explaining the model to their employees.
2. The design firms had difficulty in putting together their quality control plans.
3. The design firms had difficulty understanding how to minimize risk that they did not control.
4. The design firms were confused between the correlation of the effort invested, the minimization of the risk, the actual level of the risk, compensation conferred and profit.
5. The design firms could not explain the model to their engineering sub consultants.
6. The client's project managers had a difficult time adapting to the new model.
7. The design firms were uncomfortable with having to set a schedule and their new role of being in control and minimizing the risk.

A part of the dissertation is the putting together of an education/training package that can be used to assist the design teams and participants in the delivery of design. The effectiveness of the education will be measured by the difference in levels of understanding of the model before and after the education.

6. Conclusion

The authors have identified that design firms collectively have problems of inefficiency, ineffectiveness, nonperformance, and a lack of accountability. The authors have proposed a new model that gives total design project control to an outsourced design firm. The design firm is hired to minimize the risk of nonperformance (not delivering on time and on schedule, not delivering a design that is constructible within the budget, and not meeting the client's expectations of the design and the resulting construction). The model has been designed and is going through the first prototype testing. The success and validity of the model will be measured in terms of time, cost, surprises, risk, customer satisfaction, minimization of client PM functions, and the success of the design firms in using the new model. The originality and potential value of the new model has already been identified by the first research client, the City of Miami Beach, where the model is being used to integrate the PW, CIP, and procurement functions. In the initial testing, the designers are having difficulty understanding and educating their staffs, lead designers, and subcontractors, on the simplistic concepts of risk minimization, due to the differences of the new design model from any existing model. This has led to some unscheduled and repeated training, educating the design firms and other participants in the new design model. The efficiency of the new model has already raised concerns from some managers, questioning the sustainability of the system, the supply of design firms who can actually take control of their projects and minimize risk, and the future role of the client's PM's. Due to the length constraints of this paper, the operational details of the actual model will be addressed in another paper.

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Case Study: Best Value Procurement at Baptist Hospital South Florida

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Abstract: Construction industry structure research over the past ten years has identified the client's specification/low-bid award delivery system as the major source of construction risk (not on time, not on budget, and not meeting client's expectations). The authors hypothesize that a best value process will minimize the risk of construction nonperformance. Questions have been raised as to the benefit of the concept's application to complex hospital construction. The Baptist Hospital South Florida (BHSF) group undertook a research project to test/implement the best value process on two small hospital modification projects ($300K and $6M). The test results supported the hypothesis and endorsed two main concepts: 1) that buying best value may not increase the price and 2) performers can be identified and contracted, even in an area with a perceived lack of performing contractors. Further results are detailed in this paper.

Keywords: Best value, Case study, Cost of value, Efficiency, Hospital construction

1. Introduction

The construction industry has the following problems: a lack of performance, a lack of trained personnel and training programs with an impact on the level of expertise in the construction industry, and a high level of risk in terms of bonding and contractor business failure (Tulacz, 2002; ENR, 2004). These problems are also present in hospital construction. The traditional methods of design-bid-build and lump sum contracting have not been responsive to the problems (Uhlik and Eller 1999). Over the past two decades the construction industry has tried to identify the cause(s) of the problems in the industry and reduce the rate of non-performance. Corrective action has been taken to change the delivery systems (DB, CM@Risk, DBO, IDIQ, and JOC) in attempts to allocate risk to the party most capable of minimizing the risk. While these processes have produced some encouraging results (Pocock, 1996), they have not significantly impacted the quality of construction craftspeople (Garrity, 1999; NDU, 2005).

In an examination of the construction industry, it can be adequately described using the criteria of competition and performance (Figure 1). The two environments that predominate are the price based (or low bid) and the best value environment. The price based environment and the best value environment have the characteristics listed in Figure 2.

Figure 1. Industry Structure: Performance vs. Competition.

Low Bid Environment	**Best Value Environment**
▪ More client management /inspection	▪ Performance measurements
▪ More technical specifications	▪ Quality Control
▪ Lower quality construction	▪ Preplanning
▪ Relationships are important	▪ Risk management
▪ Increased flow of information	▪ Selection based on value
▪ More decision making	▪ Minimized client management
▪ More bureaucratic	▪ Training programs
▪ Political/confusing/finger pointing	▪ Continuous improvement
▪ Less accountability	▪ Higher profits
▪ Decreasing level of quality	▪ Professionalism
▪ Volume based contracting	▪ Attract high performance participants
▪ Lower profits	▪ Efficient
▪ Fewer entry barriers	▪ Less communication
▪ Price based	▪ Proactive
▪ Reactive	▪ “Win-win,” no leverage
▪ Less competitive	
▪ Lower professionalism	
▪ Adversarial	

Figure 2. Industry Structure: Performance vs. Competition.

The value based/best value environment is simple, defines responsibility, minimizes the number of participants, and motivates high performance and accountability for all parties. The value based/best value environment is a leadership structure that also measures performance. This concept has been tested over 450 times on $480M construction procurement, over 12 years and has had significant results (98% on time, no contractor generated cost change orders, and high client satisfaction) (PBSRG, 2006).

This paper examines the implementation of best value/value-based processes in hospital construction, specifically the Baptist Hospital group of South Florida (BHSF).

2. Hospital Construction

Hospital and medical construction projects represent one of the most complex building types to design and construct (Uhlik and Eller 1999) and interestingly, hospital construction has had a comparatively lower level of performance than the industry as a whole (Whitaker, 2006). To better understand the test area and its correlation to industry norms, BHSF project managers were surveyed for their opinions on hospital construction performance in their traditional low bid environment. Results are noted in Table 1 (With a scale from 1-10, 10.0 being the best or outstanding, 5.0 being don’t know, and 1.0 the worst or very poor).

Table 1: BHSF Hospital Construction Performance Ratings

No.	Survey Item	Scale	Rating
1	On time rate	%	40%
2	Contractors ability to minimize cost generated change orders	(1-10)	3
3	Customer satisfaction of contractor's performance	(1-10)	3
4	Ability of contractors to perform without management and inspection	(1-10)	2
5	Ability of contractors to do quality control/preplanning, minimizing risk	(1-10)	3
6	Ability for contractors to think in the best interest of the client	(1-10)	2

Moreover, in a research study by Uhlik and Hinze in 1998, approximately 2600 hospitals were surveyed to determine the top construction-related problems within hospital construction. Fourteen-percent of hospital Construction Managers identified "on time completion" as their top construction-related problem, while "keeping projects within budget," was identified by 11 percent of those surveyed. Some of the other top construction-related problems identified by the hospitals responding to the survey were: minimizing disruption of patient ward during construction, bureaucratic plan approval process/state and regulatory requirements, code compliance, and finding exceptional contractors. The results of this study were calculated based on the 175 responses; a 6% return rate (Uhlik and Hinze 1998).

The perceived complexity of hospital construction and need for client construction management and inspection, is based on additional regulatory requirements and health codes, reduced opportunities for preplanning, preconstruction investigation, and destructive testing, limited areas for staging, and the critical nature of constructing in operational hospital facilities, along with the importance of not risking the health of clients. The installation of systems in hospitals also has very specific requirements. The heating, ventilation and air-conditioning (HVAC) system is also an infection control system. Although most building HVAC systems are balanced for a neutral air pressure, each room in a medical facility has specific requirements for air balance, temperature, humidity, air changes etc. (Uhlik and Eller 1999). These challenges result in additional inspection requirements, an increase in the likelihood of unforeseen conditions, an increase in change orders, delays due to the logistical constraints, and the client's expectations not being met. Another influencing factor in the agreement of BHSF to participate in the research to implement best value concepts was the opinion that the contractors in the South Florida area were not high performing contractors; indeed, the contractor average rating of performance in an opinion survey was a 1 out 10, with 1 being very poor.

2.1 Existing BHSF Construction Delivery Process

The BHSF contractor delivery process for midsized, hospital modification projects includes the following:

1. Pre-qualification of six contractors who had previously done work with the BHSF.
2. Rotation list of vendors for invitation to bid projects.
3. Budgets are preset and may not reflect actual project requirements or cost at the time of bidding.
4. BHSF construction management is held accountable to budget despite the scope of the requirement, forcing CM into a position of needing to leverage work from the contractors.

5. BHSF users/clients often may want more than can be afforded under the budget.
6. Contractors are penalized for inability to bid (no discrepancy as to why vendors could not participate.)
7. Bids are opened publicly and the award is made to the low bidder.
8. BHSF project management decision making and contractual language govern the delivery process. Contractors do not do what is not written in the contract.
9. Contractor expertise is not given credit in the selection, nor is it rewarded at the end of the project.
10. No significant history of litigation and BHSF uses change orders to maintain the delivery of construction (due to a belief that courts will favor the small GC organizations over BHSF).

For the past five years, BHSF construction managers have identified that a Best Value process may have the capability to assist BHSF to optimize the level of construction performance BHSF receives. However, the lack of testing in the hospital environment stopped the implementation/testing. The main constraints identified by the BHSF group included the following:

1. The Best Value process was too complex, difficult to learn, and cannot work in the complex BHSF environment.
2. The paradigm was too different; and the BHSF construction managers would not adapt to the process.
3. A contractor shortage due to the construction boom in Florida would minimize the competition and increase prices.
4. A lack of contractors interested in participating in the process due to increased risk, measurement of performance, and the inability of contractors to preplan and minimize the client's risk.
5. Difficulties/delays introduced by Dade county inspectors would override performance results.
6. A lack of performing designers.
7. Difficulty in changing the mindset of BHSF that construction cannot be bought as a commodity.
8. The fear that performance costs more and that upper level hospital financial management will not approve best value if it costs more.
9. The inflexibility of BHSF policies to facilitate the process.

In the fall of 2005, the BHSF construction managers briefed their CFO to get permission to test Best Value on their construction delivery for midsized renovation construction projects. They received approval to:

1. Test the Best Value process and award to the best value and not necessarily the lowest bid.
2. Identify if the Best Value process could be implemented within the time frame of the traditional processes and result in time savings.
3. Identify if the Best Value process could make the BHSF process more efficient and effective.

2.2 BHSF Research Test Hypothesis/Methodology

The hypothesis for the BHSF test includes:

1. The concepts of best value procurement will have the same impact for hospital construction projects as for other traditional construction work. The proposed best value process of the Performance Information Procurement System (PIPS) (selection, preplanning and quality control, contractor risk management) will be successful and result in performance (results of projects on time, no additional cost from contractor generated change orders).
2. PIPS/Best value implementation will increase the efficiency and effectiveness of the construction delivery (minimize time, change orders, overall cost, while meeting client expectations.)
3. The BHSF CM's/PM's will be able to use the best value concepts.
4. The environment of best value procurement will override the negatives of not having either enough or the best qualified contractors.
5. Best value is not more expensive than low price work.
6. The BHSF's construction delivery process, and not poor performing contractors, was responsible for the poor level of performance.
7. The contractors can adjust to the mentality of minimizing the client's risk from a position of doing just what was in the contract specifications/drawings.
8. BHSF client expectation can be modified to be more realistic by the implementation of performance information in terms of the accuracy of the budget, the expected performance of the BHSF construction managers, and construction performance.

The methodology of the BHSF test would include the following major steps:
1. Determine the existing conditions through survey results from the BHSF and other hospital CM personnel, contractors, and designers.
2. Identify two project tests.
3. Modify the PIPS/Best Value process to fit the project test requirements.
4. Run the tests.
5. Document results.
6. Survey participants to show a change in performance, causes for the change, and identification of hypothesis accuracy.
7. Analyze the results to see if further testing is required on other larger hospital construction delivery processes.

Under the above methodology, testing at BHSF started in October 2005, and ended in September of 2006. Results and analysis are presented herein. A description of the best value/value-based process used in the tests (PIPS) is given in Section 3.

3. PIPS/Best Value Process

The PIPS best value system differs from other best value systems due to the following:
1. Minimizes the subjectivity and decision making of the client's professional representatives.
2. Minimizes the client's professional's function, decision making, and risk at the same time.
3. Entails three phases and extends beyond selection:

   a. Selection Phase: identification of best value vendor (price and performance)
   b. Preplanning Phase: quality control plan creation and submittal (project schedule, itemized project risks, and risk minimization plan differentiating between risks that the designer does and does not control)
   c. Management Phase: Management by risk minimization
4. Forces the best value to minimize the risk caused by items/people that they do not control without making them responsible for the risk.

In the selection phase of PIPS, the following criteria and selection processes are included:

1. Measurement of past performance.
2. Identifying the risk and risk minimization on the current project in a risk assessment plan.
3. Interviewing the key personnel being proposed on the project.
4. Prioritizing the key personnel based on past performance, risk minimization, key personnel interview, and price using the results of a risk minimization model (DIM) and a linear matrix.
5. The identification of the best value is then made from the results of the two models, and after confirmation that the best value is justifiably within the acceptable cost differential.

The prioritized best value then moves to the preplanning/quality control phase (the second phase). During this phase the contractor coordinates with the client/user, the client's technical representatives, and minimizes all the identified risks of the competitors and any concerns of the participants. The quality control plan of the best value (schedule and risk identification/minimization plan) then becomes the contractor's plan to implement the client's intent (specification) and becomes a part of the contractor's contract. Phase three requires the management of the project through risk minimization and tracking.

PIPS/Best Value process has been modified and improved on for the past 12 years. The development has caused changes in all facets of construction delivery, using optimization processes that have been identified in leadership/management theory, and employing the concept of best value outlined in Figure 2.

4. Details of the Two Test Projects

The first project run was the IT Warehouse Renovation. The project budget was $230K and the scope was renovation from warehouse space to IT call center usage (electrical/mechanical, floor plan, and fire alarm retrofit modifications). BHSF was especially concerned that the project was completed before the end user's move in date since the project had already been delayed for over a year and the end user was very impatient.

When the six contractors (from the BHSF rotation list) were notified of the test, only two contractors agreed to submit past performance reference ratings from previous clients. The researchers agreed that since past performance information was the least important, with the primary objective to put the best value contractor at risk, that the BHSF project managers could give all the contractors a past performance information (PPI) rating from previous BHSF projects. The invited bidders all retained the option of submitting any of their previous references using the PIPS survey format to supplement their BHSF ratings. This modification also led to the modification in the PIPS/Best Value process that a contractor could use any previously documented and approved performance regardless of the criteria as a substitute into the PIPS/Best Value process. This is a significant change in the PIPS/Best Value process, as it allows contractors with previously measured performance under any process/system to automatically enter the PIPS/BV environment. As in the case of the first BHSF test, this modification shortened the PIPS/Best Value process by three weeks. The second modification to this application of the process was the omission of the interview. This decision was made after the difficulty of coordinating a group of BHSF Construction Managers to sit as the evaluation committee, which jeopardized the project being awarded on schedule.

Three of the six contractors who were invited to bid submitted risk assessment plans and bids to compete on the first test project. The management plans were anonymously rated by two BHSF Construction Managers and the project architect to asses the capability of the bidder to think ahead, identify project risks and pre-plan solutions to the risks. The resulting selection was based on the analysis of risk management ratings, past performance rating, schedule and bid price. The award was based on weighting the contractors performance (management plan, past performance ratings, schedule) at 70% and the bid price at 30%. The matrix in Table 2 shows the comparison of the bidders. Vendor #2 was selected as the best value contractor, participated in the quality control plan phase of the project and was awarded the contract for the first test project.

The results of the value information included:

1. The best value contractor was the lowest priced contractor (after considering their risk minimization steps and value inclusions – not shown in the table below).
2. The best value contractor clearly identified flaws in the design that would have resulted in time delays, change orders, and quality and budget issues.
3. The value of the contractor's risk assessment plan was also immediately identified by the BHSF project manager and management staff as an invaluable step in the construction delivery process.

Table 2: Project 1 IT Warehouse Renovation Value Matrix

CRITERIA	VENDORS		
	1	2	3
SCHEDULE (work days)	65	40	75
RAP RATING	4.67	8.58	5.25
BHSF PPI	8	8.1	7.1
COMPANY PPI	No Submittal	10	9.4
PM PPI	No Submittal	10	9.4
SUPER PPI	No Submittal	10	8.9
BID (w/o value inclusions)	$362,700.00	$302,600.00	$281,406.00

The results of the selection, with the lowest bidder (with consideration of value inclusions) having the highest performance numbers, was very surprising to the BHSF construction staff, who had expected to pay more for higher performance. During the quality control/preplanning phase, the contractor was able to preplan and schedule the project, correct the deficiencies with the design, and implement a quality control plan that minimized the risk of all parties.

The second BHSF test was the build out of the Miami Lakes Medical Center for diagnostic and urgent care. The project involved the installation of MRI equipment, PET/CT scan, x-ray equipment, and renovation of the facility. The scope of the project was budgeted at $6M

($2M renovation, $4M equipment provided by BSHF). The project required subcontracting in many different disciplines and coordination with equipment vendors, information technology vendors, and other vendors retained by BHSF. The schedule for this project was also fast track as the end user had already identified a date for the opening of the facility. Four contractors from the BHSF contractor rotation list were invited to bid the project. Due to schedule pressures and regulator restrictions, the use of past performance information was foregone in the selection and two schedule proposals were asked for in the bid package: a standard and an accelerated schedule.

The resulting criteria for the contractor selection were: risk assessment plan (40%), Schedule (20%), Accelerated Schedule (10%), and Price (30%). All other PIPS/Best Value Phase 1 filters were deleted. The matrix of information collected from submissions of the four competing contractors for Project 2 is shown in Table 3.

Table 3: Matrix of Project 2: Medical Center

	VENDORS			
CRITERIA	**1**	**2**	**3**	**4**
RAP RATING	4.63	6.25	3.06	5
STANDARD SCHEDULE	147	172	175	238
ACCELERATED SCHEDULE	112	154	175	154
BID	$1,947,380.00	$1,793,307.00	$2,166,313.00	$2,179,381.14

A linear matrix that incorporated the weighting of criteria described above was used as a tool to determine the best value contractor. The total weight of the performance criteria totaled 70%, and a weight of 30% was assigned to the bid price.

The BHSF picked Vendor # 2. The selected contractor was the lowest priced contractor, had the best risk assessment plan, and met the required schedule. The contractor was immediately brought in to begin the QC/preplanning phase. In this phase the contractor was required to pre-plan the project and develop a quality control plan.

5. Results of Tests

The following are results of the two PIPS/Best Value tests run by the BHSF group:

1. The projects were awarded to the identified best value contractors.
2. Both best values were the lowest priced contractors (although not necessarily the lowest bidders).
3. Both contractors finished on time, except for client driven time delays from project modifications.
4. The BHSF group identified that the best value process produced a far superior product, minimized management and inspection requirements, in the same or less time, with a totally transparent documentation process. All documentation was produced by the contractor.
5. The process identified the BHSF delivery process, and the designer and their design/specifications as the greatest source of construction nonperformance and risk.

Table 4 shows the overall performance results of the two projects. These results are the overall results from the weekly risk management reports. Table 5 shows the performance ratings of the client and the contractors of the process.

Table 4: Performance Results of BHSF Projects

Contractor Performance Results		
BHSF Project	IT Warehouse	Miami Lakes Medical Center
# Unaddressed/Overdue Risks	0	0
# Unrated Contractor Risks	0	0
Potential Risk to Schedule	0	0
Contractor % Delayed	0%	0%
Potential Risk to Cost	$0	$0
Contractor % Over Award	0%	0%
Contractor Satisfaction Rating	10	10

Table 5: PIPS Performance Ratings from the BHSF Projects
(10 = Completely agree, 1=completely disagree)

No.	STATEMENT TO BE RANKED	PM RATING	PROJECT 1 CONTRACTOR	PROJECT 2 CONTRACTOR
1	Management and inspection by client's PM's are needed to ensure performance (projects on time, within budget, client satisfied)	4	2	3
2	Best value will result in increased performance and minimize the need to manage the contractor	8	9	10
3	Forcing the contractor to be the expert is a more efficient system and will lead to higher performance	10	9	10
4	Best value procurement will increase the cost of the project	1	2	3
5	PIPS/best value process will increase the duration of construction	1	2	1
6	Contractors consider best value selections as fair; preferring best value to low bid	10	6	10
7	PIPS/best value documentation increases everyone's accountability	10	9	10
8	Best value minimizes project risks before the contract is awarded	9	9	10
9	Transferring risk to the contractor results in everyone being more accountable	9		
10	Best value delivery motivates contractors to minimize cost generated change orders	10	7	10
11	Low bid projects have a higher final project cost than best value projects	10	7	10
12	The client's delivery system is the biggest risk to construction performance (on time, within budget)	9	9	10
13	Best value projects yield higher performance (on time, within budget, customer satisfied) than other projects industry wide	8	9	10

Preliminary lessons learned for best value in hospital construction, as taken from the BHSF tests include:

1. BHSF management changed the accountability of the construction managers from the budget to the best value cost. The BHSF management agreed that the best value cost, after getting the best value risk assessment and price, was the most accurate estimate of the project cost and that the construction managers should be accountable to that cost.
2. Contractors are far better at preconstruction services than designers.
3. Contractors can act in the best interest of the client.
4. BHSF construction managers had not been able to previously involve the clients and control client/user scope creep and expectation. With the implementation of PIPS/Best Value, the construction managers are now considering allowing the clients to participate. The PIPS/Best Value process, due to its transparency, assists in making all participants accountable.
5. The designer's performance needs to be documented. Designers also need to be selected based on value. The process also identified that even though the designers design may be incomplete, the PIPS/Best Value process can minimize the risk caused by incomplete and inaccurate specifications.
6. The PIPS/Best Value Process is robust. In both tests, filters were left out. This is the first tests where previous past performance was identified by the client. It also opens the process to allow any contractor past performance numbers.

6. Conclusions and Recommendations

The BHSF tests confirmed the following hypotheses:

1. The client's construction delivery system and designers were the major risks to performance in the BHSF environment. Although hospital construction is complex the major source of non-performance is no different than in other areas of construction.
2. PIPS/Best value is a transparent best value process that will increase efficiency, performance, and value.
3. Hospital financial managers, CM's, and PM's will understand best value if explained in terms of efficiency and effectiveness and modify award procedure to accommodate Best value methodology.
4. Based on the BHSF test results, the local environment has contractors who will finish on time, on budget, and meet the client's expectations and can meet the rigorous requirements of implementing planning, quality control, and risk management of their projects.
5. Best value/higher performance does not cost more as the lowest bidder in each procurement was selected as the highest performer.

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The selection of Building Services Consulting Engineers in Northern Ireland

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Abstract: The two main objectives of this research were to quantify opinions on the expected and perceived levels of the service/performance required by the client, and to quantify the level of importance assigned to various criteria used in the selection process. The views of six major consulting engineering practices and eight developers/project managers in both public and private sectors were obtained using semi structured interviews. A Servqual-type model was developed to analyse the gaps between the clients' expectations of the engineers' perception of their own performance, as well as the gap between the perceptions and expectations of the engineers' performance from both clients and engineers themselves.

The results indicated that the engineers clearly misunderstood what the client expected from them in terms of controlling time, cost and quality and of resources and communication. Clients were dissatisfied with all aspects of the service received other than the amount of the professional fee paid – presumably arising from the current competitive climate surrounding fees. In other words, prices were reduced in order to obtain work but the low fees earned do not permit the full service expected by developers. Clients indicated that the lowness of the fee paid was much less important to them than the level of service received, but engineers thought otherwise.

Recommendations were made on how selection methods could be improved, including better briefing, greater emphasis on personal relationships, a transparent scoring system and the use of smaller shortlists. Engineers were advised to be more open and enthusiastic, and to use job-specific written submissions based on thorough research into the clients' needs. A modest increase in professional fees might lead to increased satisfaction for all concerned with the provision or the receipt of building services engineering consultancy on projects.

Key Words: Building Services Consultants, Northern Ireland, Selection Criteria.

1. Introduction

The pre-qualification criteria used by over 90% of clients in the United Kingdom is established on an ad hoc basis to reflect the client's specific requirements for each project (Ng, 1996). The selection criteria generally used for those short-listed are experience, past performance, capability, resources and fee etc. Many different approaches have been proposed over the years to assess the influence/weight of the selection criteria used by the decision maker –with the aim to obtain the best service. Morledge et al (2006) prioritise the key factors as capability, competence, staff and cost. Kashiwagi (2004) emphasises previous success as a primary criterion, with best value for money rather than lowest price being the overall objective.

In today's competitive, tight- knit industry, the perceived service given by the consulting engineer must be seen as effective. Carlzon (1989) identified poor service as the main reason why clients felt they must change to another competitor. Svensson (2004) identified the service given to clients as the most important feature for "developing and maintaining fruitful and successful relationships". The ideal consulting engineering firm should at least meet, if not exceed, the expectations of the client in relation to the brief. To do this they must have an accurate understanding of what the client expects from them (during the pre-qualification and short list selection stages, and throughout the design and construction phase of the project). The success and growth of the consulting engineering firm is dependant upon it.

2. Selection of Consulting Engineers

Clients come from a variety of backgrounds, but this research focuses on how public sector clients, project managers, architects and private developers in Northern Ireland select building services consulting engineers.

Cheung et al (2002) proposed the use of a computer model capable of making a decision regarding the appointment of various architects tendering for a project. For this research, a similar model was used. Their model was based on five main selection criteria:

1. Firms' background (reputation, technical competence/qualifications, experience with similar projects).
2. Past performance (cost control, quality of work, time control).
3. Capacity to accomplish the project (present workload, availability to qualified personnel, professional qualification/experience).
4. Project approach (approach to time schedule, approach to quality and design methodology).
5. Professional fee.

3. Satisfaction of the Client

Another objective of this research was to investigate the difference between the client's expected service from the engineer and the actual service that he received; i.e. if his expectations were not met, or were exceeded. This was then compared to the service that the engineer thought the client should receive, and what in reality he actually got. In summary, this analysis showed how satisfied the client was with the engineer's performance and how satisfied the engineer thought the client was.

Quigley (2000) justified the use of a service quality gap analysis tool known as SERVQUAL for a similar research project. Using this tool, the satisfaction of the client was measured by calculating the difference in score of his perceptions less his expectations. Although the assessment criteria and response scale are different to Quigley's study, it does follow the same principles.

4. Questionnaire Development

Results were collected from semi-structured interviews using a questionnaire based on the top ten pre-qualification criteria identified by Quigley (2000), the five service quality variants in SERVQUAL , and Cheung's (2002) research model. The questionnaire had four sections;

- •The first section asked respondents to detail demographic information about themselves/ their company.
- •The second section asked respondents about their expectations prior to a consulting engineer being appointed i.e. how an ideal consulting engineer should perform.
- •The third section asked respondents about the perceptions after a consulting engineer was appointed i.e. in reality how a consulting engineer actually performed.
- •The fourth section asked respondents to rate the importance of criteria which may be used in the selection process.

The responses for the second and third section were recorded using a 6-point Likert scale, indicating the extent to which they agreed or disagreed with a statement. A six point scale was used to avoid the respondent picking a "mid way answer". When the importance of the selection criteria was investigated in the fourth section of the questionnaire, respondents were asked to make each part total 100 points. (See Table 1).

5. Pre-qualification of Consulting Engineers

Consulting engineers are often "pre-selected" in terms of general capabilities before they are invited to submit their technical and fee proposals. The engineers must detail their relevant experience, competence and financial standing etc. The client assesses their submission and uses it to limit the number of firms to be given further consideration (Bennett, 2003). Pre-qualification selection of consulting engineers aims to save the time and resources of the client that would otherwise be spent on unqualified/ unsuitable prospective engineers. It separates eligible consulting engineers from interested consulting engineers (Palaneeswaran & Kumaraswamy, 2001)

6. Methods of Selection of Consulting Engineers

Cost-oriented methods are used when the client wants to maximise profit whilst satisfying the minimum user requirements. Quality- oriented selection methods are more suited to complex and prestigious projects. A large emphasis is placed on the suitability and capability of the engineer rather than his fee (Ng & Skitmore, 1999). There are five methods commonly used for the selection of consulting engineers (CIC, 1998); these are the two envelope method, the cost weighted method, the budget method, design competition with prices and, finally, price negotiation.

The ACE (2003) recommend that the client, or his representative, should review all the information submitted by the engineer – weightings should be applied to "reflect the priority and importance "of each selection criterion. They encourage the client to focus on the personal relationship with the engineer; the client should meet the proposed design team in the engineer's office. Additionally the reputation of the engineer is important – the client should assess how well the engineer has performed with other clients. Finally the ACE highlights that "lowest price does not necessarily mean best value"

7. Worldwide Selection Trends

There is a wide range of selection procedures used globally (Palaneeswaran & Kumaraswamy, 2001). When consulting engineering firms are being selected in Denmark, the two highest and two lowest tenderers are automatically excluded. The firm with the professional fees closest to the average of the remaining tenderers is appointed (Hatush & Skitmore, 1996). In Italy, Peru, South Korea and Portugal, a similar procedure is used, but only the lowest and highest tender are automatically excluded (Herbsman & Ellis, 1992).

In Saudi Arabia, if the firm with the lowest professional fees is not less than 70% of the client's estimate, then they are appointed. In Canada and America, the lowest tenderer will only be appointed if a 10% contract bond is provided. In France, if the professional fees are seen as unusually low, the firm is automatically excluded (Hatush & Skitmore, 1996). The Scottish Procurement Guide recognises that consulting engineers should be appointed using value based selection methods rather than fee competition. This form of selection is widely used in the public housing sector – resulting in "fees other than the lowest being accepted" (Scottish Executive, 2002). In Germany, the selection of consulting engineers on a price only basis is prohibited.

The quality based selection method is extensively used throughout Canada, Europe and Asia. More than 30 US state governments, since 1972, have used this selection method for all their construction work. The Asian Development Bank and The World Bank are just two of the numerous international financial institutions that advocate its use.

8. Clients' Expectations

Numerous research projects have been undertaken in the field of "service quality". The characteristics of the service provided can be categorised as follows:

- **Tangibles** – the consulting engineer's physical facilities, equipment, appearance of staff, company image.
- **Reliability** – the dependability and accuracy of the consulting engineer in terms of time, cost and quality (i.e. their past performance).
- **Responsiveness** – the willingness of the consulting engineer to help their client
- **Assurance** – the ability of the consulting engineer to convey confidence and trust in their work.
- **Empathy** – the degree of ease which the client has when approaching the consulting engineer (Parasuraman et al, 1991).

Quigley (2000) undertook research based on the Disconfirmation of Expectations model whereby the amount which perceived service performance exceeds expectations will increase the level of satisfaction. Conversely when the perceived service performance is below the expectations, there will be a decrease in the level of satisfaction. He found that there were significant differences between what the client wanted and what the building services consulting engineer thought the client wanted. The service dimensions which had the greatest shortfalls were client focus and empathy. His results proved that the client is not currently satisfied with the performance of the engineer. The client expects a greater degree of "individualised flair and the use of innovative design solutions". Quigley's research also showed that clients view reliability as the most important service dimension (which was correctly identified by the building services engineer). The client's second most important service dimension was assurance – again correctly acknowledged by the engineer. In general the communication skills of the engineer were seen to play a large role in satisfying the client.

9. The Profile of Respondents

For this research, the views of eight clients and six consulting engineers from both public and private sectors in Northern Ireland were considered. Three clients were Developers, two were Project Managers and three were Architects. In addition to these, three more public sector clients, one project manager and one building services consulting engineer unfortunately felt unable to take part in this study – due to confidentiality reasons.

9.1 Clients

Of the eight clients interviewed, four classified their job title as middle management and four classified theirs as upper management. The average length of time they had in their current job was twelve and a half years. Two clients, out of eight, had attended seminars/ training courses on how to subjectively assess a prospective consulting engineer. All other clients relied upon their previous experience. Three clients, out of eight, always selected a consulting engineer from their standing list (based on personal recommendations from architects etc, they had previously used or because they were "easy" to work with). The remaining five clients similarly selected engineers for private sector projects. However for public sector projects, an advertisement is placed in the newspaper etc and the engineer is appointed following strict pre-qualification and short list stages. The amount of time that a developer spent selecting an engineer ranged from less than an hour (when they were previously used) to six weeks (when the developer had no previous experience of them).

9.2 Engineers

Of the six consulting engineers interviewed, four classified their job title as upper management and two classified theirs as middle management. The average length of time they had in their current job was seventeen and a half years. Three engineers, out of six, had attended seminars/ training courses on how to give presentations/ prepare written documents. All other engineers relied upon their previous experience. Engineers usually spent one and a half days preparing a technical submission to be selected in the pre-qualification stage of a project. On average, each of the engineers had been involved with the preparation of documents/ attendance at selection interviews for 45 projects with a mechanical and electrical value of £200,000 - £500,000 in the last three years.

10. Satisfaction of the Client

The results obtained were based on comparing expectations with perceptions of how engineers actually performed in relation to the five main selection criteria (Ling & Chong, 2004). The eighteen statements in the questionnaire related to the following selection criteria;

1. Firm's Background (statements 1- 4)
2. Past Performance (statements 5- 8)
3. Capacity to Accomplish Project (statements 9- 11)
4. Project Approach (statements 12 -15)
5. Professional Fee (statements 16- 18)

The expectation score for each of the selection criteria was the average level of service expected by the clients/ engineers (questionnaire section 2). Similarly the perception score was the average level of service received as perceived by the clients/ engineers. For example,

$$\text{Architect's perception of Engineering Firm's Background} = \frac{\text{(Average rating of statements 1-4)}}{\text{(No. of architects)}}$$

If the expectation score is equal to the perception score i.e. a gap of unity, then the client was satisfied. A negative score indicated the degree to which expectations were not met. Conversely, a positive score indicated the degree to which expectations were exceeded.
Similarly the performance of the engineer, as perceived by himself, was also determined.
Comparing results showed whether the engineer satisfied the client and indicated which criteria required improvement by the engineer in order to provide a better service.

Through the use of the SERVQUAL tool, the following "gaps" or difference in opinion were assessed;

• Gap 1: The difference between the client's expectations of the engineer's performance and the engineer's perceptions of this performance.

• Gap 5: The difference between the respondents' perceptions and their expectations of the engineer's performance.

11. Relative Importance of Selection Criteria

Table 1: Priorities of Survey Sample

	Firm's Background	Past Performance	Capability to complete	Project Approach	Professional Fee
Developer	12	15	26	25	22
Project Manager (Public Sector)	8	22	23	23	24
Project Manager (Private Sector)	8	22	23	27	20
Architect	15	29	20	23	22
Client	11	22	22	23	22
Consulting Engineer (Public Sector)	19	20	14	10	37
Consulting Engineer (Private Sector)	13	22	15	10	40

Understandably it was a difficult task to ask both the clients and engineers to firstly prioritise the selection criteria and secondly weight each criteria. There was a significant consistency between the eight clients when they weighed the importance of the fee. Similarly there was also a significant consistency between the six engineers when they weighed the importance of the professional fee. During initial discussions with many clients, the weighting they assigned to the professional fee paid to the engineer was dependant on the type of project; i.e. public or private sector, complex or simple etc.

12. Gap 1 – Difference between the client's expectations of the engineer's performance and the engineer's perceptions of this performance.

Table 2: Satisfaction of Project Manager

Performance Criteria	Engineers' Perceptions	Clients' Expectations	Gap
Firms Background	4.38	4.38	0
Past Performance	4.04	5.38	-1.34
Capacity to Accomplish Project	4.28	4.83	-0.55
Project Approach	4.33	4.75	-0.42
Professional Fee	3.84	2.50	1.34

Table 3: Satisfaction of Developer

Performance Criteria	Engineers' Perceptions	Clients' Expectations	Gap
Firms Background	4.38	5.25	-0.87
Past Performance	4.04	5.42	-1.38
Capacity to Accomplish Project	4.28	5.45	-1.17
Project Approach	4.33	5.58	-1.25
Professional Fee	3.84	3.55	0.29

Table 4: Satisfaction of Architect

Performance Criteria	Engineers' Perceptions	Clients' Expectations	Gap
Firms Background	4.38	5.58	-1.20
Past Performance	4.04	5.34	-1.30
Capacity to Accomplish Project	4.28	5.00	-0.72
Project Approach	4.33	3.00	1.33
Professional Fee	3.84	3.45	0.39

Given the usual close working relationship between the architect and the engineer, there was a mutual understanding of the approach that the engineer took for the project (i.e. time scheduling, design methodology and trust in the engineer's work). This understanding was also recognised, to a lesser degree, by the project manager.

However there were significant shortcomings for all client types in the areas of past performance (mainly cost control of capital and running costs, accurate cost estimates, quality of work and time control) and capacity to accomplish the project. This dissatisfaction of the client, particularly that associated with the engineers capacity to accomplish the project, could be directly associated with the professional fee paid to the engineer. Usually at the time that the fee is agreed between both parties, the project brief is not fully developed and the full extent of the service required is not yet known, contrary to popular belief.

13. Gap 5 – Difference between the respondents' perceptions and their expectations of the engineer's performance.

Table 5: Satisfaction of Project Manager

Performance Criteria	Perceptions	Expectations	Gap
Firms Background	4.75	4.38	0.37
Past Performance	4.75	5.38	-0.63
Capacity to Accomplish Project	4.17	4.83	-0.66
Project Approach	4.25	4.75	-0.50
Professional Fee	4.17	2.50	1.67

Table 6: Satisfaction of Engineer

Performance Criteria	Perceptions	Expectations	Gap
Firms Background	4.38	5.63	-1.25
Past Performance	4.04	5.38	-1.34
Capacity to Accomplish Project	4.28	5.39	-1.11
Project Approach	4.33	5.50	-1.17
Professional Fee	3.84	2.94	0.90

When the project manager was responsible for selecting and appointing the consulting engineers, the engineer did not meet his expectations in terms of their firms' past performance (mainly cost control of capital and running costs, accurate costs estimates, quality of work and time control), their firms' capacity to complete the projects (mainly responsiveness of the engineer, management capabilities, informing the client of developments, availability of qualified personnel), and their project approach (mainly trust, understanding of the brief and design methodology).

This could be due to the fact that the project manager is reliant on the engineer accurately estimating costs, which is fundamental to a project's viability during its initial stages. The project manager should feel at ease when approaching the engineer for such information. As the project manager is reporting directly to the client, he needs to be informed of all relevant project developments and therefore the engineer must be responsive and willing to help him. Perhaps due to lack of a formal and detailed brief, he had reservations about the engineer's understanding of the project and the most appropriate design methodology to use.

Similarly when private developers and architects were responsible for selecting and appointing a consulting engineer, there were significant shortcomings. The most significant difference between their perception and expectation of the engineer's performance was in his capacity to accomplish the project. During the interviews, the importance of relationships was highlighted. However all clients felt that the engineer exceeded their expectations in terms of the professional fee that was charged. This is most likely due to the current competitive climate surrounding professional fees.

For comparison, the engineer's expectations and perceptions were also analysed. Similar to the above findings, there were significant shortcomings in all criteria except the professional fee. Although engineers are confined within the constraints of their budget, in line with the project brief, their initial expectations may be unrealistically high. In an ideal situation perhaps the engineer would strive to deliver an "excellent" project in keeping with his firm's past performance and background. However, bound by commitments to other simultaneous projects and limited time resources, the engineer's own expectations are often not met.

14. Conclusions

The key points indicated by the research on how an engineer could improve the service given to a client are summarised here. For the first year after handover, the client/ end user should be trained every four months to ensure that they can operate the plant as envisaged by the engineer. When the engineer deals with a query on site, he must respond to it quickly. The engineer must produce drawings/ specifications as soon as possible when asked, and cost estimates need to be accurate.

The mechanical engineer on a project should have a good working knowledge of the electrical installation and be able to deal with electrical queries (and vice versa).The balance between time spent on a project and the fee paid to the engineer should be improved (i.e. if more money was paid to the engineer, then he could devote more time to the project). The engineer should spend more time with the client at the start of a project to develop/ understand the project brief.

Several recommendations as to how the selection method could be enhanced were highlighted during the research. It was generally considered that clients should set a fixed or percentage-based fee and select the engineer purely on his experience, resources, etc. (i.e. a return to former practices!). It was uniformly agreed that the engineer should be better briefed during the selection stage, and that he should be provided with advance details of the formal scoring system to be used to rate the competing engineers. It was felt that greater emphasis should be placed on the personal relationship between the client and the engineer, and that the number of short listed engineers should be kept to a maximum of 3 – 4 firms.

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Modifying infrastructure procurement to enhance social development

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Abstract: The paper reports the findings of a study by Engineers Against Poverty (EAP) and the Institution of Civil Engineers (ICE) into the factors in infrastructure procurement that are currently inhibiting the achievement of social development objectives. The paper explores, the impact/performance of the asset and the service it delivers (the product), and the opportunities during the project's construction and operation (the process). The study adopted a very broad definition of 'procurement' to embrace all stages from project identification to the final monitoring, enforcement and evaluation. Methods included reviews of procurement documentation and practice in four case study countries (India, Indonesia, Kenya and Nigeria), roundtable discussions and in depth interviews with stakeholders. This yielded a long list of inhibiting factors but also some encouraging efforts at reform. The paper concludes that procurement procedures and contract agreement have the potential to promote social objectives. However, the objectives should be clearly identified in the project design, the budget and procurement strategy have to be appropriate and implementation must be monitored and enforced.

Keywords: Contracts, Procurement, Project Design, Social Objectives, Tender

1. Introduction

This paper presents the findings of an investigation into the possibility of modifying the way in which infrastructure projects are procured in low and middle income countries in order to enhance the delivery of social development objectives. The research is based on the assumption that the procedures followed in the procurement of infrastructure and the details of the contracts entered into can have a significant impact on the social and operational performance of the asset, as well as contributing to the achievement of broader social and economic goals. Procurement procedures can therefore be used as a vehicle to deliver social objectives in infrastructure projects.

The research was undertaken by Engineers Against Poverty (EAP) and the Institution of Civil Engineers (ICE) through its Presidential Commission, Engineering Without Frontiers (EwF). These organisations share a number of common objectives.

EAP is an international non-governmental organisation that works with the engineering industry to promote social and economic development. EAP is supported by the UK Department for International Development (DFID), the ICE and the Institution of Mechanical Engineers (IMechE)

The ICE represents over 70,000 professionally qualified civil engineers worldwide. It seeks to advance the knowledge, practice and business of civil engineering, to enhance the engineer's contribution to sustainable economic growth and promote ethical standards. Engineering without Frontiers (EwF) is a Presidential Commission of the ICE established to examine the engineer's role in meeting the UN Millennium Development Goals.

The aim of the research was to identify opportunities to improve the delivery of social objectives in procurement procedures and contracts. The areas of social development opportunity explored by the project are:

- The impact/performance of the asset and the service it delivers (the *product),* and
- The opportunities during the project's construction and operation (the *process).*

Opportunities within these areas fall into two main categories, those that benefit 'labour' (defined to include employees and the self employed in the formal and informal sector) and those that bring benefits to a broader group which we call 'society'. The greatest benefits to labour are derived from the process and to society from the product, but the division between these categories is not clear cut. Examples of the former are (i) the expansion of opportunities for employment with decent working conditions during construction and operation of the asset and (ii) the development of business opportunities through the local production of inputs (machinery, equipment, materials and components) to the construction process, as embodied in the concept of 'local content'. Examples of benefits to society are the delivery of an asset that is fit for purpose, is operated and maintained in an appropriate manner, serves the needs of the community over many years and contributes to social and economic development goals. Good governance is also considered as an objective as it provides the enabling framework for delivery.

The work was guided by a panel of expert advisors set up by the ICE, who met from time to time to monitor progress and review outputs. On the advice of the panel an early decision was taken to expand the usual definition of procurement to include 'project identification' at the initiation of the project and 'monitoring and performance evaluation' at the conclusion of the construction phase. Five stages in the procurement cycle were identified as: (1) Identification, planning and design (2) Finance and procurement strategy (3) Tender and selection (4) Contract agreement (5) Monitoring, enforcement and evaluation. Consideration was also given to the operation and maintenance of the asset.

2. Research methodology

At the outset the research aimed to address two key questions:

1. How do existing procurement procedures inhibit (or enable) the achievement of beneficial social impacts of infrastructure projects in low to middle income countries?
2. How can procurement procedures be improved and utilised as a mechanism to increase the contribution of the project to the achievement of social development objectives?

Three major avenues of enquiry were adopted to address these questions:

2.1.Case studies in four countries:

Analysis of current procurement procedures and how they are applied in practice is key to understanding the factors inhibiting or enhancing social performance. It is also important to establish where social objectives are identified within procurement procedures and contract documents. In order to achieve these objectives a detailed study of national procurement policy, procedures and documents was undertaken in a small number of countries chosen as case studies. Four countries were selected: India, Indonesia, Nigeria and Kenya. They were selected because they are strategic regional leaders with capacity to promote the recommendations emerging from the research and to influence other countries in the region.

In each country a detailed analysis was undertaken of national procurement policy and legislation, national standard bidding regulations and documents. The relevant development bank's harmonised bidding document and a limited number of project documents were also consulted.

This approach allowed the identification of social obligations in current procurement procedures. In order to examine the extent to which these contractual obligations are actually met, we looked at health and safety in construction projects in the case study countries. As the research progressed, it also became important to consider the infrastructure policies adopted by the governments to meet country MDG targets.

2.2.In-depth interviews:

Interviews were conducted with representatives of over 40 key stakeholders. Respondents included the following donors: The World Bank, Asian Development Bank, Department for International Development (DFID) and the European Commission. Other respondents were government departments, international and national consultants and contractors and NGOs. Each respondent was asked about their individual work experiences and their views on current practice. The information gathered from the interviews, together with the findings of the case studies, was used to identify the factors inhibiting the delivery of social objectives through procurement. Some enabling factors also emerged from the interviews with key stakeholders. The identification of enabling factors was supplemented by an extensive review of past and current initiatives undertaken by donors, financiers or other groups to improve the performance of procurement systems to deliver social objectives.

2.3.Roundtable discussions:

Roundtable consultations were held in each of the case study countries. These meetings were facilitated and/or sponsored by the ICE country representatives, multi-lateral development banks, governments and private companies. Altogether over 100 delegates from across the stakeholder groups (donors, clients, consultants, contractors, NGOs and other local stakeholders) attended these one-day meetings.

Roundtable discussions were seen as a way of bringing developing country voices into the study. The participants in each meeting were asked to address two questions:

1. What are the opportunities to increase social development within engineering procurement procedures in the case study country?
2. What are the enabling factors for the opportunities to be achieved?

The issues raised in the discussions played a key role in drawing up the recommendations. While the views expressed were not attributed to individuals in the interests of confidentiality, it is felt that the findings and recommendations of the study (as summarised below) present a fairly accurate reflection of the views of those most directly involved in the delivery of infrastructure projects in the developing world.

3. Case study findings

Five common findings emerged from the study of procurement documents in the case study countries:

3.1.Public procurement reform is underway to improve governance

Since the late 1990s the governance of procurement policy in the case study countries has followed a similar pattern of reform and development. This is being driven by the donor's switch from funding individual projects to providing more general budget support, accompanied by an agreement to channel funding through national government systems whenever they are considered to be of adequate standard.

Following World Bank Country Procurement Assessment Reports (CPARs), Kenya, Nigeria and Indonesia took up the recommendation of the World Bank to establish a legal framework for public procurement based on the UNCITRAL Model Law on Procurement of Goods, Construction and Services (UNCITRAL, 1995).[i] Kenya and Nigeria also adopted the recommendation to create a central authority to formulate procurement policy and monitor its implementation. The objectives of procurement legislation in these countries closely follow those stated in the UNCITRAL Guide to the Model Law, notably maximising competition, according fair treatment for suppliers and contractors bidding to do government work and enhancing transparency and objectivity. By following this principle, the Model directs a procuring entity towards competitive tendering with restrictions placed on other tendering methods such as restricted tendering and two-stage tendering.

The legal frameworks have also sought to improve the governance of public procurement by adopting a complaints and review procedure based on the guidance provided in the UNCITRAL Model, by prohibiting corrupt and fraudulent practises and including a code of conduct for all procurement officials.

3.2.A limited number of social objectives in standard bidding documents

National procurement legislation does not address the contract performance or implementation phase. Instead, the expectation from the CPARs is for national governments to publish standard bidding documents. Examination of the documents in the four countries found a limited number of social objectives related to labour (conditions of employment, health and safety and trade union rights) in the conditions of contract. All four countries also give a margin of preference in the tender process (commonly 10%) to domestic contractors. A margin of preference is also granted for the benefit of tenders using locally produced goods or services. Other local content policies include a classification system in Indonesia that reduces the ability of overseas contractors to bid and bonus scores for demonstrating a history of local participation in Nigeria. Environmental obligations are more common, with Environmental Impact Assessments (EIAs) increasing. EIAs so address some social issues, such as resettlement. However, the recommendations of the EIA reports are not always included in the scope of works and consequently not implemented.

3.3.Social obligations in Multilateral Development Banks bidding documents, but questions over enforcement

When Multilateral Development Banks (MDBs) finance a project it is their standard bidding documents that usually apply and their rules that take precedence when they conflict with national legislation. The 'Master Bidding Document for Procurement of Works', which includes the Multilateral Development Bank (MDB) Harmonised Edition of the FIDIC Conditions of Contract for Construction (2005), does address governance, labour and society issues. The obligations to the labour force go further than the national standard bidding documents examined, with prohibition of child and forced labour and an obligation to ensure the supply of food and water. There is also a requirement to appoint an accident prevention officer at the Site and a comprehensive contractual obligation for the contractor to conduct an HIV-Aids awareness programme via an approved service provider. However, stakeholders have questioned how these obligations will be priced and if and how the client and his contractor will measure whether the service provider has fulfilled his obligation. Also, many of the social requirements are a test of reasonableness or do no more than 'encourage' action. Two examples are a requirement that the contractor take 'all reasonable steps' to protect the environment' and that the contractor is 'encouraged' to employ staff and labour from sources within the country.

Other social requirements may be included as part of the condition of the loan or grant, but these are usually confined to governance issues and a requirement for Environment Impact Assessments.

3.4.Even minimal social obligations may not be met

Most contracts specify, as a minimum, that contractors must obey all local laws and regulations. Legislation is generally adequate with special provisions to ensure the health and safety of the construction workforce. In the three countries where this issue was studied (India, Kenya, Nigeria) legislation has been strengthened recently with the introduction of requirements for health and safety committees at all work places, with equal worker and employer representation.

However, the actual standard of health and safety on construction sites in the countries studied falls far short of what is required by law. Monitoring and enforcement of the provisions for health and safety in contracts is inadequate. Health and safety inspectorates are generally understaffed and visit construction sites only after an accident has occurred. Few contractors are charged for contravening the regulations and when they are the penalties are too small to serve as a deterrent. There is no monitoring of health and safety from within the project team. Fear of losing contracts to competitors is a powerful factor preventing contractors from including the full cost of meeting their health and safety obligations in tenders. Workers also are fearful of losing their jobs if they complain about unsafe or unhealthy worksites. Many are simply unaware of their rights.

3.5.New procurement strategies to meet MDG targets and private participation

Governments have set specific infrastructure targets to meet the MDGs, particularly in the provision of water and sanitation, roads and power supply to improve the lives of villagers and slum dwellers. The role of infrastructure in stimulating economic growth and reducing (both directly and indirectly) the number of people living in poverty is also recognised. All four countries aim to mainstream MDGs into national planning and budgeting, but it is not clear whether this has occurred in practice. In three of the case study countries (India, Indonesia, Nigeria) responsibility for the delivery of infrastructure is being devolved down to local levels but questions have been raised as to whether these tiers of government have the technical capability to deliver.

The lack of finance to meet MDG targets also means that governments are looking to the private sector to deliver, operate and maintain infrastructure and related services and recoup their investment through user charges. Community organisations are also being encouraged to operate and maintain small scale and/or rural infrastructure assets using the funds generated from charging users for the service. This is leading to a change in procurement procedures with governments wishing to engage contractors on long-term concession contracts ranging from 15 to 25 years. Social objectives within the concession contracts go beyond the traditional ontracts with examples of the requirements from the EIA and SIA report built in the project documentation (e.g. India). There is also legislation relating to private sector participation in infrastructure that specifies various social obligations, for example laws relating to infrastructure in Indonesia make consultation with the local community a legal obligation for the client.[ii] It is then for the client to decide how this consultation is managed within the procurement process.

4. Summary of factors inhibiting beneficial social impacts

The detailed study of procurement regulations and contract documents in the four case study countries pointed to a number of factors in procurement procedures that could be inhibiting the achievement of social development objectives. For example, the lack of clear definition of social obligations in contracts and the failure to monitor and enforce the obligations that do exist in contract agreements or national legislation. The interviews and round table discussions covered a broader area (from project identification to monitoring and evaluation, operation and maintenance) and revealed other factors. The main inhibitors as they arise in the order of the procurement cycle are summarised below.

4.1. *Lack of public consultation, national plans or other clear criteria for project identification*

The process of delivering social development objectives through the procurement of civil works starts with the identification of a project. Respondents complained of a lack of transparency in the selection of projects and absence of public consultation, leading to fears that selection is based on personal or political interests rather than the interests of society as a whole. Project identification does not appear to be guided by national, local or sectoral plans, hence projects do not always meet a clearly identified need. Many projects are considered to be 'socially inefficient'. In the worst case scenario they may serve no apparent purpose – such as 'bridges to nowhere'.

4.2. *Failure to incorporate social objectives in project appraisal, design and budget*

The predominant source of project funding in low income countries is loans taken by governments from MDBs. Social conditions attached to loans are generally restricted to issues of governance. Donors fail to systematically consider social objectives during project appraisal or to set aside funds for their realisation. Social objectives are also overlooked by clients and there is little evidence of linkage between project planning and design and national development plans, national policies (e.g. for employment generation) or legislation (e.g. on occupational safety and health). Failure to consider social objectives at the design stage and to budget accordingly, may hamper the achievement of these objectives when introduced later on.

4.3. *Failure to plan and budget for maintenance*

African respondents in particular highlighted the persistent problem of poor maintenance of infrastructure assets which shortens the life of the asset and the social benefits derived from it. One obvious cause of the problem is inadequate funding for operation and maintenance, whether from general taxation, specific taxes, or user fees. Less obvious is the fact that the design and specification can themselves have a big impact on the ability to operate and maintain the asset. For example, if designs require heavy dependence on foreign technologies and skills, maintenance becomes a problem from the moment that foreign workers depart. Conversely, the capability to operate and maintain the facility should be enhanced when designs employ local technologies, skills, materials and components, embraced in the concept of 'local content'.

4.4. *Inflexible procurement strategies and adversarial contract forms*

The predominant method of procurement in developing countries is essentially traditional, with the client serving as the contracting authority and appointing through competitive bidding a consultant to design and contractor to deliver the project. The traditional method of procurement has a long history of reliability. But many regard this method as inflexible and not always appropriate. It is also highly adversarial. There is also concern at the excessive focus on competition at the expense of other objectives, such as the development of the local economy. There are several different procurement strategies that clients and donors could consider that might be more suitable in certain circumstances in delivering the project and social objectives (e.g. design/build, turnkey, output or performance based procurement). But despite their successful use in developed countries, donors have been reluctant to allow developing country clients to adopt these models.

4.5.Intense competition and selection based on lowest price

All four case study countries have accepted the basic tenet of the UNCITRAL Model Law that best value is achieved by maximising competition. However, accepting the lowest price tender can have negative repercussions with implications for the achievement of social objectives. If the tender price is very low the successful bidder may be led to cut costs by cheating on materials and taking other shortcuts that can affect the quality of the product. The successful bidder may also cut back on labour costs by pushing down wages, hiring casual workers and failing to meet contractual requirements to ensure the health, safety and welfare of the workers. In many countries intense competition (particularly from Chinese companies and other 'new entrants' to international contracting) is seen to be driving down standards and leading to neglect of social obligations. It may also preclude local contractors from entering the market as they do not have the financial capacity to take on the risk of bidding at such low prices.

4.6.Vague and conflicting messages regarding social obligations in contracts

Vague and sometimes conflicting obligations in contracts complicate compliance. For example, as the case studies noted, contractors are expected to take 'reasonable care of the environment'. It is not clear what this means and interpretation is made even more difficult in a context where national standard and guides are lacking and little attention has been paid to the specification of sustainable resources in design and delivery. There is also ambiguity in FIDIC contracts on the employment of local labour, with one clause stating it is up to the contractor who s/he employs and another saying s/he should employ nationals wherever possible. Other contracts clauses, such as 'take due precautions to ensure the safety of staff' may state the general intent but lack operational detail to inform the contractor what actually has to be done.

4.7.No clear standards for social objectives and failure to monitor and enforce standards that exist

In the countries studied project performance is often poor, with the technical as well as the social requirements of the contract not fulfilled. Sometimes the failure can be traced back to problems at earlier stages in the procurement process, such as poor design and specification, weak definition of requirements and/or inadequate budgets. But failure to enforce the conditions of the contract is also due to inadequate supervision from within the project team as well as weak government enforcement of regulations. In very poor countries, government regulatory agencies rarely manage to enforce standards due to lack of capacity, logistical difficulties and corruption. Monitoring and enforcement of basic requirement for health and safety is certainly inadequate in all of the case study countries. Project auditing (in the sense of analysis after completion to identify shortcoming, errors or mistakes) is limited. Respondents expressed the view that the implementation of many objectives, not just social, is not evaluated to a relevant and appropriate standard, with auditors tending to follow paper trails rather than actually checking the asset on the ground. Lack of effective standards for monitoring is a further problem.

4.8.Corruption is a major inhibitor at every stage of the procurement cycle

Corruption is prevalent throughout the procurement and project life cycle, from identification of the project through to monitoring and enforcement, operation and maintenance. Corruption and fear of corruption is a major inhibitor to improved contractual and social performance. It hinders decision making, undermines the efficiency of the procurement process, blocks the entry of local firms and raises project costs. Consultants and contractors stated instances where they have walked away form bids because of corruption. Others build corruption costs into the price. In its Global Report of 2005 the anti-corruption group, Transparency International, estimates that almost 10% of investment in infrastructure is lost to corruption. The real figure may be much higher.

Analysis of the stakeholders who are mainly responsible for the factors that are currently inhibiting the setting and achievement of social development objectives through the procurement process threw up some additional inhibiting factors. For example, the fact that the MDBs measure success by the quantity of funds disbursed rather than the quality of outcomes, the focus of donors on financial auditing with minimal monitoring of social outcomes and the continuation by some donors of the practice of tying aid are all seen as detrimental to the realisation of positive social impacts from infrastructure spending. Governments are also criticised for failing to enforce their own regulations or to promote their own policies in infrastructure procurement.

5. Roles of key stakeholders as agents for change

As well as the long list of problems summarised above, the research also detected some encouraging developments led by key stakeholders in the procurement process. It is by now a well established fact that the decisions taken in the early stages of project procurement have the greatest potential impact on cost. This is also true for the identification and exploitation of social development opportunities. Hence the greatest chance to influence the setting and achievement of social development objectives in public procurement rests with the donors who provide much of the funding, in partnership with the clients who create the culture for project implementation.

Donors are currently driving procurement reforms in low income countries and helping to build the capacity of procurement officials. This is related on the part of some donors (led by OECD/DAC) to a move away from project funding toward budget support linked to national and sector plans. We have seen in the case studies that the MDBs have now adopted standardised contract documents that do address some social issues, although there are questions over enforcement. MDBs have also recently agreed a common approach to fight corruption, to develop proposals to assist country capacity in anti-corruption measures and to cooperate with civil society and institutions to enhance transparency and accountability. It is now important that these opportunities are taken up and that inflexible procurement procedures and the drive for market competition do not compromise donors' desire to derive increased social benefit.

Governments are also influential in promoting social objectives as they set the framework in which projects are identified, planned, designed, procured, constructed and maintained. Governments of many countries are reviewing procedures and promoting reforms, although these efforts are complicated by decentralisation programmes. In some countries the social performance of companies is being included in assessment criteria for prequalification or registration. Environmental Impact Assessments are increasing and Social Impact Assessments are beginning to emerge. Community groups are playing an increasing role in project identification, management, operation and maintenance with positive effect. These developments indicate a growing momentum to encourage good practice and social development impacts in public procurement.

Two particular examples of good practice can be singled out. The first is the use of 'targeted procurement' by government clients to assist disadvantaged groups. Targeted procurement is a system for awarding tenders that provides the option to set targets or goals to achieve socio-economic objectives that are contractually enforceable, whilst retaining donor rules of competition, fairness, efficiency and transparency (Watermeyer, 2000).[iii] A scoring system leads to bidders competing on the basis of price and how they incorporate the social objectives into the project (for example, 90 points for price and 10 points for social objectives). Developed in South Africa to specifically target those groups disadvantaged under the apartheid system, the system has also been used to support local economic development, to promote growth within the small business sector and to target the unemployed in poverty alleviation programmes. However, successful implementation clearly depends on appropriate planning and design and clear identification of goals, as well as the willingness and ability to apply sanctions to contractors who fail to deliver the social objectives they are contractually committed to.

The second example addresses the key issues of monitoring, evaluation and enforcement. One clear message emerging from the research is that contract agreements that require certain actions on the part of the contractor (even if this is simply to observe the law of the land) have to be monitored and enforced through incentives or sanctions. The Social Aspects of Construction project, supported by UK/DFID and tested in Ghana, has demonstrated how social obligations in contracts (in this case labour standards) can be monitored as part of the supervisory process within the project team (Ladbury, Cottam, Jennings, 2003).[iv] The process is greatly facilitated if the labour force is fully aware of their rights and entitlements and all the key stakeholders are involved. On DFID funded projects in Ghana the stakeholders (including the client, contractors, labour department and trade unions) collectively identified the appropriate labour standards to apply and periodically reviewed problems and proposed solutions. Contractors complying with the standards were rewarded with bonuses. Over time and after a number of different monitoring approaches had been tried, the supervising engineers began to take over the role of monitors. The experiment has shown that consultant engineers can effectively monitor compliance with social obligations and review accounts when these are clearly defined and budgeted in contract agreements.

6. Conclusion and recommendations

A number of key messages emerge from the research. First, it is clear that there are many stages in the procurement cycle and actions in one stage are constrained by decisions taken earlier. As a general rule the decisions that are taken in the early stages, have the greatest impact on the achievement of social development objectives. The biggest potential impact on poverty probably lies in the choice of the project. Therefore, project identification must be carried out in a clearly defined and transparent manner. It is suggested that it should be in line with national, local or sector plans and carried out in consultation with the community.

Second, it is equally clear that there is little point in including contractual obligations (whether the contract agreement or preferably the specification) that require certain actions on the part of the contractor unless the actions have already been considered at the design and planning stage and budgets drawn up accordingly. Some method has also to be agreed for monitoring and enforcing compliance. If these things are in place the contract agreement has potential as a means to promote social objectives at the tender stage.

Greater flexibility is needed in identifying a procurement strategy. The 'one size fits all' approach creates an inflexible system that is not appropriate for all projects. A move away from the lowest cost approach is envisaged, with a greater willingness on the part of donors to allow two stage and targeted procurement methods. A more flexible approach by clients and donors could improve the delivery of the project and the achievement of social objectives.

Fourth, the long recognised problem of poor maintenance is still very real. This is traced to the failure to consider the whole life cycle of an asset during planning and design, so as to ensure that the asset can be operated, as well as maintained, at minimum cost and with the resources that are available locally. If these considerations are at the forefront of decision making it is likely that 'local content' (of materials, labour and business) will automatically be enhanced. Respondents from all of the case study countries and many representatives of international agencies maintained that promoting local content is an efficient means of delivering significant social development impact. They recommended that investment to meet the MDGs should use and strengthen national engineering industries and resources.

Finally, it is worth noting that corruption (a major inhibiting factor) is pervasive and must be tackled at all stages of the procurement cycle. Tackling corruption at the tender and selection stage alone (which is the stage that currently received the most attention) is unlikely to be effective as the problem will simply move to a different stage of the process. The first step in tackling corruption is to increase transparency. It is therefore essential that processes at each stage of the procurement cycle are as transparent as possible.

Based on the above, the following recommendations are put forward for discussion. The recommendations are presented in the order in which they arise in the procurement cycle.

Project identification, planning and design

1. Project identification should be in line with national, local or sector plans and/or based on public consultation
2. The whole life cycle of the asset should be considered during planning and design and an operation and maintenance strategy developed for each new project

3. Social objectives should be clearly identified at the planning stage and incorporated into the design, with funds set aside in the budget for their realisation

Finance and procurement strategy

4. Consider alternative procurement strategies to ensure the appropriate approach to deliver the specified social objectives

Tender and selection0

5. The social objectives must be clearly defined in tender documents and explained at pre-tender meetings
6. Attention should be paid in tendering to the bidder's social performance and capacity to deliver social obligations, through prequalification or the maintenance of robust registers

Contract agreement

7. The project team must agree contractual mechanisms to deliver social objectives

Monitoring, enforcement and evaluation

8. Contractual obligations must be monitored and enforced through incentives and/or sanctions
9. Social performance audits should be conducted with the same rigour as financial audits.

Further research is needed to test the feasibility of implementing the recommendations in particular contexts, as well as to test their effectiveness in achieving specific social development objectives.

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Trust, Briefing, Facilities Management and Procurement Contexts

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Abstract: The role of facilities management in effective briefing for construction projects has been long debated. Although the importance of people/communication issues in briefing has been emphasised in the literature briefing has seldom been explicitly conceptualized in terms of trust. This contrasts with the later stages of the construction process where trust has been more thoroughly investigated. In this paper some of the findings of this work on trust in construction are reviewed and their implications for the role of facilities management in briefing examined. An ability to effectively integrate facilities management knowledge into briefing is potentially an important test of the work on trust. Recent developments in the procurement of constructed facilities mean that the context for briefing is much more complex that conventionally portrayed in work on briefing. A framework for understanding trust and its potential role for integrating facilities management knowledge into briefing is explored.

Keywords: Briefing, Facilities Management, Procurement, Trust.

1. Introduction

This paper explores the potential for recent work carried out on trust in construction projects to be applied in the context of the briefing process. In particular the prospect of using this approach to better incorporate knowledge derived from facilities management into the briefing process will be investigated. An inability to make effective use of facilities management knowledge is a long standing problem and a demonstrable improvement in this area would be an important test of the trust approach. The paper draws upon the analytic framework for trust developed in the Trust in Construction Project which was supported through the Engineering and Physical Sciences Research Council (EPSRC), a funding agency of the UK Government.

2. The role of facilities management in briefing

Traditionally briefing for buildings projects has been characterized as an early stage in the design and construction process during which client requirements are made explicit; the main participants in this process are the client and architect (or other designer). This characterization has been revised over the years in response to several developments in the property and construction development process including the increased complexity and sophistication of many client organizations, a perceived need for greater building user involvement, new forms of construction procurement and a greater involvement of professions other than architecture in managing the design process (Gray and Hughes 2001). As a result of such developments facilities managers are increasingly seen as having an important function in the briefing process (e.g. Duffy, 1993, Becker 1990, Barrett and Baldry 2003, Hyams 2001). In particular the knowledge that facilities managers have of the ways in which buildings and infrastructure can support organizational function is seen as highly relevant to briefing even if it is seldom captured in practice (Blyth and Worthington 2001, Smith and Jackson 2000). The importance of feedback from building use into the design process has long been recognized; for example the RIBA Plan of Work recognized the importance of feedback from building use in the design process even if the methods for achieving this were not well developed (Lawson 1997). There are, however, problems in achieving effective feedback between many projects and it has been explicitly removed as a distinct work stage in the most recent version of the plan of work (Royal Institute of British Architects 2000). The Generic Design and Construction Protocol emphasises facilities management as an activity zone, implying that it needs to be managed from project inception and thus through the briefing process (Kagioglou et al. 1998).

The practice of facilities management has itself been changing in ways that suggest it should have a greater role in the briefing process. It is increasingly seen as a strategic factor in organizational performance rather than as an overhead (Langston and Lauge-Kristensen 2002). For example, Vischer (1996) has suggested that leading corporations tend to use an investment rather than a cost model of accommodation planning; in other words that they see workspace as a positive contribution to corporate performance rather than as a cost to be minimized. Barrett and Baldry (2003) distinguish between operational and strategic facilities management; its strategic role is to scan for future change bother in the core business and the facilities management arena to develop a policy framework that balances current operations with future needs. Smith and Jackson (2000) have suggested that facilities managers have a key role to play in strategic needs analysis during briefing. The “intelligent client” model of facilities management in which organizations have a small team of expert staff to manage outsourced services and develop strategic facilities policy (Bernard Willams Associates 1994, Roberts 2001) seems particularly relevant; such a team would have unique knowledge of the facilities requirements of an organization that would be particularly appropriate to managing the briefing process. Where the facilities manager has the “intelligent client” role in an organization he or she may be well placed to take on what Blyth and Worthington (2001) call the “project champion” role in briefing.

Despite the strengthening rationale for the involvement of facilities management in briefing, the empirical evidence for this taking place in practice is limited. Published research and case-studies of briefing, with some exceptions, are rarely clear on the composition of client briefing teams and whether the facilities management function is represented within them. Work by Bowen et al. (1999) in South Africa, for example, indicates that life-cycle costs are rarely given a high priority in briefing; this suggests that faciliites management input is not always strong in practice.

3. The briefing context

Briefing has a long history as a research problem within the construction procurement process (e.g. see Barrett et al, 1999, Kelly et al., 1992, Smith et al., 1998, Ryd 2004). A wide range of weaknesses in briefing practice have been identified and proposals put forward to remedy them. Much of this work has centred on the linked issues of understanding the client,

client/industry interaction, communications and team building. For example Barrett and Stanley (1999) structure their work around five “key solution areas”;

- Empowering the client
- Managing the project dynamics
- Appropriate user involvement
- Appropriate team building
- Appropriate visualisation techniques

Blyth and Worthington (2001) define six key areas for briefing success:

- Defining the process
- Timely decision making
- Understanding underlying agendas
- Planning for future change
- Clear and comprehensive communication
- Feedback of experience

A prerequisite for many of these solutions to be implemented is an underlying climate of trust in the briefing team; without trust effective communication and timely decision making, for example, are unlikely to take place. Hanway (2001) mentions developing trust between client and designer as an important element in exhibition design. Stuebing (2001) discusses the role of trust in allowing briefing for adaptability. Salisbury (1998), although not specifically using the concept of trust identifies the importance of “creating a healthy working relationship” and goes on to discuss the uncertainties and suspicions that can arise between client and architect during the early stages of briefing. However, research into briefing seems to have largely ignored the field of trust in construction in which the concept of trust has been developed as an analytic construct.

4. Trust in construction

The aim of the Trust in Construction Project was to carry out an exploratory study of trust in construction projects using a case study (Yin 1994) approach. One pilot and four full case studies were carried out. Trust has been defined in many ways (Blois 1999). However, a working definition for the purposes of the project was developed:

We define trust as the willingness to rely upon the actions of others, to be dependent upon them, and thus be vulnerable to their actions. Trust always involves an element of risk that a partner will abuse the trust placed in them (Wood and McDermott 1999).

The key findings of the project were the elements of trust at work in projects and their interaction with each other. A distinction was drawn between interpersonal trust and organizational trust. Interpersonal trust is that which occurs between two individuals. Organizational trust is the trust that organizations place in their own staff; it is a cultural issue. Organizational trust is in turn affected by the norms and context of industry as a whole. A construction project will bring together a number of organizations, each with its own culture of trust.

Organizational trust was found to have an important impact on the effective functioning of construction projects. Organizations that trust their own staff (Tschannen-Moran 2001) and support a no-blame culture (Woodward and Woodward 2001) tend to give project staff the authority to respond flexibly within a project team. Projects bring together different organizational cultures and where these cultures are complementary projects tend to work well. Where there is cultural conflict then problems can arise.

Interpersonal trust was explored through the development of a Trust Inventory which identified six ethical dimensions of trust as reported in Wood et al. (2002). These dimensions are:

1. Honesty/openness in communications – integrity in sharing information; no covert agendas
2. Promise keeping – never misleading by making false promises
3. Fairness/reasonableness – fair sharing of benefits; avoiding a blame culture
4. Mutuality/reciprocity – willingness to work beyond contractual obligation for mutual benefit
5. Values/ethics – the need for participants to demonstrate high ethical standards
6. Reputation – key to being trusted and in willingness to trust; has to be earned

5. Implications of construction trust work for briefing – different stages of the process and different procurement contexts

The Trust in Construction Project focused mainly on the construction phases of projects. Successful strategies to intervene in this stage were identified. Can the strategies and principles that emerged be applied at earlier stages in the process including briefing? This can at least be taken as a working proposition. The case studies used for the construction phase had been specifically selected against pre-set selection criteria (after Yin, 2003). These included the client type, procurement approach and project size. Given both private and public sector client drives towards the procurement of constructed facilities as service, rather than products, can the construction based case studies yield generalisations that are applicable in such very different procurement contexts?

The public sector alone has been required to move towards newer procurement methods based on integration concepts in recent years, following strategy documents such as Achieving Excellence (HM Treasury, 1999), and direction from both the Office of Government Commerce (OGC Report, 2003) and the National Audit Office (NAO Report, 2001). In the wake of the Egan Report, Rethinking Construction (Egan, 1998), which highlighted integration and partnering as key strategies to improve the construction industry , the UK Government Construction Client's Panel responded with Achieving Excellence (HM Treasury, 1999), which laid down targets for the number of projects which should be procured through integrated supply chains and partnering. This has been followed by the National Audit Office identifying new procurement routes based on partnering approaches as a key tool in delivering better public projects (NAO Report, 2001). It later followed this report up with a data that suggested that innovative procurement approaches, which tend to encourage partnering and supply chain integration, had a demonstrable benefit within the public sector (NAO Report, 2005).

Considering these shifts in procurement contexts, it can be proposed that the conditions to facilitate the development of trust are significantly different:

- When the client is procuring the work through an Integrated Procurement Form, perhaps a Private Finance arrangement, or through framework arrangements

- Between stages of projects - where the temporary project coalitions consist of organisations ofsignificantly different character (say design houses and materials suppliers),
- Where the traditional role and function of facilities management has been absorbed into an integrated service, into an integrated organisation and can be fully considered at briefing stage, and
- Where the conditions of engagement/employment offer significantly different incentive mechanisms for the stakeholders involved.

These contexts suggest a considerably more complex and richer picture of procurement than that depicted in conventional work on the briefing process and future research will need to take account of this.

To begin to address these and other propositions, the authors firstly propose to look at organizational trust in relation to briefing both in terms of client and industry organizations. In a trusting organization (Tschannen-Moran 2001) individuals involved in the briefing process are given the support and authority to act flexibly and effectively. The importance of the role of client "champion" in briefing has been stressed (e.g. Blyth and Worthington 2001, Salisbury 1998, Hyams 2001) and this role is likely to be severely compromised if the client organization does not put full trust in its representative. Similarly on the industry side the organization needs to place a high degree of trust in its representatives. Where trust does not exist it is likely to be replaced by complex systems of control and audit; such systems can become dysfunctional where behaviour alters to meet the requirements of the audit system (Power 1999). The issue is not just about trust within organizations, although this is important, but also between organizations that may operate with very different cultures.

Within the overall context of organizational trust briefing also needs the development of interpersonal trust amongst the individuals involved in the process. The new project will explore what this might mean using the six dimensions of the trust inventory.

- Honesty/openness in communications. Good communication, particularly of client needs has often been emphasised by many commentators on the briefing process (e.g. Barrett and Stanley 1999, Blyth and Worthington (2001), Salisbury 1998). The trust work adds to this by stressing the ethical dimension of communication, particularly in not using communication to mislead other participants in the briefing process or to pursue hidden agendas.
- Promise keeping. Briefing defines the intended output of a construction project and therefore presents a considerable opportunity, whether intentional or unintentional, for over optimistic claims (or demands) for outcomes. In this situation it is easy to make promises that cannot be fulfilled.
- Fairness/reasonableness. Briefing is a demanding task that requires substantial input from the individuals involved; this work needs to be equitably distributed amongst participants and fully resourced by their organizations. Where the client has little experience of the construction industry there is an inherent imbalance of power in the relationship; it is important that the client is adequately empowered in these situations (Barrett and Stanley 1999).
- Mutuality/reciprocity. There are considerable benefits to all parties in ensuring that satisfactory briefing takes place. Where a climate of trust exists individuals will be encouraged to commit knowledge and effort to the process with the understanding

that others will do the same. Without that climate there may be a tendency for individuals to manipulate information and contributions for their own political aims.

- Values/ethics. Where individuals demonstrate clear adherence to ethical principles in their behaviour in the briefing process a climate of trust might be expected to be enhanced.
- Reputation. Some clients have continual building programmes that allow trust to be developed over a number of projects, particularly in partnering arrangements. This allows individuals to build up reputation for ethical dealing over a long period. For occasional clients this is more difficult. Nevertheless individuals and organizations can build a general reputation that can go before them. Individuals have to gain trust by consistently demonstrating high ethical standards.

For the facilities manager involved in briefing this work has a number of implications. Where an organization is undertaking a construction project a facilities manager might reasonably be expected to have a role in the briefing process, particularly where he or she is expected to take responsibility for that building after completion. However, this role will have reciprocal responsibilities. There is a need for open communication, particularly of relevant information that might be held by the FM department. The facilities manager may also be in a position to facilitate user involvement in the briefing process e.g. by means of post occupancy evaluation; the views of users should be fairly represented and communicated. Full participation of the facilities manager in the briefing process might be expected but at the same time the facilities manager can expect that his or her interests will be fully taken into account at the same time.

6. Conclusions

Although trust in the construction delivery process has been subject to systematic analysis in recent years there has been less work on trust in the briefing process. Work on briefing has implicitly recognized the importance of trust but it has not been dealt with in a particularly structured way. The Trust Inventory of Wood et al (2002) offers a framework under which such an analysis might take place. However, there is a need to develop a programme of research to undertake such work.

The role of trust seems particularly important in fully exploiting the knowledge base of the facilities manager into the briefing process. Although the potential benefits of involving facilities management in briefing its actual involvement often appears to be either a token gesture or to come at a stage when all the major strategic decisions have been taken. In a culture of trust that engenders openness, reciprocity and fairness it might be expected that the contribution of all potential contributors to the success of the briefing process would be valued.

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Whole Life Costing of Sustainable Design

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Abstract: Sustainability is a large subject and one which is currently attracting considerable funding. However, attention is primarily being directed towards the macro economic issues of sustainable urban environments, sustainable power and sustainable infrastructure. The principles of whole life costing are well described; however, a standard method approach to whole life costing of sustainable design is not available. Whilst there are a number of publications which deal with sustainability at a global impact level, few deal with sustainability at a project level and none set a whole life cost methodology suitable for use by surveyors in option appraisal for representing costs and benefits associated with sustainability. It is clear that the majority of surveyors are grappling with the problem of a lack of tools to facilitate the production of management data in a standard form conducive for the client to make an informed cost - benefit decision.

This project is funded by the Royal Institution of Chartered Surveyors (RICS) Education Trust and builds on previous research into Whole Life Cost models and sustainability to produce a workable project based tool for surveyors focused on the key elements of insulation, controlled ventilation, micro and biomass heating and electricity generation. A standard approach to the whole life costing of sustainable design is required which is the intention of this research. This research will evolve a methodology for a judgement to be made on the basis of the full knowledge of the characteristics of the system proposed and its associated whole life costs. This paper will focus on phase one of three phases proposed which involves identifying the issues impacting sustainability. This will be done through an in depth review of sustainability literature to uncover the issues within sustainable design. The paper will conclude with the production of; a checklist of factors which impact whole life costing, and those elements of the whole life costing calculation.

Keywords: Issues, Surveyors, Sustainable Design Sustainability, Whole Life Costing

1. An Introduction to the Project

This research project is funded by the Royal Institution of Chartered Surveyors (RICS) Education Trust and aims to produce a workable project based tool for surveyors focused on the key elements of insulation, controlled ventilation, micro and biomass heating and electricity generation. This project builds on the work of a previous research project funded by the Society of Construction Quantity Surveyors (SCQS) to construct a user friendly document on whole life costing and design a software input tool for surveyors to use when calculating whole life costs. This particular project focuses on the sustainability issues to identify the barriers preventing more sustainable practices being adopted. The output of the project will be a whole life costing model containing the elements of sustainable design to promote more sustainable practices in the construction industry.

2. A Background on Sustainable Construction

Sustainable development relies on long term planning. Schmid (2003) states that; 'the future of sustainable construction has its roots in past and present actions and the future depends on our (ethical) awareness concerning the consequences of our acts and deeds.' Van Bueren and Priemus (2002) state that sustainable construction is; 'the design, development, construction, and management of real estate such that the negative environmental effects of the construction, restructuring, and management of the built environment are reduced as far as possible.'

The construction industry addresses the three dimensions of sustainability; environmental, social and economic, in different ways (Adetunji *et al*., 2003). Environmental factors in construction encompass the use of natural resources, waste minimisation, and energy and water efficiency to prevent a harmful effect on the environment. Social aspects include taking the stakeholders into account which include employees, suppliers and the community, and economic factors include the construction industry's contribution to economic growth and employment.

There are a number of drivers for change in sustainable construction outlined by Adetunji *et al* (2003), these are; government policy and regulations, business pressures, stakeholder expectations, increased realisation of the importance of the construction image, branding and reputation, and new client procurement policies. Adetunji *et al* (2003) cite Kibert (1994) who outlines what is involved in sustainable construction, this includes; whole life costing, procurement, site planning, material selection and use, recycling, and waste and energy minimisation. From this, it is evident that sustainability is a huge field incorporating different dimensions and areas within sustainable construction; this paper focuses on the whole life costing aspect of sustainable construction.

3. Whole Life Costing Defined

In recent years whole life costing has become best practice in construction procurement (Whole Life Cost Forum). Kirkham *et al.* (2004) highlights that Rethinking Construction, Best Value and procurement routes such as Public Private Partnerships and the Private Finance Initiative have lead to clients and designers putting more emphasis on the consideration of whole life costs. OGC Procurement Guide 07: Whole-life costing and cost management state that; 'value for money is the optimum combination of whole-life cost and quality to meet the user's requirement.' Whole life costing is defined as; 'a technique for examining and determining all the costs – in money terms – direct and indirect, of designing, building and facility management (operating, maintenance, support and replacement) of a building throughout its entire service life including the disposal cost' (El-Haram *et al*., 2002). OGC Procurement Guide 07 defines the whole-life costs of a facility as; 'the costs of acquiring it (including consultancy, design and construction costs, and equipment), the costs of operating it and the costs of maintaining it over its whole life through to its disposal – that is, the total ownership costs.' Total Asset Management (New South Wales Treasury, 2000), an Australian government document, use the term life cycle costing (LCC) and define the LCC of an asset as; 'the total cost throughout its life including planning, design, acquisition and support costs and any other costs directly attributable to owning or using the asset.' It should be noted that whole life costing, life cycle costing and through life costing are terms used interchangeably, however to prevent confusion, this paper uses the term whole life costing.

4. Whole Life Costing and Sustainability

Sorrell (2003) states that; 'the energy efficiency of new buildings is critical to a sustainable future.' It is highlighted that new construction can take advantage of energy efficient technology if the right choices are made on building form, fabric, orientation and building services. In terms of building services; heating, ventilation, air conditioning and lighting are where most consideration should be given to prevent problems (Sorrell, 2003). However, Sorrell highlights that building services tend to come last in the sequence of design work and therefore, usually result in being compromised to fit with the design as opposed to optimising their integration into the building to ensure energy efficiency. In addition to this, it is also suggested that for this reason building services are at risk from budget cuts and time pressures resulting in the rejection of sustainable energy features. This paper seeks to explore the issues related to sustainable design.

5. The Research Methodology

This research project has adopted an extensive research methodology consisting of three primary phases. However, this paper will focus on phase one of the three phases proposed which involves identifying the issues impacting sustainability.

Phase one consists of two strands of which strand A is the focus for this paper. Strand A includes a detailed examination of the sustainability literature to uncover the issues which impact sustainability generally. Strand B will involve the review of methods and models contained in whole life costing literature and will investigate option appraisal methodologies. Strand B will be touched on with regards to a previous project conducted on behalf of the Society of Construction Quantity Surveyors (SCQS) to develop a user friendly whole life costing tool for use by surveyors (Hunter *et al*., 2005).

Phase two will involve the construction of a whole life costing model which will include the issues impacting sustainable design. The model will be subject to robust testing and simulation exercises and will also be demonstrated at seminars involving designers and surveyors. The model will be refined in light of testing and any recommendations made for improvements. Phase three will involve the launch of the sustainability whole life costing model, the accompanying document / user guide for use of the model, and the final report describing the research methods process and the methodology for the use of the model.

6. Whole Life Cost Models

A previous research project conducted by the research team on behalf of the SCQS involved the development of a framework document on whole life costing to replace the dated Life Cycle Cost Planning publication (Smith, 1984) and an accompanying IT-based whole life costing model for use by surveyors. Prior to the development of this model, a review of whole life cost models was conducted to identify what tools were currently available on the market. A key finding of this was that there were not many user friendly models available that were capable of providing the type of system that the SCQS were looking for. Most systems adopted a 'black box' approach meaning that the user was unable to see what was going on behind the input of cost information. One of the key requirements for the model developed for the SCQS was that it be user friendly. Therefore, the tool was designed with this in mind using a 'clear box' approach in preference to a black box which prompted the user to input the information into a series of input boxes allowing them to see the information being built up in the whole life cycle costing spreadsheet as cost information was input.

The SCQS research project involved an investigation of ongoing research and tools available in the industry on whole life costing models. This included research undertaken by Dundee University funded by the EPSRC to develop a generic framework for the collection of whole life cost data for the building industry, the Whole Life Cost Forum (WLCF launched November 1999, (http://www.wlcf.org.uk), a national initiative on whole life cost, a whole life cost tool developed by the Building Research Establishment (BRE) (http://projects.bre.co.uk/wlccomparator), and EuroLifeForm (http://www.eurolifeform.com), a probabilistic approach for predicting life cycle costs.

Dundee University – This project was funded by the EPSRC to develop a generic approach to minimising whole life costs in the construction industry (El-Haram *et al*., 2002). The objectives of the project were to design a comprehensive, consistent and flexible framework for collecting whole life data; to write the specification for a construction industry maintenance management operating system and develop demonstration software; and, to quantify the benefits of implementation at the design stage of construction projects.

Whole Life Cost Forum – The WLCF claims to have been set up as the first construction industry initiative to promote the use of whole-life costs. It was launched in November 1999 with the aim of developing an online comparator tool to remove errors and prevent the reliance on spreadsheets. One of the main objectives was to advance the use of whole life costing along the entire length of the supply chain. The tool allows whole-life costs to be compared on a like-for-like basis and works on the basis that the supplier is the best source for information on whole life costs of their own products. There is also a system that provides benchmarks contained in a central database to allow for comparisons across similar projects. This tool is available on the web for those who want to set up their own project and can also be used to select suppliers and their products. The WLCF Online Comparator Tool can be found at www.wlcf.org.uk. Information is provided on whole-life costs, training materials and the organisation itself.

Building Research Establishment – WLCcomparator (http://projects.bre.co.uk/wlccomparator) is a tool developed by BRE to calculate the whole life cost of building elements and components. It reduces the amount of time normally spent working on whole life cost calculations by minimising the effort required. The tool highlights how higher capital costs at the outset can be more effective over the long term with regard to lower maintenance and operating costs.

EuroLifeForm (ELF) – This is a three-year European RTD project with 14 partners from eight countries, partly funded by the European Union under the Competitive and Sustainable Growth (GROWTH) specific programme. EuroLifeForm (http://www.eurolifeform.com) is a probabilistic approach for predicting life cycle costs and performance of buildings and civil infrastructure. The project aims to develop a design methodology and supporting data, using a probabilistic approach. It addresses technological and cost issues and considers environmental impact and other factors. The final deliverable will be a generic model for Life Cycle Costing and Performance (LCCP), in a software format. This will be applicable to the design of buildings and other facilities to optimise the whole life costs and to optimise interventions through maintenance and repair (Kirkham *et al*., 2004).

Other whole life costing methodologies are also available such as BRE's Ecopoints method which identifies the environmental impacts across the life cycle of construction materials or components from extraction to disposal. The Ecopoint system assigns weights for construction materials across thirteen categories which include climate change, atmospheric and water pollution, and raw materials consumption. The higher the Ecopoint score the higher the environmental impact (Edwards *et al*., 2000).

Since the SCQS project, other whole life costing (WLC) tools have emerged such as BRE's Whole Life Value (WLV) Framework which is a web-based tool that addresses sustainability in the built environment; http://www.wlv.org.uk. The framework allows the user to access a range of resources within a database which include guidance notes, information papers, and tools to assist in identifying and achieving higher levels of sustainability in projects (Waterman and Bourke, 2004).

Other tools also exist such as ENVEST which is also developed by BRE (http://envestv2.bre.co.uk/). This is a software tool that makes it easier to design buildings to ensure low environmental impacts and takes whole life costs into consideration. ENVEST works by identifying the elements of the building that have the most environmental impact and influence on whole life costs after this information has been input by user. It shows the effects of selecting different materials and predicts the environmental and cost impact for heating, cooling and operation a building. This information can then be demonstrated to clients and an environmental report can be generated.

Sorrell (2003) suggests that standardised methodologies for assessing whole life costs and a method for analysing the energy efficiency of design options is what is required to ensure more sustainable design. This research project aims to address this by considering those tools and methodologies already available and by identifying all the issues preventing the adoption of sustainable practices.

7. Issues Impacting Sustainability

Despite sustainable design and the adoption of sustainable practices being of benefit to the environment, the industry, and the end user, the literature review resulted in a number of issues and barriers impacting its adoption. These range from public policy to issues with the construction supply chain and fragmentation of the industry. Sorrell (2003) states that; 'barriers to energy efficiency in the construction sector are pervasive and multifaceted.' Van Bueren and Priemus (2002) state that decisions on sustainable practice are impacted by various societal and policy sectors as well as the building sector. This is supported by Sorrell (2003) who highlights that changing energy policy is not enough as the basic organisation of the industry and the relationship between the team are what needs to be right to ensure energy efficient design.

Impacts and barriers have been identified in a study conducted by Schmid (2003) who spoke to experts in the field of sustainable building in namely the UK, USA, Italy and Indonesia. The five main impacts identified were; (1) government policy, (2) market, supply chains and economies, (3) technological possibilities, (4) users, and (5) designers. The five top barriers were: (1) economies, supply chain and market, (2) users, clients and consumers, (3) designers, planners and architects, (4) government policy, and (5) other obstacles.

Bartlett and Howard (2000) suggest that there is a misconception in the construction industry that energy efficient and environmentally friendly buildings cost 5 - 15% more to build. They outline one of the reasons for this being that examples of environmentally friendly buildings are used in the press that are usually 'futuristic' buildings that do cost more to build and therefore the wrong conclusions are drawn that green buildings are more expensive and complex to build. This is supported by Sorrell (2003) who highlights that there may be a bias against energy efficient buildings as they tend to involve more design work and therefore a timelier design process despite the possible result of lower capital and operating costs. It is stated that; 'at all stages of the construction process, it can take longer to design, assess and implement novel and unfamiliar features than to use tried and trusted solutions.' In addition to this, it is insinuated that contractors may modify previous bids due to time constraints resulting in inappropriate specifications not fully addressing the client's requirements.

Bartlett and Howard outline that construction professionals as well as funders and insurers have no long term interests in the building as there is little environmental interest or financial incentive to do so. However, the introduction of the Private Finance Initiative (PFI) as a procurement route in public sector projects has meant that construction professionals now have a stake in the lifetime performance of public buildings which should impact on whole life costs.

Sorrell (2003) suggests that the organisation of the construction industry is the key barrier to the adoption of sustainable practices. This includes the linear design process, the reliance on cost-based competitive tendering and the incentives placed upon different actors. Sorrell outlines the consequences of the these barriers which are; oversizing of equipment, reduced quality, neglect of whole life costs and a lack of integrated design.

The contractual culture of the industry is another barrier. Designers are liable and if their design does not meet specification then they may get sued. This can lead to over-design and oversized equipment such as that of a heating or an air conditioning system which may be too big in relation to the load resulting in reduced energy efficiency (Sorrell, 2003). Sorrell cites Brittain (1997) who estimates that 15% or more of UK HVAC energy consumption is due to the oversizing of equipment. However, engineers are not penalised for oversizing or rewarded for specifying equipment of optimum size, therefore there is no incentive to do so.

Adetunji *et al* (2003) outlines the barriers to sustainable construction which involve the characteristics of construction industry; teams forming for short periods, divisions between the trades, diversity of stakeholders, fragmentation, rigid specifications, client unwillingness, and the conservative culture of the industry. Funding and speed of construction are other barriers preventing the adoption of sustainable practices. Their impact may be due to funds having to be spent within a specific timeframe preventing time for the design of sustainable features.

Sorrell (2003) suggests that capital constraints are a primary reason for the lack of energy efficient measures being taken. Also mentioned is time in terms of spending the time getting the right people together to discuss ideas and be creative. In a study conducted by Sorrell it was discovered that there was the perception that innovative practices took longer and usually resulted in the unexpected to be dealt with therefore, resulting in the design team going for the safest option.

Commissioning is another area where not enough time is spent to ensure an energy efficient building. This includes the commissioning of the services and the time spent training the staff in the operation of the building. Again, communication is key (Sorrell, 2003). User discipline of the building is also outlined by Van Bueren and Priemus (2002) who suggest that the adoption of sustainable features requires the user to change their behaviour to optimise the use of the facility.

A barrier that Van Bueren and Priemus (2002) outline is that people involved in location development do not take advantage of the opportunities for environmental practices by paying due regard to the infrastructure for transport, water, energy and waste which can impact the building efficiency at a later stage.

Whole life costs, the focus of this research project in the area of sustainability, are a key area for consideration. However, only the client will have an incentive to maximise whole life costs as this is of no concern to the contractors and consultants as they do not have a long term interest in the facility and therefore will opt for the most practical solutions in the short term. However, this is not the case for contracts that involve the design-build-operate-transfer route which results in the contractor being responsible for the operation of the facility as well as its construction.

8. Moving Towards Sustainable Practices

An integrated design team and good communication is required to ensure energy efficient measures are employed (Sorrell, 2003). Currently the industry is fragmented, there is a lot of subcontracting and a new team is formed for each project. In addition to this, clients have to request green buildings and have an understanding of sustainable issues (Sorrell, 2003; Abidin and Pasquire, 2005).

It is evident that due to the fragmented nature of the construction industry there needs to be somebody driving energy efficiency for it to be considered. This is supported by Sorrell (2003) and Van Bueren and Priemus (2002) who emphasize that there should be better communication, coordination and interaction between the design team. They suggest that only one or a few players should be responsible for coordinating sustainable construction to address the fragmented nature of the industry and state that; 'sustainable construction measures need the support of multiple actors at various places and times in the decision making process to become effective.' This was also the case highlighted by Bartlett and Howard (2000) who suggest that green buildings require a knowledgeable consultant being involved at each stage of the design process. Van Bueren and Priemus (2002) outline that there are conflicting goals between departments that manage the construction process.

Sorrell (2003) suggests various measure to improve sustainable practices, these are:

- Making developers more accountable for the performance of buildings in use
- Widespread adoption of whole life costing
- Development of integrated design
- Adoption of post-occupancy evaluation
- Client education
- Comparison of building performance against standardised benchmarks

Bartlett and Howard (2000); Sorrell (2003) and Abidin and Pasquire (2005) specifically mention 'value management' as a means to address sustainability. It is suggested that sustainable practices are integrated into the design in the early stages and then 'proactively value managed' (Bartlett and Howard, 2000). Value management focuses on eliminating waste and examining the whole life costs of the facility to ensure the best value option is selected based on the values important to the client. Van Bueren and Priemus (2002) emphasize the improvement of communication between players which is evidently something that value management could address.

Edwards *et al* (2000) outlines the role each of the key players in the construction industry should play towards improving sustainability. For instance, the client should be asking the contractor for WLC information, considering how to reduce environmental impacts over the life of the building and could be keeping facilities management records to inform WLC on future projects. The design team requires the knowledge to provide environmental information about the design and communicate with sub-contractors on the materials that are to be used. Materials suppliers need to be able to provide information on WLC, durability and maintenance data about their products. Bartlett and Howard (2000) support this by suggesting that construction professionals should know more about whole life costs to be able to inform their clients to make decisions based on sustainability aspects. They also highlight that manufacturers / materials suppliers have a huge influence on the supply chain in terms of being able to demonstrate the whole life costs of their products to decision makers.

9. Sustainable Practices

Schmid (2003) suggests that the industry review the way that it builds to encourage more sustainable construction. A review of fifteen case studies on sustainable refurbishment by Sustainable Homes (www.sustainablehomes.co.uk) resulted in many good practice ideas which have been collated and are tabulated in Table 1.

Table 1 – Sustainable Design Elements

Sustainable Design Element	Good Practice Idea
Insulation	• Installation of a wind skin • Dry-lined brick external walls • Cavity insulation / external insulation (board and rendered) • Loft insulation • Insulation of hot water cylinders and water pipes
Sustainable materials	• Sustainably sourced timber windows • Use of natural or recycled materials • Locally sourced products
Sustainable heating	• Solar water heating panels • Photovoltaic panels • Central heating / gas condensing boilers • Thermostatic radiator valves
Managing waste	• Organic waste disposal units • Dedicated space for storing segregated domestic waste (encourages household to recycle) • Waste separation bins and chutes
Re-using and reclaiming	• Re-using window frames, kitchen units, internal joinery and carpentry items • Reclaiming and reusing bricks and using crushed concrete infill
Other	• Low energy light bulbs • Double glazed low-emissivity glass • Grey-water recycling system / rainwater harvesting system • Installation of water butts • Underground water storage tanks • Water based paints and stains • Passive ventilation • Low-flush toilets / dual flush WCs, spray taps and low-flow showers • Time monitoring switches on bathroom water supply • Draught-proofing • Wind powered street light • Roof wind turbine

This research study explores the key elements of insulation, controlled ventilation, micro and biomass heating and electricity generation to produce a workable based project tool for surveyors. It is clear that there are many issues and obstacles to be overcome with regards to these areas from the literature and examples given. For instance, insulation is an area where huge cost savings over the life of the building could be made. Insulation provides thermal resistance in a buildings structure to prevent unnecessary heat loss. However, there are a number of considerations that have to be taken to prevent the following from occurring; air leakage, dampness, poor detailing and application, and poor quality of the product. In addition, there can also be various health and environmental problems with many types of insulation (http://naturalbuildingproductscouk). Therefore, it is important to counteract these factors and select sustainable insulation that considers the whole life costs and is better value for the end user.

Biomass heating is now becoming an area of interest particularly where the Carbon Trust are concerned. Biomass involves using material drawn from a number of sources, such as; wood, straw, crops, and animal wastes to generate heat and electricity. The Carbon Trust has launched a £5 million project to commercially develop biomass heat in the UK. The project aims to reduce the costs of biomass, reduce supply chain risks, and raise awareness. Currently there are a number of barriers that require to be overcome for the adoption of biomass to be successful, these are; high costs, an immature supply chain infrastructure and a lack of awareness of the benefits of biomass (http://carbontrust.co.uk). However, biomass has the potential to deliver carbon savings of up to 5.6MtC per annum and therefore, is an area certainly worthy of development to meet the UK's carbon targets.

10. Summary and Conclusion

It is evident that sustainability in general is a huge field incorporating different dimensions and within that there are different areas to consider with regards to sustainable construction. This paper has focused on the issues concerning whole life costing in sustainable construction with a view to improving the adoption of sustainable practices which will be dealt with through the production of a whole life costing tool incorporating sustainable aspects and issues to consider to be developed at a later stage in the research programme.

This paper has formed the first stage of the research study by clearly identifying the barriers preventing the adoption of sustainable practices in the construction industry and has reviewed the various ways in which these obstacles could be overcome. This information will be incorporated in the proposed sustainable whole life costing tool to prompt the user to consider these issues and to inform the client when reviewing the whole life costs of a facility.

A definition of whole life costing and the various tools and methodologies available have been reviewed. As well as this, a background on sustainable construction and how this links with whole life costing has been provided. The barriers to the adoption of sustainable practices in the construction industry have been identified and this will be used to inform the next stage of the research which will involve interviewing those designers involved in sustainable building projects to uncover the issues within sustainable design.

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An Evaluation of the Practices of, and Barriers to, Continuous Improvement through Learning on NHS LIFT Projects

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Abstract: The Department of Health (DoH), which is responsible for maintaining the overall health of people living in England through the National Health Service (NHS), introduced the Local Improvement Finance Trust (LIFT) initiative in 2000 to reverse the declining state of primary care infrastructure. The initiative involves partnerships between diverse public and private sector organisations to deliver improvements in facilities that will be suitable for modern primary and social care services over a 20 – 25 year period. The initiative contractually demands for continuous performance improvement from the demand and supply sides, but the attainment still remains elusive.

This paper is aimed at describing the investigation into the practices of, and barriers to, the achievement of continuous improvement through learning on NHS LIFT schemes. The investigation is part of a study aimed at developing a continuous improvement framework that will ensure that current and relevant knowledge is captured and reused during the execution of long-term partnering (LTP) relationships. The methodology adopted for the investigation involved semi-structured interviews with ten senior officers of six organisation working across three LIFT schemes following the review of relevant literature.

The study revealed that *ad hoc* procedures were mostly used for capturing lessons learned during the planning and implementation of the various LIFT projects. Although a variety of techniques and few technologies were being employed in capturing relevant project knowledge, the study revealed that the reuse of the captured knowledge have been largely ineffective. The key barriers to the achievement of continuous improvement on NHS LIFT projects identified include distrust and lack of mutual understanding, difference in *modus operandi* and timeframes of the key participants, lack of clarity and communication, lack of appropriate skills and competencies; and adversarial contexts.

Keywords: Barriers, Continuous improvement, Learning, NHS LIFT, Primary care, Social care.

1. Introduction

Although about ninety per cent of patients' contact with the National Health Service (NHS) is for primary care services, investments in the sector were on a fragmented and piecemeal basis and characterised with many small-scale developments (National Audit Office (NAO), 2005). As a result, the quality and condition of many primary care buildings has been poor and unsuitable for the delivery of modern care services. The most recent survey data from the Department of Health (DoH) revealed that as at 2000 only 40% of primary care premises were purpose-built; almost half were either adapted residential buildings or converted shops; less than 5% of General Practitioner (GP)'s premises were co-located with a pharmacy and around the same proportion were co-located with social services; and around 80% were below the recommended size (DoH, 2000).

The DoH announced the establishment of the local improvement finance trust (LIFT) in 2000, a major new initiative of sustained investment, to reverse the declining state of primary care infrastructure across England. One of the key objectives of the initiative is to bring together the various local stakeholders, interests and users that comprise the local health economy in order to seek to remedy some of the deficiencies in the existing arrangements and contribute to delivery of the investment targets identified within the NHS Plan.

The execution of LIFT schemes involves intricate processes and complex interactions amongst and between large supply chains with constantly changing members depending on which public sector participant commissions the project. Communication of vital knowledge and information between the different stages of these projects and across the disparate groups that are involved offers a significant challenge in terms of efficiency, effectiveness and interface management. The attainment of the contractual requirement for both the demand and supply sides to continuously improve performance also remains elusive (NAO, 2005). Specifically, the NAO report was critical about the inconsistencies in the evaluation and performance measurement arrangements, and emphasized the need for strengthening the accountability framework.

Moreover, the argument that the transient and often one-off nature of construction project teams is the major disincentive for structured capturing and reuse of relevant knowledge generated during project executions cannot apply to long-term relationships such as the LIFT schemes. Nonetheless, the call for capturing and reusing construction project knowledge in future phases and projects has attracted varied responses from the academia and industry. On the one hand, researchers and practitioners have searched for related good practices that have been successfully adopted and implemented in other industries, principally from manufacturing and to a lesser degree the service sectors. The underlying assumption being that borrowing something that has gained acceptance in other industries, rather than inventing a new solution, is easier to exploit (Towill, 2003). On the other hand, good practices originating from other industries or other construction projects have been rejected on the basis of being inappropriate because the characteristics of construction and of each project are perceived as "unique". While these two contrasting views may not be necessarily mutually exclusive, the authors have adopted Lillrank's (1995) suggestion that good practice adopted elsewhere can be exploited, provided that it is sufficiently adapted to the new situation.

1.1 Aim of the paper

The study reported in this paper is part of a research aimed at developing a continuous improvement framework that will ensure that current and relevant project knowledge is captured and reused during the execution of long-term partnering (LTP) relationships. The study focuses on the strategic partnerships involving public and private sectors in the development of primary and social care facilities and services under the NHS LIFT programme as typical LTP relationships. However, this paper is aimed at investigating the barriers to achieving continuous improvement on the LIFT projects.

2. Research Methodology

Following an initial literature search and preliminary interviews to familiarise the research team with recent work carried in related areas and industries, and on the background of the LIFT programme, the research adopted a qualitative research methodology in order to gain a detailed insight into the current practices. The approach involved semi-structured interviews with ten senior staff from six organisations working on three LIFT schemes. Six of the interviewees were from the public sector and include three Project Directors, two Project Managers and one Director of Primary Care from a lead PCT; while the remaining four were from the private sector and include a *LIFTCo*. Chair, a *LIFTCo*. General Manager and two external advisers. The three LIFT schemes had varying characteristics both in terms of the size and mix of stakeholder composition and project sizes, as summarised in Table 1.

Table 1: Characteristics of the LIFT schemes involved

Scheme	Number of Public sector organisations in LIFTCo.	Total cost of projects under 1st tranche
1	8 (4 PCTs, 3 LAs and 1 NHS Trust)	£20.39 million
2	12 (6 PCTs, 3 LAs, 2 NHS Trusts, and 1 Ambulance Service)	£45.6 million
3	5 (4 PCTs and 1 LA)	£34.75 million

Additional supporting documentations were also provided and used as supplementary information, and these were analysed and evaluated. Whilst the authors have sought to be fair and accurate in conveying the informants' responses, it should be noted that the sample size is relatively small and thus, the findings may not be necessarily reflective of the entire LIFT programme at large.

3. The Local Improvement Finance Trust (LIFT) initiative

The local improvement finance trust (LIFT) is the new approach designed by the DoH to deliver a step change in the quality of community-based primary and social care facilities and services. According to NAO (2005), the aims of the initiative include helping in:

- bringing significant improvements to the GP premises;
- supporting co-location of healthcare professionals;
- forging links between primary and social care;
- indirectly resolving GP recruitment and retention problems;
- shifting services away from the secondary care level;
- assisting in achieving good chronic disease management; and
- enhancing "Patient Choice" by providing patients with more choice over how, when and where they receive treatment.

Under the initiative, the DoH has provided a start-up fund of £195 million and aims at leveraging up to £1 billion of private investment in primary care between 2000 and 2010 (DoH, 2001). To date, 51 LIFT schemes have been approved in four waves. All the 42 schemes under the first three waves have reached financial close, and several are proceeding towards second and subsequent financial closes, with a total capital value (for initial buildings) of over £700 million (DoH, 2005). As at December 2005, almost 50 facilities have become operational, and over 50 more are expected to open in 2006 (DoH, 2005).

3.1 The Structure of LIFT

Under the LIFT initiative, the DoH has established a national joint venture, *Partnerships for Health* (PfH), with Partnerships UK plc (PUK). For each locality, a *private sector partner* (PSP), a consortium of diverse specialties, is identified through a competitive procurement and then a local joint venture, LIFT Company (*LIFTCo.*), established between the local stakeholders (such as Primary Care Trusts – PCTs and the Local Authorities – LAs), PfH and the PSP. Figure 1 shows the structure of a typical LIFT and the recommended shareholding limits.

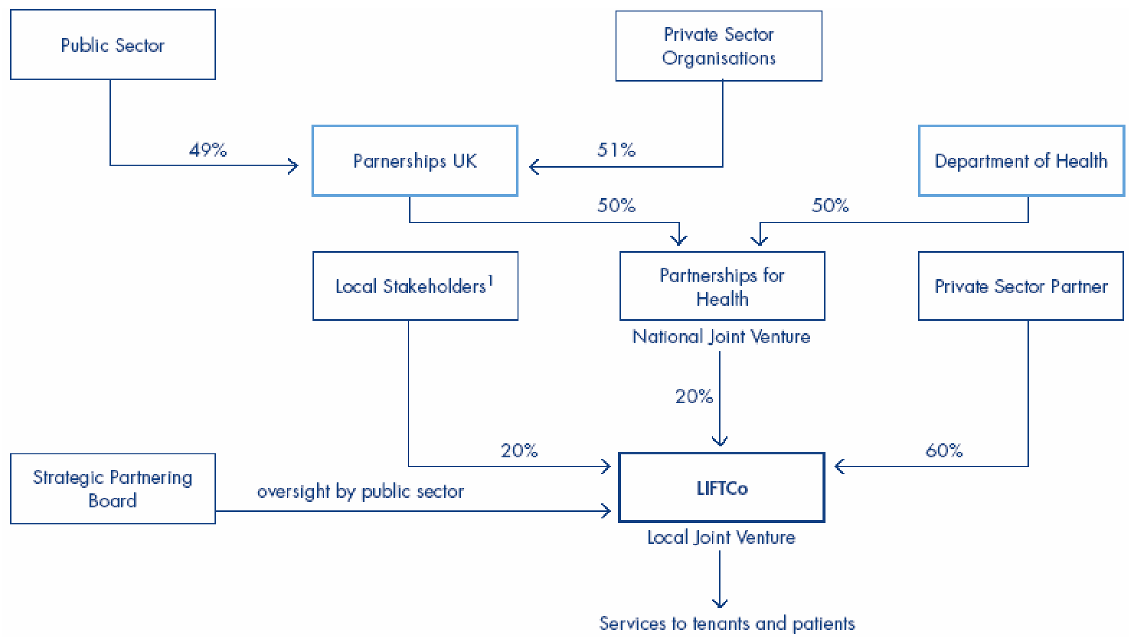

Figure 1: Structure of LIFT (Source: National Audit Office (NAO), 2005)

The *LIFTCos*. are set-up as Public-Private Partnerships (PPPs) in the form of limited liability companies under Strategic Partnering Agreements (SPAs) to deliver investment and services in local care facilities over the 20 - 25 year periods. The public sector *Strategic Partnering Boards* (SPBs) formed between the core statutory bodies in the local health and social care community (i.e. PCTs and LAs) and representatives of other interests (such as medical and dental practitioners, and voluntary sector groups) are responsible for monitoring the performance of the *LIFTCos.* and for identifying their future workloads. Each *LIFTCo.* has the exclusive right to provide new primary and social facilities and/or services commissioned by the public sector participants within its locality so long as the SPB is satisfied that the proposals meet the approval criteria and the participant's key requirements; i.e. are affordable and demonstrate value for money (VFM).

4. Continuous improvement

The continuous improvement philosophy adopts the stance that creating a development process is never completed (Oakland, 1995) and that improvements only occur if attempts are made to learn from new information generated by the process itself rather than the product (Cooper et al, 2005). The process is commonly associated with the *plan-do-check-act* (PDCA) cycle, with each phase of the cycle playing very important role in sustaining improvement in an ongoing fashion. Tenant et al (2002) recommended the development of an organisational culture and management style to support the continuous improvement of daily working practices, management of change against the achievement of appropriate quality targets, and training of teams in problem solving, use of quality tools and techniques. Although LIFT is "local" by nature and operates under varying social and economic landscapes thereby creating difficulty in applying lessons learnt elsewhere without appropriate contextualisation, construction projects are largely similar at micro level in terms of processes and resources. Consequently, some of the lessons and knowledge generated during their execution can be reused in future phases and projects. Tan et al (2005) identified the types, nature and characteristics of project knowledge that can be reused, and are grouped into the following categories:

- *Process Knowledge* – This is the knowledge pertaining to the execution of various stages of a construction project. The types of reusable project knowledge belonging to this category include briefing, design, tendering and estimating, planning, construction methods and techniques, and operation and maintenance knowledge.
- *Knowledge of Clients* – This covers the knowledge about clients' specific requirements, their internal procedures and business.
- *Costing Knowledge* – This knowledge is about the costs of alternative forms of construction and the whole life cost of an asset.
- *Knowledge of Legal and Statutory Requirements* – Regulatory requirements change over time. This knowledge covers the requirements and responsibilities imposed by regulations and the best practices to address these requirements.
- *Knowledge of Reusable Details* – Reusable details comprises standard design details, specifications and method statements. These details may be reused with adaptations. They help to avoid recreating similar details from scratch and also lead to time and cost savings.
- *Knowledge of Best Practices and Lessons Learned* – These are the proven ways of working that contribute to the success of projects, and the mistakes made that must be avoided in future projects.
- *Knowledge of Performance of Suppliers* – The suppliers referred to are consultants, contractors, subcontractors, material suppliers and others who have contributed services or goods to a project. The capture of this knowledge facilitates better selection of suppliers for future projects.
- *Knowledge of Who Knows What* – This is the knowledge on the skills, experience and expertise of each of the members of staff. It helps to locate the right people with the right knowledge for the sharing of knowledge, particularly the tacit knowledge which is difficult to codify.
- *Other Types of Knowledge* – This knowledge category includes knowledge about competitors, risk management, key performance indicators, and other specific types of key knowledge.

The approaches used for capturing and sharing knowledge has been categorised as Knowledge Management (KM) techniques (non-IT tools) and KM technologies (IT tools) (Al-Ghassani, 2003).

4.1 KM technologies

KM technologies, such as custom-designed software applications, can be very useful for capturing and sharing explicit project knowledge and help in connecting people who are geographically dispersed (Tan et al, 2005). For construction projects, examples include groupware such as Lotus Notes^{TM} which can facilitate the storage and dissemination (via the notice board function) of information and codified knowledge (such as the most up-to-date regulatory requirements and standard procedure for design). Another common groupware used is the IBM Quickplace^{TM} which is also used to enhance the interactions and communication between the project participants. Project extranet is another technology that can provide a platform for effective sharing of project information between project participants that may be geographically dispersed.

4.2 KM techniques

KM techniques such as post-project reviews, trainings, meetings and documentations of standard procedures remain important in the capture of reusable project knowledge (Al Ghassani, 2003). These approaches depend heavily on face-to-face interactions and are mostly restricted to the project participants that are co-located in the same office or organisation. Consequently, their efficiency and effectiveness are greatly undermined when project participants are geographically dispersed.

5 Interview Results and Discussion

In analysing the interviews, opinions are categorised and comparisons are made across the three schemes. Where applicable, differences in opinion between those from the public and private sectors are also highlighted. In complying with the confidentiality requirements, the authors have as much as possible tried to keep the views anonymous.

5.1 Practices of Continuous improvement

Many of the interviewees acknowledged that due to lack of effective coordination between the strategic and operational levels of management, the benefits of long-term partnerships were been inhibited. Across the three schemes, although the interviewees recognised the importance of learning from project-to-project and from other schemes, there were no any formal structures to facilitate effective knowledge sharing or capturing in the format that it can be effectively re-used in subsequent phases or projects. Lessons learnt reviews were carried out at both strategic and operational levels in one of the schemes, but the reviews were restricted to the commissioning process only. The schemes have been generally more of inward-looking relying on reflective and audit trailing techniques through the governance departments but the interviewees also recognised the need to go broader by encouraging learning from other LIFT schemes and through the use of a more systematic and structured approach. One of the interviewee opined that *"by holding meetings within the LIFT buildings, a lot of lessons for improving the future schemes can be generated"*.

The interviewees also acknowledged that there is no single technique or technology that is sufficient or capable of meeting all the requirements of capturing and sharing knowledge in any project or from project to project.

5.2 KM technologies

The interviews reveal that the Activity DataBase (ADB), a briefing, design and equipping package, is being used to provide the PCTs, Architects, health planners and consulting engineers with access to an integrated database of healthcare built environment data. The ADB uses its internal graphical editor and interface with AutoCAD to provide data in both textual and graphical formats. Although two schemes have project websites, they are not used as a platform for exchanging project information and knowledge between the participants. It was also established that some of the individual organisations use some form of common platform for internal sharing information, but there was no reported use of any other groupware or custom-designed software application for sharing and capturing project knowledge across the participating organisations working on a project

5.3 KM technologies

Although they were mainly used to satisfy contractual requirements, post-project reviews were being conducted on the projects under the three schemes within six months after the buildings have been opened. The scope of knowledge aimed to be captured in the reviews is usually wide and include various types of project knowledge, and are represented in the forms of best practices, lessons learned, do's and don'ts. Overall, only one scheme followed a systematic procedure for assessing lessons from all the stakeholders through the project life cycle using the in-house project assurance framework and through the Office of Government Commerce (OGC) gateway reviews. The reviews undertaken by the other two schemes were rather uncoordinated and *ad hoc* covering both strategic and operational levels. Post-project reviews however do not generally facilitate the effective sharing of the learning/knowledge captured because the reports are often not in the format that the lessons can be easily reused. Also, the time lapse between the discovery and creation, and the capture and sharing of knowledge leads to loss of important insights and does not allow the current project to benefit from it. Moreover, the reviews were mostly undertaken at such times that the useful lessons may have been forgotten or the projects participants have moved out of the partnership or have been tied up with pressure of other projects.

5.4 Future-proofing of facilities

Furthermore, since one of the central objectives of LIFT is to move down a number of services that are currently being provided at the secondary care level to the primary care level, it is necessary to create facilities that are relatively flexible and easy to adapt to meet the requirements of the evolving service needs. This would require both innovative design techniques and the use of modern and sustainable construction methods and materials. However, the interviewees across the three schemes indicated that inadequate attention was paid to the exploration of effective future-proofing of the facilities. The current practices rely on dealing with the flexibilities through equipment and workforce reconfiguration rather than through the walls. The approaches involve the construction of some multi-purpose rooms where a number of procedures can be undertaken, and through creation of flexibilities in working hours of staff and introduction of hot-desking in the use of the facilities.

5.5 Barriers to achieving continuous improvement on LIFT projects

The key barriers identified by the interviewees, which if removed are capable of improving performance and facilitating continuous improvement, include:

1. Distrust and lack of mutual understanding

These two themes of distrust/suspicion and lack of mutual understanding were interwoven in most responses, often leading to other obstacles. For example, as one interviewee put it, *"there can be lack of information and discussion due to lack of trust – if nothing is shared in the partnerships, then they are not really partnerships"*. Another commented that: *"understanding the other sectors is sometimes the biggest issue. One example is where the public sector partners are unable or unwilling to talk about the 'commercial concerns' or when the public (especially civil society organizations) thinks that the profit-motive of the private sectors that stake enormous resources over a long period of time is 'evil', these can get in the way of practical cooperation"*.

2. Different *modus operandi*

Linked to lack of mutual understanding is the fact that there is often what one interviewee described as: *"'culture clashes' caused by different methods of working, different accountabilities, and divergent objectives"*. Another interviewee expressed concern over the on-going reforms in the NHS which has created in a situation: *"where people spend more time in understanding the requirements and impact of the reorganisation than doing the work, and these often results in frustration"*.

3. Different time-frames

A number of the interviewees spoke about the frustration of partners operating on different time-frames. One interviewee commented that: "*the 'lead time' is often so different between each of the sectors that this can lead to problems. For example, the private sector partner tends to be slow to move up to the point that it has made a decision and then it wants action and delivery instantly, whereas the public sector is often quick to engage but then gets stuck in bureaucracy and it can take a long time to get funding even when they are committed in principle and the funding is technically available"*. Another interviewee commented that: *"partners do not always appreciate or have sufficient patience for the time commitment that is needed to make partnerships work effectively"*.

4. Lack of clarity and communication

The lack of clearly defined or communicated goals, roles and responsibilities was another obstacle cited by many of the interviewees. According to one interviewee, *"failure to agree all the difficult details ab initio can be a major obstacle"*.

The lack of clarity can lead to differing analysis of what each partner can, or should, bring to the table, and unequal or unmet expectations. Most of the times also, there is dearth of adequate operational policies that reflects demographic and service requirements over time.

5. Lack of appropriate skills and competencies

Insufficient or inadequate skills for building effective partnerships were cited as another obstacle. The necessary skill sets and competencies cited by the interviewees ranged from technical and managerial to behavioural and attitudinal. They included: expertise in healthcare, development, design, construction and facilities management, sound project management, ability to tackle unconventional problems, analytical ability, results-orientation, good at risk analysis, visionary and leadership skills, cultural sensitivity, transparency, creativity, flexibility, willingness to compromise, diplomacy, commitment, patience, empathy, negotiation, mediation and facilitation abilities, collaborative mindset, strategic thinking, interpersonal communications, strategic thinking, coaching and capacity building skills, and broader understanding of politics, global issues and the environment.

Furthermore, although independent advisors for design, QS, legal and financial advisors have been appointed on all the schemes, there were inadequate healthcare professionals with the right planning skills to support the recent changes in the NHS. One of the interviewees remarked that: *"the current crop of health planners do not possess the required expertise to support the reforms taking place in NHS, and so there is a dire need for new talents"*.

6. Adversarial context

Finally, there are the obstacles created by the broader enabling framework. Besides the legal process is often time consuming and costly. One of the interviewees commented that *"the context in which the partnership operates is critical. If the local environment - political, social, and economic - is not conducive to growing the partnership, it has little chance of succeeding. Moreover, since the challenge of sustainable development is a complex one, where results may take five to ten years to manifest themselves, a stable environment is important"*.

Other interviewees spoke explicitly about demands from government and public in the face of constantly changing policies and non-inclusion of the other supply chain partners under the partnering ethos as major obstacles to building effective and long-term partnerships.

6. Conclusions and Recommendations

This paper describes the investigation of the practices of, and barriers to, the achievement of the contractual requirement for continuous improvement on NHS LIFT schemes. The methodology adopted for the investigation involved semi-structured interviews with ten senior officers of six organisation working across three LIFT schemes.

Given the long-term and partnership features of the LIFT initiative, the interviewees advocated that the project participants need to devise ways of learning from current practices in order to be able to continuously improve the performance of current and future projects. However, the study revealed that *ad hoc* procedures were mostly used for capturing lessons learned during the planning and implementation of various LIFT projects. Although a variety of techniques and few technologies were being employed in capturing relevant project knowledge, the study revealed that the reuse of the captured knowledge have been largely ineffective. The key barriers to the achievement of continuous improvement on NHS LIFT projects identified include distrust and lack of mutual understanding, difference in *modus operandi* and timeframes of the key participants, lack of clarity and communication, lack of appropriate skills and competencies; and adversarial contexts.

The study noted that the success of the partnership would depend on the achievement of a balanced position that recognises both the needs of the public sector, for example in securing long-term value for money (VFM) and proper accountability, and the needs of the private sector to be able to, for example achieve a reasonable commercial return on investment and to manage risks that it will be taking.

The study also recommended that it would be beneficial to develop templates for capturing relevant project knowledge generated while conducting the strategic reviews at the appropriate process stages, and in a format that can facilitate their reuse in subsequent phases or projects. The interviewees also recommended that the following considerations can immensely facilitate the mitigation of the identified barriers:

- openness, transparency and clear communication to build **trust** and **mutual understanding**;
- **clarity** of roles, responsibilities, goals and "ground rules";
- commitment to **core organizational competencies**;
- application of the same **professional rigour and discipline** focused on achieving targets and deliverables that would be applied to governing, managing and evaluating the partnerships;
- **respect** for differences in approach, competence, timeframes and objectives of the different partners;
- focus on achieving **mutual benefit** in a manner that enables the partners to meet their own objectives as well as common goals of the projects; and
- understanding the **needs of local partners and all users**, with a focus on **building their own capacity and capability** rather than creating dependence.

6.1 Future Works

As part of future works, the research will develop the following:

- ➢ a process map for the LIFT procurement process showing clear information flows, deliverables, approval and strategic review points; and identifying the appropriate skills mix (in terms of roles and responsibilities) that are required to satisfy each of process activities;

- ➢ templates for capturing relevant project knowledge generated while conducting the strategic reviews at the appropriate process stages, and in a format that can facilitate their reuse in subsequent phases or projects; and

- ➢ a comprehensive continuous improvement framework.

The proposed framework will provide a platform on which learning, followed-through from planning, design and construction into occupancy, and post occupancy could become a natural part of project delivery.

7. Acknowledgements

The first author would like to acknowledge the financial support of the Commonwealth Scholarship Commission, UK. The authors are also very grateful to the individuals who sacrificed their valuable time to participate in the interviews.

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Project Alliances in the Australian Construction Industry: A Case Study of a Water Treatment Project

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Abstract: Project Alliancing is a relatively new and unproven method of procurement in the Australian Construction Industry. It has primarily developed in order to counteract the affects of globalisation and rising disputation and because of its ability to reduce risk and increase overall project success. Alliancing is a relationship-based procurement method, selecting alliance participants based on a soft dollar evaluation rather than traditional tender price evaluation. Performance is motivated by commercial incentives based on key performance indicators (KPI's) that aim to go beyond 'business as usual' targets. An important element of Alliancing is the team culture that focuses on an open book and no blame relationship. This paper presents a framework of project success factors and discusses a case study of a recent Australian Project Alliance. A semi-structured interview process involving senior project participants and a review of project documentation identified a number of project specific success factors: establishing an integrated alliance office; staging of project and stretch targets; setting project specific KPI's; facilitating ongoing workshops that include site personnel; and the use of a web-based management program.

Keywords: Australia, Case Study, Infrastructure, Project Alliances, Success Factors

1. Introduction

There has been growing use of relationship-based procurement approaches on construction projects world wide, with strategies such as Partnering, Joint Ventures, Enterprise Networks and Alliancing all used (Harmon, 2003; Walker and Hampson, 2003). Project Alliances are described as an agreement between two or more entities which undertake to work cooperatively, on the basis of a sharing of project risk and reward, for the purpose of achieving agreed outcomes based on principals of good faith and trust and an open-book approach towards costs (Kwok and Hampson, 1996; Abrahams and Cullen, 1998). The process of Alliancing involves the careful selection of best practice partners to form the alliance team. These partners then develop an alliance charter describing program and cost targets, performance requirements and risk and reward arrangements (Walker et al, 2000). The Alliance group then works as a unified team to meet the alliance charter based around a win-win attitude, trust, commitment and innovation for the projects delivery (Green and Lenard, 1999).

Recent research into relationship-based procurement methods has resulted in published work discussing the success of partnering, public-private-partnerships and joint ventures (Black et al, 2000; Jefferies et al, 2002; Jefferies, 2004; Wong and Cheung, 2004; and Li et al 2005), but little to date on Project Alliancing, particularly factors for it successful implementation in the Australian Construction industry. The paper presents a single case study approach that reviews project documentation and uses a semi-structured interview process with carefully selected project participants. This methodology has been deemed as most appropriate due to the limited implementation of Project Alliancing within the Australian Construction Industry and the small sample of organisations having been involved in such projects. Content Analysis was selected as the method for analysing the interview transcripts in order to produce the framework of Project Specific Success Factors.

2. Project Alliancing

Several authors have defined Project Alliancing over the last decade, each varying slightly but most incorporating the elements of cooperation, goals and objectives. Kwok and Hampson (1996) describe Project Alliancing as "….a cooperative arrangement between two or more organisations that forms part of their overall strategy, and contributes to achieving their major goals and objectives for a particular project." Ross (2003) states that a Project Alliance is "where an owner (or owners) and one or more service providers (designer, constructor, supplier etc.) work as an integrated team to deliver a specific project under a contractual framework where their commercial interests are aligned with actual project outcomes."

Project based alliances were first developed through the Portland Division of the US Army Corps of Engineers by Colonel Charles Cowan. Since then Project Alliancing has gained acceptance by many industries world wide particularly with the construction industry (Green and Lenard, 1999). Alliancing reduces the likelihood of litigation, risks associated with cost overruns and delays can be reduced through enhanced control, problems or changes can be efficiently resolved through the systems open communication approach, administrative costs associated with defence case building can be removed, the probability of project financial success is enhanced as an outcome of the non-adversarial and win-win culture of the procurement process (Kwok and Hampson, 1996; Armessen, 1999).

3. Globalisation

Globalisation, the creation of a single world market in one borderless world (Judy et al, 2004), has caused unpredictable social, economical, technical and political aspects in society. Subsequently, businesses have had to generate alternative management systems to counter act against globalisations so as to better manage risk and remain competitive in these uncertain times (Jefferies et al., 2000). Globalisation has created an expanded construction market which has generated huge demand for large scale construction and infrastructure projects thus presenting opportunities for the global construction industry. Project Alliancing is one procurement and management tool implemented by organisations within the construction industry and other industries to keep up with this ever developing business world (Jefferies et al., 2000).

4. Managing Disputes and Litigation

The construction industry has also identified Project Alliancing as a management strategy that can reduce risks and promote movement away from current construction practise to a more collaborative culture (Jefferies et al., 2000). The rising levels of disputes and litigation between parties on construction projects is described by Ross (2003) as an epidemic. Arousal of disputes and litigation is having a devastating effect upon the construction industry, being identified as a major cause of rising project costs, long project delays, profit declines, reduced trust of clients as well as low quality projects (Cheung et al, 2002; Harmon, 2003). This has created a movement towards developing more alternative methods of disputes resolution and dispute avoidance on construction projects. Project Alliancing is one method that has been identified as having a positive impact upon disputes between project stakeholders. Alliancing features a systematic problem resolution process, equality and rights between parties, no blame culture, open/regular communication, promotes win-win solutions and shares risk rather than risk transfer (Construction Industry Board, 1998; McGeorge and Palmer, 2002). These features all contribute to the minimisation of disputation.

5. Project Alliancing Within Australia

The first Project Alliance within Australia was the construction of the Wandoo B Development Offshore Oil Platform in Western Australia. The Wandoo B Development project was a $480million contract that started in 1994 and was successful completed in 1997 (Jefferies et al., 2000). A number of other oil, gas and mining projects were successfully delivered in the mid 1990’s through Project Alliancing including the East Spar Gas Field Alliance contract for Western Mining Corporation ($250 Million), Port Headland Iron Ore Alliance contract for BHP ($700 million) and the Roxby Downs Metal Ore Alliance contract for Western Mining Corp ($400m) (Abrahams and Cullen, 1998).

The Australian National Museum was successfully completed and opened in March 2001 and is said to be the first construction project to be procured through a Project Alliance. Project Alliancing was chosen for this project because it offered a fast delivery for a complex project with high expectations due to its cultural significance, high construction quality requirements, unique and innovative design and a need of value for money (Walker and Hampson, 2003).

6. Success Factors

Nguyen et al, (2004) simply define success within the context of the construction industry as when a project is completed on or before program, at or below budget, built to the required specifications and fulfils the objectives and desires of the client/stakeholders. Rockart and the Sloan School of Management developed a concept for identifying Critical Success Factors (CSF’s) which they defined as “those few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his or her own goals… those limited number of areas where things much go right (Rockart, 1982).”

A number of authors have assembled lists of factors that are considered to be influential upon the success of Alliancing Projects. The following table (Table 1) summarises key historical literature to develop a Success Factor framework for Project Alliancing.

Table 1: Project Alliance Success Factors

Success Factors	Cited by Authors				
Strong commitment by client & senior management	Elliot (1998)	Green & Lenard (1999)	Abrahams and Cullen (1998)	Haque, Green and Keogh (2004)	Jefferies, Gameson, Chen and Elliot (2000)
Trust between parties	Elliot (1998)	Green & Lenard (1999)		Haque, Green and Keogh (2004)	
Sound relationship	Elliot (1998)		Abrahams and Cullen (1998)		
Equity		Green & Lenard (1999)		Haque, Green and Keogh (2004)	
Mutual goals & objectives		Green & Lenard (1999)		Haque, Green and Keogh (2004)	Jefferies, Gameson, Chen and Elliot (2000)
Joint process evaluation		Green & Lenard (1999)	Abrahams and Cullen (1998)		
Dispute resolution process		Green & Lenard (1999)			
Cooperative spirit	Elliot (1998)		Abrahams and Cullen (1998)	Haque, Green and Keogh (2004)	
Flexibility & adaptability	Elliot (1998)				Jefferies, Gameson, Chen and Elliot (2000)
Tight alliance outline	Elliot (1998)		Abrahams and Cullen (1998)		
Alliance structure			Abrahams and Cullen (1998)	Haque, Green and Keogh (2004)	
Best people for project			Abrahams and Cullen (1998)	Haque, Green and Keogh (2004)	
Facilitation			Abrahams and Cullen (1998)	Haque, Green and Keogh (2004)	Jefferies, Gameson, Chen and Elliot (2000)
Commercial incentives			Abrahams and Cullen (1998)	Haque, Green and Keogh (2004)	Jefferies, Gameson, Chen and Elliot (2000)
Open communication				Haque, Green and Keogh (2004)	
Shared knowledge			Abrahams and Cullen (1998)	Haque, Green and Keogh (2004)	
Stretch targets		Green & Lenard (1999)		Haque, Green and Keogh (2004)	Jefferies, Gameson, Chen and Elliot (2000)

7. The Case Study Project Background

The project client is a large water services supplier and a statutory corporation. The client provides drinking water, wastewater and some storm-water services. The client services over 4 million customers and has A $1.5 billion in revenue, while managing $14 billion in assets, employing 3600 people and servicing 1.5 million properties. The authority governing environmental protection issued the client with 27 Sewage Treatment Systems (STS) Environmental Protection Licenses. The STS Licenses cover the operation and maintenance of the sewage system networks, and in addition, set out Pollution Reduction Programs (PRPs) specifying timeframes for detailed improvements to environmental performance. 272 sewer stations were specified as well as improvements to the operation of its catchments.

7.1 Selection of Project Alliancing and Alliance Partners

The client released a long-term strategic plan for sustainable water, wastewater and storm-water management up to the year 2021. 2 years into the upgrade project the use of traditional, lump-sum procurement methods for the works was averaging an upgrade of 16 stations per year. The required program of 250 station upgrades by the specified date was clearly not going to be achieved. The following requirements were identified by the Client:

- New performance standards for upgraded stations requiring component interchangeability.
- Careful consideration of heritage requirements, works within National Park and within close proximity to waterways.
- The works will cause impact local and state government authorities and all sectors of the community.
- Synchronization with current and future projects was required.
- Existing stations would need to remain operational during construction with no dry weather overflows.

After reviewing alternatives the Client decided that an Alliance approach would best achieve the targets as well as the cost, schedule, safety, quality, environmental and community challenges to deliver the project. An Alliance team with a single high performance culture based around a focused, single set of project objectives was then targeted. The Client sent out ‘Requests for Proposals’ and followed with an intense alliance evaluation process involving foundation workshops and a rigorous Target Cost Estimate (TCE) process leading to the selection of the alliance team comprising six organisations. The alliance contract to complete the project to upgrade 230 sewage infrastructure stations was then signed. The alliance partners, other than the client, are:

- Alliance Partner 1 is a contractor that has procured over 6,000 projects, exceeding $40 billion in value and has a long history and a strong reputation in collaborative project delivery, working with both private and public clients.
- Alliance Partner 2 is a consulting firm of engineers, planners, and construction managers that has completed more than 2,000 water and wastewater projects.
- Alliance Partner 3 is a large and successful defence and technology contractor that provides outsourced maintenance and construction services.

- Alliance Partner 4 is a professional services consulting group closely involved in the development of water and wastewater services for the client.
- Alliance Partner 5 specialises in issue management, community consultation, stakeholder management, individual and group facilitation, public and media relations and Quality Assurance (QA) assessments.

7.2 Alliance Agreement/Project Charter

The Client developed the following six objectives for the Project Alliance:

- Schedule (meet relevant License specifications in terms of sites, timeframes and performance; optimize the program roll-out rate).
- Cost (minimise lifecycle costs; better the target program cost by 20% without adversely affecting quality and operational standards)
- Works (minimal environmental impact during the works delivery and operational phases; no overflows as a result of construction)
- People (provide a safe place of work evidenced by zero incidents and injuries; have minimal impact on Client customers; all program personnel proud to be involved)
- Systems (satisfy Client's legislative and regulatory requirements; implement management systems specific to the program to meet quality processes and outcomes)
- Legacy (improve Clients capability for delivery of capital programs; implement operational improvements; enhance Client's reputation with industry).

These objectives played an important part in creating a high level of commitment and understanding between the project stakeholders prior to the formation of the Alliance team.

7.3 Key Performance Indicators

The Alliance established at the project's inception, a commercial framework of risk and rewards or commercial incentives based around the following set of Key Performance Indicators (KPIs): Community; Environment; Occupational Health and Safety; and Quality.
Performance was assessed in each of these areas with possible results ranging from 1 to5. (1) being Failure (2) Poor Performance, (3) Business as usual, (4) Best Practice and (5) Outstanding Performance. A Failure or Poor Performance resulted in a form of pain share where the Alliance paid money back to the client, Business as usual meant a neutral outcome and Best Practice or Outstanding Performance resulted in a financial gain for the alliance, distributed between the various individual organisations according to the commercial framework.

8. Success of the Alliance Project

At the end of the project, reflection upon the Key Performance Indicators revealed that over 90% of the assessment areas within the KPIs achieved "Outstanding" results, indicating that the project was an overall success for the Alliance team and the client. Table 2 forms the project specific framework of Success Factors for the case study Alliance project.

Table 2: Success Factors of the Case Study Project

Success Factors	Description
Best for project attitude	Alliance team members need to apply an attitude of "Best for Project" to all aspects of the project.
Formation of a single entity	Remove all attachments to the individual organisations eg. Company Logos, Titles and adopt a single alliance name and uniform.
Pre-project workshops & planning workshops	Early workshops between the alliance partners before client workshops to build good working relationships.
Continuous Facilitator involvement	Facilitator involvement early in the project to establish a strong alliance team and involvement at various times throughout the project to motivate the team.
Careful team selection & project specific team alignment	Alliance partner chosen carefully so to maximise the skills and performance required for achieving high standards in key performance areas.
Right personnel for Project	Personnel need to be team players, open minded and creative thinkers.
Integrated Alliance office	Central Alliance office combining all alliance partners.
Staging of project & stretch targets	Breaking the project into stages allowing reflection upon results to date and re-establishment of future stretch targets.
Project specific KPI's	Ensuring the KPI's drive the alliance in the right direction motivating success in areas critical to the project requirements.
Dedicated client & commitment by all stakeholders	Client and stakeholder to show commitment to the project through participation at a senior level.
Benchmarking & continuous performance monitoring	Implementation of benchmarking and performance monitoring to gauge success and areas for improvement.
Early commercial development	Develop commercial framework at an early stage in the project so that the team can be formed with skills necessary to achieve high performance in KPI areas.
On-going workshops including site personnel	Workshops to be conducted throughout the life of the project introducing site personnel to the project Alliancing concept and identifying the importance of their role.
Web-based management program	Single web-based program for management of the project allowing the individual partners to manage resources and share knowledge.
Participants with past working relationships	Selection of alliance partners with proven past working relationships.
Awareness of project aim, objectives & charter	Ensure all levels of management are aware of the project aim, objectives and charter.
Open book nature	Alliance participant to have an open and trusting relationship between one another.

Five 'new' success factors were identified during the interview process in the case study project. These are success factors that were not previously identified when reviewing current literature. They are discussed further below:

8.1 Establishing an Integrated Alliance Office

The group of alliance organisations where all co-located in a single office with up to 150 personnel from the various individual companies. The quotes below were extracted from the interview data:

"You need to take people out of their company environment and have an integrated office which the alliance team calls their own; with people sitting in groups according to expertise such as delivery team, designers, project managers and supervisors. The success is having all the key stakeholders working in the one room at the one time from the start, so the planner, the designer, the geotech, the communications rep and environmental rep, the safety and operations maintenance."

Establishing an integrated vehicle to drive the project alliance is an element that was seen as essential for project success, specifically in relation to team building, communication and problem solving.

8.2 Staging of project and stretch targets

An important element of Alliancing is the setting of stretch targets, which is establishing project aims extending past "Business As Usual". The case study interviews found that the project not only implemented stretch targets but staged these stretch targets throughout the project. This meant that the project was broken up into stages called Tranches. At the beginning of each tranche new stretch targets were established and business as usual improved as the project stages were completed. One of the Interviewees outlines the tranche approach to the project and the re-establishment of stretch targets:

"…outcomes were carried forward into the next tranche… it gave people focus, and we would set stretch targets, we would never aim for business as usual, our aim was always stretch targets. If we met a goal, that became our 'business as usual' and we were always improving. That was half the reason why the project was completed early, it was a continuous improving process."

By breaking the project up into tranches, knowledge was harnessed and lessons leant were built upon for the next tranche. It was important to implement workshops at the beginning of each tranche to ensure the whole team were aware of the new targets and aims. This was also a time for the Facilitator to get involved and build-up the team motivation and enthusiasm.

8.3 Project specific Key Performance Indicators

A factor identified as influencing the success of the case study project was the careful linking of Key Performance Indicators (KPI's) to the project requirements. A case study Interviewee describes this:

"You want to make sure that the KPI's are written in a way that recognizes that the right performance drives the right behaviours within the team and must make sure that the KPI's are proactive not reactive…"

The KPI's should motivate the alliance team to work harder in areas which are critical to the project's success. Some of KPI areas were safety, community and quality, with payments tied into performance within these areas, which is difficult to do with a traditional fixed price contract. The community KPI is an example of how important it is to establish KPI's which motivate the alliance team to focus on areas of the project which require special attention. Attention must be made when developing the commercial framework to align the KPI's with the projects/clients critical requirements. If this occurs then the alliance team has a better chance of achieving project success.

8.4 On-going workshops including site personnel

Alliancing focuses on forming a strong alliance team that is extremely important to the project's success, but it is equally important to create strong working relationships with the sub-contractors. For the project to be successful, the alliance team must ensure that the sub-contractors are committed and dedicated to the project and the Alliance form of procurement, as they are ones carrying out the actual site work. The alliance team on the case study project identified the importance of building strong relationships with the sub-contractors and conducted workshops for this reason. An Interviewee describes the workshop approach:

"…the alliance set up workshops where the program manager and the delivery manager would talk to the sub-contractor and let them know what the expectations were and the opportunities available. The workshops with the project sub-contractors were a critical part of building a strong working team. They allowed the organisations that were not a commercial partner still feel part of the project team and identified the importance of their role to the project and the Alliance."

The sub-contractors are an important part of an alliance project and involving them in ongoing workshops building trust, strong relationships and commitment will promote good workmanship and thus influence the overall success of the Alliancing project.

8.5 Web-based management program

The project implemented a web-based management system which was the central project management tool used by the alliance team. A number of the interviewees identified this as being a key factor that led to successful communication between the stakeholders:

"The program was a single web-based project management tool which was a big factor for success as it enabled the dissemination of information between the partners. The system held all the design documentation, correspondence, cash flows and budgets. Being a web-based system the information was available to the team anytime anywhere allowing better management and control over the project, thus assisting in the projects overall success."

The program allowed for all sections of the management team to easily interact and communicate and solve problems in real time. In order for Alliancing to be successful much interaction and communication is required between the various organisations forming the Alliance. Open communication, team building, problem solving, team-work, integration, information sharing and support are important requirements of an alliance. A program such as this enhances the likelihood of success in these key areas as it provides an important link between the individual alliance organisations and contributes to overall project success.

9. Conclusion

Relationship-based procurement approaches, such as Project Alliancing, establish and manage the relationships between all parties and remove barriers, encourage maximum contribution and allow all parties to achieve success. The use of Alliancing is due to globalisation factors and the need to successfully manage risk. Alliancing provides a project delivery method that promotes open communication, equality and a systematic problem resolution process that achieves win-win outcomes. Through a review of current literature and a single case study project a number of success factors were identified. Five factors were identified as specifically influencing the success of the case study project. These five 'project specific' success factors that extend the body of knowledge are: use of an integrated alliance office; the staging of project and stretch targets; establishing project specific KPI's; facilitating on-going workshops that include site personnel; and the integration of a web-based management program.

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Contractor selection in partnering projects – A review of bid documents

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Abstract: Collaborative interorganizational relationships often require new skills and sometimes also new attitudes from those involved. Contractor procurement for partnering projects differs from general contractor procurement in two related ways: that it is a new type of project management service and that this service is strongly related to skills, dispositions and commitment of individuals. Previous research on contractor and supplier selection has shown that non-price criteria are often assessed on the basis of past performance, which is less relevant when potential suppliers have little experience of a particular service. The purpose of this study is to investigate how clients deal with innovation and collaboration aspects in formulating criteria and requirements concerning what information contractors should provide as a basis for evaluation. The study is based on a review of public clients' bid documents from Swedish partnering projects, as well as on interviews with the clients. Considerable variation and creativity was found in the formulation of criteria and bid documents, but clients also borrow criteria, texts and sometimes entire bid documents from each other. It is concluded that clients have started to develop new procurement practices for a partnering context, but that there are unexplored opportunities for stimulating supplier development as well as the client's role in a collaborative process.

Keywords: Construction, Contractor selection, Innovation, Partnering, Service

1. Introduction

In many cases technological innovation entails changes in organization and procedure, while in others organizational innovations are pre-requisites for technological developments (Sanidas, 2004). Construction is often considered an example of the latter situation, so that the lack of innovation is attributed to the fragmented organizations in combination with adversarial relations caused by fixed price contracts and low-bid auctions. Increasingly, collaborative inter-organizational relationships are employed with the aim to improve efficiency and enhance innovation in construction.

Construction procurement is concerned with a combination of services and tangible products. Characteristic for services are that they are intangible process activities, produced and consumed simultaneously, and often co-produced in interaction between buyer and seller (Grönroos, 2000). The contractor's task comprises the service of organizing the production of and, to varying extents, also designing the building, almost always combined with a transfer of risk from the client to the contractor. Still, construction procurement has traditionally focused on the tangible product dimension, and effort has been directed towards developing comprehensive specifications of the finished building prior to commissioning a contractor. In a partnering arrangement, one or more contractors are often brought in early, to contribute to design. The contractor may also have an important role in developing and facilitating partnering activities, as well as in coordinating other contractors and consultants. Thus, clients are faced with the task to choose a contractor who possesses the competence and attitudes required to work in and manage collaborative relationships. Typically, aspects such as empathy, creativity, leadership and communication skills of the individuals involved are considered vital; qualities which are not easy to prove and assess. Further, most contractors still have little experience from collaborative project management. Thus, we may see this as a case of procurement of a service innovation, which, inelegantly, can be described as "collaboration-orientated project management".

In the UK and Denmark, central government has issued policies to encourage and sometimes require public clients to use partnering approaches in their projects. The Swedish government has been more passive in encouraging collaborative approaches and instead, most initiatives stem from individual actors. After a slow start, interest grew in 2004 when a number of projects were started. Rather unexpectedly, many of these were public sector projects undertaken by clients in smaller municipalities, meaning that the process has to fulfill criteria of transparency, fairness and accountability.

This paper analyses the strategies that some of these Swedish public clients employ in selecting construction contractors in partnering projects. The empirical basis is a detailed review of bid documents elaborated during 2003-2004. Interviews with representatives of those clients were also carried out. First, a short background to contractor procurement, public procurement and partnering in the Swedish context is outlined. Then, literature relevant to contractor selection in general and in partnering is reviewed.

2. Research on contractor and supplier selection

General research supplier selection is often concerned with developing tools and formal methods supporting supplier selection. A review by de Boer et al (2001) showed that models mainly deal with the choice phase of the procurement process, while problem definition, criteria formulation and qualification have received far more limited attention. In research contractor selection as well, a common objective is to develop methods and tools to support selection processes. As for more descriptive studies, these often investigate the criteria used by clients in contractor prequalification and selection. Based on a literature review and interviews with clients, Hatush and Skitmore (1997) found considerable variety in how criteria for contractor selection were expressed, but that these could be classified into five categories: financial soundness, technical ability, managerial capability, safety and reputation. Examples of similar pieces of research are Wong et al (2001), Waara and Bröchner (2006) and Palaneeswaran and Kumaraswami (2001). A conclusion from these studies is that criteria intended to capture technical and managerial competence are common also in projects not specifically emphasizing collaboration, and that attitudinal requirements are sometimes mentioned. Past performance in different areas is a dominant basis for selection. This emphasis on past performance also applies to selecting supplier of professional services (Day and Barksdale, 1994).

3. Selecting suppliers and contractors for partnering

Also research on selecting suppliers for strategic relationships (eg Talluri and Narasimhan, 2004) and cooperative relationships (Masella and Rangone, 2000) tend to focus on general decision support models. In a study from 1990, Ellram noted the absence models specific for selection of strategic suppliers, and that the focus also in this case was on quantifiable characteristics and known performance measures intended to assess the suppliers' ability to meet the buyer's need on a short term basis. She argued that in a strategic partnership, more attention should be paid to the supplier's potential for development and future plans.

There are a few case studies of contractor selection in partnering projects which describe the formulation of criteria and selection process more in detail. Humphreys et al (2003) developed and tested a model for selection of subcontractors in partnering projects. Contractor selection for a museum project was described by Walker and Hampson (2003), and by Brown et al (2001) for a bridge project. Bresnen and Marshall (2000) studied nine partnering projects, the majority with values over £20m. Another type of literature is handbooks and guidelines for partnering, for example Bower (2003), Erhvervs- & Boligstyrelsen (2004) and OGC (2003a, b). Examples of partnering-related criteria are "understanding of the partnering", "response to partnering", "enthusiasm for the project" (Humphreys et al, 2003), "attitudes towards the involvement of contractors in the design process" (Brown et al, 2001). "team composition and attributes of individuals", "models for evaluation and conflict management" (Erhvervs- & Boligstyrelsen, 2004). "commitment to collaborative working", "senior management commitment", "supply chain teamworking and management" (OGC, 2003b), "corporate culture" (Bowen, 2003). Compared to traditional projects, there is more emphasis on innovative proposals, ability to bring value to the project, risk analysis and performance measurement, as well as on tools for financial control.

The literature is less specific on the kind of information that should be used as a basis for evaluation, and on the principles and organization of the evaluation process. In the projects described above, different approaches are used:

- prequalification questionnaires, followed by interviews with two contractors. (Humphreys et al, 2003),
- for each criterion (12) contractors are asked to list examples (most often three) of completed projects that demonstrated the contractor's abilities and performance (Walker and Hampson, 2003),
- two prequalified contractors work separately with the design team in a concurrent engineering process, and the final selection of contractor is based on a cost/quality assessment of the resulting design alternatives.
- In the projects studied by Bresnen and Marshall (2000) selection procedures comprising interviews and presentations were used in most cases. The importance of attitudinal criteria varied, as well as how formalized the assessment was.

However, the cues that buyers use "as surrogate indicators of such intangible, subjective attributes as 'expertise' or 'competence' " (Day and Barksdale, 1994, p 45), are not described and analysed in any of these studies.

4. Methodology

Data on what projects that can be considered partnering projects are not available from general Swedish project databases. Therefore, several sources were used to identify projects to study. Some projects, the authors already knew of. Further, all regional managers of Sweden' largest contractor company, Skanska, were contacted by email and telephone, and asked to list the recent public partnering projects within their region. This way, some 20 projects were identified. Bid documents from these projects were obtained either from the Skanska contacts or from the client organization. From these, a total of 8 clients were selected for further studies and interviews. For three of the clients, two projects were included in the study, to see how the bid documents developed with experience.

In reviewing the bid documents, the focus has been on the following questions:

- How are preferences for trustworthiness and other collaboration abilities expressed in formal requirements and evaluation criteria?
- What information is required from contractors as a basis for evaluation and selection?
- How do practices and experiences spread between projects in absence of officially sanctioned guidelines and change initiatives?

5. Case studies

Below, the model of Client A is described in detail. The reasons for this are that the two bid documents from this client are the most complex and non-traditional ones, and that these documents have influenced other clients. For space reasons, a summary table (Table 1) showing a selection of variables for all projects is included, but the more specific details of the other cases are summarized in text. In Appendix 1, a more detailed account the Client A model is provided.

5. 1 Client A

Client A is a social housing company in a medium-sized town. According to the managers of client A, they developed the procurement model in-house based on own experience and ideas. The manager responsible for developing the bid documents and the model was strongly committed to partnering and the company had applied elements of partnering in previous projects. Project A1 was a project partnering case and A2 was a strategic partnering contract for up to 18 projects.

Table 1: Summary of the cases

	Type of project	Type of partnering	Contract form	Character of bid documents	Info on clients view of partnering	Info on client organization	Interview/ tender presentation	Information on grading
A1	Housing	EP	Proposed by contractor	Non-standard, short	No explicit client vision, extensive on criteria and evaluation	Names of formally responsible.	Yes, but not formally evaluated.	No
A2	Housing, new and refurb,	Strategic partnering	DB	Non-standard, extensive	Client vision in intro, extensive on criteria and evaluation	Names of formally responsible	Yes, formally evaluated.	No
B1	Community building, refurb.	EP	DB	Non-standard, short	No client vision, short and formal criteria	Steering group. Names of project group members.	Yes, but not formally evaluated	No
B2	Housing	Strategic partnering	DB	Non-standard longer than B1	Background and goals in introduction	Steering group and external PM. Names client CEO and internal PM.	Yes, formally evaluated	No
C	Housing	EP	DBB	Standard	Yes, goals and many routines.	Names of steering group and project group members	Yes, not formally evaluated	No
D	Housing and nursery	EP	To be jointly decided	Non-standard, similar to A1	No explicit client vision, but extensive on criteria	Names of formally responsible.	No	No
E	Education, refurb.	EP	DB	Non-standard, similar to B1	No client vision, short and formal criteria	Names of steering group and project group members	Yes, but not formally evaluated	No
F	Public swimming pool	EP	DB	Standard	No	Names of formally responsible.	Yes, but not formally evaluated	No
G1 and G2	Student housing and housing	Project partn., no termination option	DB	Standard	Very short	Names of formally responsible.	Yes, but not formally evaluated	Yes
H	Student housing	EP	DBB	Standard	No	Names of formally responsible.	Yes, but not formally evaluated.	No

Explanations:
G1 and G2 did not differ in dimensions described in this table
EP = Early procurement, where the contactor participates in design until cost/quality dimensions may be established; if project goals can not be fulfilled the project is terminated.

The requirements/criteria in projects A1 and A2 are summarized below:

1. First, in both projects bidders are required to identify the key individuals that are going to participate. Also, the contractors have to motivate why each person has been chosen to participate in this specific project. In A2, the contractors are further asked to explain "what is required from each person in different project phases".

2. Provide company references for partnering projects. (both projects)

3. In project A1, bidders are asked to describe "non-traditional" procurement methods, domestic and international, that they find suitable for this project. In A2 this requirement has been left out.

4. Client A has identified aspects that they consider vital to a successful partnering relationship. In project A1, these were formulated as words (trust, commitment, team spirit, etc), while in project A2 they have been developed into statements ("*There is curious listening in our dialogue*", "*All parties concerned are informed and engaged in problem-solving*", "*We economize resource use*", etc). Bidders were then required to describe what these words and statements meant to them, and what they would do to fulfil these cultural and process goals.

5. Likewise, the client company had identified ten success factors (relating to social housing) (project A1) that they wanted the contractors to comment. In A2, bidders are asked to "*Describe very briefly what you perceive as important and what you intend to contribute with within the following areas for [Client A] to obtain the best value product: 1. price, 2. delivery time, 3. maintenance cost, 4. quality, 5. aesthetic qualities, 6. functional quality, 7. technical performance, 8. competence support, 9. environmental impact, 10. company ethics*".

Thus, the approach chosen by client A is strongly based on bidders' written accounts. In the first project, it was not specified who would provide the answers, while in the second project three persons (one top company manager, the project manager and the site manager) were all requested to provide their individual answers for items 4 and 5.

In both projects, the schemes used to evaluate the responses were extensive and complex. The basis was a previously existing company-based system for evaluating and grading contractors' performance. In A1, there was a paragraph stating that *"the degree of understanding shown by the contractor and the perceived trustworthiness of the contractor*" would be important in the evaluation. In the second project, the evaluation scheme was further broken down to show how the responses of the three individuals would be weighted and evaluated in relation to each aspect and to the company based material.

5.2 Assessing partnering competence

A review of all tendering documents shows that the competences and attitudes that the clients request include aspects which are perceived as relatively unproblematic to specify, such as education and experience from similar projects. Further, clients ask for skills such as ability to coordinate and communicate, craftsmanship, and aesthetic feeling. Attitudes mentioned are commitment in problem solving, willingness to change, respect for other categories of people, social competence, and trustworthiness. Five methods for assessing partnering competence are found in the cases, and they are often combined:

1. Asking for CVs of the individuals that are proposed to participate in the project.

All of the clients except one ask for this kind of information. One client requires such information for the construction workers as well, and another for subcontractors and consultants.

A weakness in this approach is that most of the projects concern residential construction or other rather standardised buildings from which most contractors have experience. On the other hand, few contractors have participated in partnering projects and several clients expressed difficulties in distinguishing between contractors on the basis of such criteria. One tentative solution used by Client A, and copied by clients B, D and E, was to ask the contractors to explain *why* each person was chosen for this specific project.

2. Working models/systems

This category of requirements pertains to descriptions of systems and routines, either already established or suggested for this project. Apart from quality management systems or environmental management systems, common in any project, the studied bid documents included requirements to provide partnering models, descriptions of purchasing routines and how financial transparency ("open books") would be achieved, etc. Here as well, several clients complained that contractors tended to come up with rather similar suggestions.

3. References from previous clients

Asking previous clients about their experience from working with individuals and companies was a common way of assessing attitudes and personal qualities, but was also used to obtain information on how the contractor's management systems are applied in practice. Client B, however, was critical to using references at all, as references tended to present the same kinds of problems with contractors having similar experiences as the CV approaches described above: "all contractors are capable of building and none of them have references from partnering".

4. Written accounts and individual reflections

Another method used to elicit information that is used as a basis for assessing individual values and dispositions is to ask the contractors to write down their views on what partnering, or a set of core values, means to them. Some clients put much weight on such descriptions, notably A (but also B), while other clients, such as G and F, do not require any material of this kind.

The clients were concerned that such written material might not reflect actual attitudes of those involved, either because site managers and other contractor personnel are not good at expressing their attitudes in writing, or because the bidders involve central company units, borrow descriptions from other projects or provide standard company material. To avoid this, Client A (followed by B2) specifically asked for written accounts from individuals in their second project.

5. Interviews

Interviews, or meetings with contractors, are perceived as very important and are used by most clients. Client B said that they used interviews to give those who are not so good at writing an opportunity to express themselves orally and to make sure that the people meant to work in the project had also participated in developing the bid.

5. 3 Information on client views and evaluation schemes

In order to ensure equal treatment and transparency, general procurement advice often prescribe that clients should provide as much information as possible considering what aspects they will value and in what way. This is also reflected in public procurement regulation. Still, many of the clients in the cases studied clearly favoured a more open approach. For example, client B found it important to give the contractors an opportunity to "show how clever they were", and said that information on grading "would provide the contractor with the answers", leading to bids that were more similar to each other. This client further perceived such bespoke qualities as cues to the less accessible dimensions of partnering competence: "you can judge how committed the contractors are by the effort they put into preparing the bid".

Client G differs from the others in that they provide this kind of grading information. In effect, client G found it hard to distinguish between the contractors on partnering-related criteria in both their projects, although other clients did have the same difficulties.

5. 4 Character of bid documents

Another aspect that differs strongly between clients is the character of the bid documents: to what extent these follow the general standard and how the partnering content is communicated. The standardised form results in thicker documents where information on partnering aspects is found under different headings, while in the more project-specific bid documents all information on partnering aspects and contractor evaluation is found on a few pages. A standardised approach follows a scheme with which the contractor is familiar, but it is not as clear under what headings the contractor should look for partnering information. In the studied cases, conventional approaches are used when the contract for the construction work is immediately binding (Cases G), or when the project has already been out for traditional procurement (case F), but also in cases C and H.

5.5 Relations between projects

It is clear that many of the clients and consultants have had contacts and influenced each other, although contractors may also act as vehicles for spreading of practice, as in the F case. There are many similarities between the different bid documents. The same texts and requirements are found in A1 and B1, and in A2 and B2. These two regions are close enough to use the same consultant (E and B) and deal with the same contractor. But especially client A has been influential on a national level, having received many clients from other regions for study visits. The most explicit borrowing is done by client D from project A1, where the entire bid document has been copied, including the part relating to the core values of the client organization.

Some texts from client A have caught specific interest and are found in several projects. These are:

- The requirement to explain *why* individuals have been chosen to participate in a project
- the statement that the insight shown by the contractor and the perceived trustworthiness of the contractor are most important in the evaluation

6. Discussion and conclusions

There are some observations that can be made when the studied cases are compared to the approaches for contractor and supplier selection in the literature. One is that the innovation dimension implies that information on past performance is of little value, and clients have tried to find more future-oriented options and appoint contractors based on an assessment of their attitudes, commitment and potential capabilities, often as reflected in written material. The collaboration dimension implies that the commitment and attitudes of the individuals are crucial for success, and the material submitted in the bid has to be produced by these people themselves.

Further, when procuring a new service, the bid documents and the client's behaviour in informal contacts must encourage contractors to invest in developing new ways of working and sometimes also attitudes. However, clients seem less aware of this aspect and especially of their own role in the process. For example, we could imagine the client providing cvs and other personal information about their own personnel, revealing their attitudes, commitment and partnering experience, but the clients in the study convey very little information on their own role and employees, perhaps not to influence responses and limit contractors' creativity. Also, clients are keen that the contractors' bids are produced by those that are going to be active in the project and reflect the attitudes of those individuals, but do not hesitate to borrow texts and entire bid documents from each other.

Another less apparent aspect is that the process of developing responses to the requirements in the bid documents may, in itself, promote change. Bidding for many of these partnering projects requires the contractors to organize the bidding work very differently from a normal project. One example is the requirement in project A2 that individuals should describe how they, as individuals would contribute to reaching different goals. Such processes may spur more far-reaching change processes in the contractors' organizations.

In sum, clients have started to adapt their procurement practice to a partnering context, but still mainly focus on selecting a collaborative partner. The potential for stimulating supplier development is not fully recognized. Perhaps the greatest opportunity for improvement lies in clients realizing their own role in a collaborative exchange process. Further, when designing guidelines and handbooks for procurement of partnering projects, as well as in using consultants, there is a need to emphasize the need to reflect individual attitudes and local competences on both sides. Tools, procurement advice and imitation may inspire learning on both sides, but can also suppress those individual variations that foster trust.

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Appendix 1: Criteria and requirements in the projects of Client A. Authors' comments are in italics.

Criteria/ requirements	**Project A1**	**Project A2**
1	Describe organization (names), their geographical basis and why they were chosen for this project.	**A: Organization** *Same text, but supplemented with:* Describe the project organization and what is required from each person in different project phases.
2	Provide company references for partnering projects	*Same text.*
3	Describe "non-traditional" procurement methods, domestic and international, that you find suitable for this project.	*Left out, instead the client's own view of partnering is stated in introduction*
4	Important aspects that have to function throughout the project are: trust, commitment, teamwork, conflict management, contracts and procurements, common view of project goals, choice of technology, continuous improvements. 1. For each aspect, describe your aims, 2. For each aspect, how do we assure that all aspects function and the aims fulfilled? 3. How do we assure the overall performance of the project work and the finished building? 4. Are there other important areas? In that case, describe in the same way as the areas above.	*Replaced with:* **B: Competence, construction process** Describe how quality is assured in the areas "treatment" and "project execution". What do the following statements mean to you and how will you contribute to meeting them? *Treatment:* - There is curious listening in our dialogue - Disagreements are brought out to find better solutions - All concerned parties are informed and engaged in problem-solving - An ethical responsible culture prevails, where everyone are honest and trustworthy - The level of commitment and service quality is high internally and externally. *Project execution*: - Work is performed with great professional competency where responsibility for environment, health, customer needs, and the maintenance phase is particularly attended to. - We economize with resources. - We have a good work environment - We have good logistics and planning
5	[Client A] works with 10 success factors. Provide short descriptions of what the following words mean to your organization: responsibility, foresight, health advancement, diversity, resource economy, collaboration, time for you, well-being, accessible, security.	*Replaced with:* **C: Competence, central business areas** Describe very briefly what you perceive as important and what you intend to contribute with within the following areas for [client A] to obtain the best value product: 1. price, 2. delivery time, 3. maintenance cost, 4. quality, 5. aesthetic qualities, 6. functional quality, 7. technical performance, 8. competence support, 9. environmental impact, 10. company ethics
6		The control instruments should be possible to tie to a vision, such as "We build homes in harmonious, timeless simplicity - when you take a closer look, such craftsmanship, what a quality"

Exploring the significance of preferential procurement policies for the South African construction industry

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Abstract: Historically, the majority of the South African population were excluded from equitable participation in the social and economic activities of the country. Consequently, the country is characterised as having "two economies" – one developed and sophisticated and the other, poor and underdeveloped. Against this background and since coming to power in 1994, the new democratic government has been seeking ways to merge the two economies by redistributing resources equitably amongst the population whilst facilitating greater economic growth. One of the ways the government attempts to achieve sustainable redistribution and economic growth is through the use of preferential procurement polices within the broad-based black economic empowerment policy framework. The South African construction industry has been identified by government as a good vehicle for promoting government policy. This paper explores the reasons why the South African construction industry may be particularly suited to the application of the government's preferential procurement policies. The research is based on a review of literature which suggests that while the South African construction industry is amenable to promoting government policy and despite the perceived benefits of preferential procurement, preferential procurement policy remains a 'contested' concept reflecting the *ad hoc* development of practice within the industry. The paper further speculates on the difficulties and challenges of meeting the South African government's intended socio-economic objectives through preferential procurement in the industry from a conflict theory perspective.

Keywords: Construction industry development, Conflict theory, Equitable redistribution, Preferential procurement policies, South Africa.

1. Introduction

For many years, the majority of the South African population were deliberately marginalised and precluded from the economic, political and social organisation of the country (Voight, 2004). Colonial and apartheid policies resulted in a system of racial capitalism underpinned by a range of discriminatory laws (Ideheru, 2004; Gelb, 2003). Access to skills and capital markets was racially defined (Iheduru 2004). The various discriminatory laws included land laws, job reservations, influx control, pass laws, labour and education laws which have had devastating effects on the majority of the population.

Particularly during the period 1948 to 1994, state policy and practice ensured that little government investment was directed towards to the infrastructural needs of the majority black population. (In SA, the term Black refers to all non-White South Africans [which according to the historical classification includes Africans, Indians and Coloureds], whereas White refers to South Africans of Dutch and British descent who are not of mixed race heritage).

As a result, the democratic government of 1994 inherited a society with huge social and economic inequalities along racial lines. Therefore, the South African (SA) economy is characterised as comprising "two economies" – one developed and sophisticated and the other, poor and underdeveloped (Mbeki, 2001). Consequently, government has sought ways to merge the two economies by redistributing resources equitably whilst encouraging greater economic growth. One of the ways that government attempts to achieve sustainable redistribution (such as promotion of small, medium and micro enterprises, enhanced job creation and skills transfer) and economic growth is through the use of preferential procurement polices (Gounden, 2000).

The construction sector has a number of characteristics that make it particularly attractive to explore the issue of public procurement as a vehicle for achieving socio-economic objectives. This paper explores the reasons why the South African construction industry is particularly suited to the government's preferential procurement policies whilst recognizing that these policies are highly "contested" concepts whose application reflects the *ad hoc* development of industry. In so doing, the paper adopts a conflict theory perspective to highlight the challenges of meeting the government's intended socio-economic objectives and the implications this has for future industry development. It is a theoretical paper based on a review of literature.

1.1 Government intervention through Broad-Based Black Economic Empowerment

Since 1994 the SA government has been developing policies that would seek to redress the socio-economic legacies of apartheid. These policies, intended to bring marginalised individuals into the main stream economy are framed within an overarching broad-based black economic empowerment (BBBEE) policy framework. Broad-based BEE aims to economically empower all black people through diverse but integrated socio-economic strategies (South Africa, 2003). These strategies include preferential procurement, establishment and/or support of existing and new black Small Medium Micro Enterprises (SMME's), black-owned and black women-owned enterprises through investment, skills development and increasing the number of black people who manage, own and control enterprises and productive assets.

1.2 The Legislative Framework for Preferential Procurement

In line with its developmental goals, the government has realized that public procurement could play an important role in merging the "two economies" into a sustainable unified growth pattern aimed at providing an environment for optimal economic development (World Bank, 2003). The strategic importance of procurement arises from the 2-fold rationale that: a) it would encourage the participation of disadvantaged groups in public contracts for equitable redistributive purposes and b) by enabling more people to participate in economic activities; it would contribute to economic growth. Therefore, a major review of the public sector procurement system was initiated in 1995 (Gounden, 2000).

The 1996 Constitution (Act 106 of 1996) made provision for public procurement which reaffirmed and reflected its significance in South Africa. Section 217 (1) lays a legal basis for a procurement system which is fair, equitable, transparent, competitive and cost effective. Section 217(2) allows for state organs to implement a procurement policy providing for; (a) categories of preference in the allocation of contracts; and (b) the protection or advancement of persons or categories of persons disadvantaged by unfair discrimination. Section 217 (3) stipulates that national legislation must prescribe a framework within which the policy of preferential procurement may be implemented (South Africa, 1996).

Flowing from these constitutional provisions and the recommendations of the Green paper on Public Sector Procurement Reform 1997, the Preferential Procurement Policy Framework Act (PPPF) 2000 was formulated. This Act provides a framework for establishing how preferential procurement policy should be implemented. However, the Act only provides only a framework and individual state organs must determine their own implementation policy within a framework that includes a points system and specific goals.

Until 2003, the PPPF Act 2000 has been the primary legislation driving economic empowerment. It is currently under review (draft regulations 2004 of the Act) to bring it in line with the BBBEE Act 2003 and DTI's Codes of Good Practice (Daka, 2005 as cited by Cromberge, 2006). The DTI's Codes of Good Practice explain the approach to be adopted in the measurement of black economic empowerment compliance (DTI, 2001).

2.0 Conflict Theory as a Paradigm for investigating Preferential Procurement

The common themes of conflict theory are concerned with who benefits from particular social arrangements and how those in power strive to maintain their status quo (Browne, 2005; Tishler, 2001). The theory emphasises the extent to which individuals, groups and classes within society are in competition with each other over scarce resources. It argues that inequalities exist in all societies and tensions are inevitable among different interest groups (Browne, 2005; Tishler, 2001). Conflict theory opposes these inequalities on the basis that they impede the optimal functioning of individuals and society (Browne, 2005; Tishler, 2001).

Conflict theory is concerned with the ways in which inequalities are created and maintained in society. It provides a way of exploring government's socio-economic sustainability development agenda through preferential procurement. This stance acknowledges that preferential procurement is primarily concerned with the provision of opportunities to previously marginalised individuals and seeks to rebalance existing social and economic interests. Specifically preferential procurement policies are an intervention to prevent the perpetuation of inequitable participation in the public sector procurement system. However, like all government interventions, preferential procurement policies are not neutral but have distributive consequences. Therefore, this paper purports that conflict theory provides an appropriate sociological perspective to speculate on the pursuit of sustainability (socio-economic) and value through construction procurement within the South African context.

3. Preferential Procurement as a "contested" Concept

Preferential procurement policies embody strategies and tools aimed at enhancing the participation of historically disadvantaged individuals (HDI's) in the public sector procurement system. As a practice, preferential procurement refers to the procuring of goods, services and works from historically disadvantaged individuals/enterprises with the aim of promoting equal and sustainable participation in the market place (Daka, 2005 as cited by Cromberge, 2005). Economic and moral grounds are used by different interest groups to either justify or oppose the use of preferential procurement policies. However, although the grounds used are the same, the arguments are framed differently to suit the interests of each group.

3.1 A Case for Preferential Procurement

In South Africa, preferential procurement is justified for target groups as a remedy for past injustice and for enhancing economic growth. (Historically Disadvantaged Individuals or Previously Disadvantaged Individuals refer to Black people as defined in the Constitution [Act, 106 of 1996] and the BBBEE Act, 2003). Morally, it is argued that because black people were unjustly treated by white people, it follows that the harmed party must be compensated and also that treating unequal people equally is in itself unequal and unfair (Hicks, 2002; Edwards, 1995). Thus, to equalise the radical differences or opportunities, the state must engage in redistribution – to give the weaker party an advantage (Hicks, 2002).

In the context of public sector procurement, "compensation" is built into the points scoring system used in awarding tenders when established enterprises compete with emerging enterprises. Under the PPPF Act (2000), depending on the value of the transaction then either a 90/10 or 80/20 points system applies such that either 80 or 90 points apply to the lowest priced tender with the remaining 10 or 20 points allowed for achievement of specific goals relating to BEE criteria and sometimes higher price bidding by black businesses respectively. Typically, the tender will be awarded to the party scoring the highest points allowing bidders to compete on a balance between price and socio-economic goals.

The economic rationale is based on the argument that businesses that develop along racial lines within parallel economies limit economic development and the country's international competitiveness (South Africa, 1997). Here preferential procurement is justified as a means for dealing with the dual economy. Although it is likely that government may have to bear an economic "premium" for preferential procurement, the economic benefits are the elimination of the inefficiencies associated with a dual economy (World Bank, 2003) and the growth of the economy through the inclusion of the majority of the population. .

The specific benefits (both perceived and real) include the following (Brown, 2004; Watermeyer, 2000; Rice, 1992):

- Increased long-term competitive viability of historically disadvantaged enterprises (SMME's) through provision of business opportunities;
- Development of business linkages between historically disadvantaged enterprises and established firms leading to greater business potential;
- Provision of a vehicle through which skills development can take place;

- Enhanced ability of enterprises to survive and enter the mainstream economy representing a way of narrowing ownership gaps or addressing skewed ownership patterns for redistributive purposes;
- Enhanced diversity of participants in the market place to match demographic profiles;
- Representation of an economic development tool for disadvantaged minority groups;
- Potential for other social benefits such as enhanced job creation;
- Provision of an important catalyst for rapid economic growth.

However, despite the benefits, preferential procurement policies have faced criticism.

3.2 A Case against Preferential Procurement

Giving preference to some individuals over others is opposed for being morally unjust and for introducing an element of economic inefficiency into a system (Charlton and van Niekerk, 1994). In the short-run, it is always most efficient to appoint the most efficient person without preference. For example, the breaking down of tenders into smaller components (as done in preferential procurement) is not always justified because of the division of responsibilities, interdependence of activities, programming, and duplication of establishment charges and under-utilisation of resources (Watermeyer, 2004). In addition, the administration of such contracts by public bodies is more complex and costly than larger ones (Watermeyer, 2004).

There are also conflicts in respect of who the beneficiaries of BEE or preferential procurement in South Africa should be (Dekker, 2004). Questions arise as to whether people should be treated as individuals or as members of designated groups (Designated groups or Target groups refer to Black people, women and disabled people. These two terms and HDI and PDI above are often used interchangeably which causes confusion). (Hicks, 2002). It is felt by some that treating individuals as members of certain groups for purposes of getting preference in public sector procurement contracts reinforces group identities and exacerbates tensions (Charlton and van Niekerk, 1994). Preferential procurement policies redefine the way groups are socially constructed in the sense that while race was previously the criteria for subjugation of previously disadvantaged individuals, it now becomes the criterion for identifying groups to be given preference in public sector contracting (Ong, 1999). As a result, the concept of preferential policies is perceived to be racially divisive and contributing to intra-black division thereby posing a threat to the non-racial nation building (Iheduru, 2004) that lies at the heart of the post-apartheid political dispensation.

Other risks identified by Watermeyer (2004) include the reduction of competitions, lack of transparency in the procurement process, the exclusion of certain eligible parties from competing for contracts and the unfair or inequitable treatment of suppliers or contractors. Finally, there is concern over the ability of procurement to deliver secondary objectives such as the social and economic development of targeted groups. Thus, it can be seen that concepts like preferential procurement are never neutral but are subject to contestations and meanings and do not inherently imply particular courses of action (Nzimande, 2005).

4. The Construction Industry as a Vehicle for pursuing Government Policy

The construction sector has a large multiplier effect on the economy mainly because of its backward and forward linkages with other sectors, such as the manufacturing and property industries respectively (Morton, 2002; Hillebrandt, 1974). It provides the government with delivery mechanisms for many aspects of government policy (CIDB, 2004; CSIR, 2003; Hillebrandt, 1984). The reasons why preferential procurement is so significant to the South African construction industry include the following:

4.1 Government's Dual Role as a Major Client of the Sector and Policy Maker

Governments are a large player/purchaser of goods, services and works which provide them with significant opportunities to influence sectors as well as the whole economy (Gounden, 2000). Because of the significant size of their procurement capability, governments frequently use procurement as a mechanism for policy delivery to pursue multiple objectives.

The South African construction sector currently generates about R60bn a year, contributing 9% to the Gross Domestic Product (Gadebe, 2006). The government is a dominant client of the construction sector and its orders represent 50% of the demand in the sector (Gadebe, 2006) and this share is likely to increase over the next few years as the government, in partnership with parastatal enterprises, embarks on a major programme of capital expenditure estimated at R320-R400bn during the 2005-2009 (Cheetam and Mabuntana, 2006). This investment is intended to raise gross fixed capital formation (GFCF) to 25% of gross domestic product (GDP) and through this increase economic growth from 4.5% between 2006 and 2009 to 6% between 2010 and 2014 (le Roux, 2005; National Treasury, 2006). The implication of this for the construction sector is a doubling of output to R100 billion a year by 2010 (Creamer, 2005).

As the major client of the construction sector, the SA government, as with other governments around the world, is in a unique position to exert market power, making the sector well suited to government's preferential procurement policy interventions. Moreover, the strategic role of the government as policy maker enables it to promote new techniques of procurement (Morton, 2002) or set standards and/or constrain the market environment within which the construction sector operates. However, any change in the legislative framework 'disturbs' the market (as may be the intention) and generates resistance to the new order (Radebe, 2006).

4.2 Labour Intensive with Low Barriers to Entry

The labour intensive nature of the construction sector and its low barriers to entry (compared to other sectors) allow it to form a vital link between formal and informal economies. For a country like South Africa where a large percentage of the population lack skills or are unskilled (Gelb, 2003) the construction sector provides a route to acquiring skills and expertise through work experience. In South Africa, the construction industry employs the 4^{th} highest number of persons with no education (CSIR, 2003). In addition, the economic linkages with other sectors means that for every one job created in the construction industry, one or two more jobs are created either in the construction industry or elsewhere in the economy (Ganesan, 2000). Hence the sector's potential for creating employment and training opportunities make it amenable to government's preferential procurement policies.

4.3 Structure of the Construction Industry

The construction industry is highly fragmented with many small firms and few large firms. Small firms undertake the many small, labour-intensive, relatively simple, dispersed projects, which are necessary for economic development and social up-liftment within communities (UNCHS, 1996). Likewise, the SA government's belief that SMME's are a key opportunity to achieving economic and redistribute objectives means that their active promotion and participation in the construction industry is in the interest of industry development (CSIR, 2003). This is because SMME's are powerful generators of income and employment opportunities and use less capital investment per unit of output than larger enterprises (Gounden, 1997). They are also the vehicle by which the lowest income people of society typically gain access to economic opportunities (Watermeyer, 1998).

By definition, preferential procurement, as implemented through targeted procurement in the construction industry, unbundles contracts into smaller more accessible packages to assist targeted groups who may not have the necessary resources, capacity or expertise to tender for traditional contracts (Watermeyer, 1998). Therefore, the prevalence of SMME's in the industry suits the government's policy of promoting SMMEs.

4.4 Flexibility of the Construction Sector

The construction sector has a high degree of flexibility to respond to the highly variable demand for its services (Morton, 2002). Its ability to adjust to "*different framework conditions… makes this sector a major contributor to the process of development*" (Lopes 1998:648). Because of this flexibility, reductions and increases in government spending are often enabled through construction projects (Morton, 2002).

5. Challenges of meeting Socio-Economic Objectives through Preferential Procurement

In targeted procurement, direct preferences are accorded to targeted enterprises to tip the scale in their favour on small contracts with a value below a predetermined financial threshold (Watermeyer, 1998). The Department of Public Works (DPW) in conjunction with other stakeholders are actively involved in stimulating access to market opportunities and developing entrepreneurial skills of HDI's through initiatives such as the Expanded Public Works Programme (EPWP) and the Emerging Contractors Development Programme (EDCP). By 2003, the proportion of DPW capital projects awarded to emerging contractors had risen to 43% compared to 4% in 1994 (CSIR, 2003). However, despite this success, there remain a number of challenges:

5.1 Inadequate Management Systems and Lack of Capacity within the Public Sector

A lack of capacity within public sector clients and inadequate management systems affect result in serious problems particularly for small emerging contractors (CIDB, DPW and CETA, 2005). There are also limited resources to effectively and efficiently monitor, evaluate and facilitate programmes in the construction industry (CIDB *et al*, 2005) imposing constraints on growth, employment and empowerment in the industry.

5.2 Poor and Inconsistent Procurement Practices by Client Bodies

Preferential procurement is implemented inconsistently at different levels of the public sector and between provinces (CIDB *et al*, 2005; CIDB 2004; World Bank, 2003). The subjective interpretation of the PPPF Act has led to increased levels of legal uncertainties in firms and a focus on equity ownership (Construction Sector Charter, 2006). Moreover, the lack of uniformity in procurement documentation and procedure makes requirements difficult to understand, increases tendering costs, exposes parties to unnecessary risks, delays the evaluation and awarding of tenders and inhibits the participation of the emerging sector (CIDB *et al*, 2005; World Bank, 2003).

5.3 Fronting and the Abuse of Sub-contractors

There have been reports of main contractors abusing sub-contractors (mainly emerging contractors) (CIDB, 2004; CSIR, 2003). In addition, corruption and fronting for white capital (token-black syndrome) have also become endemic to the BEE process (Iheduru 2004; Voight, 2004). Fronting refers to any entity, mechanism or structure established to circumvent the BEE requirements required under various policy instruments (Construction Sector Charter, 2006). Reports suggest that companies with no BEE status had “fronted” black people and defrauded the DPW of more than R414 million over the past two years (Jacks, 2006).This undermines the objectives of empowerment, adding costs to clients and society and creates an undesirable distortion of the market (CIDB *et al*, 2005).

5.4 Poor Management and Inadequate Skills

The South African construction sector has a highly skewed ownership pattern drawn along racial and gender lines, which challenges the sector as to how to narrow the gap while simultaneously raising overall performance (CIDB, 2004). Most emerging contractors suffer from inadequate project management and entrepreneurial skills (CSIR, 2003) and lack adequate training and mentoring. Current skills initiatives such as the EDCP do not seem to have the desired impact (Radebe, 2006) and it has been argued that the focus of preferential procurement is too heavily biased towards ownership and control at the expense of the development of skills and education (IRIN, 2004).

5.5 Lack of Permanent Relationships in Structured Joint Ventures

As each DPW contract involves different partners, there is a failure to build long term business relationships between the established firms and emerging black contractors. Consequently, firms fail to reinforce the learning or skills transfer that occur on projects (CIDB *et al*, 2005). Procurement policies ought to encourage longer contracts periods and avoid frequent tendering which is expensive and disruptive (*ibid*.). The lack of continuity in access to work opportunities also causes problems for emerging contractors (*ibid*.).

5.6 Lack of Access to Capital and Finance

Most small and emerging contractors lack access to finance hindering their participation in preferential procurement but *how does one capitalise those without capital?* The late payment cycles common with public sector clients impact negatively on all contractors (*ibid*.) but invariably have a greater impact on small and emerging firms. Where BEE has been effected through ownership changes, the involvement of the same individuals suggests nepotism and bribery (Voight, 2004) although it may also reflect the very small pool or skilled and educated black elite. This raises the question as to whether the new black owners 'add value' to businesses or whether it is simply a price paid by firms to gain access to public sector work.

5.7 High Competition and Unprofitable Tender Prices

Save for a few high profile equity deals, the industry continues to be racially skewed with black participation mainly at the micro and small business sector (Construction Sector Charter, 2006). The low barriers to entry in the general contracting category has resulted in an oversupply of small and micro businesses making this particular sector highly competitive and unprofitable with low levels of sustainability (CIDB 2004; CSIR, 2003). Awarding contracts on the principle of lowest price (when all tenderers are BEE complaint) rather than best value has also impacted negatively on industry performance, resulting in poor quality as well as time and cost over-runs (CIDB *et al*, 2005). Whilst the public sector provides increasing opportunities for emerging contractors, the oversupply of new entrants has resulted in high rates of enterprise failure in the emerging contractor sector raising concerns the industry's ability to deliver both the country's infrastructural needs and socio-economic objectives (CSIR, 2003).

6. Conclusion

The majority of the South African population continue to be excluded from the ownership, control and management of productive assets and from access to training in skills. Not only is this seen as unjust but it also hinders the nation's ability to achieve its full economic potential. Since 1994, the South African government has, through black economic empowerment, sought ways to redistribute resources equitably whilst pursuing economic growth.

The government has made it clear that it will leverage its procurement capabilities to promote BEE. The 1996 Constitution provided the basis for preferential procurement the aim of which is to promote equal and sustainable participation of historically disadvantaged individuals in the marketplace. The factors that make the construction sector particularly suited to government's preferential procurement policies have been discussed including the government's dual role as a major client and policy maker, the labour intensive nature of the sector, its low barriers to entry, and the structure and flexibility of the sector.

From a conflict theory perspective, it can be concluded that while the construction sector is amenable to promoting government's policy and preferential procurement having many benefits, preferential procurement policies remain a 'contested' concept reflecting the *ad hoc* development of practice in the industry. Despite the efforts and progress made by government so far, access to work opportunities provided by preferential procurement are not always translated into sustainable empowerment or joint ventures necessarily supporting skills transfer. Preferential procurement policies are not necessarily implemented in a way that enhances long-tern sustainability of SMME's. A number of challenges which cloud the huge potential that lies in economic empowerment through preferential procurement and which have negative implications for future industry growth have been identified and highlighted

It follows that while it is important for the SA government to intervene in the industry on occasion, by and large; the government should only provide an "enabling environment" and leave market forces to work. The government's priority should be to grow the economy so that the "national cake" can increase so as to provide opportunities in which the majority of people including those who were previously excluded can participate. Therefore it is important to identify and encourage those factors in the construction sector which are crucial to enhancing economic growth.

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The Theoretical Evolution of Best Value Procurement Research

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Abstract: The Performance Based Studies Research Group (PBSRG) was formed in 1994 to solve the problem of construction industry nonperformance. The different stages included: identification of construction industry performance (1994-1997), the implementation of a best value process (1998-2001), the development of the quality control plan and information environment (2002-2005), and the redefining of best value process as a three phased process of selection (2005-present). During the evolution of the best value process, the definition of the best value environment has changed to match the characteristics of an efficient, effective, and high performance/value environment. Although recognized early in the research, the impact of an efficient environment on the major participants of the construction industry has not been fully realized until the last stage. While much has been written on changing the delivery system to increase construction performance, twelve years of PBSRG research (1994-present) accompanied by 450 construction procurements ($480M of construction services) have identified the client's selection process, management/control tendencies, and lack of accountability as the main sources of construction nonperformance.

Keywords: Best value, Performance Information, Procurement Measurement, Quality Control

1. Introduction

In the evolution of the current best value procurement research, there were (and are) three major problems identified in the delivering of nonperforming construction: 1) not on time, 2) cost increasing change orders, and 3) not meeting the quality expectations of the buyer or client: that is, the client cannot measure the difference between competing contractors/systems, the contractors do not preplan, minimize the risk of factors they control and do not control, and there is no efficient structure to minimize risk of nonperformance during the construction project. In addressing these issues, the evolution of the best value procurement process started with first differentiating contractors by performance measurements. The research then centered on creating a structure whereby contractors are highly motivated to preplan and minimize risk (i.e. perform quality control). The research is now defining an environment where contractors can perform risk management on their projects. As defined by the research, best value procurement is where the best value is selected based on performance and price, the best value contractor sets a quality control plan that minimizes risks that they control and do not control, and clients allow the best value contractor to manage and minimize risk during construction. The documentation that justifies the best value identifies what the contractor will deliver before it is delivered, minimizes risks before they happen, and catalogs the management of risks during the project - this is the developed and researched best value process presented in this paper. This research has been accomplished by the Performance Based Studies Research Group (PBSRG) at Arizona State University over the past 12 years (450 projects, $480M of construction projducts,$5.7M of research funding with a 98% customer satisfaction, on time, no contractor generated cost change orders, and at 40% of the current client PM effort).

2. Identification of Performance

In the mid 1980's, Capt Dean Kashiwagi, United States Air Force (USAF), investigated the performance of the sprayed polyurethane foam (SPF) roofing system. It was identified as an experimental roofing system with very poor performance and needing approval from USAF Civil Engineering Services Center for specification and installation. The objective of Kashiwagi's thesis at Arizona State University in 1983 was to determine if the SPF roofing system was a viable option, and if so, why was it called an experimental system and not widely used by the USAF? After a two year study that investigated over 250 SPF roof installations in six states, Kashiwagi determined that the SPF roof system was a performing system if installed correctly. Follow on studies through the late 80's and early 90's identified the following:

1. There were performing SPF roofs (20 years, not leaking) all over the country.
2. The characterization that SPF roofs were experimental and nonperforming was not supportable with performance information. Documented performance information in the National Roofing Contractor's Association publication (governing roofing body in the United States) is unmatched by any other roof performance study.
3. Performing SPF roofs required performing contractors and manufacturers.
4. Some SPF roof systems outperformed other systems. The Neogard Permathane systems passed rigorous Factory Mutual hail testing (Kashiwagi and Pandey, 1996) in laboratory and field tests of existing roofing systems, clearly differentiating itself from the other silicone, acrylic, and urethane coated SPF roof systems.
5. Without the proper information, clients could easily make the wrong decisions on SPF roof systems. For example, Texas A&M stopped using urethane coated SPF roof systems due to the reversion problems (materials reverting to its original liquid components) and the Dallas Independent School District outlawed the installation of SPF roof systems due to misinformation (DISD, 2001; Kashiwagi and Savicky, 2003).

The study identified the amount of misinformation/professional bias in the roof industry and led researchers at PBSRG to identify why documented performance information was not more widely used in the roofing industry to select roofing contractors/systems. This problem was also identified by other experts in the industry. It led to the development of the Construction Industry Structure (CIS) model, the identification of the impact of the low-bid award procurement system, and the current resulting system of specifications, minimum standards, construction management and inspection.

3. Construction Industry Structure and Rationale for Best Value Procurement

Kashiwagi's (1991) dissertation "The Performance Based Procurement System" serves as the foundation of best value procurement research at PBSRG. The dissertation included:

1. A method to performance line contractors and roofing systems using the following performance information (proven service period of roofs installed by the contractor, proven performance of the manufacturer's roof system that was being installed, warranty period, and price).
2. A method to compete contractors installing different roofing systems based on performance and price utilizing the Displaced Ideal Model (DIM).
3. A CIS model to explain why performance information and price (value) was the best way to procure a performing roofing system.

In 1994, the first set of industry tests were conducted to procure roofing systems for clients in the Phoenix and Tucson metropolitan areas. The results were highly successful, as clients procured their roofing systems based on price and performance (best value). The clients were convinced to do the testing based on the logic of the CIS model (Figure 1) (Kashiwagi, 2004).

Fig. 1. Construction Industry Structure Model

An examination of the model showed that the worldwide competitive marketplace was driving the construction away from sole sourced or minimized competitive negotiated bidding (Quadrant III), and moving toward higher competition while maintaining the high performance (Quadrant II). Because of the inability to use non-subjective performance information (on time, minimized change orders, and customer satisfaction), the clients moved to the low bid or price based environment (Quadrant I in Figure 1). The low bid environment has the following characteristics (Kashiwagi and Savicky, 2002):

1. Technical specifications using ASTM test derived minimum measurements of physical characteristics of the material. ASTM standards are minimum standards which are not derived from documented field or service performance of materials.
2. Because the minimum standards are not performance related, manufacturers were motivated to minimize the performance of their materials to meet the minimum standards.
3. Because the technical specification was not performance related and did not differentiate between alternatives, the lowest priced systems with long term warranties were being procured.
4. Due to the concern that contractors and manufacturers were not motivated to perform, but rather motivated to sell and install products that met minimum standards, the client hired construction or project managers to inspect the constructed work.
5. The managers and inspectors could only inspect using the technical specification (which was not based on performance). Technical specifications have no relationship to performance unless the system has documented performance information.

Due to these characteristics, the resultant low bid environment has:

1. Low construction quality: clients outsourcing construction to contractors with the lowest price and the lowest performing systems.
2. A management model: clients' representatives managing, directing, and inspecting contractors' work.
3. No performance information: a lack of performance information to differentiate contractors, subcontractors, and construction systems.
4. An inefficient environment: more construction management/inspectors, confusion/risk over liability of nonperformance, and lower performance.

The PBSRG research identified the client as the source of the inefficient low bid environment due to the following:

1. The client outsourced the construction, then directed the contractors through minimum specifications (which had no relationship to performance), then managed and inspected the contractors' work (minimized the risk of nonperformance).
2. The client identified construction as a commodity (no difference between contractors) then directed the contractors to lower their price regardless of the risk of nonperformance, then created the change order process to minimize unaddressed risk.
3. The client made the professional designer/engineer/construction/project manager the expert to minimize construction risk, and not the contractor who does construction.

The realization that the client controlled the level of performance of the construction industry helped to explain why the unilateral efforts of the industry to start training centers has not impacted the level of quality or the attraction of high quality personnel into the industry. It also helped explain why contractors would rather increase their profits by doing more work (volume based) rather than become more efficient (failure of the industry to embrace principles such as lean). It also helped explain the predicament of the surety industry that has a difficult time minimizing payouts even though it uses financial data (many contractors are undercapitalized and one job away from financial ruin). It also helped explain why high tech projects such as the "Big Dig" have performance issues and tremendous liability. The CIS research refined the understanding of the differences between the Best Value environment and the Low Bid Environment.

The evolution of the current best value procurement has moved across four definable stages:

1. Best value as a selection process only and the development of this selection process
2. The transition of best value selection from objectivity to subjectivity and the intermixing therein.
3. The expansion of BVP from selection only to include a preplanning/quality control element.
4. The further expansion of BVP to include selection, QC, and a performance information environment.

3.1 Phase I of BVP Development: Selection Best Value Procurement Process

The research identified that to obtain high performance and best value (BV) the performance based environment must be formed (Kashiwagi, 2004). This is where performance and competition are high (Quadrant II in Figure 1). The best value environment was defined as having the following:

1. Performance information (PI) (e.g. for roofing, PI includes maximum proven service period, average service period, number of roof installations in the reference sample, warranty value (the maximum warranty value cannot be greater the maximum proven service period), percentage of roofs that leaked, percentage of roofs that never leaked, percentage of roofs that still leaked, number of times the roof was maintained per year, and customer satisfaction of the roofing contractor and roofing system).
2. A brief description of the difference in value being provided by the contractor/manufacturer.
3. Method to prioritize the best value contractor (based on price and performance). The prioritization was performed using the DIM to prioritize the alternatives.
4. Updated performance rating of the best value roofing contractor and manufacturer after they completed the project.

This was the first BVP system (Stage 1 Best Value Procurement Development). The major emphasis was selection: to select the best performing roof contractor based on price, documented past performance information, and difference in functional value. The best value contractor would then provide their own specifications including the functional value (pseudo-design-build). This process was run on 171 roofing procurement tests from 1994 – present. The best value selection model highlighted the use of past performance information to identify the best value contractor. The process was also used on storm damage repair, modification of facilities, and new construction. The aim was to differentiate vendors during the selection process. Past performance information was critical to the process, and much effort was required to compile the PI. The contractor’s ability to identify the project risks before contract award and the key personnel’s ability to understand construction risk was also important. PBSRG research mirrored efforts in the industry that focused on performance based requirements in the selection of performing contractors. However, the use of the selection-only-based BVP process did not eliminate all performance problems.

Tests identified potential flaws in BVP. The tests emphasized that selection without a structure to force quality control and the management of risk during construction. From the research, major BVP tests have resulted in the following results:

1. Federal Aviation Administration (FAA) Western Region: the best value process allowed for twice the amount of storm damage repair work to be procured. However, due to the lack of real time documentation during the projects, the process was unable to decrease the contract administration’s workload, which minimized the value of the process and allowed the FAA contracts office to end the process.
2. State of Hawaii: a new political party was elected affiliated to a political constituency that did not favor the awarding of projects based on price and performance. This political party stopped the BV process by forcing the best value initiators out of the organization. The BV process did not have a structure that: forced the contractors to practice quality control, minimize risk, and measure and document performance and nonperformance (Kashiwagi and Savicky, 2002).
3. State of Utah: general contractors who were leveraging subcontractors and acquiring projects based on relationships/reputation, opposed the nonbiased BV selection process and measurement of performance in terms of minimizing change orders, on-time, and meeting client’s expectations, and changed the objective based selection process back to a

subjective, relationship based selection process. The BV process was stopped due to the government's mistake in thinking BVP was based solely on selection, and did not understand the importance of the contractor preplanning/quality control, the measurement of performance during the project, and the management of risk and contract documentation/administration by the contractor (Kashiwagi and Byfield, 2002).

4. State of Wyoming: the procurement office resisted best value procurement due to the misunderstanding that BV was a selection process.
5. State of Georgia: project managers thought the process was only a selection based process and tried to manage the projects in a bureaucratic price based environment. They did not realize that they had to change their delivery environment to a BV environment.
6. US Coast Guard Western Region Procurement Office: discontinued the process due to their inability to fit the Performance Information Procurement System (PIPS)/BV to the Federal Acquisition Regulation (FAR). The procurement office used the rationale of the "low price competitive range" instead of determining the BV based on performance and price. The authors propose that this confusion was due to an unclear methodology that compares value in an objective manner, before a subjective decision is made by the procurement officer (as required by the FAR).

PBSRG researchers propose that the main obstacle to clients grasping BVP is the lack of a clear definition (minimizing the need for subjectivity). Most clients seem to understand that BVP (Commonwealth of Pennsylvania, 2006; Palaneeswaran, 2000): is not price based, allows the client to identify value, leaves "the how" and the construction to the vendor. On the other hand, clients do not have a clear understanding of (Vann, 2001; Calder, 1997): how to justify awarding to the best value, how to create the BV environment where the contractor performs quality control/minimization of risk and the client does not manage the contractor, how to minimize the risk of nonperformance once the BV contractor is awarded the project, and how to force the best value contractor to think in the best interest of the client.

3.2 Phase II of BVP Development: Subjective Selection and Justification Based on Objective Performance Information

As the research evolution continued, it was proposed that a best value award should collect objective information, but use it subjectivity (meet the client's definition of value). Deming (1982) stated that the client identifies value. Even though the client is unable to explain their decision in terms that everyone will fully understand, the client can explain their subjective decision based on price and performance. The methodology of BV is shown in Figure 2. The authors uses the terms objective (what can be measured by a person with knowledge) and subjective (what people will disagree upon based on their perception of limited information) and propose that objective and subjective are opposites. Thus, if a client/buyer is trying to use objectivity, they are trying to minimize any subjectivity or decision making. Therefore, the objective portion of BV selection should minimize: decision making, assisting any option to score higher if the preponderance of information does not dictate a differential, and changing the value of any number that is already an objective number.

In consideration of objectivity, if the selection committee members for BVP must make a decision (use their subjectivity) in evaluating proposals or some criteria, they should instead rate the alternatives the same, and move to the next phase. Conversely, if the alternatives (or proposal(s)) are relatively outstanding they should be rated a 10, if relatively very poor, a 1, and if the rater does not know if a proposal or criteria is relatively better or worse than another submission then they should be rated a 5. If alternatives look the same in past performance information, identification/minimization of risk and the ability to accept/minimize risk, the authors propose that the options are not inherently different, and the award should be made on price. BVP transfers the risk of justification of BV to the contractors, and should not force owners to make decisions (accept risk). After the risk report and interview of key personnel are rated, all three factors and price are used to prioritize the alternatives using a linear matrix and a risk matrix decision models. The prioritized order of the alternatives and the raw data are then given to the decision makers.

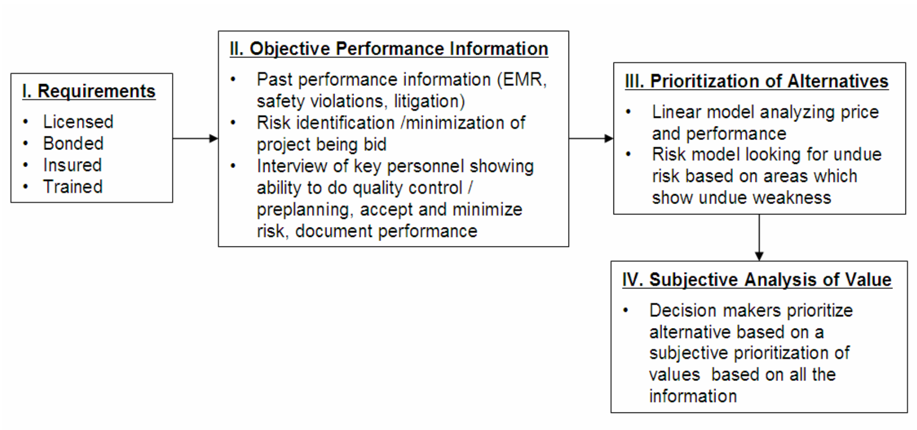

Fig.2. Methodology of Best Value

Once the alternatives are prioritized, the client's selection group must make a subjective identification of the best value (level of performance for the best price). Figure 3 proposes a process with the different options:

Option 1: if the risk and linear models both select the same vendor as the best value, the subjective decision is probably to award to the alternative based on being the best value and the lowest price. The subjectivity is minimized due to the overriding documentation of best value.

Option 2: if the best prioritized value is not the lowest bid, however if it is within a preset range of the average or next best value's bid, the best value can be selected with the rationale of the selection group being justified with the performance information.

Option 3: if the prioritized best value from the two models is different, the group can analyze the information and pick the best value with their justification made from the performance information.

Option 4: if the prioritized best value is over a preset amount over the next prioritized best value, and the selection group cannot agree on the added documented value of the best value, the award goes to the next prioritized best value with the lower price. The justification is that after prioritizing the alternatives based on the objective of best value for the lowest price.

This change in the best value process from the prioritization models (e.g. DIM) deciding the best value to allowing the contracting officer or selection committee to subjectively select the best value based on performance and price allows the more bureaucratic agency procurement agents to make a decision. The BVP process was changed to allow this after repeated testing found that if the objective performance data is used to prioritize different alternatives, rarely does a subjective decision override the objective prioritization. The authors propose that testing has shown that most government agencies are not comfortable replacing their decision makers with models. Also, the decision making identifies when the best value cannot be justified due to a large differential in cost, protecting the client against political criticism.

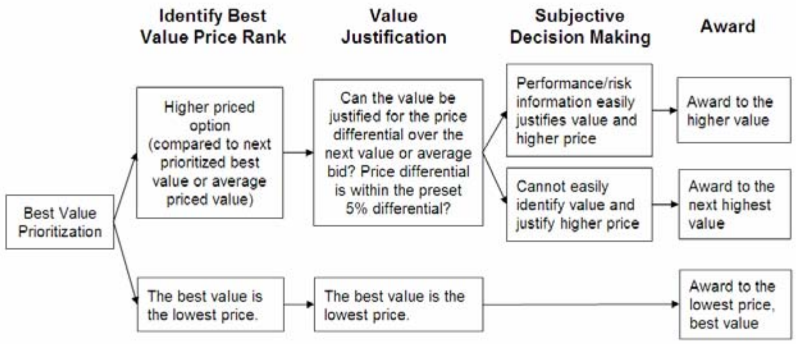

Fig. 3. Subjective Identification of Best Value

3.3 Phase III of BVP Development: Quality Control/Preplanning

One of the problems identified in the testing of best value procurements is that client professional representatives do not understand that BVP is an outsourcing, leadership based process, and not a technical relationship with a contractor (See Figure 4). The selection of the best value contractor requires a change in function of the client's technical representative.

The change in function does not end with selection. Under the continually refined best value process, once the best value contractor (BVC) is identified the process is not complete, but instead the contractor moves to a pre-award or clarification period. The BVC is given the following:

1. All contractor identified risks.
2. Any concerns from the client's professionals.
3. Requirement or specifications that the bid is based on.
4. Any statements made in the interview.

In the evolved process, the contractor is required to generate a quality control (QC) plan. It includes a schedule and a list of risks (made up from the above four items), and a prioritized list of risks and actions to minimize the risks. The QC plan is an internal document for the contractor to be proactive to minimize risk of items that they do not control. The contractor may have a plan to minimize the technical risk that they do control, but that is already controlled by the general conditions and technical requirements of the specification. A quality assurance (QA) checklist that is signed and dated every week of the project is also developed from the QC plan. The QC/QA program becomes a part of the contractor's contract. The authors propose, and preliminary results show, that if a contractor: meets the legal requirements of the client; is selected based on value; has key personnel who have the experience to accept and minimize risk; provides a proactive schedule and QC plan that is inserted in their contract and its performance rating is documented, the risk of nonperformance is severely minimized (US Army Medical Command, University of

Minnesota, Arizona School Facility Board, Nadaburg School District, General Dynamics, City of Miami Beach, State of Missouri, Baptist Health, and City of Peoria projects).

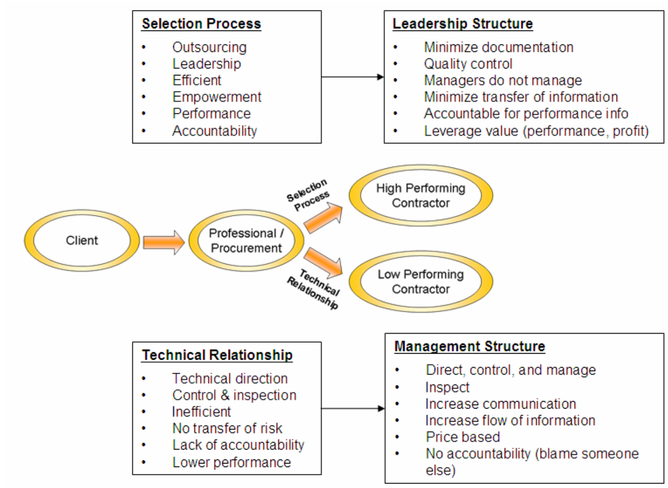

Fig. 4. Technical or Outsourcing Relationship with Contractor

3.4 Phase IV of BVP Development: The Information Environment

The latest development of BVP is the performance information environment that measures the performance of not only the contractor but also all participants who bring risk to the construction project. The main mechanism is a weekly risk report that identifies both unforeseen risk and risk that the contractor does not control, but attempted to minimize using the QC plan actions. If a pre-identified risk happens it is reported on the weekly. The contractor then documents on the weekly: the cause of the risk, actions already taken, resulting action based on the QC plan, and additional cost, time, and quality implications of the risk if not corrected according to the pre-approved contractor proposed plan. If the plan does not happen, the client is responsible for the cost/time ramifications. The weekly report also measures all participants in terms of time, function, and performance. Because the weekly protects the contractor by identifying risks that the contractor does not control, and it is easy to determine if they have implemented their QC steps to minimize the risks, the weekly report holds the participants accountable to not become risks to the project. Figure 5 shows the schematic of the QC/QA program, the weekly report, and the information system that will identify relatively risky projects for a client's PM/CM group.

The Performance Information Environment (PIE) is updated weekly and does the following:

1. Measures the ongoing performance of all projects of a client: project managers, inspectors, plan reviewers, and contracts personnel based on performance of the projects (on time, on budget, number of change orders, change order amounts, client satisfaction with risk minimization).
2. Measures the performance of client's professional representatives based on the projects they are participating in.
3. Measures the relative performance of all contractors.
4. Measures and identifies problems in the process based on cost and time.

The PIE is theoretically built on the principles of the best value environment. This system is currently being tested at the US Army Medical Command, University of Minnesota, Entergy Power Company, City of Peoria, and City of Miami Beach.

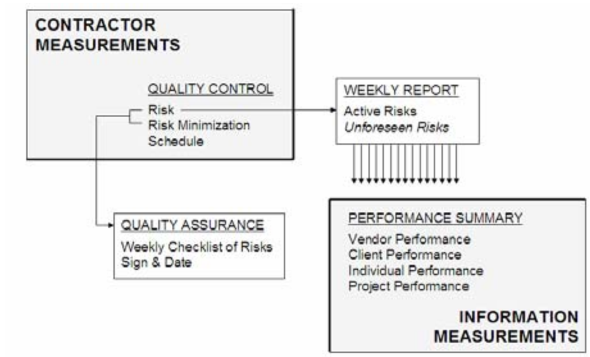

Fig. 5. Performance Information Environment

4. Conclusion

BVP started off being a selection process. The best value process encountered political/legal opposition due to the change from low bid awards and the legal constraints of government groups. The selection/justification of the best value was modified to include subjective decision making of contractors based on objective performance information. The third significant development was the implementation of the quality control/preplanning phase. The fourth significant development was the performance information environment that forced the identification and minimization of risk that the contractor did not control by participants in the delivery process. The PIE identified what the contractor is responsible for, what they are responsible to minimize the risk of, and who is responsible for the risk. The information system also measures all participants who bring risk, thereby not only identifying the accountability of the contractor, but all participants. The contractor documents the risk, because it is in their best interest. By being assigned to minimize the risk and document the risk, the risk is transferred to the contractor. Continuing research is investigating the performance of all the mechanisms of the best value delivery system.

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Procurement Impacts on Construction Supply Chains: UK Experiences

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Abstract: SCM has long been advocated as a means of improving the performance of supply chains in construction. SCM can be defined as a network of different organisations, linked upstream and downstream in a chain, aiming to produce quality and value in the services and products for the end consumers through integrated processes and activities. The drive for SCM has frequently come from the public and private sector client base. With one of the purposes being to achieve increased levels of integration of the whole supply chain, the industry has had to respond to drivers embedded in the changed procurement arrangements that have been implemented. This paper reports on an investigation into the impact of changed procurement systems on supply chain firms in the UK. It will discuss different initiatives by clients and by the UK government in order to drive some form of supply chain integration..

Keywords: Construction industry, Procurement driving change, Supply chain integration, Supply chain management

1. Introduction

SCM has long been advocated as a means of improving the performance of supply chains in construction and as a means of making a more effective and more efficient industry. The main reason for the advocation of this philosophy was the successes within other industry sectors. However, the drive for SCM has frequently come from the public and private sector client base. With one of the purposes being to achieve increased levels of integration of the whole supply chain, the industry has had to respond to drivers embedded in the changed procurement arrangements that have been implemented. This paper reports on an investigation into the impact of changed procurement systems on supply chain firms in the UK.

SCM can be defined as network of different organisations, linked upstream and downstream in a chain, aiming to produce quality and value in the services and products for the end consumers through integrated processes and activities. In order to achieve the optimised level of integration of the whole supply chain, the industry has responded in various forms. This paper will give an overview of what is being done in general and specifically within the construction industry to support the integration of supply chain.

Saad et al. (2002) argue that the construction industry has moved to the adoption of SCM philosophy, without having benefited from earlier philosophies in other industry sectors such as Just-in-time, Total Quality Management, and Concurrent Engineering (Khalfan *et al.*

2001). In other words, features from the above mentioned philosophies have become part of the current practices of the construction industry because of the adoption of SCM which lay the foundation of integrated construction supply chains. One of the features of the integrated construction supply chain is that they are centrally coordinated and the relationship between firms is maintained for the duration of a specific project and beyond. These chains are not only directed towards the minimisation of transaction costs, but also towards the enhancement and transfer of expertise between all the parties (Vrijhoef and Voordijk, 2003). This paper will review the literature related to the construction supply chain integration; efforts in the form of current reports; industrial practices in order to achieve supply chain integration within construction industry; and will also give a brief overview and initial findings of a project undertaken by the authors at the SCRI Research Centre at University of Salford.

2. A brief review of Supply chain management in construction

In the construction industry, an increasing number of construction organisations have started showing a realisation of the importance of SCM concept (Akintoye et al, 2000; Vrijhoef and Koskela, 2000; Dainty et al 2001a). However, unlike the retail and manufacturing sectors, the construction industry has been slow and reluctant to employ the concept of SCM (Love, 2000). According to Ofori (2001) by using a SCM philosophy, various problems associated with the traditional practices in the construction industry can be resolved. These problems may arise due to the presence of win-lose arrangements,; uncertainties encountered by various construction processes; lack of exchange of information and knowledge; increasing price competition due to the purchases of supplies from numerous suppliers; and the existence of environment of fear, dishonesty, and frustration (Asad et al., 2005).

Proverbs and Holt (2000) advocate the use of the SCM philosophy as a mean to effectively reduce the overall construction costs. They advocate early involvement of subcontractors and suppliers in a manner similar to the early involvement of the contractor during the procurement process. According to them this would give an opportunity to the concerned parties to offer their expertise which could result into potential cost savings and can become a stepping stone in improving two way communication among the collaborating partners. On the other hand, Dainty et al. (2001b) have stressed the need to facilitate inter-firm relationships, achieve mutual benefits, and build trust among key interfaces in the supply chain. According to them it is crucial to take away the deep-rooted barriers of traditional relationships and the adversarial culture, and instead, introduce a change management framework to facilitate the implementation of supply chain management at the operational level.

Tan (2001) on the other hand has identified the key drivers towards a fully integrated supply chain. According to him, these drivers may include; changes in the corporate culture, trust and communication among all the parties involved, information/knowledge sharing, suppliers' evaluation for supplier development process, and sharing common goals of waste elimination and increased efficiency. Dainty et al. (2001a) have suggested changes which are required to make supply chain integration more effective. These changes include developing trust between parties; ensuring fair payments; early involvement with projects; educating the construction workforce; improving communication skills; knowing the operations of other type of organisations within construction supply chain; knowing the benefits of supply chain integration and partnering; understanding new contractual documents; client and main contractor organisations accepting that sub-contractors can bring added values to the construction project delivery process; and willingness to share knowledge.

Barratt (2004) proposed a 'collaborative culture' for enhancing integration and improving collaboration among the supply chain partners within the construction industry. He opined that the collaborative culture is made up of number of elements including; external and internal trust; mutual pain and gain, information exchange in the supply chain, transparency and quality of information flow, communication and understanding, effective cross-functional activities and process alignment; joint decision making; use of measures to assess the performance of the whole supply chain, commit resources at the early stages of project development process, intra- and inter-organisational support, corporate focus on SCM, demonstration of a business case for collaboration, and a notion that collaboration does not need to be based on technology. One of the ways to bring collaboration and integration within the industry is through aggregating the supply and demand, which would result into enhancing the collaboration among the construction firms. This will be discussed during one of the later sections.

3. The impact of changing procurement systems on supply chains

This Section describes a research project, that seeks to explore and explain the impact of the changing procurement systems, of both public and private sector clients, on the behaviours of firms in the construction supply chain.

In the UK the NAO (NAO report, 2001) has endorsed the public sector moves away from lowest cost and adversarial approaches towards the newer forms of procurement. In particular, it calls for the entire supply chain, including clients, to be integrated. Through *Achieving Excellence* (HM Treasury, 1999), the Government had already committed all government departments to:

- To work with industry to reduce waste in all aspects of construction procurement and management;
- To enter co-operative relationships with their suppliers to ensure an open and mutually productive environment, and
- To ensure an integrated supply chain.

Building Down Barriers (Holti et al., 2000) has investigated the Ministry of Defence *Prime Contracting* procurement policy. While concerned with project specific partnering, it suggested that there was some anecdotal evidence that the members of the successful project teams had kept together and moved on to other projects with other clients. Building Down Barriers (BDB) was unable to follow this through to examine the form of relationships and the exact benefits that were flowing. However, BDB suggested that the effective configuration of long-term supply chains might be different for different kinds of construction. Further, this would suggest that appropriate models of supplier development, commercial relationships and agreements are needed for the different circumstances. This demands a contingency view of supply chain integration.

The conflict between the process of market liberalisation and the development of effective and efficient industries is a common phenomenon. Many researchers have argued that procurement systems should be appropriate to the circumstances - not only to the client's circumstances but also to the circumstances of the industry. For example, Martins and Taylor

(1996) in the context of the New South Africa, argued that they should encourage appropriate, people intensive technology and processes, and also open the way for learning and skill development. In these circumstances the procurement process assumes a greater status than it is normally afforded. This overseas example serves to emphasise the need in the U.K. context, not only "to consider current procurement and contractual relationships".... but also ...."to examine the structure of the industry" - which was actually the original brief referred to by Sir Michael Latham (Latham, 1993).

This project was timed to investigate the changes that are occurring in the supply of consultancy and contracting services in response to client procurement initiatives.

3.1 Aims and objectives of the project

The main aim of this research proposal was to determine if there are ways of integrating the supply chain that will ensure service and product quality whilst still supporting the government and client initiatives, aimed at increasing the competitiveness of the construction sector. Specifically this project had the following objectives:-

- Identify current international and national best practice in supply chain integration;
- Reveal the *critical success factors* for the establishment of effective and efficient supply chain integration – the behaviours/ responses to the new means of procurement made by successful firms in innovative supply chains. How successful firms are coping – through individual and corporate responses – (change programmes/change agents, training, alliancing, merging, new ventures etc. will be revealed);
- Test the proposition that the effective configuration of long-term supply chains will be different for different kinds of construction;
- Produce a contingency model of supply chain integration (which would lead to appropriate models of supplier development, commercial relationships and agreements for different circumstances); and
- Best practice guidelines for supply chain members to determine appropriate forms of relationships in response to the needs of different clients and produce best practice guidelines for clients and other members of the supply chain to determine appropriate forms of relationships in response to the needs of different clients.

3.2 Methodology

Literature reviews and semi-structured interviews have been completed that explore the changes that are occurring throughout the supply chain. The immediacy of the need for information to feed the client, firm and institutional policy development only serves to emphasise this. Four case studies of construction projects have been conducted.

4. Case studies

The case studies attempted to uncover the perceptions of firms within the construction industry with regard to the existing partnering arrangements they currently undertake. The research used multiple methods to collect qualitative and quantitative data. Basic quantitative data and company documentation were used to provide research context while qualitative data, collected in the form of a number of unstructured interviews, sought to understand how innovative procurement was viewed by different supply chain partners. The case study approach followed the protocol developed by Yin (1994) in order to improve the validity of the research. As a result, the research included a number of key elements such as clear and concise research objectives, research propositions, case study selection criteria, unit of analysis, a structured questionnaire, unstructured questionnaire for interview, a predetermined case study procedure, and an interview guide (Yin, 1994). The study involved multiple visits to each organization involved, including an average of three interviews with the Managing Directors of these companies and other staff and a few other interviews with their supply chain members in North West of England. All interviews lasted for at least 1 hour. An assumed name for each company has been adopted for the purpose of confidentiality, when reporting the case studies. Since, all four case studies are being analysed when this paper is written; therefore, the conclusions present here are based on findings to-date.

The senior management of each of the above-mentioned organisations was interviewed. Soft System Methodology (SSM), along with case study research method, was used to analyse the interviews, used for organisational analysis. For the social and organisational aspects, the research draws on contextually rich modelling techniques of SSM (Checkland, 1981) with its emphasis on a stream of cultural analysis within construction organisations, and the industry overall. The SSM is selected because the research is dealing with the softer social issues and phenomena such as changes in the behaviour of people and companies in response to the changed in procurement routes. The whole idea to adopt soft system methodology to carry out this qualitative research revolves around the advantages of using SSM. Once the interviews were carried out, the rich pictures were developed and these pictures helped the researchers to identify the issues and areas which have been affected by the change in procurement strategies. The root definitions and CATWOEs were then developed from the rich pictures which helped us to understand the transformation of past situations and circumstances to the present scenarios. Some of the results are reported in this paper as observations of changes due to the innovative procurement, and motivational issues affecting the adoption of innovative ways of working.

5. Findings

Only two of the four case studies are reported here as data analysis was still under way at the time of writing. Therefore, the conclusions presented here are based on findings to-date. The first case study explores the initiatives taken by a public sector client to motivate main contractors and their supply chain participants to adopt innovative ways of working within a project team. The second case study examines how a group of Local Authorities (LAs) and Registered Social Landlords (RSLs) aggregated their demands, under a motivated leadership, which resulted in cost savings and economic growth of the region where it is based.

5.1 Case study 1

The first case study was involved a public client - a local council, that had developed a Framework Agreement to construct educational buildings (primary school in the first phase) in the value range £500,000 to £5 m. For this client-led innovative and new way of developing educational infrastructure, three Constructor Partners were appointed in 2004 for three years initially. Since the appointment, a number of educational projects have already been delivered, some recently started, and some of them are in the early stages of design.

Benefits from the Innovative Framework

The core values of the framework agreement, that are based on the partnering concept, agreed by the client and all other participants, include: Trust; Honesty; Openness; Commitment; Co-operation; and Respect. The council's vision is that this framework agreement will deliver good quality school buildings that will lead to:

- Better educational results;
- Greater inclusion within the community;
- Better safety and environmental performance; and
- Reduced demand on future school budgets by addressing whole life cycle costing at the inception of the projects (Khalfan and McDermott, 2006).

The major benefits are being and would be achieved in the following broad area by adopting the strategic partnering framework for the development of Primary Schools:

- Improved design;
- Less waste and duplication;
- Improved delivery;
- Greater quality;
- Greater certainty of cost;
- Better whole life cycle costing;
- Building of trusting relationships; and
- Bringing of all "project knowledge" together at the inception of a project.

Examples

The council has changed the mechanism of selection for contractors and sub-contractors. It used to be the case that small companies were rejected based on their turnover. Now the turnover figure is not used as part of the selection criteria and is considered afterwards when the percentage of the work is being allocated. Therefore, those companies, which used to be left out (specially the SMEs) because of their small turnover, are now able to pass through the initial two-stage selection process of the council, and then they are awarded work which is equivalent of 25 % of their turnover (irrespective of how much it is!). On the other hand, the selection is now moved from traditional to Quality-Price Mechanism. The council uses 70% - 30% respectively for the selection. The council also uses a specific quality and performance criteria to select the companies for the framework agreement during the selection process.

5.2 Case study 2

In the North West of England, an initiative by a group of local authorities and Registered Social Landlords has resulted in the formation of an organisation which procures on behalf of the partners involved for social housing renewal within the region. The initiative has adopted the idea of bundling/aggregating the present and future demands of different client organisations, as mentioned earlier in this paper, and putting them forward into the market to get the best price from the sub-contractors and suppliers in return for certainty of continuous workflow. The organisation operates in such a way that it has two separate agreements, one with the contractors and installers to supply labour only and the other with the suppliers and manufacturers to supply products and material only. They are also involved in skill development of the local labour with an agenda of the economic and social sustainability of the region in parallel with achieving hard environmental targets.

Benefits from aggregation

As discussed above, the bundling of demands by the local government and initiatives by central government departments have raised awareness and now more and more companies, especially SMEs are collaborating and offering their services as a package, as a supply in response to the demands. Other benefits seen within the case study, which are in addition to the benefits highlighted through aggregation earlier, include

- Direct and continuous employment, and subcontracting opportunities offered by the contractors to the local labour because of continuous work load for both, their own employees and other subcontractors.

- Skills development within the local community through Apprenticeship and Training schemes. Contractors have to take on board trainee and give them both on the job training and flexibility for attending colleges.

Examples

This section reports some of the examples from the best practices being implemented by the supply chain involved:

- Even for subcontractors (self employed people hired for labour only by main contractor), continuity of work is given. Other attractions include prompt payment (one week); PAYE (Pay as You Earn) paper work done by the contractors; they do not have to incur tender costs because they get to know upcoming work around 12 months in advance.

- The people working on site (both direct employees and subcontractors) are trained in the underpinning concepts of the working arrangements. This includes the understanding about the partnership among the local authorities and Registered Social Landlords and their initiatives to encourage apprenticeships.

- One of the supply chain partners describes the relationship; 'The relationship of suppliers and contractors is changed because there is no money involved between them!' This is because the whole procurement is open book.

- Another supply chain partner sheds light on the benefits as; 'Since RSLs are working together in one area, therefore, there are no conflicts and no problems in getting the material. If they were working against each other, then contractors would be fighting among and with suppliers for material supplies.'

- Work-force smoothing - a simple management concept is now being practised within the supply chains associated with the framework, for upcoming years.

- The power to select the product and allocate the profit margin is shifted from contractors and moved to clients. But on the other hand, there is also a guaranteed profit to all the involved supply chain partners for a longer period of time.

6. General Conclusion

To-date, the results from both case studies are showing savings in time and cost. To maintain the momentum of these gains there must be a continuation of the positive attitude amongst the partners in sharing their knowledge and experiences on future projects. By this approach, further benefits will be passed onto the client and end users. At this point, there is a positive approach by all partners to take the unthought and innovative approaches forward to achieve its targets. All the partners in the supply chain are committed to the innovative ways of solving problems, and new methods of working with each other as an integrated team. The supply chain partners in both case studies are highly motivated to the framework agreement because of the continuity of work, agreed profit margin, long- term relationship with client and other supply chain members, and recognition of their quality services in response to the invitation to work with the clients, fully subscribed to innovate the processes related to procurement and supply chain integration within the construction industry. Money saving through reducing cost is another motivating factor for being part of such framework agreements especially for main contractors and subcontractors. One of the biggest cost reductions is achieved through not incurring cost in tendering for jobs for the same client for a period of say 3 – 5 years.

7. Summary

This paper presented two case studies, showing how different organisations established their procurement processes on innovation, and innovative thinking in management and integration of their supply chain, once unthought within the construction industry. The case studies reveal the role of the client organisations in introducing the innovation procurement and role of these unthought initiatives to integrate the supply chain participants within the construction industry.

The findings have also revealed some of the factors underpinning the motivation of those companies working within the new procurement environment, including both the client and contractors. This includes the continuity of work for both the contracting companies and their supply chain partners; transparent and open book accounting system which give added value to the clients; long term relationship among all the supply chain partners; definite profit margin for a longer term period for the contracting organizations; visibility of the future work with the existing clients; over all growth of companies involved in terms of turn over and profit margin; job security for directly employed people by sub-contractors; recognition as forward thinking contractors and clients within the UK construction community through news and presentations; training for staff employed by these companies as part of their skill enhancement programme; and self – satisfaction from the quality work done and services provided.

Teams play an important role in the success of any project, and the consideration of teamwork, resulted because of innovative procurement initiatives was seen as a significant motivating factor by all the companies interviewed as part of the case studies presented. It can be suggested that effective teams resulting from innovative procurement strategies can lead to increased output, greater creativity, increased work quality, and higher morale among the group members (Schermerhorn et al., 1994; Vecchio, 1995). The case studies also offer learning opportunities for other construction organisations seeking to establish innovative procurement strategies in order to integrate the supply chain and would be able to gain courage to introduce unthought innovations within their activities. There is also a need to report on the findings from all the cases at the end of the project, which would reveal the in-depth and holistic view about the changes occurring in general due to innovative procurement within the industry on one hand, and would also give perspectives of different participants involved within the construction supply chain.

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Contracts and production

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Abstract: It is argued that a change in the prevailing theory of production is also influencing how contracts, especially in construction, are being conceived. It is contended that the theoretical shift in question, both in production and contracting, concerns the metaphysical presuppositions of respective theories. This claim is further justified through a critical analysis of how risks and collaboration between parties are considered in conventional contracting.

Keywords: Contract, Production, Theory, Risk

Introduction

It is well-known that in many countries, the construction industry is not viewed to provide adequate service to its customers. This situation has led to a broad search of novel operating methods, covering, for example, contractual strategies and production management models. However, it has turned out that renewed contractual strategies, even if marginally superior, often do not provide the benefits wished. Correspondingly, it has been realized that renewal of production management often collides with the conventional contractual strategies in use.

Here, it is contended that the current change in how production (broadly viewed, i.e. design included) is understood is – and has been - leading to a reconsideration of contractual arrangements. A fundamental explanation of this impact, which, at the root, is related to the coherence of metaphysical presuppositions in the theories of production and contract, is offered. This explanation is further illustrated through two issues which in conventional contracting have proved to be problematical: risk and collaboration between contract parties. Further illustration is given of the search for coherence between contracting and production management in the form of a practical case.

1. Changing theory of production management and contractual arrangements

The conventional theory and practice has considered production as transformation of inputs to outputs, intermediate or finished products (Koskela 2000). The total transformation can be decomposed into smaller transformations, until such tasks are encountered that can be assigned to employees or subcontractors. The total cost of transformation can be minimized by minimizing the cost of each decomposed part of it.

However, this transformation theory has increasingly been challenged by two other theories (Koskela 2000). The flow theory focuses on what happens in the time line. It emerges that there are two sorts of activities in production: transformations but also non-transformation stages, which are called waste. The elimination of waste is the primary prescription. The Toyota Production System and its derivatives are based on this theory. In turn, the value generation theory focuses on the process starting from customer requirements and ending at the fulfillment of those requirements through a product or service. The realization of the best possible value is the prescription of this theory. The quality movement has been based on this theory.

In practice, the methods based, mostly implicitly, on the flow theory and the value generation theory have proved to be superior in comparison to conventional methods based on the transformation theory. However, the switch to these new theories has been relatively slow.

One possible explanation for the slow uptake of the new theories is related to the difficulty of conceiving and overcoming the metaphysical difference between old and new theory (Koskela & Kagioglou 2005, Rooke & al. 2006). The transformation theory is based on thing metaphysics, which sees the world consisting of atemporal, discrete things. In practice, this is reflected in the view that production is a sequential execution of independent tasks. Instead, the flow theory and the value generation theory are based on process metaphysics, which conceives the world as consisting of temporal, indivisible processes. In practical terms, this is mirrored in the view that the best results, regarding both waste and value, are achieved through collaboration across tasks, as they are held as being interdependent.

The production theories are silent on how production is initiated or maintained and how the different inputs to production are acquired. Instead, these aspects are addressed, for example, by the theory of firm and the theory of contracting. Here, the focus is on contracting.

The conventional theory of contracting sees a contract as focusing on a bargain (Cheshire et al. 1996), i.e. a transaction. However, Macneil (1974) interestingly questions this view:

> A transaction is an event sensibly viewable separately from events preceding and following it, indeed from other events accompanying it temporally – one engaging only small segments of the total personal beings of the participants. Only this separability permits such a clean and clear definition of contract […]
> But is the world of contract a world of discrete transactions so defined? Or is it a world of relation, an ongoing dynamic state, no segment of which – past, present, or future – can sensibly be viewed independently from other segment. Is it a world entirely of segmented personal engagements, or is it one tending to engage many aspects of the total personal beings of participants?

Based on his critical examination of transactional contracting, Macneil (1974) defines and expands the concept of relational contracting. The dividing line between these two forms of contracting is whether the contract is viewed referring to an independent event or to an ongoing relation. It is easy to note that transactional contracting, as defined by Macneil, is based on thing metaphysics, whereas relational contracting is based on process metaphysics.

Thus, transactional contracting is metaphysically coherent with conventional production theory, and of course has been part and parcel of conventional production practice. However, this coherence cannot rectify the idealization errors of both the transformation and the transaction concept, which in practical application generically cause counterproductive results (Koskela 2000, Koskela & Kagioglou 2005). In a nutshell, purchasing is an inappropriate conceptualization of the contracting process, which in construction is rather dedicated to the design, formation and operation of the production system (Koskela & Ballard 2006).

In turn, relational contracting seems to be metaphysically coherent with new production methods based on the flow and value generation theories. That relational contracting supports such methods in practice is increasingly accepted (Ballard & Howell 2005, Cullen et al. 2005, Colledge 2005, Owen & Howell 2005).

The broad conclusion of this brief analysis into fundamental presuppositions of contracting and production is thus: The shift towards new theory of production is associated to a shift towards relational contracting. To further justify this argument, two central and interrelated issues in contracting, risk and (aversion to) collaboration, are considered.

2. Risk and collaboration in conventional contracting

The traditional contract essentially defines the two sides of a transaction: the deliverable and the compensation. In construction, the ultimate deliverable typically is described either through drawings and specifications or requirements, while compensation is monetary. Thus, both sides are predetermined as fixed things. From this outset, there are two derivative issues that play a major part in the formulation and implementation of conventional contracts: risks, and independence of the contractor.

In conventional contracting, the allocation of contractual risk to different parties is seen to be of central importance (Murdoch & Hughes 1996, Cox & Thompson 2006). Risk is usually understood as exposure to a proposition of which one is uncertain (Holton 2004). There are thus two essential components: exposure and uncertainty. It has to be noted that the very procedure of predetermining the price, i.e. proposition, creates the risk, as the future is genuinely open and uncertain when the price is set.

The conventional (construction) contract defines the delivery of the completed building (or other facility) at a given date as the one side of the transaction. The question is not about an employment contract, based on which the employer (owner) could give daily directives to the contractor. Rather, the underlying idea that the contractor is just responsible for achieving the deliverable at the given date, without interference from the owner during the process. Thus, conventional contracting implies great independence for the contractor, and thus aversion to collaboration.

In the following, both issues, risk and aversion to collaboration, are critically analyzed.

Risk

2.1.1 The understanding of the origination of risk is too simplistic

The underlying assumption in contractual risk allocation is that we are able to identify the risks, analyze them for their likely occurrence and severity, and respond to them (Murdoch & Hughes 1996). Indeed, there are risk causes that are straightforward, such as ground or weather conditions. In such cases, it may be possible to reliably estimate the occurrence.

However, there are unfortunate events which have a complicated process of emergence, due to many contributory causes, which may be related to acts or omissions of several different parties. Such cases are uncovered especially in accident investigations (Dekker 2005) or in claim cases where the parties are unable to solve problems and resolve disputes within the commercial contract. These cases indicate that the process of production (as well as design) evolves in a network of mutually communicating and interacting agents (or more widely: work stations), connected through material flows. Here, even seemingly small problems of communication or modest variability of material flows may accumulate to cause drastic problems or substantial delays at the project level, or, as in the case of construction, systemic productivity losses, and other problems, at the day-to-day level. Thus, failures can not necessarily be explained through malfunctioning of individual parts of the production system, but rather through the properties of the web of dynamic, evolving relationships. This is cogently formulated by an experienced project manager (Bevan 2005): "Setting aside the elements, are we our own main real risk?"

Unfortunately, the way risks are allocated in traditional contracts to different contract parties does not help in responding to this kind of emerging risks. Worse, these contracts establish "rules of the game" that reduce emphasis on solving problems at the project level or producing predictable material flows within the organizations. In this way, traditional contracts increase project risk.

2.1.2 The notion of risk ignores frequent adverse events that are predictable at the aggregate level

The term risk is used for referring to a finite amount of deviations from the baseline, having significant costs impacts. Are all risks covered by this common usage?

Obviously, taking lead from Pareto's law, we could claim that in this way, the "significant few" risks are addressed, leaving the "trivial many" aside. However, this can be challenged. Risks hit a project at many different levels. There are risks threatening the viability of the whole project. But there are also risks at the task level. Evidence for this is given when we look at the weekly plan on a site. In a normal situation, only half of the tasks or so get done during the week as planned (Ballard 1997). That cost-adding risks realize in a big share of tasks is well-documented fact. However, these daily mishaps are not conceived as risks because at the aggregate, contractual level, their cost impact is roughly predictable, and it is included in the cost baseline. The many studies into waste – as unnecessary activities or events have traditionally been called in operations management - in construction have indicated that the order of magnitude of the relative amount of waste in construction is 50 %. However, the pre-occupation with the big risks tends to leave the significant total contribution of small local failures, but overall present risks out of focus.

2.1.3 The focus merely on risk is misplaced

Avoiding risks requires an effort to prevent bad things from happening in relation to the baseline. That good things happen is the implicit assumption, actually the very baseline, represented by the description of the deliverable (or agreed price). Even if we would argue that we can reach the baseline by avoiding all bad things, it is an open question whether we can exceed the baseline just by avoiding bad things. Here, a glance to other areas of knowledge is illuminating.

The philosopher Hintikka (1989) argues that in a historical analysis, both ethics and logic have similarly drifted from the original Greek understanding of their subject matter. In the ancient Greek thinking, ethics (or moral theory) concerned the achievement of moral excellence, through various virtues. These virtues covered courage, moderation and justice (Parry 2004). However, the Victorian times saw a redefinition of ethics. According to the new understanding, a virtuous person is he who merely avoids moral errors. Similarly, logic was originally established by Aristotle as the art of interrogative reasoning. However, the advent of modern logic meant that the idea of the art of reasoning was forgotten and logic was redefined as the art of avoiding logical errors.

Based on everyday experience, it is clear that just by avoiding errors, moral or logical, we cannot achieve moral excellence or become sharp thinkers. The achievement of excellence requires also other principles and efforts than just the avoidance of errors. Analogically, it can be argued that for achieving excellence in project realization, more is needed than avoiding risks from happening, i.e. deviations from a predefined baseline. Unfortunately, conventional contracting, like modern ethics and logic, is not oriented towards enabling excellence.

It can also be noted that in any construction project, many significant improvements would be emergent, originating in the conversation among experts. Regarding design, such conversation has been called positive iteration by Ballard (2000).

2.1.4 Discussion on risk

The three fallacies related to risk were explained as separate, independent cases above. However, in all of them, the underlying cause is related to the metaphysical stand chosen:

- In the case of the origination of risk, the prevalent thing-based conceptualization allows the causes of risks being related to tasks and parties, but emergent risks, being process based, remain just invisible. These process-based risks arise when the commercial contract ignores the interdependent relationship of the parties and shapes communication systems so they serve to protect interests rather than solve problems.
- Regarding the ignorance of the frequent, small risks that are predictable at the contract level, the very nature of a transactional contract, with predetermined price (an abstract thing) leads the attention towards preventing deviation from the predicted costs, but no more.
- In view of the focus merely on risk, when both the price and the deliverable are predetermined (as things), the attention is directed away from improvements in either. Also, many significant improvements would be emergent, and thus beyond the purview of a thing-based conceptualization.

2.2 Aversion to collaboration

Why a contract should rather enable and support collaboration during the realization of contracted work than eliminate or hinder, has actually been answered above. Collaboration is simply needed for

- enabling good or excellent things to happen,

- preventing bad things from happening, and
- adjusting appropriately when they do.

Unfortunately, conventional contracting does not support such collaboration.

3. Example of new contractual arrangements stimulated by new production thinking

Already, leading clients are actively pursuing relational contracts that support waste minimization and value maximization, the intrinsic goals of new production theory. As one illustrative example, the development work of Sutter Health, a California not-for-profit healthcare provider, is briefly described, based on (Lichtig 2005a and 2005b).

Sutter Health has a construction programme of 5.5 billion US dollars to be completed by 2012. The organization has recently adopted the lean project delivery system for its construction programme. In this connection, it has also revised its commercial and contractual strategies to promote lean project delivery and to avoid constraining it. In outline, the new arrangements focus on

- Creating an integrated project team including the owner and all designers and constructors
- Creating a collaborative design environment emphasizing collective exploration of underlying requirements and possible solutions
- Joint management and ultimate sharing of financial risk
- Joint management of disputes
- Developing an incentive program that rewards overall value creation and waste reduction at the project level, rather than the individual company level.

The implementation of the new production and contract arrangements has included training, web based portal for sharing information and experiences, vendor forums, the establishment of a Lean Executive Leadership Group for industry executives participating in the programme, as well as the preparation of a new template of Integrated Agreement for Lean Project Delivery.

The crucial feature of this example is that the new contracting arrangements are advanced in coherence with wider endeavours for changing production management methods, rather than as an independent initiative. Transactional contracting for construction has caused companies to focus on individual performance without regard to the interdependent nature of their performance within the project system. This relational contract, however, focuses the attention of the project participants on these interdependencies – making them both visible and important. The contract calls for deliverables of the team's plans, developed collaboratively, to address major causes of waste in the flow of information, the development of designs that are constructible and within budget, and the reliability of the commitments made among the project performers. This impels the project team to have conversations about topics rarely considered across these boundaries.

It is also easy to see that there is a pursuit to avoid the pitfalls of conventional contracting, relating to aversion to collaboration and handling of risk. Thus, collaboration is enabled contractually (new template of Agreement), technologically (collaborative design environment, web portal, nD modeling) and socially (integrated project team). In addition, the owner is making a substantial financial investment in this preconstruction collaboration by paying the expenses of the integrated project team. The incentive program, especially, is geared towards achieving excellence in project realization by rewarding the entire team based upon project-wide success in achieving performance metrics that exceed established metrics. Joint exposure to and management of financial risk contributes to collaborative mitigation of emergent risks. The production management system, which involves the use of the Last Planner System, aims at the mitigation of small but frequent risks to the smooth progress of daily and weekly work.

4. Conclusion

It has been contended that the current change of production theory influences contractual arrangements. Thus, any consideration of future contractual arrangements must cover this change of production theory. In such a consideration, especially significant seems the resonance and synergy between new production theory and relational contracting. In contrast, the implementation of new production theory seems to be hindered by transactional contracting, and symmetrically, the implementation of relational contracting will be constrained by the use of production methods based on the transformation theory.

Lastly, it is necessary to pinpoint that even if there is new theory both regarding production management and contracting, the practical ways of theory implementation in each relevant context are often still under exploration and experimentation.

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Understanding Procurement Methods in Practice:
An Alternative Perspective

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Abstract: The aim of this paper is to propose an agency-structure perspective on understanding how procurement methods are enacted in practice. It is argued that procurement methods manifest within a complex web of interconnections between various actors and the industrial structure. As an example, this paper focuses on the interrelations between the quangos' promotions of procurement initiatives and construction firms' responses to these initiatives. An understanding of such interrelations is achieved by integrating three sources of data regarding procurement developments. First, an analysis of the industry is considered as structural forces which influence procurement developments. This knowledge will be obtained through a literature review of the industry, including the overall economic conditions, the state of the industry itself, and the nature of construction demands. Second, the business path development of construction firms is regarded as responses to procurement initiatives. The method of case study will be applied to understand how construction firms' business path is related to procurement initiatives of time. Finally, a review of quango construction reports will be undertaken. Each report's key recommendations and impacts related to procurement initiatives will be identified. The three sources of data will then be plotted onto a timeline graph in order to form a more in-depth analysis. An assessment of the three sources of data at a chosen point/s for interconnections and causal relationships would then be undertaken. It is concluded that considering the interrelations between the three sources of data will offer a greater understanding of procurement methods in practice.

Keywords: Agency structure, Business path, Construction industry, Construction reports, Procurement initiatives

1. Introduction

There are a number of industrial forces and actors, each with their own agendas, all trying to influence and shape the construction industry into what they think it should look like. At the same time there are a number of other issues to be considered, such as companies, gurus, economic issues, competition, and government policy. This research contends that procurement research is fragmented, being polarized by numerous industry constituents such as quangos, practitioners and industry commentators. Data types have already been identified as relevant in analysing types of procurement (Gruneberg and Hughes 2004). McDermott (1999) provides a coherent review of the different theoretical foundations associated with procurement whilst also arguing it is a social science. Furthermore, it is argued that only by considering the interaction between numerous constituents can we hope to inform the debate. This is done by using procurement as a lens through which to present an alternative research method for developing work.

From this introduction, this paper moves to provide some reasoning for the chosen data sources of interest; historical observations/industry commentators, past construction futures reports and case studies of practicing firms. With the relevance of these established, the paper goes on to outline a research design, embracing the data sources mentioned. From there the paper presents an example of how the future research may unfold before drawing initial conclusions.

2. An Alternative Perspective

The positions from which to view and understand procurement are numerous, ranging from 'history, sociology, economics, psychology, law and politics' (McDermott 1999). Green (1994) related procurement research towards a positivist orientation, thus tending to accord with a structural, rather than an agency perspective. When combined with the diversity of methodological approaches this means the available research findings lack cohesion. This lack of cohesion is compounded by research focussing upon different constituents within the industry, such as professional institutions (Winch 2000). The purpose of this paper is to present an argument for looking across data traditionally embedded within different perspectives to bring a greater degree of cohesion. Traditional approaches, related to competitiveness and procurement, have focused solely upon either agency or structure related to competitiveness and procurement.

Theories empathising with the structural dimension recognise the 'exogenous structural constraints' of particular contexts 'in which actors were seen as subordinate to the social system' (Whittington 1988). Theories within this dimension differ in the importance placed upon structural influences. However, they all share fundamental beliefs such as 'there are external rules and regulations governing the external world'; that reality has a 'continuing order and pattern' and they thereby seek 'to provide an explanation of what is' (Burrell and Morgan 1994). Theories empathising with the agency dimension 'celebrate agency but belittle structure'. They further embrace the notion of an 'actor's capacity for independently motivated action' (Whittington 1988). Research that emphasises the importance of agency also offers numerous different theoretical positions. However, a common aspiration 'is to understand the subjective experience of individuals'; using theories 'constructed from the standpoint of the individual actor as opposed to the observer', with 'an attempt to get inside and to understand from within' whilst viewing 'social reality as an emergent process' (Burrell and Morgan 1994).

There has of course been much debate within the construction management (CM) literature of the validity of differing research approaches, thereby echoing the 'paradigm wars' of other disciplines. Seymour *et al.* (1997) did much to initiate a debate regarding the relevance of the interpretive paradigm in CM research. In response, Runeson (1997) mobilised a robust defence of the 'scientific method'. Raftery *et al.* (1997) advocated a multi-methodology approach whereas Wing *et al.* (1998) focused on the need to match different approaches to different research questions. Irrespective of the relative merits of these arguments, the search for less polarized and more inclusive approaches continues to gain relevance. The previous section briefly outlined literature associated with competitiveness and procurement, which traditionally empathizes with either agency or structure whilst not fully appreciating their interconnectivity. It is proposed that taking a cross-sectional view across a number of different data sources may well offer an improved understanding.

There is evidence of research recognising and empathising with integrative thinking in CM literature. Loosemore (1998) combined the traditionally separate techniques of social network analysis and content analysis in order to help understand crisis management. Others have gone further, for example, Fernie (2005) utilized Gidden's (1979) structuration theory to argue that supply chain management 'does not make sense in the construction sector'. Larsen (2005) used a multi-methodology approach to generating a framework synthesizing innovation diffusion concepts traditionally embedded in different paradigms. Other recent works, which sought to empathise with an integrative perspective, include Green and May (2005) who sought to understand the 'micro arenas' and 'macro structures' related to lean construction. Harty (2005) added support to the middle ground through a socio-technical systems perspective in order to understand how innovations manifest themselves differently within different contexts during the diffusion process. Finally, Bresnen *et al.* (2005) has also exploited the structuration theory, although the focus of the work was on understanding changes in project-based organisations. It follows that a research orientation that appreciates the role of agency and structure, and their interconnectivity, potentially offers a richer understanding of the interrelationship between competitiveness and procurement than previously seen within the CM literature.

As such, the research is clearly comfortable at embracing data sources from different backgrounds, thus providing a subtle salute to the terms multi-methodology and triangulation. However, the theoretical position to be adopted for this research finds empathy with the realist school of social science. As such, we are equally as comfortable with the notion of objectively knowable entities, yet at the same time appreciate that individuals may interpret things very differently because of their own belief systems. This encourages quantitative data, derived from the assumption that social practices can be codified, calculated and consequently measured. Similarly, it accepts that actors can interpret the reality they encounter in very different ways and the reality is often reflected through discourse.

3. Procurement Enacted in Practice

Building upon the notion of agency-structure, it is clear that procurement is influenced, yet also influences many elements within and beyond the UK construction industry. In order to clarify this, a hypothetical example is presented below (See Figure 1). This demonstrates the structural forces present within the industry (the outer bubble), the many numerous actors (each potentially with their own agenda), the interaction between them and the potential influence this may have upon procurement.

Clearly, how procurement is enacted may also influence the various actors and even the broader structural forces within the industry over time. In this paper we begin solely by building a case for looking across the structural forces (industry commentators), the firms and the quango initiatives (construction reports).

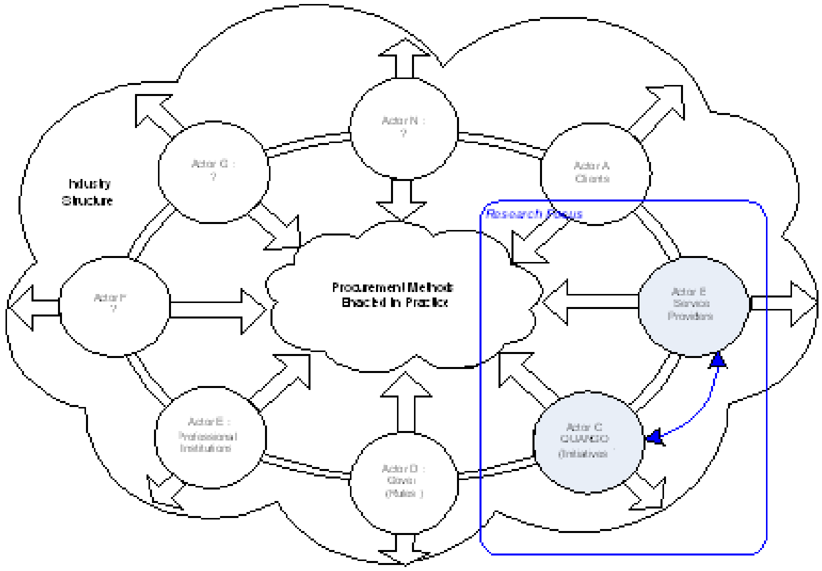

Fig. 1. An agency-structure perspective on procurement methods in practice

4. Three Sources of Data regarding Procurement Developments

4.1 Review of Construction Reports – Procurement Initiatives

Numerous reports on construction have been published by governments in the past in order to try and exhort the industry to perform better. For example, Langford and Murray (2002) have reviewed the reports published between 1944-1998 (e.g. The Simon Report in 1944, The Latham Report in 1994, and The Egan Report in 1998) to help understand how successive governments have sought to shape and improve the performance of the construction industry.

These construction reports have attempted to steer possible future developments of the industry, and also tried to form an agenda for the industry and clients to follow. Procurement methods were often regarded as one of key areas for improvement. A number of procurement initiatives, such as prime contracting and partnering arrangements, have been promoted through the form of these construction reports in different periods of time. To a certain extent, these construction reports have influenced and shaped public sector procurement policies or strategies over time. A temporal overview of past construction reports will provide an understanding of what procurement initiatives have been suggested in the last few years. This review of past construction reports is considered as a set of knowledge regarding the development of procurement initiatives.

4.2. Analysis of the Industry – Changes in the Industry and Procurement Developments

From an agency-structure perspective, the industry itself is considered as an exogenous influence on shaping procurement methods in practice. The analyses of the industry offer the set of knowledge for understanding the environment in which procurement methods are developed and enacted. Such industrial analyses include the overall economic conditions (e.g. fiscal issues, interest rates, etc.), the state of the industry itself (e.g. output, number and size of firms, professional institutions), and the nature of construction demands (e.g. public housing, infrastructure orders). This set of knowledge will be sought through the review of relevant literature, such as Bon (1997), Bowley (1966), Hillebrandt (1995), and Ive and Gruneberg (2000) for example. In general, it is argued that an in-depth understanding of procurement developments cannot be achieved without having an over-arching understanding of developments within the industry. The interrelation between industry changes and procurement developments is the main consideration.

4.3. Business Path Developments of Construction Firms – Firms' Responses to Procurement Initiatives

As a service provider, a construction firm plays a crucial role in how procurement is enacted in practice. It is proposed that firms operate, in relation to procurement, somewhere upon a sliding scale. At one end of that hypothetical scale firms would be completely passive, accepting developments in procurement as they occur. However, at the other end of the scale firms would take a proactive role in shaping and developing future procurement methods with their clients and others. This is a simplistic example, as numerous additional factors have currency here; however, the point being made is that firms are involved in the shaping of procurement, albeit to differing extents. It is this involvement, perception and enacted that will, together with the other knowledge sources, better inform the procurement debate.

In order to understand this better, it is proposed that a number of case studies are conducted. These will potentially reveal a variety of approaches within each firm suited to their individual context. It is initially proposed that regional contractors be the choice of focus for these case studies as they form the majority of the industry and their voice often goes comparatively unheard within research.

5. Integrating Tree Sources of Data: a Timeline Graph

The research aims to combine these three sources of data together by initially presenting them graphically on a timeline (See Figure 2). From the initial research findings it is possible to present here a sample of how the data may look as the research unfolds. This will help clarify the complex interconnectivities between the bodies of knowledge, which impact upon how procurement is enacted in practice.

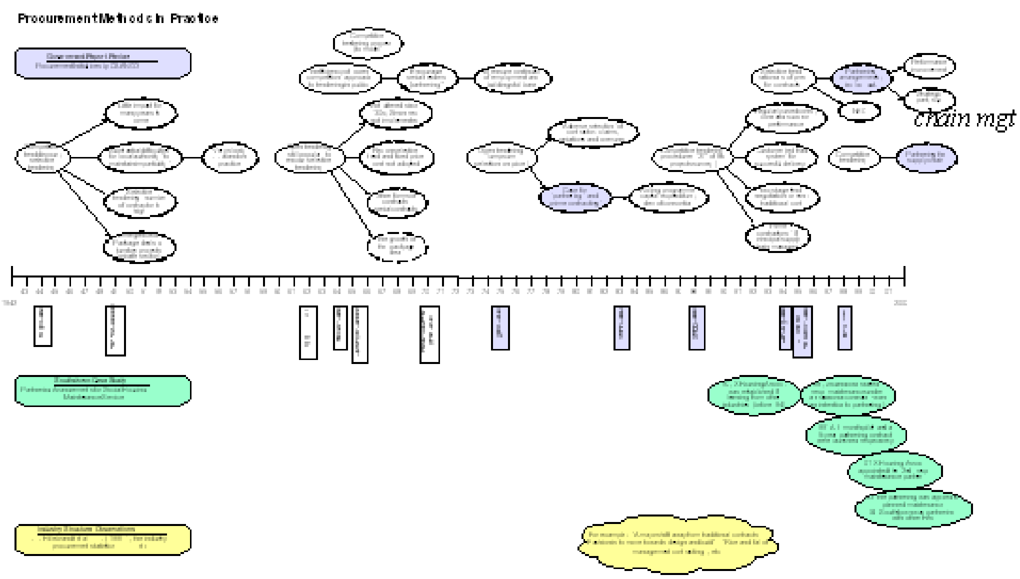

Fig. 2. A cross-section analysis: three sources of data regarding procurement developments

6. Discussion

As stated earlier the notion of looking across different bases of knowledge in order to improve understanding is not new. It is however greatly underrepresented within existing CM literature. Whilst the key arguments here focus upon three bases of knowledge, it is accepted that there are many potential actors which influence how procurement is enacted, as demonstrated in Figure 1. However, for the purposes of this research, it is proposed that three of the most relevant are used simply as a starting point.

Once the data is collected, individually understood and plotted in relation to time, a cross-sectional analysis can be conducted. This will potentially be done by choosing a specific point of time, and then looking across the three bodies of knowledge. It is suggested that by looking for possible causal interconnections, linkages and influences a rich understanding of how procurement is enacted can be offered. An example of this may include a case study firm describing how it moved to a particular procurement method in partnership with their main client. Such a claim may find resonance with the industry commentators or the construction futures reports. Conversely, the storyline may be absent from the other knowledge sources, potentially indicating that the case study firm has a unique story in shaping their own strategy through procurement methods and client relationships. Such a firm would not have been overtly influenced by the rhetoric of recent construction reports or by other developments within the industry.

Furthermore, it is proposed that the developing research may embrace more themes associated with competitiveness and strategy than just procurement. Potential themes emerging from the literature include IT, skills and training (having the right people suited to the firm and the client), and prefabrication and standardisation. The ongoing work is now focussed upon the empirical data collection and literature reviews in order to begin plotting the data and identifying the causal relationships and interconnectivities.

7. Conclusion

The aim of this paper was to raise awareness of the interconnectivities between attributes influencing our understanding surrounding how procurement is enacted in practice. It has been argued that by drawing upon what can be described as different data sets we may be able to improve our understanding of procurement now and for the future. This would draw upon construction futures reports, historical analysis of the industry and case study data drawn from firms currently practicing within the industry. A timeline is suggested in order to highlight the potential interconnectivities between these traditionally separate data sets. From there, it is argued that by identifying the potential causal linkages an additional understanding may be achieved which will help inform the debate surrounding procurement.

Acknowledgement

This paper is part of a research project, '*The Big Ideas: Sustained Competitiveness in the UK Construction Sector – a Fresh Perspective*'. The entire research project is a collaborative research venture between Loughborough, Reading, and Salford University's Innovative Manufacturing Research Centres (IMRCs) and is funded by The Engineering and Physical Sciences Research Council (EPSRC) in the UK. Their support is gratefully acknowledged.

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Performance Improvement through Procurement Innovation in the New Zealand Construction Industry

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Abstract: An initiative engaging clients and the construction industry supply chain has been established in New Zealand, to publicise the benefits and encourage wider adoption of procurement and project delivery innovations throughout the industry. Innovative projects have been engaged as 'demonstration projects' to increase the knowledge base in the industry and encourage wider adoption of innovation in procurement. To prove the business case for change, a set of industry key performance indicators has been established to measure the benefits of innovation. Research has been carried out to support the initiative, including analysis of the significance of the construction industry to the New Zealand economy and an investigation into the range of procurement approaches currently used in the industry together with case studies of a range of relevant construction projects.

Key words: Construction, Procurement, Innovation, Collaboration, Demonstration

1. Introduction

The following paper describes an initiative that aims to facilitate efficiency improvements and a culture change in the New Zealand construction industry. The various activities associated with this initiative are described and the results obtained so far are discussed.

1.1 Characteristics of the construction industry in New Zealand.

Recent research commissioned by BRANZ (2003) shows that the New Zealand industry has a major influence on the national economy. Whilst the construction sector's direct contribution to GDP is only around 5%, a 10% improvement in construction efficiency will result in a 1% change in GDP due to multiplier effects and gains in related sectors. Despite the importance of an efficient construction industry to the economy, the government has not intervened to encourage efficiency improvement as governments in other countries have, but sees the responsibility lying with industry.

The structure of the industry supply chain is similar to many Western countries, albeit on a smaller scale. There are approximately 10 major civil engineering and building contractors with a similar number of major consulting firms. Much of the physical work is carried out by a large number of small sub-contractors. There is a range of public sector and State Owned Enterprise clients together with a large number of private client organisations.

Construction procurement approaches used range from traditional, lump-sum, competitively tendered contracts, to performance-based maintenance contracts and recently New Zealand has experienced the introduction of alliancing arrangements. The small size of the construction industry in New Zealand has historically facilitated a greater proportion of cooperative relationships between the various members of the supply chain, particularly on civil engineering projects. In some cases the cooperative relationships have been formalized in partnering arrangements, in other cases collaborations have been more ad hoc.

1.2 Promoting innovation in construction project procurement and delivery

Recently the industry has experienced new levels of collaborative procurement arrangements, adopted by State Owned Enterprise client bodies as well as local and central government clients. There is high level of interest in new forms of contract and procurement (Henriod and Le Masurier, 2002) and there is a movement for change underway in parts of the industry. However, the efforts of a few enlightened clients and construction companies have been dispersed, without a coordinated 'critical mass' of innovators or a coordinated process for knowledge-sharing which could benefit the industry as a whole. It was recognised that an industry owned initiative, similar to the UK's Construction Excellence, could help facilitate wider adoption of innovation, in particular innovation in procurement which was considered to offer the greatest potential for efficiency improvement.

2. Methodology

2.1 Steering Group

Key industry players were identified who have been involved in recent years in promoting procurement innovation; these individuals were invited to form a steering group to guide the initiative. The steering group has representatives from the whole construction supply chain including clients. Facilitating this steering group is the Centre for Advanced Engineering (CAE) at University of Canterbury. CAE has a track record in facilitating expert groups and providing technology transfer and is recognised as an effective independent voice on engineering and technology-related matters. CAE fulfils the role of a knowledge broker and integrator across a number of engineering disciplines and since CAE already had an infrastructure programme it provided the ideal platform from which to establish a construction industry innovation initiative.

The initiative, known as Best Practice in Construction Procurement and Delivery, has a two-pronged approach: 'bottom-up' focussed on processes and 'top-down' focussed on policy, with the former leading and facilitating the latter.

2.2 Demonstration Projects

A fundamental part of the 'bottom-up initiative' has been a programme of demonstration projects. Current projects using innovative procurement approaches (alliancing, partnering, integrated supply chains, etc) have been engaged in a peer review process. The purpose of the demonstration project process is two-fold, firstly to share experience and knowledge among the teams involved in the projects and secondly through the use of project key performance indicators (KPIs) to provide tangible evidence of the benefits derived as a result of the innovations. At the end of each project a case study is produced and seminars organized to showcase best practice and innovation to the wider industry.

Table 1. Demonstration project process

Stage	**Process**
Stage 1	Outline of the project innovations and anticipated benefits through meetings with the project team and submission of an application form.
Stage 2	Presentation by the project team to a peer review panel where the project is judged on its suitability for inclusion in the demonstration project programme.
Stage 3	Presentation and discussion by demonstrating projects to the peer review panel on the key performance indicators (KPIs) that will be used to demonstrate the tangible benefits specific to the innovation.
Stage 4	Collection and processing of KPI data and benchmarking with other demonstration projects.
Stage 5	Summarising and evaluating lessons learned and evidence of the benefits derived from the innovation in a final presentation to the peer reviewers.
Stage 6	Publication of a case history and dissemination to wider industry.

The demonstration project process is based on that used by UK's Constructing Excellence, and follows the steps shown in Table 1. A peer review panel made up of representatives from current and past demonstration projects reviews each of the demonstration projects to validate the innovations put forward. Stages 1-5 in Table 1 are confidential among the panel members, which provides a 'safe' environment for panel members to share their knowledge and experience with like-minded people and ensure that the benefits are proven before going out to a wider audience at stage 6.

2.3 Benchmarking

Whilst the demonstration projects use project-specific key performance indicators (KPIs) to benchmark internally, much of the evidence of the benefits from innovations is anecdotal. Without standard performance metrics to enable direct comparisons between projects and clear guidance on how to measure performance, it is difficult to prove the business case for innovation. Therefore, another underpinning element of the initiative has been to develop a national set of industry KPIs. A KPI steering group was set up to pursue this particular area and a set of KPIs was chosen based on what were considered to be the main areas for performance improvement in delivery of construction projects. The KPIs chosen are shown in Table 2 and use similar definitions to the UK's Constructing Excellence (2005) headline KPIs.

Table 2. National Key Performance Indicators

KPI
1. Customer Satisfaction – Product
2. Customer Satisfaction – Service
3. Quality – Defects
4. Accidents
5. Predictability – time
6. Predictability – cost
7. Turnover and Profits

The project to establish and run a pilot trial of these KPIs has been carried out with funding from BRANZ and the first set of data has been published by CAE (2005). Since there are no previous data sets for New Zealand no conclusions can be drawn about ongoing benefits from improvements in procurement in the industry. However, the data have been compared to the 2004 data from the UK

The results show that the New Zealand industry is performing about 10% below the UK industry across most of the KPIs given in Table 2, the exceptions being a higher score for 'Predictability of time for construction' and also higher 'Profitability' (10.1% for NZ in comparison to 7.5% for UK). Once established it is hoped the national KPIs will provide a means of differentiating the better performing players from those who rely on traditional lowest price procurement processes and will allow industry players to measure their current performance and gain feedback on the potential for performance improvement. A process for regular industry benchmarking against the national KPIs will help to make the business case to industry and policy makers to do things differently, for the benefit of both individuals and the economy as a whole.

3. Case study – Grafton Gully Freeflow Alliance

3.1 Introduction

The Grafton Gully project was developed to improve the efficiency and safety of Auckland's central city motorway. The project was very large by New Zealand standards, involving the construction of three bridges, one underpass, retaining walls, and 80,000m2 of new pavement. One of the bridges constructed carries a live rail line over the road alignment and the bridge was built beside the original rail tracks and then slid into position. Construction also involved cooperation with ten utility companies to relocate and put in place service lines for the new traffic layout.

The Freeflow Alliance was formed in late 2001 by the four main parties, Transit New Zealand, Fletcher Construction, Higgins Contractors and Beca Carter Hollings and Ferner to complete the full delivery of the project. This was the first alliance to be implemented on a public sector project in New Zealand and as such was a major innovation for the New Zealand industry. This led to the project being nominated as a demonstration project under the Best Practice in Construction Procurement and Delivery initiative.

3.2 The Challenge

The Alliance had to deliver a new major motorway link in an already congested section of highway, with many stakeholders and utility providers involved, as well as a significant amount of earthworks to be completed. The planning and management of traffic flows was a critical task, with 40,000 vehicles passing through the site per day, throughout the project's life. As the site was located near a residential and commercial area, the Alliance had to make sure that there would not be any significant environmental and noise issues resulting from the construction works.

3.3 The Solution

The structure of the Alliance was such that it promoted innovative thinking, open and honest communication and mutual support. The owner, designer and constructor were all based under the same roof, which allowed quick decision making and decisions that were in the best interest of the Alliance, rather than an individual party. The flat organisational structure made it easier for each party to communicate with each other and solve problems.

A unique work culture was created, based on the concept of collective responsibility that was both new and refreshing for the participants. With open book transactions, constructors working on the project had less pressure to under-resource, which ensured that no safety component was being overlooked.

The search for innovative techniques and a drive to achieve value for money provided the impetus for value engineering exercises, that helped the project stay below budget even after unforeseen risks materialised. Transit as a client and owner participant, was very much involved on site and with integrating the project delivery team. The collective reputation of the Alliance also helped fast track construction regulatory processes.

3.4 Benefits

Through the measurement of project specific key performance indicators, the following benefits were demonstrated as a direct result of the alliance contract model innovation:

• Safety – A very strong safety culture was developed on the project and there were no serious accidents on the project, and very few lost time injuries.

• Cost – The works were completed approximately 7% below the target out-turn cost, with savings achieved through innovative design, the close collaboration of the design and construction team and active management of risks and opportunities.

• Time – The works were finished ahead of schedule. The project was handed over in February 2004, 1.5 months early.

• Work Pride – There was a strong sense of pride amongst employees in the task they were doing. Everyone felt part of the team.

• Quality, Aesthetics, Traffic and Stakeholders - An unprecedented amount of positive feed back from the community to Transit and the Alliance on the lack of traffic disruption, the tidiness of the site and the high quality look of the project.

4. Results.

The Best Practice in Construction Procurement and Delivery initiative has developed steadily, from the 'bottom-up' over the past 3 years. Several of the larger construction and consulting companies and major clients in New Zealand have supported the initiative both financially and through the steering group. Five demonstration projects have been completed, covering a range of project types, scales and procurement approaches and several further demonstration projects are currently underway. All projects are demonstrating excellent levels of performance in the industry KPI areas. The demonstration project process appears to be achieving its aims, with increasing interest in innovative forms of procurement. For example, based on the success of the Freeflow Alliance, Transit New Zealand have established the Northern Gateway Alliance for construction of an even larger motorway to the north of Auckland and the Department of Corrections have established five alliances for the construction of four new prisons around New Zealand.

The initiative is beginning to make some headway now in the 'top-down' policy area. Now that the national KPI project has produced the first round of results there is an opportunity to demonstrate to policy makers in government the benefits that can be obtained from improved procurement processes. It is hoped that the government will see the benefit to the national economy resulting from a more efficient construction industry and support this initiative, in collaboration with industry.

A barrier encountered, due to the lack of capacity of industry to cope with the current workload, has been getting the key people to spend their time in meetings and in the peer review process. The irony is that during the buoyant times when innovation could be thriving, companies do not have the spare resources to consider and implement new ideas. However, the number of new projects using collaborative relationships in the industry is steadily increasing.

5. Conclusions

From a historical perspective, it has been proposed that innovation in construction procurement in New Zealand has occurred organically through the involvement of various enlightened individuals. Though the industry in New Zealand is small and new ideas and ways of working can spread relatively easily, traditional approaches to procurement are dominant in many sectors, with associated inefficiencies often in evidence. In order for innovation to spread more rapidly, a coordinated approach was needed and the paper has described the various aspect of an initiative to facilitate innovation in construction procurement. The initiative was established in collaboration with industry and used as its foundation the evidence available from existing best practice projects. A process has been described by which the learning from such projects is captured. The KPI results from a national benchmarking initiative will further underpin the business case for procurement innovation and help towards achieving the overall objective: improving the efficiency and culture in New Zealand construction.

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Harmonised Procurement Policy Environment – Identifying Key Themes Towards The Development Of A Conceptual Model

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Abstract: Capital works procurement and its regulatory policy environment within a country can be complex entities. For example, by virtue of Australia's governmental division between the Commonwealth, states and local jurisdictions and the associated procurement networks and responsibilities at each level, the tendering process is often convoluted. There are four inter-related key themes identified in the literature in relation to procurement disharmony, including decentralisation, risk & risk mitigation, free trade & competition, and tendering costs. This paper defines and discusses these key areas of conflict that adversely impact upon the business environments of industry through a literature review, policy analysis and consultation with capital works procurement stakeholders.

The aim of this national study is to identify policy differences between jurisdictions in Australia, and ascertain whether those differences are a barrier to productivity and innovation. This research forms an element of a broader investigation with an aim of developing efficient, effective and nationally harmonised procurement systems.

Keywords: Capital works, Procurement Policy Reform

1. Background

This research has been conducted by the University of Newcastle, Australia, as part of the Cooperative Research Centre for Construction Innovation (CRC-CI). The impact of policy harmony on the construction industry business environment and its effects on the ability for organisations to be productive and innovative was identified as a key area for investigation that had been lacking in Australian construction research. This was based upon numerous industry studies over the last decade that have identified the property and construction industry as one of the most over-regulated industries in Australia. The studies also showed that the construction industry displayed a disharmonised policy and regulatory framework (Bell, 1996; PM, 1997; Productivity Commission, 2004).

For the purposes of this study, procurement is focussed on Capital Works Project Procurement, which refers to the organisational strategy within which a building or civil infrastructure project will be realised, acquired or obtained and the ensuing contractual relationships between government client and major parties. The key themes distilled from a literature review and anecdotal industry evidence outlined in this paper coupled with a corresponding policy analysis have been the basis for formulating a research methodology to survey and interview relevant government and industry stakeholders. This paper discusses the theoretical issues surrounding procurement policy harmony and suggests a framework for a procurement policy investigation in Australia in the context of international studies.

During the foundational stages of this project it was necessary to consult with representatives from the procurement industry to determine key areas of concern. As a CRC-CI partner and a large multinational industry representative, John Holland Group (JHG) was well placed to inform researchers of the difficulties and successes in working with procurement policy across federal, state and local jurisdictions. With JHG's collaboration and a pilot survey of seven senior executives of the company it was identified that they experience procurement policy differences between state jurisdictions, between state and the Federal systems, and even within a state. It was also identified that particular methods of project procurement and their interpretation by government employees differed, particularly design-and-construct and public-private partnership strategies. The impacts upon the business efficiency of the firms included increased time to complete tenders and ensure compliance, wasted time as similar tender documentation needed to be restructured, innovative tenders were misunderstood, and tendering costs were higher due to retraining of staff and time overruns.

This pilot material provided a useful context to understand the background to the literature review outlined in this paper and the policy document analysis that has been completed as part of the study; together these three activities assist in the direction of the study design and validated the rationale and significance of the investigation.

2. Key Themes of Policy Harmony – A Literature Review

A literature review of construction management and economics literature has indicated that potential barriers to (or catalysts for) innovation and their attribution to policy and procedures can be distilled to four key themes – decentralisation (Egan, 1998; Latham, 1994; Kelman, 1990), risk & risk mitigation (Sharp & Tinsley, 2005; Williamson, 2004; Jaggar et al, 1991), free trade & competition (Arrowsmith, 1995; Uttley & Hartley, 1994), and tendering costs (Kumaraswamy et al, 2005; Wood, 2006; English & Guthrie, 2003). Each of these is now discussed.

2.1 Decentralisation and devolution of responsibility

The UK construction industry has been subject to a century of periodically intense scrutiny with a view to improving policies and procedures, and fostering innovation. Two more recent investigative reports, Constructing the Team (Latham, 1994) and Rethinking Construction (Egan, 1998), are habitually cited in literature regarding any facet of construction industry reform. A key concern (reiterated in subsequent literature) is the effect of decentralization. Previously a monolithic procurement client (Latham, 1994) with centralized purchasing institutions, the UK government has devolved responsibility to subordinate public authorities with the aim of increasing flexibility and competition.

Analysis of the current procurement authority environment in Australia similarly has to deal with decentralization and its effects; already the sheer number of policy documents between states and the commonwealth is overwhelming – analysis and industry anecdotes reveal further ‘tailoring’ by individual procurement bodies of the non-prescriptive guidelines that creates barriers to innovation. Where ‘government has ceased to be a single procurer… the untying of Departments from [a central procurement agency] has resulted in the emergence of a wide range of procurement techniques’ (Latham, 1994). The greater the number of procurement bodies, the greater the requirement for individualised policies; inherently, more methods means more conflict and confusion, and greater avenue for exploitation. Additionally, a popular perception exists that managerial success can be measured in terms of the change a manager enforces during their tenure. Procurement policy is perhaps an easy target for ‘streamlining’ or tailoring to improve the efficiency of a particular government entity for the appearance of such change, to the detriment of policy harmony.

Decentralization can also lead to the diminution of in-house professional skills (Latham, 1994). The devolution of responsibility from a central government core to individual entities creates a corresponding dilution of skill sets and experience; the effects on in-house skills, education and the iterative learning process are pronounced. Breaking apart central procurement bodies necessarily involves fragmentation of corporate knowledge; unless rigorous training regimes are established for passing on accumulated knowledge and practices, dilution of core skill sets is likely to result. This can have positive implications, especially when ingrained practices are root cause of stifled innovation, efficiency or burdensome red-tape. The negative results are more obvious and immediate, however; increased stress as unfamiliar employment responsibilities are forced on workers (and its flow on effects), fractured methodologies, perpetual reinvention of the wheel and so on. The loss of in-house skills leaves clients variously vulnerable to exploitation or so cautious as to necessarily inhibit innovation. High staff turnover within individual Public Sector bodies, and the cyclically shifting political agenda are further cause for concern. Already an industry that suffers from instability due to the unique nature of every project and fragmented stakeholder environment, decentralization and the consequent proliferation of varied procurement practices further removes foundational standards. The benefits primarily reaped through standardization and experience are difficult to achieve in project procurement when policies are multivalent and competitive tendering discourages familiarity. Put simply, standardization ‘can provide much greater predictability about what is performed, by whom, how and when’ (Egan, 1998).

The criticism of decentralization, however, does not constitute a call for the reintroduction of a central procurement body. The ‘delegation of authority within the public sector to those best placed to assess local needs’ (Latham, 1994) is well supported. What is identified, however, is a need for more robust monitoring and standardization of practices, and adequate education and training for those with whom the new procurement responsibilities are divested.

The Egan Report builds on the research and results of the Latham Report with an aim to make the UK construction industry as a whole demonstrate the internationally renowned excellence evidenced by elite but non-indicative construction sectors. Low profit margins, lack of investment in research and development, and a flagging training regime are cited as prime barriers to construction innovation (Egan, 1998). In discussing drivers for change, committed leadership is seen as a primary progenitor for innovative change (Egan, 1998). Considering the devolution of procurement responsibility to managers not intrinsically motivated toward procurement innovation (ie beyond the terms of their usual employment, interest or skill set), the ability for the procurement environment to foster committed leadership is, at times, questionable. What intrinsic motivation is there for a manager within the health department, with a background and interest in healthcare provision, for example, to grapple with the nuances of procurement policy across different jurisdictions? Whilst a singular example, it is argued that long-lasting committed leadership requires some intrinsic motivation toward the project itself.

The transition from rigid rule-based procurement methodology to a value-based system that enables the exercise of discretion in procurement spending and the consequent benefits for innovation and value-for-money have been well documented in United States procurement reforms and practice (Kelman, 1991). However, ‘Procurement reform sought to reduce rules, hierarchy and specialization, not to eliminate them… Rules can help produce good decisions that can help an organization do its substantive job better. If an organization has learned that certain approaches to dealing with recurring situations work, it can use rules to codify and transmit such information’ (Kelman, 2005).

2.2 Risk + Risk Mitigation

Risk is an inherent component of the procurement tendering process. The allocation of risk can be cause for great tension amongst client and tenderer. At the very least, innovation or the intention to innovate can be seen as too great a risk for a tenderer in a competitive environment. The cost of innovation in terms of risk can be manifold. Firstly, it might generally entail greater cost to the client initially, thus provoking an unfavourable response during the competitive tender process (where ‘best value’ is a subjective term, price is more tangible). The high costs of tendering (Dalrymple et al, 2006) conceivably limit the willingness to risk innovation itself through fear of not winning the elusive contract. Secondly, the innovative tenderer is also more likely to be experienced in government procurement processes and therefore be savvy in risk allocation; this could be seen as detrimental in a competitive environment, where other tenderers are more naïve in the acceptance of risk. Thirdly, innovation as an unknown quantity is an inherently risky business, especially for the client. Fear of the unknown, and the very real and high cost of failure in the construction environment must increase the tendency to accept tried and tested methodologies. In the politically competitive public sector, conservative procurement practices are likely to be the mainstay for fear of retribution. There seems to be an obvious but poorly addressed need to develop trust in partnerships rather than bargaining for individual gain (Jaggar, et al, 2001). Critical to this development is the notion of information opacity as distinct from transparency; whilst the latter is needed for the evolution of trust, the former still predominates.

Acknowledgement of these attributes surrounding risk and innovation (in conjunction with many other issues) has seen the evolution of Public/Private Partnerships (PPP), Private Finance Initiatives (PFI) and Privately Financed Projects (PFP). Despite overt intentions to share risk in a fairer and transparent manner, policies on risk allocation in PPP vary between jurisdictions. The state of Victoria has been the leader in fostering PPP relationships and consequently developing policy for PPP instigation and management. Other states and territories have absorbed Victoria’s advances into their own policies, and 2003 saw the inaugural National PPP Forum with aims to ‘deliver better coordination, information sharing and support among Australian governments in relation to PPP projects’ (Sharp & Tinsley, 2005). In spite of

> *…various technical and terminology differences, there is a tendency towards homogeneity. Such a homogeneous approach has benefits to both the public and private sectors by way of increased certainty and lower transaction costs. (Sharp & Tinsley, 2005)*

If there is an acknowledged tendency and advance toward uniformity, and differences in risk allocation are minor or technical (in a legal sense), the question must be asked why there is any difference at all. For example, Why not use Victoria's acknowledged experience and skill as a basis for standardization and replication of PPP policy across jurisdictions, at least at the state level? The requirement for additional in-house or ad hoc addendums indicates the difficulty of formulating encompassing policy guidelines without being so general as to be superfluous, and also the potential for multitudinous additions to policy on a department by department, state by state manner that would further confuse an already convoluted regulatory environment. Preliminary information obtained from industry partners for this project suggests that PPPs are currently a root cause of regulatory disharmony between jurisdictions, due either to differences in methodology selection, implementation, management, experience or outlay costs.

Partnering, or project alliancing, is raised as a positive step forward in procurement conduct (Egan, 1998). A diversion from traditional procurement methods, partnering involves the selection of a small and dedicated professional team (client, designers, contractors, construction managers) who agree on design, risk management and dispute resolution issues and share profits and losses evenly. Contractual obligations are minimized, if no not abolished entirely. For its acclaimed successes, however, partnering is a difficult procurement option to instate and maintain, and generally requires a culture shift amongst participants used to the adversarial nature of the construction environment (Egan, 1998). At present, Australian procurement policy does not mandate methodologies for construction, and leaves the choice (within broad guidelines) with the procurer. Considering the difficulties of implementing partnering and (despite its potential rewards) a consequent tendency to avoid additional complexity, impetus to ingrain partnering or project alliancing as an appropriate alternative methodology may be aided by policy intervention. Whilst the promotion of PPP/PFI and Project alliancing signals 'the current preoccupation… with non-legislative solutions to the problem of opportunism through the development of more trusting relations between participants' (Williamson et al, 2004, p63), perhaps there is scope for legislative solutions to improve exposure to a valuable alternative procurement methodology.

As a generalized extension of partnering as discussed here, long-term relationships in procurement are heralded as a boon to innovation and improvement. Unfortunately, they are also rare (Egan, 1998, p29). Benefits of long term relationships seem obvious, yet the already discussed fragmentary nature of the construction industry does not promote longevity. Importantly for this review, however, the present policy environment also seems to mitigate against the long term relationship; lack of standardization, niche procurement practices brought about through decentralization and an overarching emphasis on competition creates a culture of short term thinking.

2.3 Free trade + competition

Uttley & Hartley (1994) discuss procurement policy in the fluid and volatile regulatory environment leading up to the establishment of a European Union (EU) single European market. Problems are identified with governments of individual states historically looking after the interests of state players at the expense of free and diverse trade. Similarities can be seen within the Australian context; replacing the 'Single European Market' with 'Commonwealth of Australia', and 'European States' with 'Australian States and Territories' is a beneficial analytical tool. English and Guthrie (2003) enunciate a similar sentiment in discussing privately financed projects (PFPs), whereby 'in Australia it is not possible to talk about one initiative in the singular tense. Because of our federal system, we essentially have seven different PFP initiatives' (English & Guthrie, 2003). New South Wales state procurement policy, for example, still has industry preference schemes to benefit country NSW suppliers, and Australia-New Zealand partnerships that place a substantial (20%) price loading on non-ANZ applications when tenders are being refereed (NSW Government Procurement Policy, 2004). Other states have similar policies that promote the use of local resources in the tender evaluation process. States such as Western Australia (Government of Western Australia, 2002) and South Australia (Government of South Australia: State Procurement Board, 2005) use a similar 20% loading on foreign resources in tenders, while Queensland Procurement Policy states the need for evaluation of contribution to advancement of government priorities (Queensland Department of Public Works, 2004). This signals a conflict between Commonwealth and State policy guidelines, and could cause corresponding confusion amongst tenderers. More importantly it is potentially at odds with various free trade agreements imposed by the Commonwealth and purportedly adopted by the states and territories, and finds resonance with problems raised in the literature discussing EU formation tribulations, where the aim of 'public procurement policy in the EU was to dispel discrimination and government protectionism in public procurement, viewed as one of the major barriers to the achievement of the Internal Market' (Erridge et al, 1998).

Arrowsmith (1995) raises pertinent research questions for considering Australia's approach to procurement in relation to notions of free trade. Using 'reforms' in European Community procurement policy as case studies, beneficial comparators are found for evaluating procurement policy at different government levels and its implications on 'free trade' between states and territories. Important issues regarding policy as an instrument for social change are raised at a more philosophical or theoretical level, issues that have not really been considered in Australian-focused literature reviewed to date. The belief that free trade in procurement is the way forward are counteracted with examples where a more restrictive procurement policy is better placed to shape and monitor social policy (anti-discrimination for example), national industrial and technological objectives and state aid. Review of Australian policy with respect to these issues may lead to further research avenues regarding the (at present) seemingly unquestioned nature and theoretical makeup of procurement policy that affect the construction industry, in addition to the more practical and tangible barriers to innovation.

> *In an open market, policies which are merely protectionist are obviously unacceptable, but the EC rules also appear unsympathetic to the use of procurement to promote other goals, even those which the Community accepts sometimes require a compromise of free competition through, for example, the provision of state aid. (Arrowsmith, 1995)*

The underlying competitive foundations of free trade provide a neat segue into a discussion of competition and competitive tendering in capital works procurement. Whilst 'best value' may have replaced compulsory competitive tendering as procurement weapon of choice, the belief that competition is the best driver for advancement is still a fundamental component of procurement policy. Egan argues that ‘the repeated selection of new teams… inhibits learning, innovation and the development of skilled and experienced teams’ (Egan, 1998, p19). Continuity is vital in developing product identity, enhancing production methods, refining quality and exceeding customer expectations (Egan, 1998, p20). Added to the fray is the somewhat liberally interpreted notion of ‘best value’ in procurement. As the foundational clause of procurement nationally, the subjective nature of best value (despite its advances from initial CCT where cost was the only consideration) spawns extensive guidelines, methodology and balances in order to make the process more transparent and less vulnerable to exploitation. As the Hon Peter Slipper suggested in 2003, we ‘probably need to elaborate on the concept of ‘value for money’, because it can mean different things to different people’. When value for money is the stated core principle of the Commonwealth Procurement Guidelines, this admitted subjectivity in assessment seems at face value to inherently undermine aims of objectivity in the procurement process.

> *The tender process is vulnerable to manipulation by all parties. It is protected to some extent by the general legislation against gross misdemeanours such as fraud, and by more special legislation against anti-competitive behaviour such as collusion. The Code currently falls outside the legislative framework, rather offering suggestions of appropriate individual behaviour – leaving the "invisible hand" of market competition to provide the long-term economic solution. (Williamson, et al, 2004, p66)*

2.4 Cost of tendering

It is noted that the following discussion is presented as it relates more to procurement policy by governments as clients and their ethical responsibilities in their role as initiators of projects. The literature and discussion does not to any extent highlight disharmony identified in relation to tendering costs – it only highlights that this is a problem in general – which of course is not entirely new but needs to be considered as context for our study.

Kumaraswamy et al (2004) highlight a discrepancy between demands for dramatic increases in productivity (Australia, Hong Kong, Singapore and the UK are raised as key examples) and a desire for increased levels of innovation. Whilst the former is a boon to construction industry economic prospects, the increased demands and time pressures have a stifling affect on innovation – ‘dominant industry pressures to "get it right the first time" and to do this fast, direct participants towards already tried and tested procurement and operational routes’ (Kumaraswamy et al, 2004). Where increased demand could (and often does) promote innovation in the form of competition, niche finding and increased consumer discernment, the exemplified results in the construction industry run contrary to the beneficial potential.

These ‘dominant industry pressures’ may have a parallel in terms of procurement policy. Conforming to policy requirements (and the varied requirements between levels of government) could be seen to be a stifling pressure – those with the procedures established to easily conform to policy in a specific area or state have an advantage in tendering; unless propensity toward innovation is evidenced from within the ‘conformist’ companies the ‘tried and tested’ will be the likely route (especially in risk averse environs). Additionally, even new and innovative companies may need to curb their own tendencies toward innovation as they, at least initially, mimic the ‘tried and tested’ to be competitive.

Expensive and lengthy tendering processes with no guarantee of remuneration for effort expended, coupled with increasing time pressures and demands, can lead to a culture of ‘doing things as they’ve always been done’. Innovation has the potential to increase the risk of tender failure for its high levels of inscrutability (fear of the unknown). For capital works procurement, it has been ‘suggested the costs of abortive tendering be borne more directly by the client, being the major recipient of the benefits accruing’ (Williamson et al, 2004). Whilst a whole research topic in itself, client reimbursement for unsuccessful tendering costs may increase the viability for smaller, more flexible and innovative contractors to offer tenders infeasible in circumstances that generally favour larger, institutional, established and more conservative players. ‘Cost’ must also be considered in non-fiscal terms – limiting innovation can be a demonstrated cost of the tendering process. Conforming to policy requirements and the varied requirements between levels of government could be a stifling pressure – those with the procedures established to easily conform to policy in a specific area or state have an advantage in tendering; unless propensity toward innovation is evidenced from within the ‘conformist’ companies, the ‘tried and tested’ will be the likely route, especially in risk averse environs.

Additionally, innovative tenders have the potential to be implicitly non-conforming tenders (Wood, 2006). Thus innovation is either stifled, or tenderers are required to submit alternative tenders alongside conforming tenders, thus adding to tendering cost. Prospects for a two- or multi-staged tendering process demanding innovation have been raised (Wood, 2006). Initial calls for expressions of interest by innovators (EOII) concerning a broadly defined project can be used to refine requirements, reassess priorities and promote innovative practices. Once initial stages of filtering innovations versus requirements are completed, a refined tender request can be forwarded to shortlisted or prequalified tenderers for second-stage tendering incorporating identified and desirable innovative practices. This can also have the effect of 'levelling the playing field' (English & Guthrie, 2003) and allowing a more objective comparison of tenders based on a more quantifiable base standard of innovation and cost. A potential downside, however, is the loss of competitive edge by the avant garde innovator, whose first-stage innovations are then taken as the basis for further stages of competitive tender (ie the 'secret' is broadcast). Such divulgence requires benevolence potentially lacking in a culture of competition and adversarial relationships. Whilst basic standards of innovation may be increased, the best innovations may not surface at all in a two-stage process for fear of losing competitive ground in future projects.

3. Conceptualisation

The transition from rigid rule-based procurement methodology to a value-based system that enables the exercise of discretion in procurement spending requires clarity in definition and interpretation, and transparency and communication of those interpretations. Rules can help produce good decisions that can help an organization to do its substantive job better. If an organization has learned that certain approaches to dealing with recurring situations work, it can use rules to ‘codify and transmit such information’ (Kelman, 2005). This project has the potential to identify areas in Australian procurement policy where the ability to exercise discretion under a value-based system conflicts with a lack of expertise, education or clear and binding guidance. Ongoing monitoring and evaluation of a balance or synthesis between regulation and discretionary freedom are required to achieve policy harmony.

Figure 1 'Problem Conceptualisation of Harmony in Procurement Policy' summarises the key issues identified to date. It also maps out the next stage of our work which is to confirm the problems in relation to differences between various jurisdictions through a national survey. We aim to find, according to industry and government practitioners, what the causes for policy disharmony and harmony are, and what constitute the key impediments to or catalysts for harmony in relation to procurement policy.

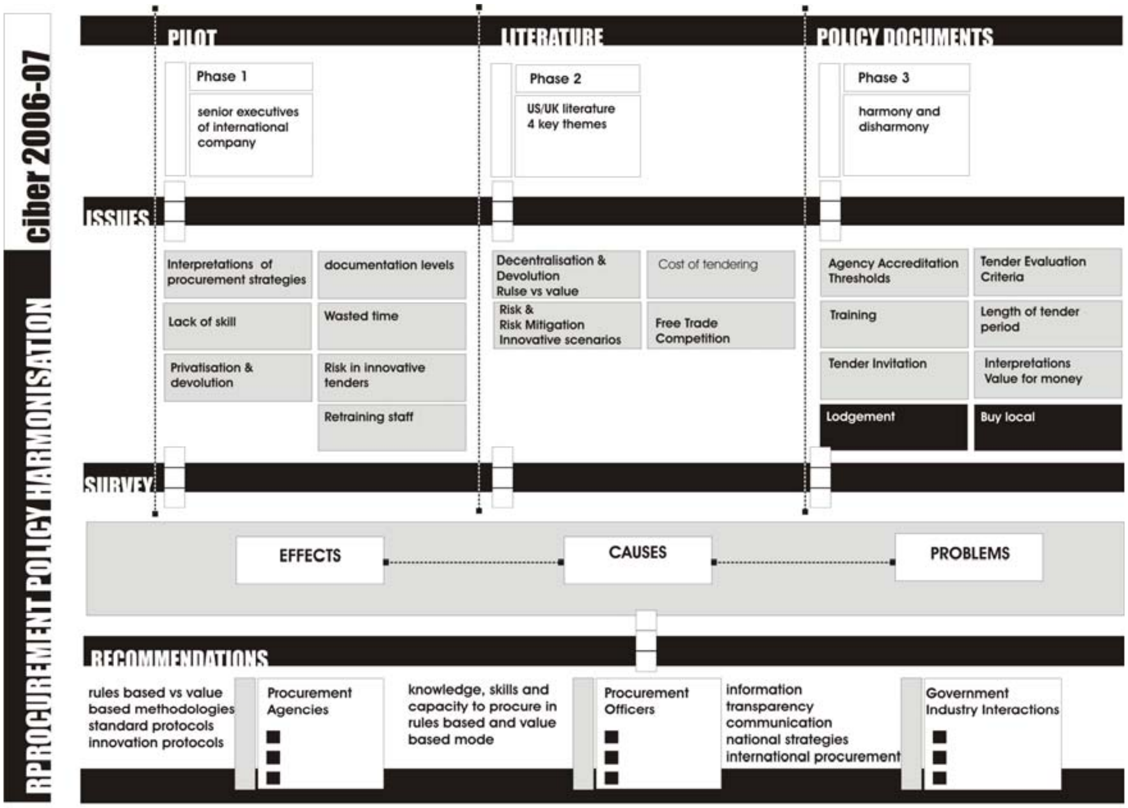

Figure 1. Problem Conceptualisation of Harmony in Procurement Policy

The areas of concern identified in the literature review, policy analysis and anecdotal evidence suggest the following key areas are worthy of investigation;

1. Devolution and decentralisation: skills, training, philosophy, interpretation;
2. Risk: tender evaluation criteria, value for money, project procurement strategy interpretations, rules vs. situational decision making;
3. Cost of tendering: tender documentation, length of tendering; and
4. Competition: accreditation thresholds.

4. Conclusion

Although there is considerable literature on procurement policy, the review has highlighted a lack of an analysis on the impacts to the construction industry business environment of the decision-making behavioural differences between government jurisdictions, specifically targeting procurement policy, process and practice. Ongoing research into discrepancies between procurement policies at various levels of jurisdiction has highlighted potential areas for conflict, divided into pre- and post-tender categories. In the pre-tender stage, Public

Private Partnerships (PPPs), purchasing thresholds, tender evaluation, 'value for money', supporting documentation requirements and tendering timelines are key areas for potential conflict. During post-tender stages, contract management, claims and dispute resolution are identified as critical areas. The resolution or harmonisation of these areas may enhance prospects for construction innovation. What is needed now, however, is an understanding of the current regulatory environment as understood by government and industry stakeholders conducting daily business in the capital works procurement arena. It is anticipated that this real-world analysis will aid in the consolidation of constructs arising from the anecdotal evidence, literature and policy analysis.

The costs of procurement inefficiencies to the construction industry and government clients are high. Tendering evaluation, contractor selection, procurement methodology selection and construction management in capital works projects inherently involve huge financial commitments; even small gains in procurement efficiency have a large effect on involved parties. In addition to fiscal benefits, it is hoped that the streamlining of procurement policy and procedure will provide the required impetus to achieve innovative results in capital works procurement.

Acknowledgement: The research described in this paper was carried out by the Australian Cooperative Research Centre for Construction Innovation.

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Decision Support Methodology for Prefabrication Decisions on Green Building Projects

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Abstract: The growing interest in sustainable construction, technological improvements, and increasing labor costs provide opportunities for prefabrication strategies to enhance 'green' or 'sustainable' building projects. In such projects, choosing the appropriate prefabrication strategy under variable project conditions becomes important to achieving outcomes that help meet green building goals, such as reduced material use and improved energy efficiency. Subsequently, decisions about prefabrication should be carefully coordinated with a series of tactics throughout the team selection, design, procurement, manufacturing, and construction stages of a project. The goal of this paper is to help project teams take full advantage of potential prefabrication opportunities and determine appropriate strategies across different building systems in order to better achieve overall project goals regarding initial cost, schedule, quality, and sustainability.

Existing decision-making tools for prefabrication are limited and typically focused on construction decisions. Building upon the existing concept selection optimization techniques, a decision-making framework is proposed in this paper. It allows project teams to examine opportunities existing in the whole delivery process of a building system, compare different options (e.g. subcontractors & material suppliers, procurement methods, designs, construction methods, etc.), and make effective prefabrication decisions through understanding the synergies and tensions among prefabrication strategies, building processes, and building performance early in the design phase. A value-based dynamic programming tool is presented and its application on an actual case study projet is described. Conclusions regarding the use of this tool, and the potential value of prefabrication strategies on sustainable projects are provided.

Keywords: Decision-making, Green Projects, Prefabrication Opportunities, Strategies, Tactics

1. Introduction

'Green' or 'sustainable' buildings are those in which efforts are made to minimize resource consumption and maximize energy efficiency and the health of occupants. These facilities are considered to have health and productivity benefits for occupants and have increased in demand by both public and private owners. In the U.S., these facilities are also considered to be more challenging to design, and are often associated with cost premiums. The efficient delivery of green buildings is thus an important question facing both academia and the architecture, engineering, and construction (AEC) industry.

One strategy worthy of exploration is reducing construction costs by improved production and reduced waste, and using the savings to offset the costs of some high performance building components. Prefabrication, preassembly, and modularization have been successfully employed in the manufacturing industry (especially in the highly competitive automotive and aerospace sectors) as an application of *Lean Production Principles* that aim to streamline production of systems and reduce waste. A disconnect exists, however, between the commonly perceived benefits of prefabrication and the outcomes that are valued on green building projects, such as reduced material use, recycling of materials, improved quality, and reduced construction time. The terms prefabrication, preassembly, and modularization are often interchanged in practice, and not well defined. In this research the term "prefabrication strategies" refers to the "single or combined use of prefabrication, preassembly, and modularization on site or at a location other than at the final installation location."

2. Objective

This paper presents the latest findings from on-going research examining a prefabrication strategy selection methodology (PSSM) for building systems. While intending to be universal in application the research focuses specifically upon curtain wall systems, mechanical systems, and wall frame systems. Derived from the existing techniques for concept selection in product design, the methodology used helps project teams examine how the system-level prefabrication strategies can be achieved by a series of tactics (i.e. approaches) at different project stages (e.g. team selection, design, procurement, manufacturing, and construction) and how the selection of these strategies can contribute or detract from project goals through evaluating the interplay between prefab-related tactics, building processes, and building performance.

3. Opportunities and Benefits of Prefabrication

Although widely used for over a century in construction, prefabrication strategies are still considered by many industrial professionals as merely an approach to reduce labor costs. Viewed with more scrutiny, prefabrication strategies have vastly more to offer in terms of reducing construction time and first cost, improving quality, and helping achieve the sustainability objectives for a project. Potential benefits associated with these four opportunity areas are further explored and summarized in Table 1.

The conditions in the building industry are far more complex than the manufacturing industry due to the fact that every building project has a unique location, design requirements and priorities. Therefore if not employed appropriately, prefabrication strategies can also result in negative impacts to projects such as change orders, coordination problems, long lead times, and poor quality due to inappropriate dimensional tolerances.

Table 1: Potential Benefits of Prefabrication Strategies

	1st Cost (Budget)	Time (Scheduling)	Quality	Sustainability
Potential Benefit Areas	Reduced material waste and increased material recycling	Preconstruction speed (e.g. design, planning, and procurement)	Customer requirements (e.g. aesthetics, expected functions, and life-span)	Health and safety during construction
	Direct labor (i.e. field workers) savings	Manufacturing & delivery speed	Design/Engineering tolerances	Improved occupant health
	Indirect labor (e.g. field overhead) savings	Increased speed of construction on-site	Streamlined information flow & management processes through design, manufacturing, and construction	Economic development in local communities
				Material reuse and/or recycling
	Design speed			Flexibility/adaptability
	Equipment requirements			Reduced operation & maintenance requirements
	Reduced rework			
	Reduced transportation			

4. Background

4.1 Current Decision-making Tools for the Use of PPMOF

Systematic analysis and decision-making is the key to successful implementation of prefabrication strategies. Two existing tools, the PPMOF (Prefabrication, Preassembly, Modularization, and Off-site Fabrication) decision framework by CII (Construction Industry Institute) and the IMPPREST (Interactive Method for Measuring PRE-assembly and STandardisation benefit in construction) toolkit developed at Loughborough University in the UK are the most important. Both of these tools contain a preliminary decision guide followed by a quantitative analysis. The first part is based on very basic project information such as schedule, site attributes, availability of local labor and suppliers, etc., whereas the latter part usually asks for more specific details (e.g., material cost, labor cost, equipment type, etc.) to increase the accuracy of its results. Both tools are available in either paper form or computer-based version. IMMPREST considers PPMOF as a whole and uses the term "Standardization and Preassembly" (S&P), while the PPMOF framework enables the users to further perform tactical analysis of PPMOF alternatives. A notable feature of IMMPREST is that it brings "softer issues" such as health and safety, sustainability, and effects on management and process into the decision-making of S&P and explicitly defines the ways to measure since its researchers argued that "monetary measures are inadequate for items that cannot be directly attributable to an element" (Blismas, et al, 2006). While both conceptual frameworks intend to facilitate a more systematic thought process and hopefully better decisions, some embedded limitations make them less likely to be widely accepted by the industry. The major drawbacks include:

- **Ambiguous definition of work processes:** The terms prefabrication, pre-assembly, and modularization are not explicit. According to CII's (Construction Industry Institute) definition (CII, 2002), prefabrication is often focused on components which involve the work of a single craft, while preassembly is generally used on a system, and modularization includes portions of many systems and essentially refer to increasing levels of prefabrication work with modularization at the highest level. In practice, actual work strategies involve combinations of prefabrication and pre-assembly. One of the primary features of these strategies: the location the work takes place, is also missing from these definitions, e.g., factory, off-site, or on-site.

- **Lack of practicability in intended functions:** The goals of the existing tools are either too general or too specific. The tool PPMOF developed by CII aims to identify one strategy as the best solution for a project but its value is blurred by the fact that these strategies are always mixed together during their practices and it is ambiguous how to make clear distinctions between them. The IMMPREST tool by Loughborough University in the UK intends to facilitate the evaluation of benefits from use of "standardization and preassembly" as a project-wide strategy, but it still relies heavily on the decision-maker for issues such as where and how to implement strategies. To ensure the successful implementation of prefabrication strategies, a series of decisions need to be made during design, supply chain management, manufacturing, and construction. Therefore further assistance on identifying the PPMOF opportunities in these stages can be very helpful to a project team.
- **Scope limitations:** Another common shortcoming of these tools lies in their quantitative analysis section, which requires very specific details (e.g., material cost, labor cost, construction equipment type, etc.), whereas such information is typically unavailable at early stages of a project and the situation can be even worse for design-build projects due to their nature. Undefined or poorly-defined designs only make it difficult to utilize these tools and may even mislead the final solution. The IMMPREST project team found out that "many of the items listed were not currently recorded in any meaningful way" in a follow-up survey, which was why the toolkit, especially the in-depth part was not so well accepted (Pasquire et al., 2005).
- **Lacking a comprehensive perspective of PPMOF benefits:** Neither of these tools fully considers the needs of sustainable building projects and even though IMMPREST does include some of the soft issues in its evaluation, the users still cannot tell how the value-set on these projects may influence the selection of prefabrication strategies. To address this issue, more descriptive and comprehensive sustainability criteria and the potential sustainable benefits of prefabrication strategies need to be clearly defined.

4.2 Available Decision-making Techniques in Concept Selection

The purpose of the proposed PSSM is to help a project team find a 'best-fit' prefabrication strategy for a building system. The term 'prefabrication strategy' here denotes a system-wide plan which involves many decisions in every stage. More specifically, it means the path of selecting which prefabrication opportunities to take advantage of and what tactics to use throughout each stage of a project. Different prefabrication strategies indicate different combinations of such opportunities and tactics. The research problem is considered as a multi-stage decision-making problem. Decision-makers need to evaluate a series of inter-woven prefab-related opportunities and associated tactics across different stages and try to determine a combination that benefits a project the most within given constraints and available resources. The methodology therefore should allow the team to consider all possible combinations and eliminate infeasible or suboptimal options with quantified measures.

Being aware of the limitations embedded in the traditional decision-making process for prefabrication strategy selection and the related tools, applicable technical resources were sought from engineering design, industrial engineering, manufacturing, and architecture. A number of widely used decision-making techniques for concept weighting and selection have been reviewed, such as SMART (Simple Multi-Attribute Rating Technique) (Schultz et al., 1998), QFD (Quality Function Deployment) Matrix (also known as "House of Quality") (Sullivan, 1986), AHP (Analytic Hierarchy Process) (Saaty, 1990, March et al., 1993), etc. Although adjustments still need to be made to suit the specific needs in this research, two multi-stage decision-making approaches: the CSM methodology and dynamic programming provide valuable insights and bring great potential into this study.

The CSM Methodology

In the selection of building systems, many trade-offs exist that can complicate the choice of design and construction strategies. For example, in the case of a curtain wall system, it is highly advantageous to assemble building skin components in a factory environment to maintain good quality, reduce material waste and minimize potentially dangerous construction activities on a building perimeter. However, the shipping and logistics of larger prefabricated components can present many on-site challenges and costs. The evaluation of concepts with such trade-offs can be difficult to perform. In addition, design teams often lack knowledge of all potential benefits and trade-offs associated with prefabrication practices used by different building trades. King and Sivaloganathan (1999) proposed a new methodology for concept selection. The functions are very similar to QFD however a quantified measure is used to evaluate coupled decisions. The structure consists of two parts (see Figure 1). One is a compatibility chart, where numerical scores are assigned between every two concepts (see Table 2). A typical concept vs. function chart in which scores are given based upon how each concept fulfils each function is also provided. The overall score of each configuration equals the summation of concept-function scores multiplied by the product of compatibility scores. A macro is used at the end of the process to perform and order the calculations since the number of possible configurations is typically extensive.

The methodology intends to facilitate more complicated decisions; however, the computations used here are not exhaustive, which means the final decision is based on results from only some of the possible combinations. In addition, when a large number of concepts and/or criteria are involved, the matrices grow bigger and more complex, and the procedure becomes lengthy and cumbersome. These limitations can be overcome however, providing a well-defined structure of decisions and options are identified, and choices are limited to a realistic number of considerations that can be understood by a user of the tool.

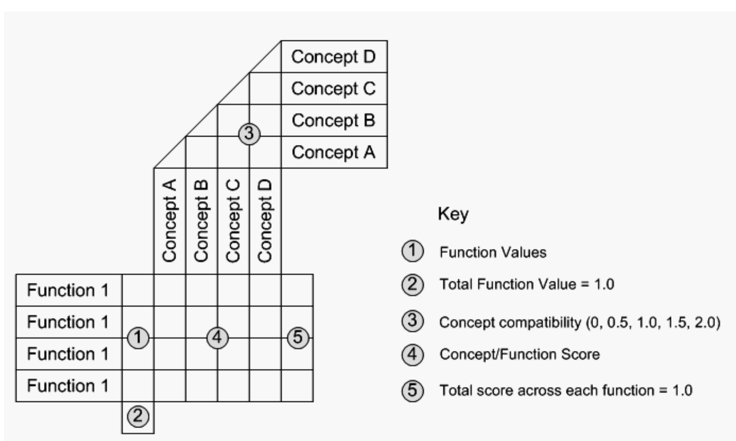

Fig. 1. Function-concept matrix showing relationships exist between potential concepts (Source: King & Sivaloganathan, 1999)

Table 2: Concept compatibility scores (part 3 in Figure 1) assigned between two concepts (Source: King & Sivaloganathan, 1999)

Score	Meaning
0	Mutually exclusive concepts that cannot be combined
0.5	Difficult to have concepts together, but possible
1.0	No effect on concepts if both are chosen
1.5	Good combination of concepts that work together
2.0	Excellent combination, the concepts reinforce each other

One goal of this research has been to define a set of functions and concepts that can be applied across variable types of building systems and permit the use of a usable yet comprehensive concept-selection approach by project teams.

Dynamic Programming

The concept of dynamic programming (DP) was first introduced by Bellman (1957) as a tool to solve many complex optimization problems involving a sequence of interrelated decisions, such as network problems, scheduling problems, allocation problems, etc. Figure 2 illustrates a very common application of DP called the "shortest path" problem, where the ultimate goal is to identify the shortest path that connects nodes from stage I to stage V knowing the distance between every two nodes at two consecutive stages. An important feature of DP is that it allows decision-makers to consider every possible combination during concept selection to achieve the 'real' optimality. Software such as WinQSB's dynamic programming module is available to perform the extensive calculations.

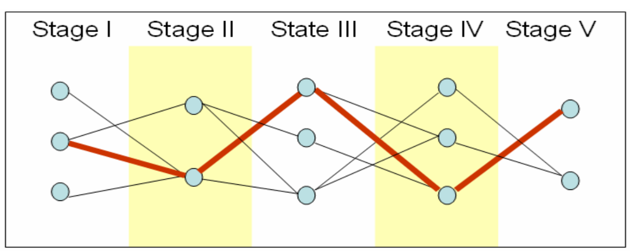

Fig. 2. Shortest Path Problems

5. Proposed Decision-Making Process & Framework

To achieve the goal of this research, a holistic view of the overall decision-making process needs to be established. A building system therefore was examined first at the stage-level. The following five stages: *Team Selection (TS)*, *Design (DS)*, *Procurement (PRO)*, *Manufacturing (MFG)*, and *Construction (CON)* were identified according to the way a system was typically produced and installed.

The investigator then conducted preliminary interviews with experienced trade contractors that were involved in this research. The main goal of these interviews was to collect the critical prefab-related decisions they typically made during the five stages to ensure a successful delivery of these building systems. Despite the distinguishing features of system types, decisions that could help bring out more value of prefabrication strategies were further categorized into 14 general areas, also called "*opportunities*" (annotated by stage as Team Selection: TS-i, Design: DS-i, Procurement: PRO-i, Manufacturing: MFG-i, and Construction: CON-i, where i = 1, 2…n opportunities). Assuming value is created when process or product waste is reduced and/or quality is increased, the criterion used for identifying these opportunities is defined as: "any potential value-added process or attribute that is enabled by increasing the scope of prefabrication strategies during design, procurement, manufacturing, and construction". Also based on the interview results, a set of potential "*tactics*" (annotated by stage as Team Selection: TS-ij, Design: DS-ij, Procurement: PRO-ij, Manufacturing: MFG-ij, and Construction: CON-ij, where i = 1, 2…n, j = a, b, c…) in each stage and for each opportunity were predefined. For example, "*TS-2: Subcontractor Selection*" is one opportunity area in *Team Selection*, whereas "*TS-2a: Design-Build Subcontractor*" and "*TS-2b: Subcontractor without in-house design capability*" are considered as two potential tactics in this area. One is not necessarily always better than the other since project conditions and available resources may vary.

Figure 3 below shows the relationship between stages, prefabrication opportunities, and their tactics. This research problem can be viewed as a shortest path problem in DP with the exception that the goal is to maximize utilities instead of minimizing costs. The following rules apply in order to make use of the CSM methodology and DP:

a) The tactics for each opportunity should be discrete.
b) At most one tactic will be selected for each opportunity.
c) Tactics are selected based on their overall contribution to the original project goals regarding initial cost, schedule, quality, and sustainability. Therefore, making good decisions here requires a decision-maker to maximize the combined value of tactics he/she selects for each opportunity.

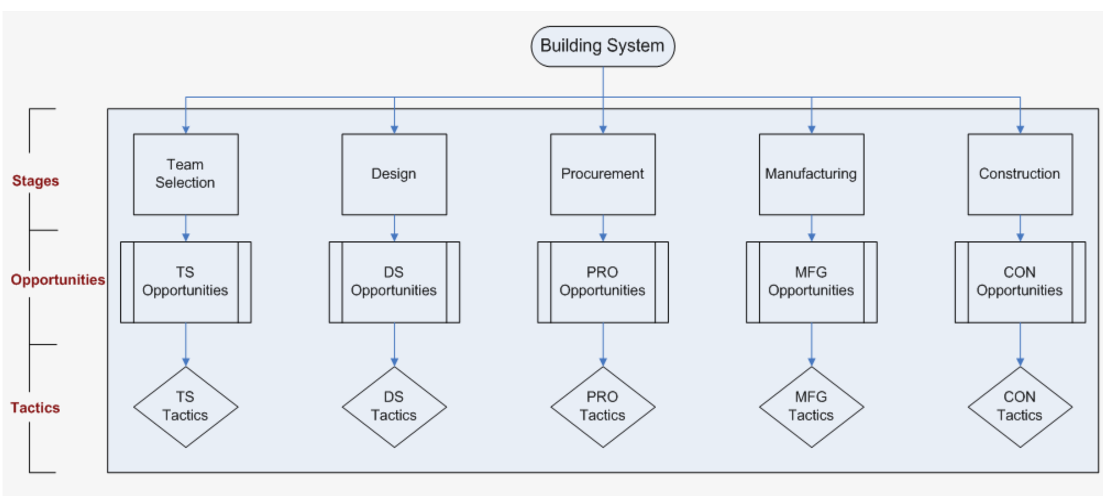

Fig. 3. Stages, Prefabrication Opportunities, and Associated Tactics

This approach allows the effect each tactic has on others throughout the five stages to be assessed and to measure this effect at a summary level, providing a more quantitative analysis in the overall decision-making process. A value table is used to prioritize project goals so weights can be taken into account to evaluate the impact tactics on the project.

Due to the fact that these tactics are not always complementary, their interrelationship will be assessed in the compatibility matrix. A similar compatibility scoring structure from the CSM methodology will be used in which alternative pairings are assigned a numerical value depending on their level of compatibility (Figure 4). For instance, "having an integrated design environment (e.g. a design-build project team)" does not affect "the availability of local skilled labor" ("design-build" is an alterative in the design stage and "labor availability" is an alternative in the construction stage). Therefore the compatibility of these two alternatives can be given a score of 1, meaning there is no compatibility tension.

By considering the individual project-wide impact of each tactic and the interrelation among all potential tactics, an "optimized" combination of tactics can be derived which suggests the best-fit prefabrication strategy for a building system for that project. The dynamic programming is used here to calculate the overall value of every tactic combination. The one with the highest value is identified as the optimum solution to the case being analyzed.

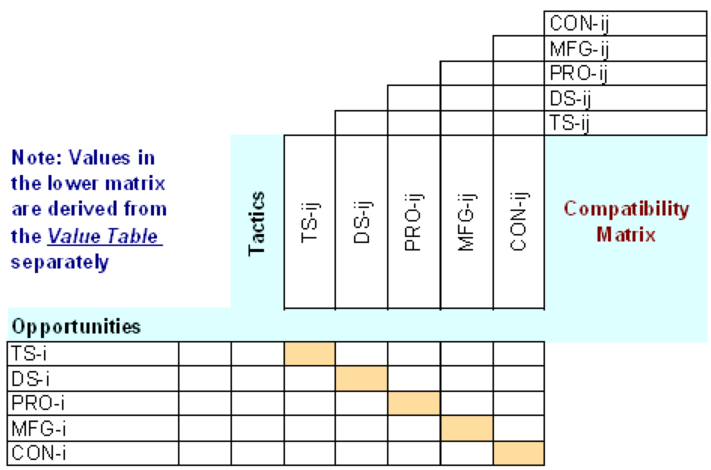

Fig. 4. PSSM Analytical Matrices

6. Pilot Case Study: The Early Childhood Learning Center (ECLC)

The proposed PSSM is applied to the roof system on a 4000 SF childcare facility: the Early Childhood Learning Center (ECLC) for illustrative purposes. This project was built in the summer of 2005 for Chief Dull Knife College in Lame Deer, Montana and was mostly designed and constructed (except for sitework, foundations and MEP work) by a group of volunteer students and faculty from Penn State University, University of Washington, and University of Wisconsin. A LEED certified green building was pursued, therefore green materials and sustainable technologies were employed which included an SIP (Structural Insulated Panel) roof frame, a mix of SIP and strawbale wall systems, radiant floor heating, evaporative cooling, CO2 monitoring, and digital climate control. A unique feature about this project was its "blitz-built" environment. The superstructure of the ECLC had to be completed in three weeks by a group of unskilled or semi-skilled volunteers. Hence "the use of prefabrication strategies to achieve the compressed schedule must be carefully balanced with the desires to maximize volunteer labor" (Luo, Riley, Horman, 2005).
Two types of roof panels were considered during the early phase of design.

Option 1: R-Control SIPs: An R-Control SIP consists of a Perform Guard Expanded Polystyrene (EPS) insulation core and OSB skins. The typical weight is about 3-4 psf. Panels are provided by a local manufacturer and are available in variable sizes which can be erected onsite either manually or by mechanical equipment such as a crane. Prep-work is needed before installation. The project team had worked with this manufacturer several times before on its previous projects and had a good relationship

Option 2: Agriboard Panels: Agriboard is made from compressed wheat or rice straw with exterior skins of straw-based OSB and structural support of laminated strand lumber (Agriboard Industries, 2006). These panels weigh about 14 psf (for 7-7/8" panels) (Agriboard Industries, 2006) and thus a crane is often required in the field. The panels are produced out-of-state which increases the material cost, however, since they arrive ready for installation with minimal prep work, a smaller crew is needed.

The following are the three possible prefabrication options for the roof panel erection:

1. Preassemble and erect R-Control SIPs onsite by hand;
2. Preassemble R-Control SIPs onsite and erect them with a crane;
3. Install Agriboard panels with a crane.

To maximize the value of these options, there are some other decisions to be made, such as "should the team stay with someone they know of", "at which stages of the project and system design should the subcontractor/manufacturer get involved", "what panel size should we choose", "who will provide the crane if needed", etc. The potential solutions to each question are considered as "tactics" and in many cases they are interrelated, contributing or detracting from one another. These potential system-level prefab-related tactics along with the overall project goals will be defined, assessed and analyzed by the project director and the research investigator using the proposed PSSM. The results should be able to identify the best combination of tactics for the given project conditions, which implies a good balance among work flows, labor use, construction costs, quality, and sustainability objectives.

7. Discussion and Conclusions

Prefabrication strategies can result in many outcomes that are synergistic with the goals and values pursued on green projects. A disconnect exists between these potential benefits and the typical process used to select prefabrication strategies. This paper presents a methodology to account for a comprehensive and thorough set of opportunities that exist through team selection, design, procurement, and construction phases of building projects. A dynamic programming methodology is applied to assist with the identification of a "best fit" approach for a given system. In a simple case of a roof panel system selection, the complex interaction between variable types of prefabrication approaches is illuminated.

Prefabrication strategies require time and extensive system knowledge. Some decisions need to be made early even before the design starts such as determining the appropriate procurement method and selecting the right team, which can have a tremendous impact on many other decisions later on. Without an effective tool to identify available prefab-related tactics and judge their values rationally, it is hard for project teams to quickly select the strategies that will bring the best outcomes under specific circumstances solely based on their past experience.

Case study research is currently in progress to identify patterns of interactions between prefabrication strategies across variable types of building systems. Additional research on how to best utilize prefabrication to achieve sustainable goals is needed. The key variables that dominate the decision-making process and the attributes of building systems which can most benefit from prefabrication strategies must be identified. Meanwhile, to ensure the results can be generalized across systems, multiple and diverse building systems must be tested.

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Attaining Sustainability through Construction Procurement in Singapore

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Abstract: Procurement is considered to be the key to performance improvement in the construction industry. Clients, through their bargaining power, can provide incentives and rewards to encourage good performance. Pressure from end purchasers and users would encourage clients to adopt the right policies in these regards. To enable them to do this, both clients and end purchasers require education and the correct information. A sound regulatory framework would also encourage appropriate action by all parties involved.

This paper considers recent trends in sustainable development in Singapore. It discusses efforts being made by clients (especially private clients) to attain sustainability on their projects through the approaches to procurement which they adopt. The paper first considers the importance of sustainability and the measures taken at the broad industry level, for example, through regulations such as those made under the Environmental Pollution Act 2001 (for example, the need to employ an Environmental Control Officer) and policy guidelines, such as the Green Mark scheme of the Building and Construction Authority (BCA). It is suggested in the paper that sustainability should be one of the key words of the construction industry and its clients; its attainment should be an objective, and a paramount consideration on all projects. Clients should evaluate the track record of both consultants and contractors in terms of sustainability during the procurement process. A concerted effort by government, industry and clients should be made.

Keywords: Client Action, Education, Performance Information, Sustainability, The Future

1. Introduction

Many studies show that the procurement approach adopted on a construction project leads efforts in improving performance. The theme of the W92 symposium in Montreal, Canada in 1997 was "Procurement – The way forward". The conclusions reached at the symposium confirmed the theme (Davidson, 1998: xi):

> On the *power of procurement*, there was little doubt expressed by the Symposium participants… The importance of the building owner's decision was clearly recognised as fundamental in setting up the framework for all subsequent activities…

The potential of clients using procurement to influence progress towards greater contribution of the construction industry to the efforts to attain sustainable development is also highlighted. The Commission of the European Union (2004) urges member countries to, among other actions, introduce sustainability requirements into governments' tendering procedures. The Working Group for Sustainable Construction (2001) suggests that clients, especially public clients, should take the lead in promoting sustainability in construction; clients should measure and report their progress in promoting sustainability in construction; and sustainability impacts and their mitigation should be addressed during the planning and design stages. The Group recommends that (p. 16):

> a. Clients should be encouraged to assess tenders on the basis of the economically most advantageous tender, balancing price, quality and life cycle costs, for which the quality assessment criteria should include sustainability factors.
>
> b. The award of contracts on the basis of 'concessions' linked to solutions on the basis of 'facilities management' taking increased account of life cycle costs … may have its advantages.
>
> c. Tenderers may be encouraged to put forward alternative technical solutions that take into account environmental aspects.

The Working Group (2001) discusses sustainable construction programmes in several European countries, in which the procurement process features prominently. It notes that:

> …conscious of their responsibility regarding the realization of sustainable development, more and more public purchasers wish to, and actually do, integrate environmental considerations into their procurement policy (p. 15).

The UK government has incorporated sustainability in all its procurement of goods and services, under the national strategic framework for attaining sustainability, "*Securing the Future*" (HM Government, 2005). Several examples are given in this paper. The Oxford Radcliffe Hospitals NHS Trust introduced "sustainable solutions from a brief through design, into construction" (Office of Government Commerce, 2006: 1). The clients and contractors prepared sustainability and biodiversity action plans. Measures taken on the site included: engagement of a waste management company to segregate and dispose of waste, leading to the diversion of over 90% of waste from landfills; introduction of a green transport plan for the workers; selection of linoleum flooring manufactured from renewable materials, which has a long replacement life cycle and is biodegradable; use of ceiling tiles made of 30% post-industrial waste; and collaboration with paint supplier to supply paint in 10 litre metal cans, making polyethylene terephthalate cans unnecessary.

2. Aims and Objectives of Paper

The aim of this paper is to discuss how clients can contribute to the efforts to attain sustainability on their construction projects through the procurement processes they adopt.

The objectives of the paper are to:

1. consider the nature and challenges of sustainable development with respect to construction, concentrating on environmental sustainability
2. discuss recent trends in sustainable development in Singapore, focusing on building, and considering mainly the efforts of clients to attain sustainability on their projects through the approaches to procurement which they adopt
3. suggest initiatives which can be taken to make the attainment of sustainability a paramount consideration on all building projects.

3. Sustainable Development and Sustainable Construction

Pearce (2006) analyses various definitions of "sustainable development" and notes that it is a value-laden expression. Du Plessis (2005) also discusses many definitions of sustainable development and "sustainable construction". "Sustainable development" has several aspects. For example, the Hong Kong government adopted the following guiding principles of sustainability (Planning Department and Environmental Resources Management (2000): economy; health and hygiene; natural resources; social; biodiversity; cultural vibrancy; environmental quality; and mobility. This paper focuses on the environmental aspects of sustainability. This is important with respect to building owing to the environmental impact of buildings. Lutzkendorf and Lorenz (2005), and Gluch and Stenberg (2006) provide a catalogue of these impacts. Chen *et al*. (2005) highlight the following environmental challenges from the development of housing estates in Beijing, China: inefficient land use; water shortage; air pollution; traffic congestion; deterioration of the ecological system; high energy consumption; and high volumes of waste.

The literature highlights the need for a cradle to grave approach in the effort to attain sustainability in construction, with action being taken at all the stages of the process (see, for example, Sjostrom, 1999). Actions to protect and enhance the environment can be taken at many levels. For example, governments provide the statutory and policy frameworks for action by business enterprises and individuals. They also offer incentives and support mechanisms including advisory services.

3.1 Sustainable Procurement

In a paper on their sustainable procurement policies, the Office of Government Commerce and Department for Environment, Food and Rural Affairs (2003: 2) note:

> Sustainable development means achieving four objectives at the same time: effective protection of the environment; prudent use of natural resources; social progress which recognizes the needs of everyone; maintenance of high and stable levels of economic growth and employment.

Thus, sustainable procurement would seek to attain these objectives, within the context of achieving value for money.

Knowledgeable clients have influenced the process by which their buildings have been designed and constructed. The Environment Agency (2006: 2) notes:

> We have made progress as a public sector client adopting the principles of sustainable construction. But we could do more. We will identify sustainable construction targets when developing our capital projects, such as reducing waste and pollution incidents, setting targets for recycling aggregates or enhancing biodiversity. …we will adjust our appraisal framework and procurement practice so that sustainable construction objectives are taken into account.

To influence the construction process effectively, clients require knowledge and commitment. The Office of Government Commerce and Department for Environment, Food and Rural Affairs (2003) adopt the environmental purchasing hierarchy suggested by Morton (2002): dispose/end of life management; recycle; re-use; reduce; eliminate; and rethink. The Central Procurement Directorate (http://www.cpdnii.gov.uk) proposes the following 12 principles which govern public procurement: (i) accountability; (ii) competitive supply; (iii) consistency of application of general procurement policy across public sector; (iv) effectiveness in meeting the commercial, regulatory and socio-economic goals of government; (v) efficiency and cost effectiveness in all procurement processes; (vi) fair dealing in ensuring suppliers are treated fairly and without unfair discrimination; (vii) integration of procurement policies with other economic and social policies; (viii) integrity (no corruption of collusion with suppliers and others; (ix) informed decision making; (x) legality; (xi) responsiveness; (xii) and transparency.

Themes of sustainable construction procurement offered by the UK Office of Government Commerce (2000) are: (i) re-use existing built assets; (ii) design for minimum waste; (iii) aim for lean construction; (iv) minimise energy in construction; (v) minimise energy in use; (vi) do not pollute; (vii) preserve and enhance bio-diversity; (viii) conserve water resources; (ix) respect people and their local environment; and (x) set targets. Similarly, the action plan of the Government Construction Clients Group aimed to achieve, between 2004 and 2006: procurement in line with value for money principles on the basis of whole life costs; less waste during construction and in operation; targets for energy and water consumption for new projects that meet the least current best practice for construction type; protection of habitat and species; targets developed in terms of "respect for people" for all procurement; an increased number of new and refurbished projects achieving at least "very good" rating under an established assessment scheme; increased engagement with local communities in decision making; and improved industry performance. By March 2006, all projects of members of the Group (an increase from 25% in 2004) would have criteria for evaluation of sustainability included in the procurement procedures.

4. Trends in Singapore

4.1 Importance of Sustainability in Singapore

Singapore has a comprehensive body of statutes, regulations and codes which govern activities, outline good practice, provide norms and targets, prohibit harmful actions and products, and set sanctions. These include the Environmental Pollution Control Act and the State Lands Encroachments Act. The institutional framework for forming, implementing and enforcing policies is headed by the National Environment Agency (NEA) which was formed in 2002. Its vision is: "an enterprising agency, embracing all in caring for our clean and healthy environment - today, for tomorrow" (http://www.nea.gov.sg/). Its mission is: "To ensure a sustainable quality environment in Singapore". It seeks to accomplish these by working with the community through: facilitating and providing environmental services; promoting environment-related industries; and training and public education.

The framework for action to attain sustainable development in Singapore is the national Green Plan, first published in 1992. Over 17,000 people participated in the formulation of the current Singapore Green Plan 2012 (2006 edition) (Ministry of the Environment and Water Resources, 2006). It is a ten-year blueprint with the following focus areas: (i) air and climate change; (ii) water; (iii) waste management; (iv) nature; (v) public health; and (vi) international environmental relations. Two aspects of SGP2012 which may be discussed this paper are: "clean land" and "clean air". To reduce the volume of waste generated in Singapore, SGP2012 proposes: volume reduction by incineration; waste recycling; reducing landfilled waste; and waste minimisation. With limited land and only one landfill site, Singapore currently incinerates about 90% of waste generated. C&D waste such as concrete products, are prominent in the non-incinerable waste which must be landfilled. SGP2012 aims to achieve "Zero Landfill"; this has implications for construction.

Singapore has maintained a high standard of air quality by setting stringent emission standards, promoting energy efficiency, and using energy sources that emit less pollutants such as natural gas. The concentrations of major air pollutants (sulphur dioxide, nitrogen oxides, carbon monoxide, ozone and particulate matter below 10 microns) are below the levels set by the World Health Organisation (http://www.nea.gov.sg). SGP2012 offers the following proposals on clean air: introduce a framework, programmes and policies to control the emission of air pollutants; leverage on regional co-operation in the control of haze; focus on targeted sectors to promote energy conservation and the use of cleaner energy sources such as compressed natural gas, fuel cells and solar cells; engage and encourage industries to implement effective air pollution control measures; and explore and test new technologies which are suitable for Singapore to adopt.

4.2 Measures for Construction Industry

Many regulations have been introduced to guide and control building activities in Singapore in order to reduce their environmental impact. These relate to: (i) design, such as the mandatory overall thermal transmittance values of building facades; and (ii) management, such as the regulation under Section 62 of the Environmental Public Health Act (Chapter 95), and the Environmental Public Health (Employment of Environmental Control Officers) Order 1999 requiring the occupier of the construction site to employ an Environmental Control Officer on a full-time basis if the contract sum of the construction project is $50 million (US$1 = S$1.58) or more, or part-time for projects with contract sum between $10 million and $50 million to supervise and promote environmental public health on the site (http://app.nea.gov.sg/cms/htdocs/article.asp?pid=951).

Contractors which wish to undertake public-sector projects are required to register with the BCA (which is responsible for the development of the construction industry). The criteria for registration for large and medium-sized firms include certification to the ISO 9001 quality management system (since 1999), ISO 14001 environmental management system (since 2004) and ISO 18000 health and safety management systems.

The BCA launched the Green Mark for Buildings Scheme (Green Mark) in January 2005. The aim was: "to move Singapore's building and construction industry towards environment-friendly buildings and help strengthen Singapore's position as a global city committed to balancing its development with care for the environment" (Foo, 2005). The objectives of Green Mark are to: promote environmental sustainability in the construction industry and raise the awareness among developers, owners and professionals of the environmental impact of their projects; recognise building owners and developers who adopt practices that are environmentally conscious and socially responsible; and identify best practices in the design, construction, management and operation of buildings.

Under Green Mark, new buildings are assessed in terms of: (i) Energy Efficiency; (ii) Water Efficiency; (iii) Site and Project Development and Management; (iv) Indoor Environmental Quality and Environmental Protection; and (v) Innovation. On existing buildings, "Site and Project Development and Management" is replaced with "Building Management and Operations". To ensure that buildings given the Green Mark are well maintained, they are assessed every two years. There are four levels of Green Mark ratings: Platinum Star, Platinum, Gold and Silver. The Green Mark provides a label of environmental performance to guide end purchasers and users. It also provides information on the track record of practitioners and firms to facilitate selection during procurement.

4.3 Efforts by Clients

In this section, the sustainable procurement practices of some clients in Singapore are presented. The case study of one large developer is followed by examples of other clients.

4.3.1 Case Study: City Developments Ltd

City Developments Ltd (CDL) has a large portfolio of properties in Singapore and overseas, including an international chain of hotels. Its environmental policies and practices are now discussed.

CDL declares that it is "committed to offering a living environment that is conducive for a healthy and comfortable lifestyle". It has formulated an Environment, Health and Safety Policy to monitor and control the impact of the firm's activities on the environment. CDL was the first private property developer in Singapore to be awarded both ISO 14000 and OHSAS 18000 certification for property development and project management services (in 2003). The company believes that it takes measures to raise environmental and health and safety standards in all its projects to deliver quality buildings that are easy to maintain and efficient to operate. For example, CDL indicates that it introduces innovative ecological features into the homes it builds to promote greener living. Its homebuyers are encouraged to "recycle, reduce and reuse"; this is supported by the firm's Care and Recycle Programmes at some residential developments. In planning a new development, CDL makes efforts to preserve the natural foliage and integrate the natural terrain into its landscaping. Table 1 shows some environmental features in three of its condominium projects including Savannah Condo Park, the firm's first "eco-condo".

Table 1: Environment-friendly features in some CDL residential condominiums in Singapore

	Savannah Condo Park	Changi Rise Condominium	Goldenhill Villas
Water taps built in planter boxes for residents to maintain high-rise gardens.	**X**		
Lush landscaping.	**X**	**X**	
Energy saving lighting fitted along ventilation walls, boundary fences and other common areas		**X**	**X**
Rooftop air turbines that provide energy efficient cooling and reduces utility bills			**X**
Energy-saving air-conditioning systems for all houses.	**X**		
Eco-friendly architectural design that creates convection wind to cool the residence naturally			**X**
Specially designed roof gardens that provide rooftop insulation to minimise dependency on air-conditioning			**X**
Solar panels installed in the clubhouse to convert solar energy into usable electricity to be be used in selected rooms and water heaters for the clubhouse.	**X**		
An odourless and mechanised pneumatic waste disposal system that removes solid waste from refuse chutes in individual homes to a sealed compactor within the bin centre or a mobile truck.	**X**	**X**	
A designated green corner with colour coded bins placed at strategic locations to encourage residents to recycle.	**X**	**X**	
Use of environment-friendly building materials such as recycled wood chips in laminated flooring instead of timber to help conserve natural resources and the environment.	**X**	**X**	
An ecological pond that maintains water clarity and controls odour, algae and bacteria growth by recirculating the water through an aerobically active filter bed.	**X**	**X**	
Provision of bicycle racks to encourage residents to cycle as an alternative to driving.	**X**		

Source: http://www.cdl.com.sg/cdl2.nsf/ws.htm

CDL requires contractors and subcontractors it engages, and consultants it commissions to be certified to ISO 14001. Its contractors must also meet criteria including material waste. It awards the 5-Star Environmental, Health and Safety Award to firms meeting the stringent comprehensive evaluation criteria. CDL's sustainable procurement practices have shown results by influencing its business partners. Consultancy and construction firms which undertake its projects have some of the best practices in Singapore's construction industry. Tiong Seng Contractors (Pte) Ltd won the coveted Construction 21 Best Practice Award in 2006 (it was the only winner that year) for implementing a wastewater recycling system for silt water management and recycling for use in construction. The system had been procured and adapted with the encouragement of CDL, and used on several of its projects by the contractor. CDL projects have also won many awards for good environmental performance. Table 2 presents the environmentally responsible features of CDL's projects which won (four of the total of eight) Green Mark award in 2006.

Table 2: Environmentally responsible features of CDL projects which won Green Mark Gold in 2006

Residential Project	*Environmentally responsible features*
City Square Residences	* Construction using diaphragm wall uses less strutting materials * Extensive use of solar-powered light-emitting tiles, pole lights, bollard lights in landscaping * Dual chute pneumatic refuse collection system segregates recyclable and non-recyclable waste * Extensive use of sunpipes to send light into the three basement levels * Use of silt treatment and water recycling plant to recycle treated water for washing and cleaning
St Regis Hotel & Residences	* Self-cleaning ceramic façade cladding system saves water * Condensate water recycling saves up to 19,300m^3 of water per year * "Wetstep" silt water treatment system saves 3,210 m^3 of water per month * Motion detection system is integrated with lighting for private lift lobbies * Dual chute pneumatic refuse collection system segregates recyclable and non-recyclable waste
King's Plot 3 Residences	* During construction, water treatment system was used to recycle treated water for washing and cleaning * All units are supplied with 4 ticks energy labeled air conditioning systems * all units are provided with dimmer controls in living/dining and master bedrooms * Tanks on fourth storey collect rainwater to be used for watering plantson ground floor by gravity fall
The Sail @ Marina Bay	* Construction using peanut-shaped diaphragm wall eliminated strutting, making the working environment safer and cleaner * Staircase shelter – uses less concrete and steel for construction and less materials for accessories * Solar powered system for heating pool and powering aircraft warning lights * Dual chute pneumatic refuse collection system segregates recyclable and non-recyclable waste

Source: BCA, 2006

CDL was one of only two companies to be awarded the Singapore Green Plan 2012 Award in 2005. This award recognises individuals and organisations which are considered to make outstanding contributions towards the attainment of environmental sustainability in Singapore. The firm also won the prestigious Singapore Environmental Achievement Award 2004. CDL is one of very few companies in the world which meet FTSE4Good's Socially Responsible Investments standards of corporate social responsibility. The firm was recognised by FTSE4Good for working towards environmental sustainability, and developing positive relationships with stakeholders. CDL won the Merit Award for Best Public Relations Work for the Environment at the PR in the Service of Mankind (PRISM) Awards 2002. It also won the Green Leaf Award in 2000 (administered by the then Ministry of the Environment) for being the first developer in Singapore to install eco-friendly lifts and innovative pneumatic refuse collection systems in selected condominiums, and for setting aside large proportions of site area for greenery and landscaped gardens in its projects.

4.3.2 Other Private Developers

Some other clients have good records in sustainable procurement. Table 3 shows the environmental features of other projects (other than CDL works) which won the Green Mark award in 2006.

The two projects which won the Green Mark Platinum award in 2006 were Republic Polytechnic and Tan Tock Seng Hospital (BCA, 2006). The knowledgeable clients' procurement approaches led to many environmental innovations on both projects. Republic Polytechnic has a "Campus in the Park" look. Its features include: use of photovoltaic solar energy for general lighting and power; a pneumatic waste conveyance system; and multiple ventilation modes for the sports hall. Tan Tock Seng Hospital uses hydrogen fuel cell technology as back-up power; a heat exchanger supplies hot water to the kitchen by extracting the air conditioning system's waste heat; and energy saving dual sensor (carbon dioxide and temperature) system controls mechanical ventilation in the basement carpark.

Table 3: Environmentally responsible features of residential projects of developers other than CDL which won Green Mark Gold in 2006

Residential project (Developer)	*Environmentally responsible features*
RiverGate (Riverwalk Promenade Pte Ltd)	* Sprawling landscape on the ground; green vista is extended vertically to top of towers * Water drip line system, operating with timers and rain sensors, are installed in the sky and roof gardens * All systems have dual flushing system water closets all units are provided with inverter multi-split air-conditioning systems * Guard houses use recycled water collected from integrated basins to flush toilets
The Tresor (Keppel Land Realty Pte Ltd)	* Waterless urinal in clubhouse toilet * Ductless mechanical ventilation fans in basement car park * Use of recycled plastic in equipment in children's playground
The Azure (FCL View Pte Ltd)	* Solar powered light-emitting tiles, pole lamps, bollard lights in landscaped areas; solar powered water heater in clubhouse changing room showers * Use of sunpipes to send light into basement carpark * Environmentally friendly lightweight plastic grid for turfing along fire engine access way * Pneumatic refuse collection system segregates recyclable and non-recyclable waste
Varsity Park Condominium (CapitaLand Residential Singapore)	* Blocks of buildings are oriented to reduce direct sunlight into apartment units * Basement carpark has about 20% opening for natural light and ventilation, eliminating the need for full mechanical ventilation and water sprinkler fire-fighting system * Gearless traction elevator

Source: BCA, 2006

5. Recommendations

A national construction industry development strategy should be formulated for each country. It should aim to enhance the performance of the industry from all the key perspectives: cost, time, quality, the environment, health, and safety. The environmental perspective should be given pride of place owing to its long-term benefits to end purchasers and society. This blueprint should highlight the roles of each of the stakeholders in the efforts to realise the objectives of the initiatives, and provide for an administrative mechanism for implementing the strategies.

Clients should incorporate the protection of the environment in their corporate missions, policies and objectives, and procurement approaches. Clients should evaluate the track record of consultants and contractors in terms of sustainability during the procurement process, and assess their performance on the projects in these regards.

Clients, consultants and contractors should be educated on environmental issues of construction. The educational programme should be developed and delivered by the national agency for construction; the professional institutions; the contractors' association; and the clients' association. End purchasers and users should also be educated on sustainable development and sustainable construction. They would then constitute a market force which would compel developers to adopt sustainable procurement practices.

Smaller developers' companies could pool their resources, to enable them to exercise control of the features of the main items they procure, and to gain economies of scale. End purchasers and users in each country could also form associations to represent their interests to clients and the design team.

Projects utilising best sustainable procurement practices, both locally and overseas, should be documented by the construction industry development agency, and the case studies disseminated among practitioners.

6. Conclusion

Sustainability should be one of the key words of the construction industry and its clients. Its attainment should be an objective, and a paramount consideration on all projects. For the individual project, arguably the most relevant aspect is the environmental one. Clients, as prime movers of projects, can play a significant role in enhancing the environmental performance of the design and construction teams. There is scope for applying the principles of sustainable procurement on all construction projects.

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Whole –Life Costing and Cost Management Framework for Construction Projects in Nigeria

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Abstract: Costs and Value are not always well managed by clients. Some Clients are concentrating on the wrong goal –lowest tender price rather than best value, but focusing on the initial capital costs of a construction project does not give value for money. Building owners need to think in terms of achieving value by meeting the needs of end users with a higher quality project at lower –life costs.
This paper presents the results of a study with the objective to establish the importance of various processes used in making decisions and estimating on whole-life costs. To determine the importance of various items of costs in cost management using whole-life approach. The study was carried out through questionnaire survey administered to a population of 30 construction professionals in consulting firms and clients' Organisation. The data analysis included a statistical comparison of means and interpretation. It is expected that this study will enable clients to integrate the design and construction processes and also involve the integrated team early in the design as this will facilitate the planning of long term costs over the life of the project.

Keywords: Construction Projects, Cost Management, Framework, Nigeria, Whole-life Costing.

1. Introduction

Cost Planning and control of building designs were aimed at minimizing initial construction costs alone. However, many users of buildings have discovered that the running costs of buildings usually impact significantly on the occupiers budget (Dale, 1993). There are a number of current trends that are of concern for design professionals, these include: facility obsolescence, environmental instability, operational staff effectiveness, total quality management and value engineering (Kirk and Dell'Isola, 1995). Clients are often over optimistic in their estimates of costs and the time required for delivery. In some cases, actual budgets were twice as much as estimates (Mott MacDonald, 2002). If 'real value for money' is to be achieved, then clients must direct their professional advisers not to focus on capital costs only, but to acknowledge the significance of other costs and revenues associated with the acquisition, use and maintenance and disposal of an asset (Ballestry et al, 2004)

2. Whole –Life Costing and Cost Management Framework

2.1 Definitions

Several definitions of whole-life costing exists BSI(1999) defines whole-life costing as a tool to assist in assessing the cost performance of construction work, aimed at facilitating choices where there are alternative means of achieving the client's objectives and where those alternatives differ not only in their initial costs, but also in their subsequent costs. Another useful definition is adopted by the Construction Best Practice Programme (CBPP, 1998a): The systematic consideration of all relevant costs and revenues associated with the acquisition and ownership of an asset. The whole-life costs of a facility (often referred to as through-life costs) are the costs of acquiring (including consultancy, design and construction costs, and equipment), the costs of operating and the cost of maintaining a facility over the whole life through to its disposal. That is, the total ownership costs (AECP, 2003).

Cost management is the process of planning, estimating, coordinating, controlling and reporting off all cost related aspects from project initiation to operation and maintenance and ultimately, disposal. It involves identifying all the costs associated with the investment, making informed choices about the options that will deliver best value for money and managing those costs throughout the life of the project, including disposal (AECP, 2003)

2.2 Whole- life Costing As a Decision Making Tool

The main use of whole life costing is in the effective choice between a number of competing project alternatives and this is mainly applied during the early design stages (Griffin, 1993). Further to this, the ability to influence cost decreases continually as the project progresses, from 100% at project conceptualization, to typically 20% or less by the time construction commences (Paulson, 1976; Fabrycky and Blanchard, 1991). Furthermore, once the building is completed, there is a slim chance to change the total cost of ownership because the decision to own or purchase a building normally commits users to most of the total cost of ownership (HMSO,1992). 80-90% of the cost of running, maintaining and repairing a building is determined at the design stage (Kirt and Dell'Isola,1995; MacKay, 1995)

2.3 Implementation Of Whole- Life Costing In The Construction Industry.

Most basic principles of whole life costing are well developed in theory it has however not received a wide practical application in Nigerian construction Industry. Most building sectors in other countries have not fully adopted whole-life costing methodology (Larsson and Clark; 2000, Wilkinson, 1996;Sterner,2000) although it has been used predominantly in public procurement (Clift and Bourke, 1999). Many researchers (Brandon,1987; Ashworth 1996; Flanagan et al 1989;Ferry and Flanagan; 1991,Al-Hajj, 1996; Bull, 1993;Wilkinson, 1996;Blinta and Sarma, 1997; Smith et al, 1998; Sterner, 2000; among others), have tried to highlight areas causing difficulties in the application of whole-life costing in the industry. Kishk and AlHajj (1999) categorized these difficulties on the part of the industry practices, the client, the analyst and the analysis tools currently being in whole- life costing

2.4 Construction Industry Limitations

The capital cost of construction is usually separated from the running cost. It is normal practice to accept the cheapest initial cost and then hand over the building to others to maintain. Furthermore, there is no clear definition of the buyer, seller and their responsibilities towards the operating and maintenance costs (Bull, 1993). In addition, there is lack of motivation in cost optimization because the design and cost estimating fees are usually a percentage of the total project cost (McGeorge,1993).

2.5 Client Limitations

Bull (1993) pointed out that there is also a lack of understanding on the part of the client. This may increase the possibility of subjective decision making. In addition, there are usually multiple aspects of needs, desired by the clients (Chinyio et al, 1998). Most of these aspects cannot be assessed in a strict whole- life cost framework (Kishk et al, 2001), Some of these factors are intangibles such as aesthetics. In some projects, these intangibles are also in conflict with the result of whole life costing (Wilkinson, 1996)

2.6 Analysis Difficulties

The major obstacle facing the analyst is the difficulty of obtaining the proper level of information upon which to base whole- life costs analysis. This is as a result of lack of appropriate, relevant and reliable historical information and data (Bull, 1993). Furthermore, cost of data collection is expensive (Ferry and Flanagan, 1991)

2.7 Cost Management and Reporting: Overview

Management of the overall cost of the project is the responsibility of the project manager, reporting to the project sponsor. In managing project costs, the main tasks are to:

- Manage the base estimate and the risk allowance
- Produce cost reports, estimates and forecasts
- Operate change control procedures.
- Maintain an up to date estimated outrun cost and cash flow
- Initiate action to avoid overspend
- Issue a monthly financial status
- Delivering the project at the appropriate capital cost (having considered the implication of quality, programme and whole-life objectives, using value criteria established at the start of the project)
- Ensuring that, throughout the project, full and proper account is monitored of all transactions, payment and changes.

The project sponsor has overall responsibility for the project, including the estimated cost, and will need to be satisfied that appropriate systems for controlling costs are in place and functional. Where significant costs are attached to a design, these must be properly reviewed against the budget decision and properly authorized. For complex projects, there might be delegated levels for each cost centre. Value management and value engineering have an important part to play in influencing cost (AECP, 2003) During construction, instructions issued to the integrated project team, whether for change via a formal change control procedure of for clarification of detail, have a much more immediate impact on cost. The project sponsor needs to establish procures for instructions and information that ensure:

- Instructions are issued within delegated authority
- Instructions are costed and their impact assessed before use
- The instructions is justified in terms of value for money and overall impact on the project
- The cost of all instruction monitored on a continuous basis

3. Objectives of the Study

The study seeks to identify the principles of whole-life cost management and basically has two objectives:

1. To establish the importance of various processes used in making decisions and estimating on whole-life costs.
2. To determine the importance of various items of costs in cost management using whole-life approach.

4. Data Collection and Analysis

The study was carried out through questionnaire survey. The questionnaire focused on:
The profession of the respondents, construction industry experience, framework for making decisions on whole-life costs, estimating whole-life costs and cost management. Most of the questions were derived from journal publication. The respondents were asked to assess the importance of the variables used in the research instrument. A 5-point Likert scale of 1 for not important, 2 for of little importance,3 for somewhat important, 4 for important and 5 for very important was used. Statistical analyses were undertaken using the Statistical Package for Social Sciences (SPSS).The analysis ranked the variables on the importance index.

5. Results and Discussion

Thirty questionnaires were collected and were found useful for the study. The demographic characteristics of the respondents are presented in Table 1.

Table 1: Demographic Characteristics of the Respondents

1.	Variables Profession	Freq.	Cum. Freq.	Percentage	Cum. Percent
	Civil Engineer	2	2	6.7	6.7
	Builder	2	4	6.7	13.4
	Architect	4	8	13.3	26.7
	Estate Surveyor and valuers	7	15	23.3	50.0
	Quantity Surveyor	15	30	50	100.0
2	Construction Industry Experience				
	Over 30 years	8	8	26.7	26.7
	21-30 years	7	15	23.3	50.0
	11-20 years	7	22	23.3	73.3
	1-10 years	8	30	26.7	100.0

The majority of the respondents (50%) are Quantity Surveyors, the remaining (50%)are Estate Surveyors and valuers, Architects, Builders and Civil Engineers. About 53.4% of the respondents are made up of respondents that have over thirty years experience and those that have less than ten years experience in the construction industry.

5.1 A Framework for Making Decisions on Whole-Life Costs.

Importance index for five processes that facilitate decision making in the application of whole-life costs on projects are shown on Table2.From the table the most important process based on the ranking of the Mean Item Score(MIS) are: Integrating the design and construction processes(4.97);this is followed by involving the integrated project team early(4.87).Others are :Taking account of the needs of the end users of the facility(4.53);team members responsible for design and construction should work together(4.53);making the sustainability of the completed facility a priority.

Table 2: A Framework for making decisions on Whole-Life Costs

Variables	Importance index	Rank
Integrating the design and construction processes, so that the integrated project team can take responsibility for the cost and quality implications of their design, with input from those who will be responsible for operating and maintaining the facility.	4.97	1
Involving the integrated project team early on so that they can advice on how the design will affect cost, health and safety during construction and in use, speed of construction and the operational efficiency of the completed facility.	4.87	2
Taking early account of the needs of the end users of the facility in order to avoid costly design changes at a later stage.	4.53	3
The team members responsible for design and construction should work together to identify the most cost-effective design over the life of the facility.	4.53	3
Making sustainability of the completed facility a priority, taking full account of its whole life costs.	4.47	5

The views of the respondents were based on the importance of the processes in the objectives of whole-life costs. From the surveys all the processes are considered important because all the mean item score are above 4.00. The ranking only shows that some processes are more important than others.

5.2 Estimating Whole-Life Costs.

Importance Index for sixteen variables is shown on Table 3. From the table, the four most important variables in estimating whole- life costs based on the ranking of the Mean Item Scores (MIS) are: ensure the project team is integrated from the outset of the design process (4.97); use techniques such as value management and value engineering to minimize the potential for waste and inefficiency (4.80); ensuring financial reviews at key decision points as this will confirm if the project is still affordable (4.53); determine total investment needed to complete a facility (4.40).The four least important variables are: ensuring that variation orders are properly authorized (3.90); Preparing estimates and cash flow in line with the project programme (3.90); draw up a design brief that is output based with explicit reference to value (3.67); Specify at an early stage any constraints on capital costs.

Table 3: Estimating Whole-Life Costs.

Variables	Importance Index	Rank
Ensure the project team is integrated from the outset of the design process, to enable specialist suppliers to contribute to the design.	4.97	1
Use techniques such as value management and value engineering to minimize the potential for waste and inefficiency.	4.80	2
Ensuring financial reviews at key decision points as this will confirm if the project is still affordable	4.53	3
Determine total investment needed to complete a facility, such as the cost of design, construction cost and land cost..	4.40	4
Check how the facility will enhance the core business operations that will take place in the facility.	4.40	4
Produce an output based specification	4.23	6
Planning and controlling both commitments and expenditure within budgets so that unexpected cost over/under runs does not result.	4.20	7
Compare capital and predicted whole-life costs with the benchmark cost for a similar facility procured in the same way.	4.17	8
Ensuring that the contracts provide full and proper control and that all costs are incurred as authorized.	4.13	9
Ensuring that designs meet the scope and budget, delivering quality that is appropriate and conforms to the brief.	4.10	10
Defining what is to be included in the project and limiting expenditure accordingly.	4.00	11
Ensuring all expenditure relating to risks is appropriately allocated from the risk allowance and properly authorized.	3.97	12
Ensuring that variation orders are properly authorized	3.90	13
Preparing estimates and cash flow in line with the project programme.	3.90	13
Draw up a design brief that is output-based with explicit reference to value, involve the users of the facility and others in its development.	3.67	15
Specify at an early stage any constraints on capital costs.	3.50	16

5.3 Cost Management

Importance Indices for twelve items of cost in Cost Management are shown on table4.The ranking of the Mean Item Score (MIS) shows that the four most important variables are: construction costs (5.00); planning costs(4.40);maintenance costs(4.33);consultancy costs(4.30),while those that are of little importance are information technology costs(2.93); health and safety costs (2.50).

Table 4: Cost Management

Variables	**Importance Index**	**Rank**
Construction costs	5.00	1
Planning costs	4.40	2
Maintenance costs	4.33	3
Consultancy fees	4.30	4
Cleaning cost	3.87	5
Cost of operations	3.63	6
Cost of in-house resources	3.40	7
Security costs	3.33	8
Cost of utilities	3.30	9
Cost of Alterations	3.27	10
Information technology cost	2.93	11
Health and safety costs	2.50	12

The views of the respondents are based on the importance of these costs in cost management. The result of the survey shows that construction costs is very important, while planning costs, maintenance costs, consultancy fees are important. The ranking shows that some costs are more important than others in cost management of whole-life costs.

6. Conclusion and Recommendation

The study has been able to establish the importance of various processes used in making decisions and estimating on whole-life costs. The paper also determines importance of various items of costs in cost management using whole-life approach. It is evident from the study that integrating design and construction processes as well as involving the integrated team early is essential in whole-life costs. The use of techniques such as value engineering and value management to minimize potential for waste and inefficiency is also useful in whole-life costs of projects in Nigeria. In cost management using whole-life approach, ten items of costs are very crucial, with construction costs being the most sensitive. There is need to integrate the design and construction processes and also to involve the integrated team early in the design as this will facilitate the planning of long term costs over the life of the project. This is because long term costs are more reliable indicators of value for money than initial construction costs. In planning for the long term costs emphasis must be placed on the following: construction costs, planning costs, maintenance costs, consultancy fees, cleaning cost, cost of operations, cost of in-house resources, security costs, cost of utilities, cost of alterations.

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The Specialist Task Organisations (STOs) Procurement Approach: a means to improve the owners' contracting strategies and the project objectives

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Abstract: This paper presents a specialist task approach of a project execution process. The aim of the paper is to develop a procurement framework to improve owners' contracting strategy and project implementation processes in terms of the project objectives of time, cost and quality. The study covers all contracting stages, phases, the stakeholders' responsibilities and risks as well as interrelate project execution processes. The paper begins with the theoretical background/concept of the STO approach and followed by a case study for validation. The proposed task-oriented approach utilises integrated product (task) development, integrated management, and fragmented execution via task organisations. The STO concept allows the owner's design team to produce overall design, which is used by the STOs to produce technical detailed engineering design solutions and project cost estimates. The merits of the STO approach include, the shifting of competition from only single design and cost-based to multiple of designs, life-cycle costs, alternative materials, and maintainability implications. The STO approach assumes a modular approach to design, and allows experts (STOs) knowledge in design and construction through their involvement from preconstruction through project starts up.

Keywords: Construction, Procurement, Project, Specialisation, Task Organisation

1. Introduction

This paper was driven by the existing problem in the construction industry, i.e. owner or client dissatisfaction in terms of prolonged delivery times, exceeded budgets and the non-attainment of quality standards. Adbel-Meguid (1997) refers to the construction industry as an open organisation where different components/disciplines are interchangeable and intervening according to prevailing conditions and work environments. Previous studies have linked the owner dissatisfaction with supply chain management, contracting and procurement processes (Latham (1994; Egan 1998). Originally, Latham (1994) recommended the formulation of effective construction processes that will result to increased project performance in the UK context. Many studies have proposed integration and partnering, i.e. taking a single point of responsibility in order to avoid fragmentation that is believed to be the root cause(s) of the construction industry ills (Latham 1994; Egan 1998). However, Cox and Ireland (2002) emphasise that the Latham (1994) and the DETR (1998) reports suffer from inappropriate methodology in analysing the causes of inefficiency in construction procurement as well as choosing the subjective preference for partnering solutions. Readily, some of the flaws in partnering (e.g. the false dichotomy between the points of responsibilities) are well demonstrated in the repeated formation and the subsequent break-up of project teams when in most cases the fragmented construction is one-off or seldom repetitively embarked upon.

Nevertheless, the Egan (1998) reports' five key drivers of change are adopted for designing the proposed STO approach: committed leadership, a focus on clients, integrated processes and teams, a quality driven agenda, and commitment to people. However, integration and partnering of processes will be achieved through fragmented tasks that, in turn, will be carried out by specialist task organisations. In the STO route, a robust integrated management system will ensure that managing the fragmented task-based supply chain results in healthy competition, high specialisation, balanced responsibilities sharing and finished innovative projects in terms of reasonable price, high quality, lower risks, and completion on time. The STO route involves specialist task organisations to deliver their complete parts (by integrating design, supply and installation; and maintenance). The extension of CM from product development point of view provides a solution based on integration in development tasks (and organisations) and fragmentation in execution tasks (and organisations).

The procurement route was chosen as the focal means because it defines the contractual process through all the project phases. Procurement routes may also serve as levers for the reengineering of construction project processes as a whole. . .

Proposition

The integrated management coupled with the integrated product development process and the fragmented execution process (contracting, design, constructing, installing and handing over) by using specialist task organisations to manage/execute the task packages will provide more flexibility in project processes and enable higher performance in terms of project objectives than the alternative procurement routes will allow.

This study is carried out via literature review, constructive research approach and validated by a case study. The scope of the study is procurement routes and limited to new and old large buildings.

2 Concept of the STO Route

According to Love et al. (1998) procurement is an organisational system that assigns specific responsibilities and authorities to people and organisations, and defines the relationships of the various elements in the construction of a project. Consultants and contractors use many delivery methods to meet owners' project goals and requirements such as quality, speed, budget, flexibility, buildability and accountability (e.g. Skitmore and Mardsen 1988, Chua et al. 1999, Alhazmi and McCaffer 2000 and Cheung et al. 2001). It is herein argued that most of existing project delivery systems, contracting systems and procurement routes are either completely fragmented or integrated with associated management systems. Insufficiencies in current procurement routes are herein characterised as follows: (i) procurement routes are based on the extensive fragmentation of the whole process (the multiple points of responsibilities) or (ii) procurement routes are based on the complete integration of the total design and implementation process (a single point of responsibility). The shortcomings due to this two-extreme edge classification take the disadvantages of fragmentation for the advantages of integration and vice versa, leaving the total project and procurement management problem unsolved.

In turn, it is herein envisioned that construction projects with related procurement and implementation processes be managed better through the combinations of new solutions for project development/design management and value chain/production management. New combinations may readily exploit the existing principles guiding both integration (e.g. design and build contracting) and fragmentation (e.g. agency CM). New combined solutions contradict the work of proponents of relying solely on extensive fragmentation or full integration. Combinations can be innovative and fragmented/differentiated under the integrated management system. They align all project parties with the common goal of producing economic, on-time and high-quality construction projects.

The new concept of the specialist task organisation (STO) route applies the principles of specialisation and innovation to carrying out the core tasks/activities through product/project development, implementation and possibly finished product maintenance. The STO route utilises semi-autonomous integration in product/project development processes and full fragmentation in implementation processes. The total scope of the product/project in question is procured from among organisations that are specialised in the various development/design, manufacturing, supply, installation, construction and maintenance tasks (Oyegoke 2005).

The targeted advantages of the proposed STO route are as follows: (1) it allows competition among many alternative designs of STOs, (2) it shifts competition to design, life cycle management, materials and maintenance solutions, (3) it exploits expert knowledge in shaping implementation processes project by project, (4) it adds more value to project implementation processes due to short feedback loops and clearly defined users' requirements, (5) it prefers specialisation over generalisation, (6) it eliminates paradoxically the weaknesses of the fully fragmented and integrated approaches by utilising their biggest merits and (7) it enhances construction productivity and eliminates the waste of construction resources by integrating the demand chains and supply chains. The STO route is more applicable to building projects where prefabricated elements and standardised materials are used as well as to large and complicated building and infrastructure projects.

The STO route enhances the development of better communication, coordination, co-operation and information systems. It re-engineers the current ways of arranging contractual relationships, distributing responsibilities and allocating risks, compensating for services. It is adding more value to construction projects.

2.1 Operational Model of the STO Route

The operational model of the STO route is illustrated through its 11 phases in Figure 1. In the context of a construction project, the route starts with (1) a client who is identifying his construction needs. (2) Thereafter, this client forms an STO management team of experts (Project manager) which guides the client and manages the project through the remaining phases.

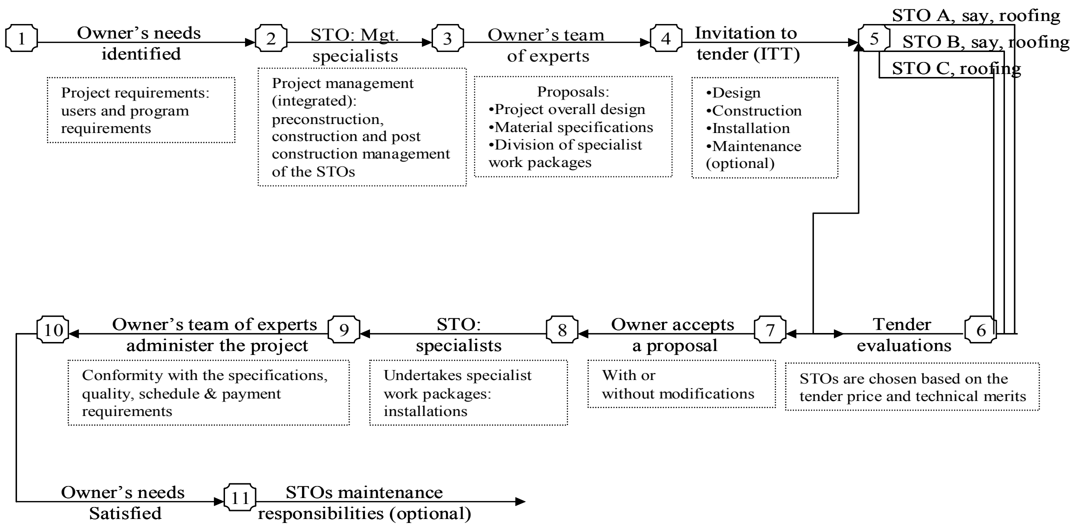

Figure 1. Operational 11- phase model of Specialist Task Organization (STO) route.

(3) Next, the STO management team is augmented with a design sub-team that provides the overall product design, documents and performance specifications. The overall design is used to set the cost plan and the target for the total scope and each task. The long design period is cut short as the traditional design and costing is eliminated. More alternative designs from diverging perspectives prepared by one or more experts are also available. (4) The STO team sends out invitations on behalf of the client to STOs to tender for their parts of the project. The instructions to tenderers (ITT) spell out project information (general plan (drawings)) and performance and technical specifications), tender format, selection and evaluation procedures, rules for disqualification, the latest date for the notification of intention and tender submission date. (5) For each main part, multiple competing STOs prepare their tenders in two parts: technical and price tenders. A technical tender contains information on the relevant and specific experience of the STO in similar or related jobs. 5-10 reference projects are required (not older than 5 to 7 years). In order to have reassurance on quality and adherence to procedures, each STO is asked to produce the technology/method statements relating to their tasks. Tenderers are required to describe in detail the volume and content of the reference projects, their actual role, involvement and duration (actual working months). A price tender is required to be based on the suggested technical solution.

(6) The management team evaluates the tenders by giving the scores to the technical and price tenders as well as to the completion times in a proportion that justify the complexity of the project. Hence, the economically/technically most advantageous tender is selected. An open or close competitive selection process may be used as described by Poage (1990), for example. The STO is required to submit a performance statement on how (methods) and when (schedules) to carry out the task with the tender. (7) In turn, the client accepts the bid with or without modifications. Besides the price, the STO selection is based on design/engineering solution, constructability, maintainability, life cycle costs, schedule, stated methods and technical specifications through the closing negotiation with the client.

(8) In construction phase, the STO management (PM) team integrates the implementation of each STO's packages in order to avoid the repetition and duplication of activities and to allow for the exploitation of specialisation. The STOs are requested to submit a tentative

programme as part of tender. Each of these tasks is coded as the key events with the sub-events that are integrated to form the events planning/programme. In order to monitor project progress a milestone plan is derived form the event plan/programme.

(9) Each STO carries out the construction works (installation) of its package/part in conformity with the technical specifications. Cost control activities are cut down because the STO's solution has been critically reviewed and the fixed price agreed upon, thus, eliminating changes, variation and undue claims.

(10) Project close out is carried out by the STO management team (PM) after all the STOs have successfully completed their share of the project. The STO management team (PM) compile all the necessary documentation for the smooth running of the facility from the STOs. These documents are handed over to the owner and if needed basic training are given on usage, health and safety, etc. This stage signifies project practical completion, STOs final payments are effected (except retention fees), and the STO management team (PM) communicates the closure of the project to all stakeholders. The management team also provides a formal project hand over report to the owner that includes post implementation review on overall success, attainment of the objectives originally stated, lesson learnt, and deliverables.

(11) The STOs as optional service/responsibility carries out in maintenance activity. One of the options is to include maintenance contract or clause for a specified duration as part of the main contract. This should be longer than normal defect liability period. Other option is to have a yearly maintenance fee for the life span of the product. Nonetheless, the STO are bound to make good defect of their work within defect liability period.

The schedule advantage of the STO route lies in the fact that the project implementation can be managed as a fast track by the specialist task breakdown. The involvement of STOs in detailed technical design shortens the project period as a whole. The management team initiates contracting/procurement activities preceding detailed technical designs. Concurrent design and construction shortens the completion time as well. For instance, the early portion of works like sub-structural works, a frame structure, etc. can be carried out while the contracting/procurement and the detailed design of the late works (tasks) like the infill, finishings, etc. are being performed.

2.2 Contractual Arrangements of the STO Route

By construction project, the contractual arrangements and the resulting organisation structure of the STO route are being formed through the client's decision to establish the STO management team (PM). In turn, this management team carries out all integrative management, coordination and administration tasks as well as gives preconstruction advice on scheduling, budgeting, value analysis and bidding. The team does not guarantee the fixed price, the schedule completion or the targeted quality. In turn, the client enters into the contract with the design team for the overall design and the technical specifications of the proposed scheme. The project scope is then divided into specialist tasks according to project needs. Tenders are invited to be submitted by competitive STOs accordingly. The client selects the STOs on the basis of the submitted specialist packages including the completed design (engineering design), the specifications of materials, the fixed costs and schedule.

In Figure 2, **the contractual arrangements of the STO route** are illustrated. The STO route is based on the following ideas:

- The client is fully relying on the expertise and competences of the STO management team throughout all project phases.
- The design team is assigned to the development of the overall drawings with the project requirement, material, technical and performance specifications
- The construction/site management task organisation is assigned in order to avoid repetition in administration and supervision, the duplication of equipment and to supervise/coordinate project quality, schedule, cost etc.
- The STOs are contracted for each segment of the project scope with their complete detailed (engineering) design, manufacturing, construction, installation and (optional) maintenance.
- Each of the STOs is responsible for the risk associated with the design, the construction failure and the uncertainty in cost, time and project quality, by segment and subcontract scope.
- Each of the various STOs has a direct contract with the client.

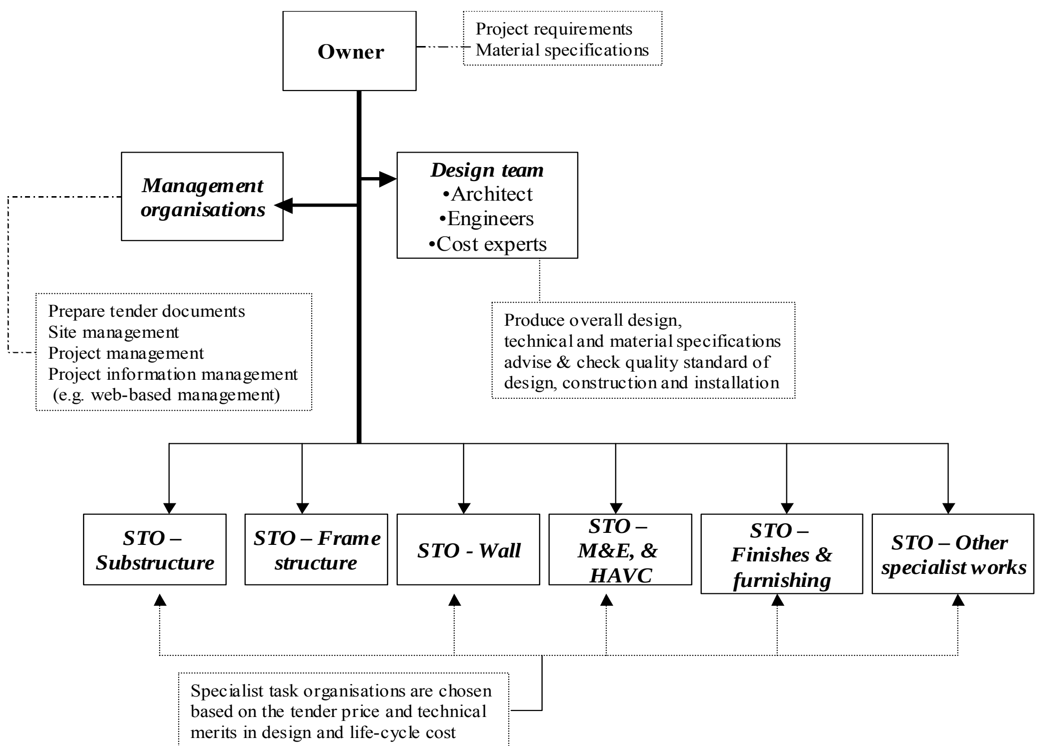

Figure 2. Principal contractual arrangements and organisation for Specialist Task Organisation (STO) route project by project.

3 Case Study 1 – Three Office Blocks

Example 1 consisted initially of two office blocks (with the option for the third one). The owner is the insurance company who developed the office blocks under the separate limited liability company (subsidiary). The owner's team comprised of the risk-carrying CM contractor and the designers. The CM contractor was selected early to allow his participation in the preconstruction project management. He acted as the owner's main representative and negotiated the direct contracts between the owner and the specialty contractors. The leaseholder and user is the multinational IT service company. The latter was involved already in the conceptual overall design.

The project was divided into eleven main tasks: sub-structural works, a structural frame, a glass facade, cladding, roofing, in-fill, HVAC systems, electricity, plumbing, external works and minor specialist works (e.g. art, security and surveillance). The procurement procedure involved the design team that produced the overall detailed design upon which the estimate was requested. In addition, the design team provided the general information for the bidders to provide the alternative designs and the estimates.

Office building design

When the user's requirements were first fully established, the design team was commissioned to produce the overall project design. The concept design went through the series of the adjustments to accommodate the user's solutions. The conceptual/detailed designs with the technical, performance and material specifications were sent to potential bidders, i.e. specialty contractors.

Bidding procedure

Within the invitation-to-bid documents, the owner provided the general information about the blocks, e.g. the floor areas and the building volumes. The first block is 7283 sqm and 49 000 cum. The second block is 7400 sqm and 48 400 cum with 149 sqm for the sauna section. The documents included the concept design followed by the detailed design (after three weeks) in order to enable the two-way bidding: the bid based on the detailed design and the alternative one based on the specialty contractor's own solution. Specialty contractors could utilise their expertise by adding, subtracting, adjusting the original detailed design or by offering a new concept. The additional information was submitted for such own solutions. For instance, the owner would provide the items in the preliminaries (site services) that might have cost consequences if unmentioned (e.g. a main crane and water and electricity for works). Each specialty contractor submitted their technical designs/working drawings to the design team that pre-checked and then sent them to the town planning authority for the approval. All grey areas were captured in the joint meeting with the bidders.

The merit of the owners' documents is that it permitted the specialty contractors to compete on equal footings. However, the owner had the right to divide each main task into its elements for procuring them from different suppliers and involving additional specialists for installations in order to minimize the cost.

The initial construction period was given to be May-December 2003 for the structural frame. The specialty contractors were asked to submit also their project schedules. The selected specialty contractor is liable to liquidated and ascertain damages. The retention fee of 2% was set for the period of 24 months (defect liability period) from the date the building was put in use. The performance bond was specified at the level of 10 %. The last payment (10 % of the cost) was to be paid after the owner had inspected that the specialty contractor's performance complied with the contract.

The specialty contractors were selected based on their previous performance and the prequalification exercise. Each specialty contractor was asked to specify the design fee (if his design was to be used) and, in cumulative terms, the price of the materials to be delivered to the site, the cost of the installation and the additional crane services.

Structural frame

The owner's invitation-to-bid documents included the structural specifications in such terms as beams, columns, floors, the spacing of trusses and the load-bearing structure of each frame. The minimum requirements concerned the heights of the ground floor (4.5 m), the basement and other floors (3.6 m), the heating and ventilation room with the free space (4.6 m), the special spaces in the basement, especially the maintenance route (5.0 m). Five structural frame contractors submitted the bids that followed the original invitation with some changes only. Many other contractors bid both the original steel frame and the alternative concrete-based frame. The annexes consisted of the architectural and structural drawings plus the responsibility distribution chart. During the evaluation process, the submitted drawings were incorporated into the overall design to ensure the programme compatibility and the master schedule. The selection criteria of the owner were based on the fixed price bid, the general quality level, the compatibility with the other project tasks (design and construction) and the life-cycle management. Three major negotiations on prices took place before the contract was signed. The winner submitted also the alternative scheme.

Glass facade

The owner's invitation-to-bid documents included the scope of the glass façade included the wall, doors, windows, the complete aluminium frame and the accessories as well as the sun and rain screen. The extra features like the glass wall for the main entrance and hall were included in Block 2. Contractors were asked to bid for each of the elements on a functional block-by-block basis. During the procedure, the design team made twice some changes that were communicated to contractors. The costs of the bid included the design (optional), manufacturing, materials, delivery and installation as well as the site machinery for the installation (except the major crane). No overheads were allowed for the specific items of material or labour.

The winner submitted the bid based only on the owner's detailed design. The advantage of this approach was that competition was based on the design, the materials and the life cycle management. One of the winner's merits involved the alternative glass type that suited best the environmental requirements. The sound, solar and light penetration qualities of the glass took into account the location near the highway. The fixed price contract was agreed upon. The winner's work schedule was adjusted and incorporated into the master schedule.

3.1 Case summary/discussions

Case study	Results supporting the adoption of the STO route
Case 1	The project was divided into the specialist tasks. The bidding resulted in the best flexible design of the frame contractor and the design team's drawings for the glass façade, respectively. Healthy competition took place between specialists in terms of design, materials and life cycle costing. Each task was clearly specified to eliminate problems with task interdependence and schedule adherence. The CM contractor managed the prequalification, the balanced evaluation of the tenders and the choice of the best technical solutions with their beneficial cost and quality implications. The specialty contractors' own solution reduced the cost and shortened the duration without any changes in the quality. No major problems in communication, coordination and cooperation. The advances were re-gained in the case of the third office block with the same project team.

4 Conclusions

Fragmented specialisation is being increased due to the complexity of projects, client demands, advanced building materials and plants and skill development that result in the erosion of the dominant roles of architects, engineers and/or main contractors. In turn, the suggested integration in building design and the fragmentation in project execution may result in the elimination of the weaknesses of both fragmentation and integration as well as the utilisation of their positive attributes.

Evolving STO management teams oversee the overall design, site services, contracts, IT management, site supervision and administration. The effective dynamism of STO management firms can become far greater than the traditional firm responsible for the total management task or construction works. The division of the scope of building projects into a set of tasks should be specified in detail in order to avoid the overlapping of responsibilities. The responsibilities of professionals on issues like negligence and incompetence should be drawn out vis-à-vis the detailed design and other responsibilities as part of the STO route. The STO route takes into account in contracting stage constructability, method statement, maintainability and total life cycle costing of the project. The management principles of the STO route allow contractors to specialise themselves and focus their core businesses, i.e. specific tasks (packages, sub-systems or parts). When construction STOs' expertise on site, environmental, statutory and contracting requirements is combined with designers' innovations, STO managers can set more demanding but achievable goals, choose a clear business strategy and enhance commitment to projects and partnering spirit. In turn, all this reduces conflicts, time wasting and subsequently project costs.

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A Critical Review of Published Research on PFI/PPPs in Construction

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Abstract: This paper presents an analysis of PFI/PPP research papers published in construction journals over the last decade. The analysis also included a study of the references cited in these papers. Results show that research topics were largely selected on an ad hoc basis and that the effort expended was of unequal weight and relevance. This fact, in turn, calls for further coordination between researchers and research organisations and, furthermore, leads to useful conclusions related to research gaps that need to be addressed by the academic community in the near future.

Keywords: PPP, Research, Review.

1. Introduction

There are a significant number of countries that have been using Private Finance Initiative (PFI) / Public Private Partnerships (PPPs) for the production of essential infrastructure projects. In the UK, for example, over 700 such projects have been implemented since 1987 (HM Treasury, 2006). In France, two of the most well known PPP projects are the Channel tunnel and Euro Disney. PPPs have also been used as a construction procurement method in the United States (US Department of Transportation, 2004) and Japan (Kengo, 2005). A number of other countries have also used this approach to develop and modernize their infrastructure (Anagnostopoulos, 2005).

If PPPs are popular worldwide, how effective is the related research conducted by the construction community? This is the main question put forward by this paper. The purpose of answering this question is twofold; (a) to develop a taxonomy of research topics in order to formulate areas for possible further investigation, and (b) to appraise the impact of research conducted in Universities and Research Institutes to real world applications in order to estimate the correlation (if any) between research and practice.

This paper presents the preliminary findings of an on-going research effort undertaken by the authors to address the above question. It should be noted, however, that the answer is neither straightforward nor easy to provide. In this paper, therefore, the scope is limited to a macro statistical analysis of published work in selected journals. We hope to be able to present a more elaborated analysis of the matter in the not too distant future.

2. Methodology

A somewhat similar research to this paper was presented by Al-Sharif & Kaka (2004) who analysed published papers on PPPs in *Construction Management and Economics* (CME)*, Journal of Construction Engineering and Management* (JCEM)*, Engineering Construction and Architectural Management* (ECAM) *and International Journal of Project Management* (IJPM) from 1998-2003.

In this paper, four journals were also selected for analysis. These journals belong to the top ones in the construction field as classified by Wing (1997) but they are also readily accessible from Greece through the HEAL (Hellenic Academic Libraries) system. The journals selected were CME, JCEM, *Journal of Management in Engineering, ASCE* (JME) and IJPM. The time span considered was the period 1996-2006.

Expanding the research period from five (1998-2003) to ten years (1996-2006) is not, however, the only difference between this study and the one presented by Al-Sharif & Kaka (2004). The second, and perhaps more important, difference is that in this work the authors attempted to classify construction journals based upon the number of related research cited in the references section of the papers examined. In this way, a measure of the paper publication impact on the research community as a whole has been developed.

It should also be noted that papers were selected based on the criteria as proposed by Al-Sharif & Kaka (2004). More specifically, titles and abstracts were first scanned to identify relevant terms such as PFI, PPP, BOT (Built-Operate-Transfer), BOOT (Built-Operate-Own-Transfer) etc. If in doubt, the relevant papers were consequently reviewed. Once suitable publications were identified, their references section was also studied to analyse cited work. The results of this phase are presented in the next paragraph.

3. Results

3.1. Journal Papers

Figure 1 shows the total number of papers published in the selected journals and the PFI/PPP related papers.

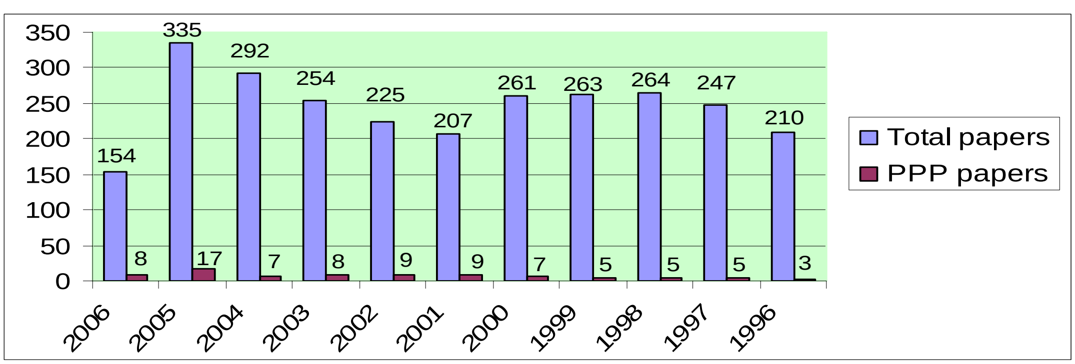

Fig. 1: PPP papers published yearly

Figure 2 summarises the total published papers in each journal.

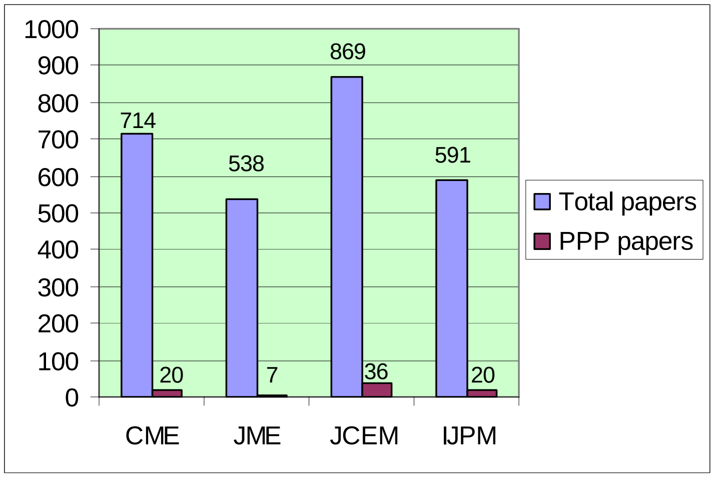

Fig. 2: Published PPP papers in each journal between 1996 – 2006

Al-Sharif & Kaka (2004) report that 2,6% of the publications were relevant to PPPs. This research found 78 papers out of 2712 totally published (2,9%). We can reasonably accept that published work on PPPs account for less than 3% of the total research output in construction management.

3.2 Researchers

97 researchers published 78 PPP journal papers. Only 6 researchers published 5 or more papers, as shown in Table 2. Among them, three researchers belong to the same University (Nanyang Technological University, Singapore).

Table 2: Researchers with 5 or more papers.

Researcher	Institution	Country	Papers published
Tiong, R. L. K.	Nanyang Technological University	Singapore	18
Zhang, X. Q.	The Ministry of Water Resources of China & The University of Hong Kong	China	13
Wang, S. Q.	Nanyang Technological University	Singapore	6
Kumaraswamy, M. M.	University of Hong Kong	Hong Kong	5
Ting, S. K.	Nanyang Technological University	Singapore	5
Ashley, D.	Ohio State University	USA	5

3.3 Researchers' origin

Authors come from 18 countries. It is observed that researchers from different Universities and countries cooperate in some articles. For example, Ashley, D. cooperates with Tiong, R. L. K. and Ting, S. K or Bakatjan, S. cooperates with Tiong, R. L. K, as well.
The majority of researchers as shown in Table 2 come from Asia. USA, China, Hong Kong and the UK also seem to be major contributors.

Table 3: Researchers' origin

	Country	**Number of Research centers**	**Number of Researchers**	**Number of Papers published**
1	Singapore	2	11	21
2	USA	15	20	18
3	China	6	7	13
4	Hong Kong	3	8	10
5	UK	9	16	8
6	India	5	7	4
7	Turkey	3	6	4
8	Australia	4	4	4
9	Taiwan	5	5	2
10	Germany	1	2	2
11	Canada	3	3	2
12	Egypt	1	2	1
13	Thailand	2	2	1
14	Greece	1	2	1
15	Malaysia	1	1	1
16	South Africa	1	1	1
17	Ghana	1	1	1
18	Indonesia	1	1	1

3.4 Research Centers

63 research centers contributed to PPP research. Nanyang Technological University (Singapore) is in the lead having contributed 19 papers. Arguably Singapore is very active in the area as one more research center from Singapore appears on the table (Table 4).

Table 4: Research centers with 3 or more papers published

	Research center	Country	Papers published
1	Nanyang Technological University	Singapore	19
2	National University of Singapore	Singapore	8
3	Ministry of Water Resources	China	7
4	University of Hong Kong	Hong Kong	6
5	Ohio State University	USA	5
6	Technische University Berlin	Germany	3
7	Middle East Technical University, Ankara	Turkey	3
8	Hong Kong Polytechnic University	Hong Kong	3
9	Glasgow Caledonian University, Glasgow	UK	3

3.5 Analysis of cited papers

Table 5 shows the top 10 journals cited in research papers on PPPs.

Table 5: Top 10 Journals cited in PPP papers

	Journal	Times cited
1	ASCE Journal of Construction Engineering and Management	174
2	International Journal of Project Management	54
3	Construction Management and Economics	37
4	Engineering, Construction and Architectural Management	30
5	ASCE Journal of Management in Engineering	29
6	Journal of Project Finance International	17
7	ASCE Journal of Infrastructure Systems	9
8	Project Management Journal	8
9	Journal Infrastructure Finance	8
10	China Economic News	8

Table 6 shows the top researchers cited in research papers on PPPs.

Table 6: Top Researchers as cited in PPP papers

Author	**Times Cited**	**Author**	**Times Cited**
Tiong, R. L. K.	152	McCarthy, S. C.	17
Wang S. Q.	37	Smith, N. J.	16
Kumaraswamy, M. M.	37	Walker, C.	14
Ashley, D.	35	Smith, A. J.	14
Zhang, X. Q.	34	Akintoye, A.	14
Ting, S. K.	29	Shen, L. Y.	12
Merna, A.	21	Dias, A.	12
Alum, J.	20	Ioannou, P. G.	12
Yeo, K. T.	17	Levy, S. M.	10

Finally, Table 7 summarises the most frequently cited papers.

Table 7: Most frequently cited papers

	Author/year	Title	Publication	Times cited
1	Tiong, R. L. K. (1995)	Risk and guarantees in BOT tender	JCEM, 121 (2)	17
2	Walker, C. and Smith, A. J. (1995)	Privatized Infrastructure–The BOT Approach	Thomas Telford	14
3	Tiong, R. L. K. (1995)	Competitive advantage of equity in BOT tender	JCEM, 121 (3)	10
4	Levy, S. M. (1996)	Build, operate, transfer: paving the way for tomorrow's infrastructure.	Wiley	
5	Tiong, R. L. K.,et al. (1992)	Critical success factors in winning BOT contracts	JCEM, 118 (2)	10
6	Shen, L. Y., et al. (1996)	Application of BOT system for infrastructure projects in China (in Chinese)	JCEM, 122 (4)	9
7	Ogunlana, S. O. (1997)	Build-operate-transfer procurement traps: Examples from transportation projects in Thailand	Procs CIB W92	9
8	Ye, S. D. & Tiong, R. L. K. (2000)	NPV-At-Risk Method in Infrastructure Project Investment Evaluation	JCEM, 126 (3)	8
9	Tiong, R. L. K. (1995)	Impact of financial package versus technical solution in B.O.T. tender	JME, 121 (3)	8
10	Wang S. Q. et al.(1998)	Evaluation and competitive tendering of BOT power plant project in China	JCEM, 124 (4)	7
11	Kumaraswamy, et al. (2001)	Government role in BOT-led infrastructure development	IJPM, 19 (4)	7
12	Zhang, W. R., et al. (1998)	Risk management of Shanghai's privately financed Yan'an Donglu tunnels	ECAM, 5 (4)	7
13	Woodward, D. G. (1995)	Use of sensitivity analysis in Build-Own-Operate-Transfer project evaluation	J. of Project Management, 13 (4)	7
14	Merna, A., Smith, N. J. (1996)	Guide to the preparation and evaluation of build–own–operate–transfer (BOOT) project tenders,	Asia Law & Practice	7
15	Tiong, R. L. K., Alum, J. (1997)	Evaluation of proposals for BOT projects	IJPM, 15 (2)	7

Paper content

Papers studied were analysed according to their content in three categories: technical, financial, and stakeholder relationships - contractual related.

The technical category comprises of the special issues concerning the construction of a PPP project and found particularly fit for this purpose, such as innovative design management, specialised quality management, safety, health and environment techniques etc.

The financial category concerns issues that relate to the financial viability of a project, such as risk management, cost management, financial management, and value improvement.

The stakeholder relationships - contractual related issues include all aspects relevant to the association of the involved parties, such as conflict management, teamwork, personnel management, procurement, integrative management etc. (Table 7).

Table 7: A categorization of PPP papers topics

Proposed Taxonomy	**Subjects**
Technical Management Level	Design management
	Quality management
	Safety, health and environment
	Work management
	Testing, commissioning, hand-over/acceptance, etc
Financial Management Level	Risk management
	Cost management
	Value improvement
	Financial management
Stakeholder Relationships – Contractual Level	Conflict management
	Teamwork
	Personnel management
	Procurement
	Integrative management
	Goals, objectives and strategies

The categorisation was at first based on the title of the paper and the keywords provided. As other researchers have reported (e.g. Al-Sharif & kaka, 2004), keywords are not always indicative of the content of a paper. For this reason all papers were scanned. The results are summarised in Fig. 3 below.

The overwhelming conclusion from this analysis is that there are no papers published concerning technical issues. Although one might have expected that there would be contributions related to innovative managerial techniques best fit for PPP projects, this is not corroborated by this analysis. The most possible explanation is that PPPs concern a much wider audience than that of engineering management, a fact which has led considerable research effort to be expended on other issues such as financial management, risk management and contractual relationships.

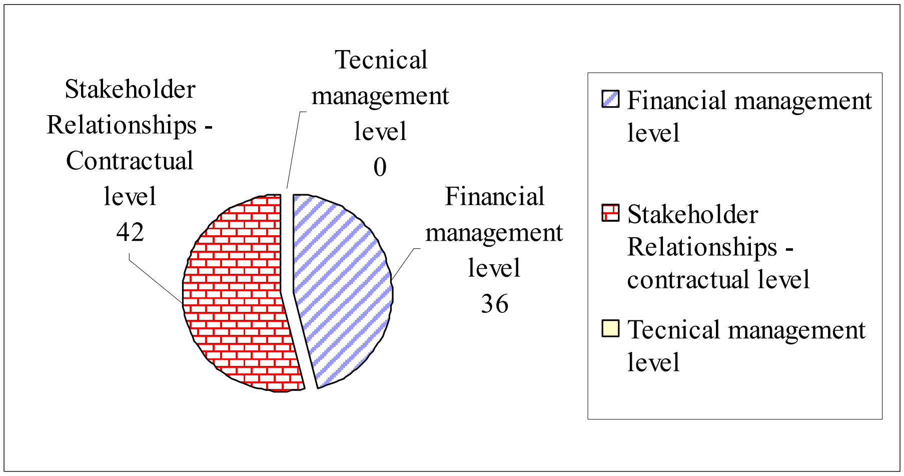

Fig. 3: Taxonomy based on PPP paper content

The second conclusion is that there is a shift of interest from stakeholder relationships, a topic which was prevalent in late 1990's, to financial management related issues. To-date, there is a balance between papers devoted to these two topics.

5. Conclusions

PFI/PPPs have become a major procurement system for financing, building and managing construction in recent years. As the trend is expected to be maintained well into the 21st century, it is worth investigating how effectively the topic is addressed by the research community and what may or should be the future research directions.

In this paper the authors have examined the above issue based on a statistical analysis of papers published in four leading journals in the field. They observed that about 3% of all papers published in construction journals are devoted to PFI/PPPs. Most of the papers (≥ 50%) originate from Asia (Singapore, China, Hong Kong and India) whereas the USA and the UK follow. Nanyang Technological University of Singapore is clearly in the lead as 1 out of 3 papers published on the issue originate from this Institution. As far as journals cited in PPP publications are concerned, *ASCE Journal of Construction Engineering and Management* (JCEM) is in the first place as almost 50% of all works cited refer to this journal. Other important journals in the field are the *International Journal of Project Management* (IJPM) and *Construction Management and Economics* (CME). These three journals account for more than 70% of all references made in PPP related papers. Finally, two research papers by Tiong, R.L.K. are among the most referenced works in the field.

The topics selected for PFI/PPP research relate to conceptual issues (e.g. the importance of PFI/PPPs, comparison of PFI/PPPs to more traditional procurement methods etc), alternative evaluation techniques (e.g. Net Present Value) and issues related to process improvement, stakeholder relationships and risk management or legislative and financial subjects. A statistical analysis of the research topics selected revealed that technical issues (e.g. innovative design management specially developed for PFI/PPPs) have not been addressed by the research community, whereas there is a balance between stakeholder relationships and financial issues (including risk management).

There was no indication found that the research effort is correlated to the relative significance of PPPs in a specific geographical area (country). Research is initiated on an ad-hoc basis and the effort expended in of unequal weight and relevance. It seems that the choice of the topic is based on the preferences of the researcher, his intuition and his environment.

Clearly there is a need for establishing taxonomy of issues related to PPPs. The authors of this paper feel that the existing research associated with PPP financial viability and relationships needs to be continued, however, special care needs to be taken for other aspects of PPPs, such as project closeout, testing, commissioning, handover and acceptance, quality management, user satisfaction, and operational and maintenance issues.

Finally, further coordination between researchers is required in order to facilitate research in the PFI/PPP domain. On the whole, establishing best practices for PFI/PPPs research will be of benefit to all related parties.

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An Exploration of Sustainable Construction Procurement Practice at the Project Briefing Phase

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Abstract: The construction industry in the UK leads the way in embracing sustainability issues by focusing on the human aspects of construction and the life style issues associated with sustainability. Sustainability in terms of a construction project requires a broad and long-term view to be taken of the environmental, economic and social impacts of the decisions taken at its early stages; and 'designing' the project thoughtfully, creatively and imaginatively during the early phase is fundamental to achieve sustainability targets.

An investigation of the theoretical framework related to sustainability in comparison with current practices is presented, and how the feasibility and briefing processes work for a sustainably procured project is explored. The research is based on a qualitative approach that captured data from a small number of practitioners.

The study indicates that the 'Brundtland' definition still remains relevant as an overall definition of sustainability. The conclusions indicated that, in practice, the feasibility and briefing processes are actually more complex compared to the straight forward theoretical guidelines; and it is the subjective nature which makes the process complicated. The decisions taken during the early phase of a project proved to be beneficial. The study also revealed that the costs of a sustainable project were found to be higher by approximately 6 to 10%. The early involvement of project stakeholders during the briefing process was found to be beneficial for the project. But the control and interpretation of the information from a large stakeholders group with a diverse knowledge base is extremely important. The main finding was that, the level of stake-holders education was the key in order to produce a sustainable project successfully.

Keywords: Decision making, Feasibility, Briefing Processes, Sustainable Construction Procurement

1. Introduction:

Construction is a major and primary sector of the UK economy and its consideration of the issues of sustainability covers a huge spectrum of the sector. The performance of the construction industry has a huge impact on the quality of human life in terms of sustainability. It faces the challenge of responding to the UK's changing demographics, with people living longer and in a wider and more fluid variety of social relationships, and their structural changes in societies demand a correspondingly diverse and adaptable built environment. Thus the role buildings play is fundamental to the realisation of sustainable development. The UK government has set its targets; however, it is equally important for each individual to understand the process of achieving the sustainable development targets and to contribute to it.

The purpose of this work is to investigate the theoretical framework related to sustainability in comparison with current feasibility and briefing practices for a sustainably procured project. This process has been undertaken with two main phases of activities; literature review and semi structured interviews with a small group of project stake holders who were involved in the procurement process of a sustainable project. The work concludes with the evaluation of the findings related to the concept of sustainability and the briefing process of a sustainable construction project.

2. Sustainable development and sustainable construction procurement

The typical definition of sustainable development is closely related to the oft-quoted Brundtland definition (Milne *et al.* 2004); defined as the 'development which meets the needs the needs of the present without compromising the ability of future generations to meet their own needs' (DETR, 1998). This definition, although accepted as the global standard, is increasingly seen as being a virtuous but imprecise concept which is open to various and often conflicting interpretations. (Edwards, 2002) For instance, it does not explicitly challenge growth and indeed assumes there is an ability to reconcile development and planetary imperatives. (Milne *et al.* 2004) A recent report by the European Agency states that environmental policies can not achieve sustainable development by themselves. Economic sectors will also need to change and assume their responsibility towards sustainability. Sustainable construction has been defined by BSRIA as the creation and management of healthy buildings based upon resource efficient and ecological principles. It is the set of processes by which the industry delivers built assets which enhance the quality of life; offer customer satisfaction, flexibility and the potential to cater for user changes in the future; provide and support desirable natural and social environments; and maximise the efficient use of resources. (GCCP, 2000) However, according to Campbell (2005) 'many clients still think that sustainable construction is a bit like bran; probably good for you, really not that tasty, and something only health fanatics would buy.'

The divergence of opinions proves that sustainability is such a broad idea that a single definition cannot adequately capture all the nuances of the concept. (Mitchell *et al*, 1995) It is probably true now that the dichotomy of 1970s and 1980s has been replaced by a sustainable development synthesis, in that there is general agreement that uncontrolled exploitation of natural resources is not beneficial to humankind in long term. As a result it may be possible to set some common 'sustainability' goals for the procurement of all construction projects, since in many respects the issues that revolve around projects are the same.

3. Feasibility stage and issues related to sustainability

Construction projects have their own specific set of environmental and sustainability issues. The feasibility phase deals with the preparations of a checklist of the issues and the establishment of the criteria against which the issues can be assessed. (CIRIA, 2001) The decisions taken during the early phase are more effective; however, as the project uncertainty is at its highest during this phase, the value generation depends on the way the early phase is executed. (Kolltveit and Gronhaug, 2004)

Prior to the decade of 1980s, feasibility studies were conducted considering the cost benefit analysis, and the availability of finances and technology. (Winston, 2002) However, it has now become important to access all the project issues against economic, social and environmental criteria before taking the 'decision to build', 'what to build' and 'where'. (CIRIA, 2001) As expressed by Huges (2004) regarding the importance of location, 'a bunch of energy-efficient houses are not much use without the necessary transport links or the creation of an actual community.' The site location should be evaluated taking into account the flexibility in use, air quality, noise levels, existing services, land contamination, ecological value of the site etc. Careful site assessment can also be helpful to capitalise on the land's potential views, solar access, natural drainage opportunities, natural shading through vegetation, cooling from prevailing winds- while minimising or avoiding damage or disturbance to the site and surrounding areas. (James and James, 1999) Expressing concerns over industry's reliance upon various decision making tools, Gluch and Baumann (2004) indicated that the industry still needs to understand the fundamentals of the decision making process, and the tools that involve people in the decision making process must be developed.

Until recently, the running and maintenance costs and the overall environmental impact of a built facility have been a lesser consideration though in most cases, these costs far exceed the initial construction costs. Recently several research projects have been carried out to develop the life-cycle costing methodology for the construction industry for placing it in an environmental context, but still the actual incorporation of environmental consequences in its approach is not sufficiently clarified. One of the major limitations for the application of life cycle costing, as explained by Bartlett and Howard (2000) is that, 'very few individuals or businesses pay all the costs.' Also, the premium return levels quickly pay back any initial capital investments in 'visible' quality to the investors. However, by linking environmental issues with financial consequences, the decision makers can possibly be persuaded to take environmental issues into account in their investment decisions. (Gluch and Baumann, 2004) The concept of life-cycle costing is now gaining importance in the construction industry, and at last, financial institutions have started recognising that lower whole-life costs can justify a higher purchase price. (Bucknall, 2005)

As indicated by Bucknall (2005), historically the design teams have not communicated well with the end users. However, concern for sustainable project development should now be seen as the opportunity for designers to educate the stakeholders about any benefits such as long term value and achievement of social and environment sustainability resulting from sustainable designs. (Halliday, 2000) This should be considered during the early stages of design to avoid later revisions and subsequent delays. (Murray and Langford, 2004)

4. Sustainability and the briefing stage

The preparation of the brief is a crucial activity in the procurement process but as far as the UK construction industry is concerned, briefing continues to be highlighted as a weakness in the construction process. (Barrett *et al*. 1999) Latham (1994) also came to similar conclusions on the need to improve the quality of briefs. The briefing process can be divided into two major stages such as; strategic briefing and project briefing (CIRIA, 2001). Strategic briefing sets out the client's vision and overall objectives of the project, and provides an opportunity to test them against the sustainability criteria. (Halliday, 2000) The project brief converts the strategic brief into construction terms; and options such as environmental performance, social impact of the project and affordability can be assessed at this stage. (CIRIA, 2001) Design brief, technical brief etc. can form further sub-sets of the project brief.

4.1 Strategic briefing stage

Strategic briefing springs from the current operational needs, but it also takes a longer perspective and further identifies how the usage might change and the factors that effect these changes, which helps the clients to manage the construction process. (Ryd 2004, citing Bertelsen *et al*. 2002) Models within Rethinking Construction (1998) have shown that as a client's involvement in detailed briefing migrates along the entire supply chain and thus the end products are more highly valued by the ultimate customer. However, many construction projects suffer from poor definition due to inadequate time and thought being given at an early stage; and also as the majority of the construction clients still operate with a vague and intuitive understanding of what is meant by building design quality, how it adds value, and how to evaluate the value added towards their business strategies.

The brief of any building ultimately determines its quality, and what is often forgotten or ignored, is the need for quality to extend beyond the operational life of the building and, finally, its demolition; Also, when preparing for a sustainable project, sustainability criteria have to be identified at strategic briefing stage as changes at later stages are more likely to cost in both direct and knock-on effects. (CIC, 1997) Integrating the sustainability criteria into the project goals is important but there is still disagreement in the concept of developing a separate sustainability brief as it may prove helpful to express the sustainability criteria within the main brief with the links and connections between various sustainability issues and the opportunities for environmental enhancement and damage mitigation. In order to incorporate sustainability into the strategic brief, issues such as; briefing guidance or professional advice and development controls and Local Agenda 21 need to be considered in addition to the usual briefing issues. Some examples of the issues to be addressed are; the site, its location, its natural history and its response to climate, landscape, ecology and infrastructure; site specific hazards such as flooding, exposure, subsidence etc; project's impact on public transport infrastructure and amenities by the project; community participation and commitment to identify the opportunities and barriers. The projects benefits to the community; energy efficiency and energy savings targets; minimum use of natural resources; enhancing the quality of life and user satisfaction; flexibility against future changes etc. (CIRIA, 2001)

A further aspect of successful strategic briefing is to identify the selection criteria for appropriate team members who can contribute to the process through to the preparation the project brief. It is important to select the team that know what is required to deliver in this market which is driven by least cost, small margins and quick returns. (Campbell, 2005) When considering the energy efficiency aspects of the buildings, the CIC (1997) guidelines suggest that project's designers should be appointed at the early phase of the project. It is increasingly acknowledged that a broader set of consultants needs to be assembled than just an Architect, Quantity Surveyor or Project Manager, with strong client 'buy in', in order to deal with the wider set of issues related to sustainability. (Campbell, 2005)

4.2 Project brief

Preparing the project brief comprises of prioritising the sustainability objectives and it is necessary that it promotes sustainable development, ensures the value for money and life-cycle cost, identifies the critical decisions in delivering sustainability objectives, includes targets for sustainability and assess the risk of not meeting sustainability objectives. (CIRIA, 2001) It is also vital that the strategic brief is reviewed, feedback from key stakeholders is obtained, and performance targets using Best Practice Guidance are set at this stage.

The design brief forms a part of the project brief and it provides the basis for scheme and detail designs. It also identifies the constraints that are not under the designers' control. According to Twinn (2004), 'a good building design has always been about more than just satisfying a set of minimum functional requirements, but it has never been so much about adding sustainability.' Hence the task at this stage should be to draw the designers' creativity and ingenuity to present quality designs in which the full range of sustainability issues must be an integral part. There are good examples of 'green' buildings where efforts have been made to ensure energy efficiency while maintaining a good internal environment by implementing important design strategies, such as; maximising the use of natural elements, design for low energy usage and CO2 emissions, good internal environment and long life. The design brief should help in the identification of the design concepts, such as; eco-efficiency, reducing resource depletion and eliminate waste, use of local resources, energy conservation, involvement of supply chain, protecting bio-diversity, reducing pollution, supporting community etc. (CIRIA, 2001) The requirements should be listed as performance specifications and quality criteria mentioning its maximum and minimum limits. The same should apply for operating and construction costs. Such forms of basic data should be obtained from the existing buildings; or alternative concepts should be used and compared in order to achieve the best solution. As far as environmental performance is concerned, the rating from the numerous environmental impact assessment methods can also be used.

5. Research findings and analysis

This analysis within previous sections points to the nature of the relationship of the theory, and also identifies the need to investigate the theoretical framework related to sustainability in comparison with the current practice; and this has been carried out taking qualitative research approach that captured data from a small number of practitioners including Clients Project Manager, Clients Architect, Project Manager and Sustainability Manager who were involved in the procurement process of a sustainable project. Prior to conducting the semi-structured interviews, a template of the relevant issues was prepared to allow interview consistency, as shown in figure-1.

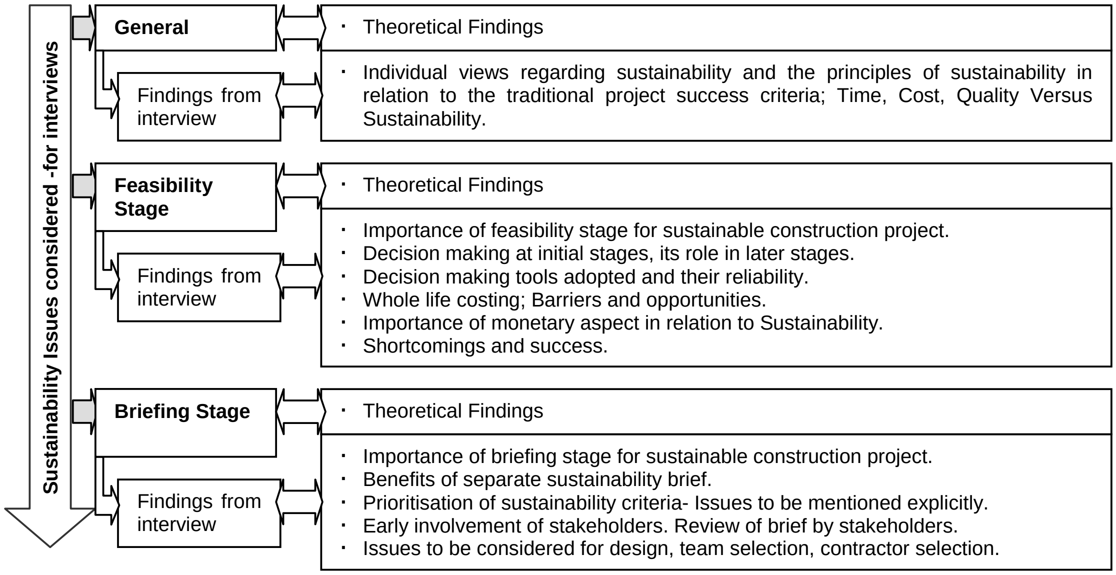

Figure-1 Model showing the framework of issues investigated within this research

5.1 Sustainability in general

The interviewees indicated that sustainability is about contributing to the local economic development, environment and managing the impact on the community. Their individual perceptions did not really conflict, but each focused on different areas based upon their individual views; however, they all agreed that clients and end users education is the major concern. Findings also indicated that the balance among all the principles of sustainable development is necessary; however, the industry must recognise first in which area it can contribute most effectively; also, and all the social, environmental and economical objectives should be established under the main project objective. One of the findings indicated a different dimension by suggesting that the economical principles can be considered as the supportive 'pillar' but that depends upon the requirements and contexts of the project. Considering the relation between traditional project success criteria (time, cost and quality) and sustainability, interviewees indicated that the major aim should be to achieve sustainability; however, each of them had different views about where the emphasis of 'sustainability' should be placed. One of the interviewees suggested that the project success should be measured in terms of sustainability; and time, cost and quality should be the sub criteria under sustainability; while the other indicated that sustainability should be considered as a part of the 'quality' criteria. The sustainable project which they were involved in, placed sustainability on top of the agenda, and time and cost constraints were kept flexible in order to achieve the desired 'sustainable quality' as the project was not profit oriented. However, if the project process proves to be successful, it was expected that the same process can be replicated to achieve the same sustainable 'quality', but with 'cost' and 'time' savings.

5.2 Feasibility Process

All the interviewees agreed that the feasibility stage is very important in order to establish the bench marks, to clear any misconceptions, and to identify clearly the limits of what can be achieved. Findings revealed that the large stakeholders group with diverse knowledge base, time constraints and the project politics can be considered as the major challenges; as these have the potential to change the way things are evaluated during this phase. The feasibility process for sustainable projects is relatively less well-known to the majority of stakeholders which adds to the complexity of the process. However, educated stakeholders are the key to deliver successful process. The decisions which are made at the early stages are important to a project as it helps to design the framework which is vital for successful project delivery. The various decision making tools available can not go beyond the rational limits to address such 'subjective' nature of the issues related to sustainability, and hence, their effectiveness depends upon the complexity of the project. Findings indicated that these tools can not be relied upon entirely, but they can be helpful in identifying a checklist of issues which need to be considered during the early stages of the project. It was indicated that the major emphasis should be given to stakeholders consultations through discussions, brainstorming exercises, presentations, and questions- answers sessions in order to prioritise the core issues related to sustainability.

Findings revealed that the sustainable project can cost approximately 5 to 10% more as; it typically involves a more innovative approach which is less familiar to project participants. It was also indicated that the typical investment cycle is far shorter than the building life cycle which can be considered as one of the barriers for the end users to understand the importance of whole life cycle. Sustainability, when combined with the monetary aspects, can become a matter of interest, however, there is concern also of losing concentration from other important aspects of sustainability and that can be prevented by educating the stakeholders.

5.3 Briefing Process:

Findings from the interviews indicated that clients' initiatives are the key to successful briefing, and the client must put himself in a strong position to ask the design and construction teams to deliver against a robust brief. Most of the stakeholders regard sustainable buildings as an end product and not as a process, and all this ultimately leads to the stakeholders' lack of education and awareness of sustainability. Educating the stakeholders regarding the degree of sustainability and innovation also helps to prevent the teams from bidding high prices for unknown risks. Findings also indicated that within the strategic brief, a framework must be set up that consists of; the requirements to use the local supply chain, establish contractual and communication strategies, and stake-holder management including the end users; and it should also indicate explicitly the social, environmental and economic objectives. Interviewees also indicated that the sustainability criteria should be included within the main brief with the links and connections between various sustainability issues rather than preparing a separate sustainability brief, which can also help not to lose sight of the over all objectives of the brief. However, a separate sustainability brief may help to prepare an initial framework of the issues related to sustainability. One of the findings indicated that the social aspects should be prioritised explicitly because of the subjective nature of this aspect. The process of prioritising the objectives is complex, but it can make the process straight-forward to evaluate the 'trade off' between different objectives, in case any trade off is unavoidable at the later stage.

All the findings indicated that the stake-holders must be involved from the early stages; however, the first step should be to identify the key stake holders who have knowledge of what impact the information they provide can make on the overall vision. It is vital that the key stakeholders review the brief to ensure that the information provided by them is analysed and interpreted correctly. According to the findings, the selection criteria for the project team and their performance benchmarks should be expressed explicitly within the brief.

6. Conclusions

It was realised that the Brundtland definition can be considered as still being the 'global' definition for sustainable development; as the majority of the 'micro' definitions revolve around it. The major drivers realised for sustainable construction are; legislation, social and political recognition of the concept and the key finding was the level of 'stakeholders' education. Considering the principles of sustainable development, a holistic approach was found to be the way forward and a balance between social, environmental, and economic principles was found to be vital, however, the industry still need to identify the areas on which it should concentrate to obtain maximum benefit. Analysis of the data indicates that there is a general consensus that sustainability should form an integral part of the design and construction process, but the argument is still unsettled on whether sustainability should be given the highest priority, or be placed within the quality criteria or be placed with one of the other parameters of time, cost and quality.

The feasibility phase of the project was found to be very important for two reasons. Firstly it sets up a frame-work to facilitate the successful delivery of any project, and so understanding whether it is sustainable or not; and secondly, it establishes and formulates a set of bench-marks against which the different criteria can be assessed. The theory calls for consultation with all the stake-holders, to identify these issues and responsibilities; but in reality the large stakeholders groups with different knowledge base makes the process very complex. Project politics also plays an important role during the process and it needs to be considered as a separate factor.

The decisions taken at an early stage of a project life-cycle are effective but this study shows that, both the theory and practice, have different views on 'why'; it is either because change is expensive at later stages or because they are more manageable during the early stages. The available decision making tools can not always be relied upon as they are not robust enough to tackle the subjective nature of the concept, and more importance should be given to the public consultations and brainstorming exercises. A review of the theoretical framework also supports the view that sustainability doesn't come at any higher price, but in the view of practice, the sustainable project costs more as the concept is new and the project teams tend to bid higher prices to cover the risk of involving the unknown. However, once the industry becomes familiar with such practice, the costs can be brought down considerably; in some cases even less then a conventional project especially if we consider the whole life cycle of the project. All these arguments also prove that the monetary aspects of project evaluation still play dominating role in the development of a sustainable project.

The briefing stage is an important phase considering the evidence collected from both, the theory and practice. The framework for preparing a successful brief is not dissimilar in theory to the practice. However, in practice the complexity of the process is actually higher compared to the straight forward theoretical guidelines. This can be justified because of the subjective nature of the concept. All the arguments lead us to one conclusion namely that the educated client is the key in delivering a successful sustainable project. A separate brief for sustainability can not be always beneficial because of the close integration of the sustainability criteria with the other project success criteria's (time, quality and cost). However, it can be helpful to determine its framework, which in turn helps to determine the sustainability objectives and responsibilities for the project. Regarding the prioritisations of the sustainability objectives into the brief, it is beneficial to explicitly express the overall vision of the project into the brief, along with the consequences of omitting any of the objectives.

Evidence from both, the theory and practice, agree that the early involvement of the stakeholders in the project process is necessary. It can therefore be appreciated that the key lies in, identifying major stakeholders, identifying what crucial information is required for undertaking the project, obtaining the necessary information through consultations at an early stage; interpreting and collating the information into the brief; and finally, analysis and review of the brief by the key stakeholders, to ensure that the information was interpreted correctly. It can be concluded, that the key to successful sustainable project procurement lies in identifying the team which knows exactly what the clients' vision is. Thus it is extremely important to educate or at least make all the stake holders aware of the project objectives in order to appreciate and respect the process.

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Development Actions in Support of Successful Customer Relationships in Construction Projects

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Abstract: A sound customer relationship is a prerequisite for profitable business operations and the establishment of long-term cooperation. By enhancing customer focus, it is possible to reduce the sources of dissatisfaction, avert threats to the customer relationship, and improve the benefits to all the parties to the procurement process. A construction project with its multi-faceted customer relationships where the contractor has a specific relationship with the client's customer, i.e., the user of the premises, poses special challenges to successful customer orientation.

The present study, based on interviews and workshops carried out in spring 2005, sought to identify the key success factors and threats related to the development of a good customer relationship in business space projects.

The best way of improving customer focus is to neutralize any threats that could jeopardize a sound customer relationship, i.e., by developing the aspects that affect customer expectations or frequently cause disagreement. In order to achieve better performance, a number of recommendations were made that address the contractual framework related to construction projects, the coordination of sub-processes according to the method of procurement involved, the procedures for cooperation, and the exchange of information between the parties. The recommendations aim to improve the whole process. Through the individual sub-processes, their combined impact will be felt on the overall construction process.

Action is required from individual companies as well as on a broader front in the form of collaboration with all the players in the field. If the threats to customer relationships can be eliminated and success factors reinforced, the procurement process will become more customer-oriented and conducive to the evolution of a good customer relationship. Implementing the recommendations calls for the adoption of new action and behaviour patterns both by the client and the contractor, but the results will ultimately benefit both parties.

Keywords: Construction Process Management, Construction Project, Customer Relationship Development, Threats and Opportunities.

1. Introduction

Construction is a service activity characterised by attributes such as a project-type nature, a process approach and use of networked resources in implementation. Typical features of project activities are their one-off nature on the project level, the constant changing of the parties involved, and constant transformation of the implementing organisation. The recurring replacement of one party by another imposes special requirements on the creation of customer relationships and customer orientation in construction projects.

In firmly established fields of activity such as in the construction and real estate clusters, the competitiveness and productivity of companies are typically based on efficiency in production. For customers in the building sector, the price of products and systems outweighs features and properties in importance as a selection criterion. As a result, it had made sense for contractors to focus on cutting production costs. However, in an knowledge-intensive society, customer orientation and service business are becoming more important competitive advantages than production efficiency. During the past few years, customer satisfaction and orientation have gained in importance relative to more traditional quality indicators in the evaluation of project success factors. (Construction Industry Technology Strategy, 2002; Pekkanen J, 2005.; Pinto & Rouhiainen, 2001; Yasamis et al., 2002; Chan and Chan, 2004; Love et al. 2000,). Healthy profits and long-term customer relationships are achieved by responding to customer expectations. Instead of trying to improve efficiency in production and attain price leadership, an increasing number of companies seek to achieve a competitive advantage by differentiating from the competition by offering value through product features, service and by improving the quality of the customer relationship in order to ensure its continuity.

Over the past few years, customer-driven service offerings in value generation in the construction and real estate cluster have gained in importance to have a major impact on the success of companies providing construction services, aside from efficiency in production. A sound customer relationship contributes both to improved financial performance and the establishment of long-term cooperation. Because the standard of technical expertise and the building products available are more or less identical irrespective of the contractor, customer orientation is becoming an increasingly important competitive tool in the construction sector as well. Accordingly, companies engaged in the construction business are paying more and more attention to improving customer relationship management in order to maintain and enhance their competitiveness in the marketplace. Another factor contributing to this trend is that the use and ownership of premises is becoming increasingly distributed.

The on-going transition in the construction business from a production-driven approach to a customer-oriented service should be supported by developing existing operative procedures. A major role in this is played by the interactive relationship between client and contractor because it is through the client that the needs associated with a multi-dimensional customer relationship are communicated and that the contractor must satisfy by relying on the network of companies offering the required services. A greater understanding of the key success factors and threats to a sound customer relationship makes it possible to improve the *modus operandi* in a way that supports customer focus.

In order to enhance customer responsiveness, efforts should be made to develop the procedures in such a way that the client finds them appropriate both in relation to service providers and his own customers. Where possible, the contracts, selected method of procurement, and the more informal procedures applied in the process should all help communicate the needs of the client and end-users to those implementing the project. Among other things, clients want to cut down on the time required for the completion of a construction project, have the opportunity to make alterations to the plans for as long as possible during construction, and shorten the time span from the investment decision to the time when the premises can be turned over.

From the standpoint of service providers and suppliers, there is also a need to develop the operations because the project executors are expected to have increasingly highly developed capabilities for identifying and helping to achieve the clients' objectives through their expertise and partner networks. It is no longer just the technical expertise or cost efficiency in construction that are important; what counts is the ability to understand the customer's business and to know how to support it by providing all-round service. The important thing is to give due consideration to the customer's overall needs and requirements in the provision of the products and services. Success calls for sound customer relationship management and a contract system and procurement method that support interaction with the customer.

2. Customer network in a construction project

Generally, a customer is taken to mean a company or consumer with whom the supplier of a product or service has a direct contractual relationship. In a building project, the client purchases the construction service from the executors, typically a contractor. A narrow interpretation of the customer relationship sees the client as the contractor's customer. Aside from their mutual relationship, the main parties to a construction project (client and contractor) have, in the background, their own customer interfaces with third parties (*Fig. 1*). As part of the supply chains, the companies supplying products or services to the contractor add value to the final product. By making use of the parties to the supply chain, the contractor offers the client a number of service processes while delivering a physical product to the user of the building, the end-customer.

In the construction process, the satisfaction experienced by the future end-user and the client is determined not only by the performance of each supplier but also by the smoothness of cooperation within the entire production chain. The ability of each player in the construction value chain to create value for the project and other players also affects the end-user's evaluation of the project (Love et al. 2000; Burati et al 1992).

While the client can also be the user of the building, the roles are increasingly being diverged. Thus, there are two dimensions to the contractor's customer relationships. Within a multi-faceted customer relationship network, it is no longer enough to know the needs of the closest customer; instead, this understanding must extend further in the supply chain up to the end-user. To be able to satisfy a need, it is necessary to understand the business carried on, not only by the customer but also by the customer's customer to ensure that that service providers can, thought their actions, support their value generation as effectively as possible. The role of the user of a building is significant because the built-up environment offers a platform for business operations and societal activities. Buildings must be functional in supporting whatever activities are to be carried on and contribute to the financial performance of the user's business.

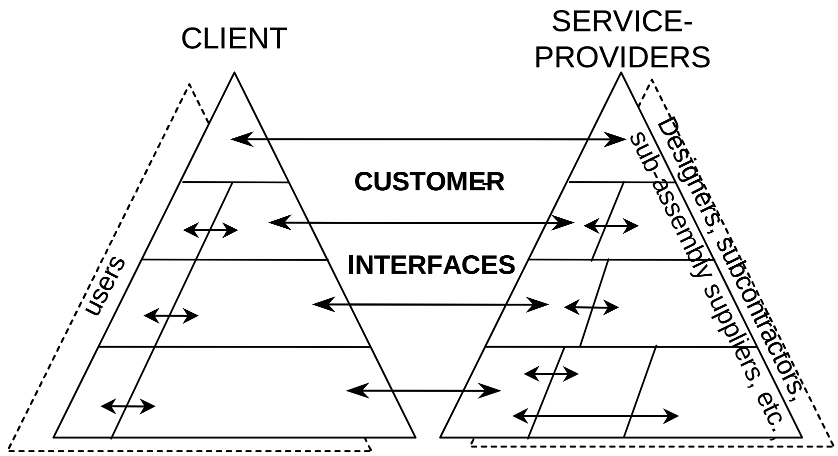

Fig. 1. Multi-dimensional customer relationship in a construction project (Pekkanen 2001).

Consequently, a customer relationship in a construction project can be understood as being not only multi-dimensional but also as having several parallel levels between the client and the contractor (*Fig. 1*). There are three such parallel levels: strategic, tactical, and operative. Communications between the parties to a construction project takes place on these levels (*Kornelius & Wamelink 1998, Hatch 1997*). Each level of the organisation has its own role whose significance changes with the progress of the project.

By improving customer orientation, it is possible to eliminate some of the sources of dissatisfaction, avert threats to customer relationships and generate benefits for all those involved in the project process. The problems with customer orientation in building production often stem from the inherent features of project activity and the practices related to the perception of the players as opposing parties, an attitude that is deeply rooted in the industry (*Kärnä 2004*). Another aspect of building projects is the multi-dimensional customer relationship in which the contractor, via the client, stands in a specific relationship with the client's customer, i.e., the user of the premises, presenting a number of challenges to successful customer orientation.

The most efficient way of improving customer focus is to reduce threats to a good customer relationship, in other words, to develop aspects that affect customer expectations or serve as typical sources of disagreement between the parties. In a building project, this means that the needs of the client and end-user have to be analysed, something that calls for improved and deeper interaction between the client and the service provider.

3. Research method

A survey based on interviews and workshops was conducted to explore the views of clients and contractors concerning the success factors and threats to a good customer relationship in a construction project and the potential for improving customer orientation. The primary data was gathered by interviewing experts. In order to define the subject of study and to achieve the objective, the qualitative thematic interview was selected as the method of investigation because the goal was to chart the perceptions, experiences and observations of the interviewees as to the problem being addressed. In the course of the study, representatives of a total of six office space construction clients were interviewed. In order to increase the validity of the findings, the interviews were followed by workshops focused on the clients' and contractors' views as to the main threats to a customer relationship and customer orientation. Prior to interviews and workshops, a literature study was carried out to help determine the themes of the interviews.

The survey was limited to office space construction because it is in this type of projects that the multi-faceted nature of the customer relationship and the divergence of the roles of the operator, investor, and client are the most typical.

4. Changes required to support the evolution of a good customer relationship in a construction project

The thematic interviews and workshops brought to light a number of success factors and threats related to the formation of a good customer relationship in a building project. The clients' and contractors' opinions concerning the things that affect the evolution of a successful customer relationship were then classified and grouped into ten success factors and threats (*Table 1*). Based on the data gathered in the interviews and workshops, the key areas where improvements are called for in terms of strengthening the success factors and averting threats to a customer relationship were identified in the context of existing forms of project execution. The efforts to improve the overall construction process need to address the following (*Fig. 2*):

- management and coordination of sub-processes in a project
- clarity of the contract system and allocation of responsibilities
- improvements in collaborative procedures and exchange of information.

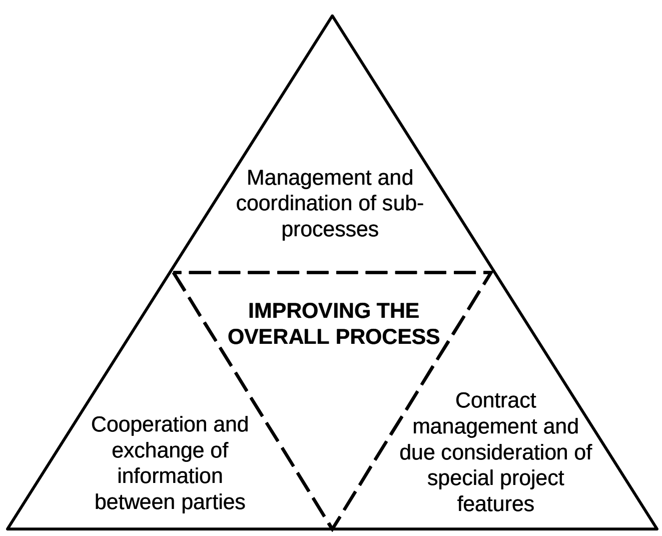

Fig. 2. Recommendations for action in the three sub-areas in support of the efforts to improve the overall construction process.

Many of the success factors and threats related to customer relationships can be influenced by developing procedures in more than one of said sub-areas (*Table 1*). The following table gives a more detailed summary of the needs for change in said three areas.

Table 1. Key success factors and threats where improvements are called for in customer relationship management

Success factors and threats according to interviews and workshops	**Areas where improvements are required**		
	Management and coordination of key sub-processes	Development of contract systems	Improvements in collaborative procedures and information exchange
1. Open communications			X
2. Systematic exchange of information		X	X
3. Joint problem-solving and ability to achieve the established objectives	X	X	X
4. Mutual trust	X		X
5. Flexibility in the face of changes	X	X	X
6. Mutual efforts to develop the business relationship			X
7. Poor applicability of information	X		X
8. Different expectations as to product and process outcomes	X	X	X
9. Poor management of sub-processes	X	X	X
10. Unclear or insufficient responsibilities and powers		X	

5. Recommendations for responding to the need for changes

To respond to the need for changes, a number recommendations for action were prepared addressing said three areas. The aim of the recommendations is to improve the overall construction process. Through the individual processes, the effects of the recommendations, which are closely intertwined, will be felt throughout the construction process. By means of these measures, it is possible, in the first place, to remove threats to the evolution of a sound customer relationship while at the same time strengthening the success factors (*Fig. 3*).

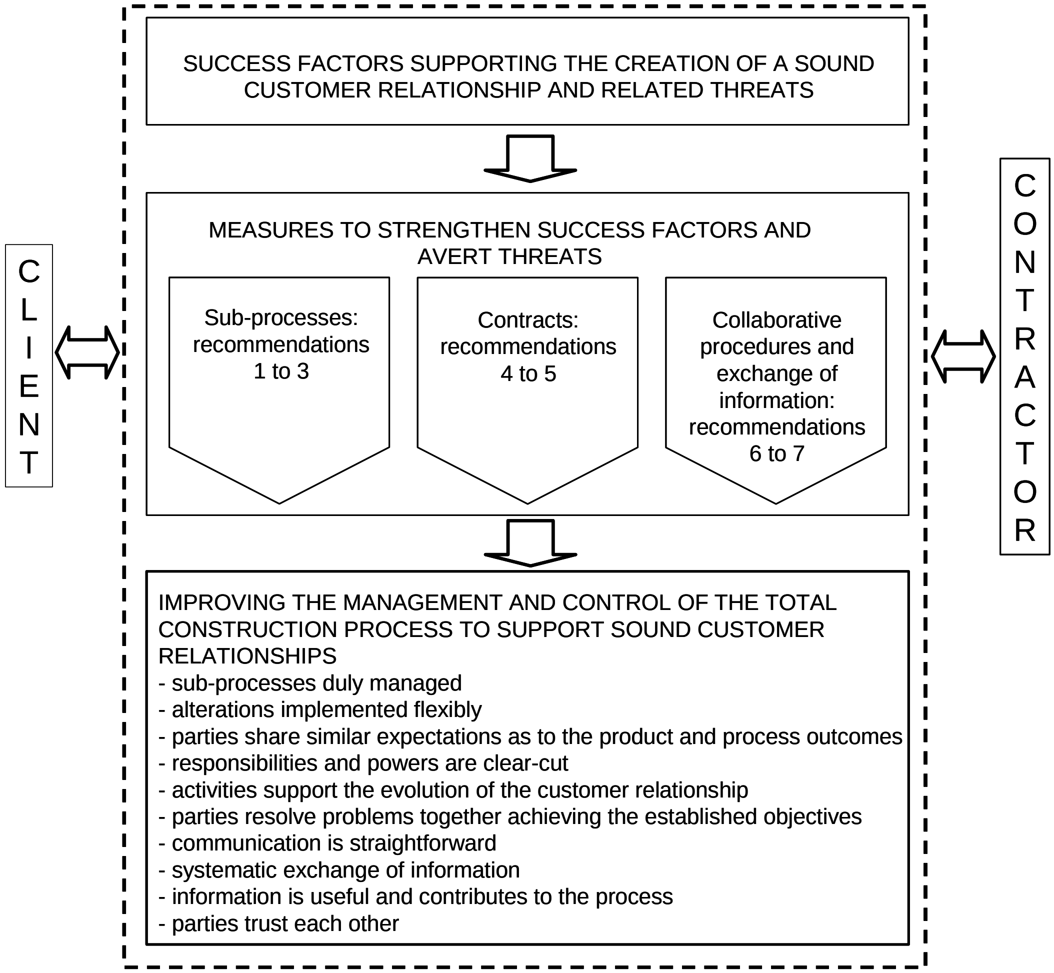

Fig. 3. Required improvements in procedures in order to strengthen success factors in customer relationship management and to avert threat.

According to the study, important development actions include:

1. Improved management of the design and planning process
2. Improved management of the construction process
3. Improved integration of the design and construction processes
4. Creation of a forward-looking contractual framework conducive to improvements in performance
5. Creation of a contractual framework that supports cooperation between the parties and is conducive to active involvement
6. Creation of informal interactive mechanisms that are complementary to conventional cooperative procedures
7. Development of information exchange to support process management.

Additionally, *Table 2* provides a summary of the most important development actions within each of the seven sub-areas.

Table 2. Recommendations for improving the construction process in support of a good customer relationship.

<table>
<tr><td colspan="3">PURPOSE OF THE RECOMMENDATIONS: A GOOD CUSTOMER RELATIONSHIP IN THE MULTI-FACETED CUSTOMER RELATIONSHIP CONTEXT
- FINANCIAL PERFORMANCE (IMPROVED PRODUCTIVITY)
- PRESERVATION AND EVOLUTION OF THE CUSTOMER RELATIONSHIP (PARTNERING)</td></tr>
<tr><td colspan="3">OVERALL PROCESS MANAGEMENT</td></tr>
<tr><td>Main objective of development efforts</td><td>Area or aspect to be developed</td><td>Main development areas</td></tr>
<tr><td>Create better control procedures in order to achieve the project- and process -related objectives of the project</td><td>Management system for sub-processes
Especially the development and coordination of design and construction processes specifically to each individual procurement method</td><td>Improved management of the planning process
– Identification of customer needs and their communication for inclusion in realistic input data for design
– Bringing the plans gradually to sharper focus
Improved management of the construction process
– Preparation and adoption of a procurement strategy
– Management of changes during the project
Improved integration of the design and construction processes
– Identification of critical decision-making stages and action planning
– Assurance of the commitment and performance level of the entire supplier network in case of changes</td></tr>
<tr><td>Clarify allocation of responsibilities, defuse disagreements in advance and support the adoption of new forms of collaboration in the sector</td><td>Contract issues
Coverage of the contract system and clarity in the division of duties and allocation of responsibilities</td><td>Creation of a forward-looking contractual framework conducive to improvements in performance
– Creation and adoption of contracts that support the entire construction process
– Clarification of the rules of the game on application of new methods of procurement
– Improvement of risk management performance
Creation of a contractual framework that supports cooperation between the parties and is conducive to active involvement
– Full utilisation of contract-based management
– Development and systematic adoption of contract reviews</td></tr>
<tr><td>Make sure that the expectations of the client and user are communicated to executors and strengthen mutual trust between the parties</td><td>Customer communications
Encouraging information exchange and interaction</td><td>Creation of informal interactive mechanisms that are complementary to conventional cooperative procedures
– Improved inter-personal communications
– Development of a feedback system
Development of information exchange to support process management
– Development of systematic reporting to make it more forward-looking
– Assurance of the timeliness of information flow and the usefulness of the data from the recipient's point of view</td></tr>
</table>

The areas where improvement are called for identified in the study and the more detailed proposals for action based on the findings provide a sound basis for enhancing customer relationships and customer orientation in a building project. Efforts to this end must be made both at individual companies and on a broader front in the form of cooperation between several players. A methodology where the recommendations for developing activities are based on the identified success factors and threats to a sound customer relationship offers a new approach to enhancing cooperation.

The recommendations were selected with a view to areas that offer the greatest potential in terms of improving the overall process in construction. To facilitate practical application, the recommendations were structured so as to allow them to be subdivided into smaller component parts that can be implemented as a series of individual measures. As far as the various parties to the construction project and the specific procurement methods are concerned, the focus of the measures lies on slightly different things. Even so, a significant improvement in the formation of a customer relationship and customer care calls for parallel actions and enhancement of the process on all the three fronts targeted by the recommendations. More often than not, special measures are required in individual areas in order to have a new, generally accepted procedure developed and adopted. While this calls for new modes of operation and behaviour patterns on the part of both the clients and contractors, the benefits will also felt in the business operations of both.

6. Conclusions

The success factors and threats associated with customer relationships show that the control and management of the overall process in a construction project need to be modified. When development efforts are made, due consideration should be given to the multi-faceted nature of the customer relationships and related customer chains and levels and the needs and requirements imposed by various procurement methods. The purpose of the recommendations is to improve the overall construction process. Through the individual processes, the effects of the recommendations, which are closely intertwined, will be felt throughout the construction process. By means of these measures, it is possible, in the first place, to remove threats to the evolution of a sound customer relationship while at the same time strengthening the success factors.

A number of areas for further research can be identified on the basis of the study, a typical theme being the customer relationship in a construction project. Similarly, upgrading the overall management of the construction process to set a completely new standard of performance calls for investments in research and development. As far as the construction process is concerned, such research and development efforts should target the following:

→ Management of the design process and increased interaction in design
→ Development of collaborative and operative processes for the warranty period
→ More efficient use of information technology and particularly the product model technology
→ Development of customer relationship management in the various phases of the overall process
→ Development of contract systems to encourage cooperation and a forward-looking approach
→ Development of information exchange and communication process between the parties
→ Confidence-building measures between the parties to a construction process.

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Innovative Approaches to Developer Selection and Procurement for Housing Market Renewal

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Abstract: This paper presents an overview of the use of the housing tool kit procurement model and uses a case study approach which focuses upon the procurement process adopted to select lead developers. The study considers the capability assessment carried out via the pre-contract qualification exercise, follow up activities, negotiation and selection processes and how this approach seeks to inform the attainment of best value. The outcomes of this study denote the commitment to an ongoing improvement process to ensure project successes and the wider benefit to community via the housing market renewal programme.

Keywords: Housing, Management, Performance, Procurement, Regeneration**.**

1. Introduction

The development of effective procurement systems to meet the needs of the client is now an established objective for many major projects. This is particularly relevant to the needs of the housing market sector. The history of the past 40 years of the housing market in the UK has been one of boom and bust over a repeated cycle (Muellbauer and Murphy 1997), this cycle has also prompted the consideration of the value, both in terms of the quality of the housing stock and its impact upon those who buy and live in that stock.

The UK has experienced a continued rise in the demand for homes, particularly in the South East of the Country, which has led to pressures upon land use and subsequently resulted in an increase in housing prices (Evans, 1991). This situation is contrasted with the collapse of the housing market in areas which have been less attractive to those able to afford housing. The phenomenon of low and falling demand for housing became evident in the UK in the late 1990s (Bramley and Pawson, 2002). This issue has been observed in both the private and public sectors and has led to societal problems in the inner cities and former industrial centres in the North of England. The issues of low employment, low aspiration, social exclusion and economic decline are particularly prevalent in these locations (Peach, 1998, Wilcox, 2001, Elevate, 2006).

Within the context of the housing market renewal programme, this study seeks to review the issues facing regeneration practitioners in the UK. It provides a summary of public policy and interventions in the market and summarises the tools available to achieve these aims through the procurement process. The study considers two case study examples and provides a comparative study of both and presents the lessons gained from this process.

2. Housing Market Interventions

As a means of resolving the imbalance within the housing market, the UK government have made a major policy decision to support the housing sector. This mode of intervention extends beyond the provisions of section 106 of the Town and Country Planning Act 1990 and include a range of activities concerning the development of sustainable communities. These were led by the Office of the Deputy Prime Minster, now superseded by its replacement, the Department for Communities and Local Government. A fundamental principle of sustainable communities is that occupiers have access to decent home at a price they can afford, in a place in which they want to live and work. This premise is defined in the five-year plan *Sustainable Communities: Homes for All*, (ODPM, 2005), which defines three key objectives (i). Introducing HomeBuy schemes; (ii) achieving decent homes by 2010 and (iii) introducing home information Packs.

The decent homes concept has been a prime driver for the public sector housing market. To achieve the investment in housing, the local authorities have been allowed to used a range of actions to generate the financial capital necessary, including the transfer of stock to a non-profit housing association (RSL), who can borrow money from the banks; by creating an Arm's Length Management Organisation (ALMO); a company owned by a council or by entering into a Private Finance Initiative (PFI); a partnership between the private and public sector, with funding provided by the government.

A further means of improving local housing stock has been via the activities of the housing market renewal pathfinders (ODPM, 2005). Low housing demand and abandonment have affected many towns and cities in the North and Midlands. Economically this situation makes house removal extremely difficult to achieve. The dichotomy is such that although these areas are often situated close to or even within cities, where the economy is growing, these neighbourhoods remain disconnected from the new jobs, with residents experiencing low skills levels, worklessness, high levels of crime or fear of crime, and poor facilities. The programme which includes nine pathfinder projects has been established to renew failing housing markets with funding provided via partnerships of two or more local authorities, who work together with local partners. The pathfinders are charged to develop strategic approaches to dealing with the problems that exist within their areas. The pathfinders draw on a wide range of funding streams from local authorities, the Housing Corporation and other public bodies, as well as maximising investment from the private sector.

Pathfinder activities include physical housing works, including refurbishment, replacement and new build. These activities are linked to other actions to achieve economic regeneration, including actions to tackle social problems such as neighbourhood renewal and management, reducing crime and antisocial behaviour.
Across each of the above activities, the concept of best value and best practice has been set as a duty, requiring councils to review all the services, which they provide for local people, including housing, and improve them by the best means available through continuous improvement (DETR, 2001 and ODPM, 2005). This has a direct impact upon the procurement systems used in order to achieve effective and efficient systems.

3. Achieving Best Value Through Procurement

The procurement pathway for public sector housing has traditionally involved the selection of the lowest price. A good representation of the changes in public sector procurement in the housing market has been the Constructing Excellence Housing Forum Partnering Toolkit (Constructing Excellence, 2006). This is an advisory tool that involves the necessary planning decisions relating the organisation's needs, procedures, culture and its supply chain. Notable reference points in achieving good project outcomes are related to the concepts of Decent Homes and Sustainable Communities (Egan, 2004 and CABE, 2005). The toolkit is based upon a range of demonstration projects that have focused upon achieving customer satisfaction and best value through partnering. The tool kit comprises the following stages:

i. The Business Case: a clear business case relating to best value policies, business planning and asset management is seen as essential to a successful procurement process. Issues such as corporate values and value for money are seen as the basis for this approach. An Asset Management Plan which includes including information on property conditions and customer needs and linking objectives to the Decent Homes Standard is proposed as a good way forward. This should include the evaluation of the long term costs and benefits, defining project success criteria and consultation with project stakeholders. The toolkit also focuses upon the development of a clear client team structure and a commitment to a project review at key stages. Above all visible leadership and strong management must be evident.

ii. Internal Partnering: This process involves the establishment of an effective team and ensuring that all stakeholders are fully committed. The integration of the team across the client structure and developing an understanding of best practice procurement processes with the necessary skills in place are critical elements.

iii. Overcoming Resistance to Change: The implementation of Partnering, Rethinking Construction and Best Value procurement infer step changes in process working and institutional expectations. Typical actions will include role development, training and awareness, mapping new processes and communicating the change process.

iv. Procurement Strategy: The selection of the procurement strategy will influence the whole cycle of the construction process and project relationships. The objective is to ensure that the client secures defined services and outputs from suppliers that will meet fully defined business needs and objectives. Customer involvement, risk and value management will be central to this strategy through life time project performance management and problem solution protocols.

v. Ensuring Probity, Audit Trails and Accountability: Attaining clarity in the procurement process, where lowest cost is not the option can be seen as problematic. The best value agenda is gradually working towards a way of meeting the needs of the wider societal outcomes, such systems must be open to scrutiny and public sector access, as such there should be clear and open communication links across the procurement team.

vi. Dealing with Regulatory Controls: It is necessary to work within the regulatory controls such as local authority standing orders (Sos), these are systems established to gain the best value offer to the client. Engaging officers and elected members are part of the assessment system. The EU procurement regulations such as the OJEC procedures will apply to large scale schemes as such clear planning, notification and awareness is essential. There is some degree of concern that such processes may infer excessive time delays although the process allows for the definition of a clear and auditable process. Notably, the award of tender must be at lowest price or "most economically advantageous". A range of criteria may be considered in order to achieve this aim, including price, project duration, running costs, profitability and technical merit.

vii. Assessing and Managing Risk: Objective and verifiable information on property conditions and customers' needs should be used to guide or test early project decisions. This is a crucial stage also for establishing a gateway approval system to review the project at key stages over its duration that addresses all risks and whole project cycle management with appropriate recording systems, as part of an integrated team process.

viii. Focusing on Sustainability and Whole Life Value: The establishment of whole life costing and value systems will help deliver better long term and efficient services in terms of cost comparisons and in achieving sustainable solutions over lowest cost options. Such approaches are aided by the development of integrated supply chains through collaborative working arrangements.

ix. Using Performance Incentives: Incentives can be used as a way of improving performance and outcomes, such as customer satisfaction, money need not be the prime focus of such measures. Contractors may be rewarded for exceeding performance targets such as bringing added value, achieving quality and customer satisfaction.

4. Performance Management

Housing forum survey data shows that 96% of projects used key performance indicators as a means of tracking progress and diagnosis of issues and problems. Project experience highlights the importance of balancing the range of number of indicators in order to provide a clear and cost effective method of working. Long term partnering arrangements provide a basis for performance management strategies, which can be used to deliver community benefits to local communities by focusing upon issues such as job creation, training and sustainable business development. Housing clients can exhibit leadership, within legislative guidelines, to drive the wider community agenda. Ensuring that performance targets are in place, as part of the procurement process, allows an effective assessment system to measure community benefit. Such targets are particularly useful in tracking the performance of long term projects with the pay off for contractors relating to long term contractual commitments (Constructing Excellence, 2006).

5. Case Study Examples

In this study, two case study examples are reviewed. Both are major project developments managed through Elevate East Lancashire and its partner local authorities. The projects are both long term new build housing developments, which involve a private developer working alongside the public authority. As a means of ensuring optimal advantage to be gained from the projects and ensuring that best value practices are attained the procurement route has been geared towards a partnering arrangement. It is important to note that the pathfinder in this case has undertaken a range of additional measures to develop leadership and partnering skills with respective stakeholders by which to meet the needs of the regeneration process. In this study, the process by which the partner developer is obtained is presented.

Case Study 1: Burnley – Burnley Wood with Healey Wood Developments

The procurement process can be best presented by means of an open invitation and open briefing session to potential developers. This process was followed by the submission and review of a pre-qualification questionnaire (PQQ) which upon evaluation led to an invitation to negotiate process with a short list of candidates.

The PQQ questionnaire can be best summarised as guide to the submission of previous experience and intent using as much factual and co-oberated information as possible. This included the review of criteria which included aspects relating to best value capability. The measure was based upon a process of evidence based submissions. The criteria included aspects such as company and technical information such as quality assurance accreditation and health and safety management systems. A commitment to environmental management and sustainability was also required including materials usage and recycling. The sustainability agenda was also widened to include experience concerning diversity and equal opportunities and how this applies to aspects such as recruitment, training and promotion. Specific guidance on this area focused upon processes such as Investors In People and the Respect for People toolkit. Track experience of developing the construction skills agenda was of particular significance in the questionnaire process. Wherein the resolution of the skills gap concerning the recruitment of skilled staff including highly skilled operatives and qualified professional staff was addressed (CITB, 2002 and CIC, 2004). The project focused upon a commitment to ensure that people are given the chance to access the on-site vocational training and employment opportunities. Specific categories included the long term unemployed, college apprenticeships and developing training partnerships.

The focus upon long term commitments was tested in terms of the capability to maximise the economic return by utilising integrated supply chain management was emphasised. This was also complemented by a commitment to partnering particularly with regard to public sector projects. The societal issues of community consultation were tested through the ability to work with communities and to develop proactive relationships.

The final section of the PQQ involved a written statement concerning project competence tested the experience and capability of the bidder to take the development lead; the approach innovative and sustainable projects; community engagement; Neighbourhood Master Planning; partnership details in previous projects and how this experience could be geared to meet the needs of the sub-region.

The procurement process following the PQQ submissions involved the evaluation of submissions through a team process, involving council officers and Elevate personnel with the aid of external advisors. The teams were selected to review each category of the PQQ and their feedback was subsequently fed into a coordinating team. This team worked with the council representatives to agree a short list. The developers were then invited to tender for the development via a detailed ITN document. This document described a detailed overview of the development opportunity and offered scope for the developers to bring forward a workable development opportunity. These written criteria were used as the basis for the ITN process, where a more developed submission was requested. These criteria are detailed in table 1 with a comparative view of those criteria used in case study 2.

The submissions were evaluated by an evaluation panel consisting of the Council, in conjunction with Elevate and Lancashire County Council. This process also involved the invitation to prospective lead developers to complete a familiarisation visit to the ADF areas. This process would be followed by a presentation to the evaluation Panel and a post-presentation interview. Further negotiations were then encouraged to aid the evaluation process and to develop or improve the submissions.

The final stage of the selection process involved a full appraisal of all aspects of the partnership and land collaboration agreement prior to making the final recommendation for approval by the Council for each ADF area, so as to ensure value for money and affordable submissions were generated. The process had to ensure probity and accountability in the procurement process; with is compliance with all relevant Legislation and Regulations.

The Submissions were evaluated in respect of evidence set against the following criteria:

(a) Partnership working: Appreciation of the roles and responsibilities of all stakeholders in the process; Ability to work closely with the Council and other stakeholders to develop and deliver viable development frameworks within zones; Robustness of the proposed partnership arrangement; Prior experience in working in partnership with local authorities and Registered Social Landlords on urban regeneration projects.

(b) Recognition of the actions needed to transform these zones into sustainable communities; Evidence of understanding urban design principles; Integration of the proposals with the surrounding area.

(c) Financial: Proposed return for the Council and its partners; Financial standing of the prospective Lead Developer and ability to secure capital investment; Understanding of all legal and financial constraints on the council as a local authority; Proposed basis of risk sharing.

(d) Corporate: Contribution to the realisation of the Councils vision , values and aims; Approach to equal opportunities including the consideration of any policy or statement; Complaints procedure; Approach to health and safety issues; Compatibility with the Councils objectives and policies.

(e) General: Approach to increasing the training and employment opportunities for the local community; Arrangements to engage and consult the local community and other stakeholders in the process; Approach to environmental issues and physical sustainability; Evidence of added value; Degree of innovation; Robustness of all parts of the Prospective Lead Developers proposal; Openness and accountability; Evidence of understanding the Council's overall requirements.

Case Study 2: Hyndburn

In this procurement process, the same pre-qualification questionnaire as described in case study 1, was adopted. In this case study, a partnership between Hyndburn Borough Council and Elevate East Lancashire agreed a shortlist of four prospective Lead Developer Partners

(LDP's) for the Neighbourhood projects designated within Accrington and Hyndburn, which were smaller than those included in case study 1.

Due to the size of the ADFs, the Council intended to appoint only 1 (one) "Preferred" LDP from the shortlist. Each short-listed prospective LDP was invited to submit a formal submission following distribution of the Invitation to Negotiate (ITN) document for subsequent evaluation. The prospective LDP's were invited to a "Developer Open Day", to meet and hear from; Council Officials, Senior Elevate Representatives, Master Planners and other stakeholder or funder bodies and to make accompanied 'familiarisation' visits to each of the Neighbourhood areas.

The submitted ITN were evaluated by a selection panel comprising council members, officers and others, in conjunction with Elevate East Lancashire, their advisors, funding organisations and Lancashire County Council, the criteria used in this study are presented in table 1. As part of the evaluation exercise, the prospective LDP's were invited to clarify their written proposals to the selection panel during the appraisal period. The prospective LDP's were also be invited to provide a presentation to the selection panel, which will include a post-presentation interview with the key delivery and project staff. The avenue for further negotiations as with case study 1 was also permitted. Figure 1 presents the process map adopted for the total process.

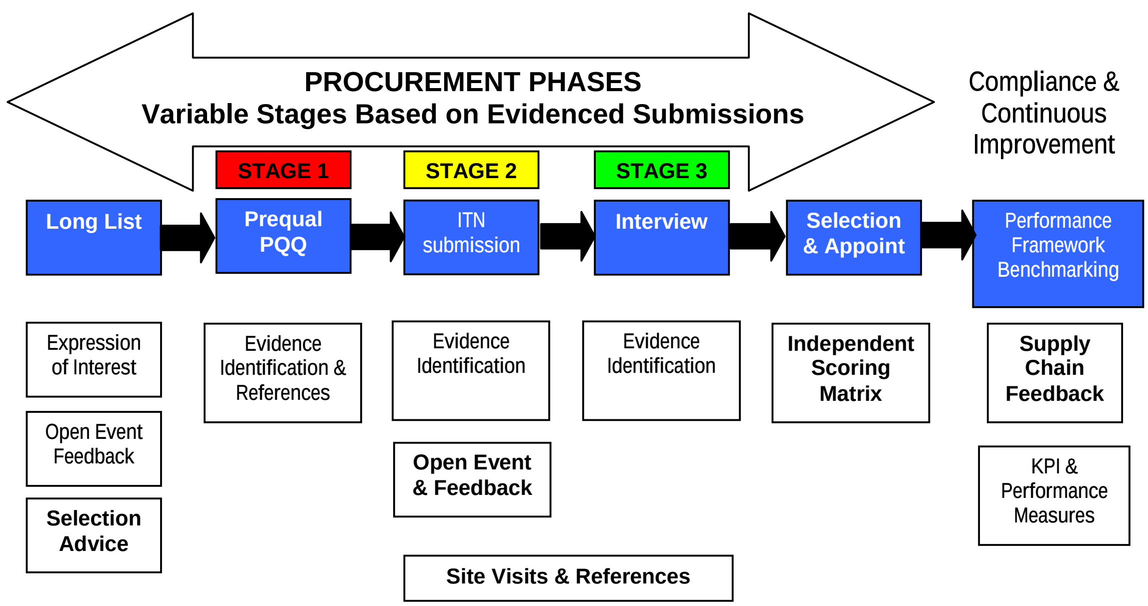

Figure 1: Procurement Phases – Process Map

Following the evaluation and full appraisal of all aspects of the written submissions, clarifications and presentations, the Council was charged with the responsibility of selecting the preferred developer again with the remit to determine the most economically advantageous option within a clear and transparent process.

During the planning and delivery phases, the appointed Lead Developer was required benchmark their performance against a key performance indicator framework negotiated as part of this procurement process to demonstrate compliance and continuous improvement. This will form the basis of tracking the entire project and mirrors case study 1.

The following principles were used to guide the procurement process and its outcomes. These included the adoption of best value, value for money and affordability issues. These are difficult to summarise in simple terms and reflect the iterative process adopted. The selection panel focused upon the section of economic advantage gained; environment, employment, social and neighbourhood management; probity, accountability, transparency and audit scrutiny which was set by the relevant EU and UK Legislation and Regulations; meeting the Council's and the ODPM's requirements for the 'pathfinder'; achievement of value added and community benefit. These principles were manifest in the following ITN criteria as denoted in table 1. This table also lists the respective weightings for each selection criteria.

Table 1: Burnley and Hyndburn Project Criteria

ITN Question	Burnley	Hyndburn
	% weighting	% weighting
Finalise the master plan and partnering capability	18	18
Business and financial planning	10	15
Employment, training and local economic development	7	-
Affordability and sustainability	-	15
Ecohomes standard & sustainable construction	8	-
Cost of construction & affordability	8	-
Financial contribution	8	-
Community engagement and sustainable communities	7	12
Design, innovation and architecture	7	15
Quality	5	9
Health, safety and welfare issues	5	9
BME & socially excluded or hard to reach groups	7	-
Legal framework and performance framework	5	7
Performance measurement framework & PKIs	5	-

6. Evaluation

The two case studies provide an overview of the developer selection process and present a live study of the principles of the decision making process. In reality the process of agreement and negotiation is somewhat more protracted than evident from the tool kit. However, the process of attaining shared cultures within both the internal and external partnering phases imply that negotiation will be an ongoing process. In meeting the principles of the tool kit it can be expected that total stakeholder involvement will involve a high degree of participation and reflection. The scale of case study 1, is such that the risks implicit in a long term high volume project will necessitate such discussions.

It is evident that the task of achieving best value in the public sector is a process of consensus and negotiation. The key outcomes relate to a common goal to achieve social benefit. This is evident in the adoption of social benefit clauses. These are now accepted as a natural outcome of such projects. The task of agreeing benchmarks for performance has been again an area for discussion and patience particularly in respect of affordability and feature as a separate study. This aspect indicating the degree of new ground to be covered and the fact that the procurement process is in effect a process of innovation to resolve what will be invariably quite novel project delivery issues.

An evaluation of both case studies is hard to place in exact terms although it is clear that a close correlation between the case study examples and the tool kit process does exist. In terms of the time undertaken in the pre-contract phase it is still too early at this stage to provide any firm outcomes.

In both case studies, a series of performance criteria were adopted to enshrine the principles of community benefit. It was possible in both cases to achieve relatively similar principles in the negotiation phases. These criteria were derived from the PQQ and ITN documentation related to the following areas: (i) local employment; (ii) training provision; (iii) a commitment to diversity and representation in the workforce; (iv) a commitment to using the local supply chain; (v) health and safety; (vi) sustainable construction; (vii) community awareness, consultation and profiling. The differences in table 1 across the case studies show an attempt to simplify the negotiation process in case study 1 by combining common areas and removing possible duplications.

What is very tangible is the endorsement of the performance management indicators by all parties. Indeed proactive steps in progressing towards a benchmarking process are very much evident. This is now leading to a process of sharing and learning between project partners.

7. Conclusions and Observations

This paper has provided a review of the need for government intervention in tackling the issues of social housing. This is particularly evident in areas of low housing quality and demand. The added issues of community engagement presents both a unique opportunity but also a difficult project task that necessitates the need to act responsibly and carefully with social skills that may not be a inherent trait of the traditional construction team.

The experience of the housing market pathfinders offers the opportunity to resolve the problems of urban renewal through best value which can be attained by the adoption of long term partnering arrangements. The culture of partnering arrangements has presented the need for new methods of collaborative working and project operation. It is evident that openness and appropriate protocols are necessary to protect the public investment in such activities.

The housing tool kit offers a way of recording the necessary steps in achieving openness, probity and social benefit with performance measures, which can provide advantages to both industry and society.

The paper has presented two case studies of procurement systems which have been designed through best value to achieve society benefit. Both case studies are set in areas with pressing issues relating to housing market renewal and regeneration of both society and industry. It is clear from these case studies that the tool kit, whilst not the template for these actions, is closely mirrored. It is evident that the tool kit presents a workable process model. Experience shows however, that the respective steps are iterative and subject to reflection and continual review. This is perhaps the main outcome of the best value process wherein risk management and review are essential features at all stages in resolving the long term issues of regeneration now facing society.

Acknowledgement

The authors which to acknowledge the Elevate East Lancashire pathfinder and its partner organisations for their support offered in the completion of this study.

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Using the System Dynamics Methodology to Model the Competitive Index of Firms in the UK Construction Sector

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Abstract: In addition to assisting with the sense making of the complex interrelationships identified to exist between the external issues addressed in Goodier et al, 2006, system dynamics is also helping to interpret the findings from classical literature and firm case studies that have been undertaken into construction sector evolutionary pathways. These pathways have been structured using an adapted version of Teece's Dynamic Capabilities framework.

This populated framework forms the basis for the development of a system dynamics model of competitiveness. The dynamic activity in the model is driven by a performance metric – a competitive index. This paper presents the model development focusing on contractual competitiveness and the variables that impact on this during contract delivery. Feedback mechanisms are employed in the model to dynamically impact performance variables associated with the delivery process, thus updating the competitive index. It is envisaged that the competitive index may be applied to individual firms, thus providing construction suppliers and procurers with a dynamic indicator of a firm's delivery capacity and competitiveness.

Keywords: Competitiveness, Construction, Dynamic Capabilities, System Dynamics.

1. Introduction

This paper is based on continuing research at the University of Salford for the collaborative research project, between the universities of Loughborough, Reading and Salford. The research is centred on 'sustained competitiveness in the UK construction sector', with a number of particular objectives for each university. The primary research aim is to engage industry in the development and implementation of an integrated strategy in support of sustained, innovation-based competitiveness. This will be achieved by exploring and verifying possible economic, social and environmental future trends (Loughborough University), understanding the current structure of the UK construction sector (Reading University) and exploring their system interconnectivity using the mathematical feedback modelling methodology known as 'system dynamics' (Fleming et al, 2006). It is hoped that this collaboration will engage industry in an informed debate to help define a programme of action for individual or groups of firms, as well as providing strategic guidance for policy makers, culminating in a ten-year research agenda.

The University of Salford is using the system dynamics (SD) methodology to help understand the UK construction sector. This will potentially give insights into how firms (or types of firm) can use pivotal high-leverage variables to achieve sustained competitiveness. This is achieved by constructing a series of models, from a variety of theoretical perspectives, which convert a firm's characteristics into a competitive index (CI). This metric is then used to decide which firms in the construction sector are most competitive, and correspondingly win more of the available contracts.

The dynamic capabilities perspective is a firm-specific analysis. It focuses on the extent to which firms are able to re-configure their resources and re-modify routines in order to remain competitive in changing environments. Its framework consisting of three key elements – managerial processes, asset positions, and path dependencies – provides an intrinsic view of how competitiveness is operationalised and sustained inside firms. In summary, it is argued that the competitiveness of construction firms relies on two key qualities. First, the capacity to understand and identify the competitive forces in play and how they change over time; second, the capabilities to re-configure resources and re-modify routines to interact with their changing business environment.

The SD models run over a period of 20 years which allows a greater appreciation and understanding between causes and possible effects over the long-term, rather than just the immediate implications. Another notable SD model on competitive behaviour of firms in the construction industry is *A Dynamic Competition Model for Construction* (Kim, 2006), though this paper looks more into bidding behaviour and market changes. These insights will provide a greater understanding of the dynamic behaviour of the firm and its environment and thus enable improved decision making to be undertaken with regards to all aspects of procurement activity as addressed in Goodier et al (2006). The SD models therefore need to take possible future developments in the UK construction sector into account.

2. Dynamic Capabilities Framework

When attempting to understand how construction firms become and remain competitive, it is important to understand the changing context within which they operate. The UK construction industry has been influenced by a number of factors in recent decades: 'economic and industrial factors, government policy, social and technological changes' as well as 'external influences and changes which have been brought about by the industry itself'(Hillebrandt et al, 1995). Therefore, for a firm to remain competitive it needs to evolve in conjunction with the broader changing environment. To understand these dynamics of change the University of Reading has been engaging with medium-sized regional contractors, companies large enough to engage in some degree of strategising, to create detailed case-studies using an adapted version of Teece's 'dynamic capabilities framework' (DCF).

There are a number of dynamic capabilities frameworks, however, the Reading University research team have embraced the approach proposed by Teece (1997) as a broad view on the competitive strategy of firms. Teece and Pisano (1994) wrote that the first term 'dynamic' refers to 'the shifting character of the environment' whilst the second term 'capabilities' emphasises the ability of the firm to 'adapt, integrate and reconfigure internal and external organisational skills, resources, and functional competences' to create or sustain competitive advantage. Other perspectives, such as the competitive forces framework (Porter, 1980), fail to provide an intrinsic view of how firms adapt to their changing environment. The three key factors of a firm's dynamic capability are its 'resources', the way in which these are assembled and organised to perform activities in the form of 'routines', and the distinct capabilities that enable a firm to conduct its core business.

Building upon these three key components of dynamic capabilities an analytical framework for understanding the competitiveness of UK construction firms is proposed. The 'asset position' of a firm is examined in greater detail, examples would be: technological assets (e.g. the utilisation of specialised construction technologies provided by sub-contractors or manufacturers); complementary assets (e.g. the investment in computer equipment and trainings for the development of bespoke project management software); reputational assets (e.g. a good track record, a leading market position, an award for excellent performance, or a Kitemark for achieving certain standards); financial assets (e.g. owning properties and raising cash from external markets); structural assets (e.g. a flexible organisational structure and a vertical integration with sub-contractors and suppliers); institutional assets (e.g. the pre-qualification systems or procurement rules); and market assets (e.g. special types of construction works or contracting services).

The 'managerial and organisational processes' of a firm refer to the way things are done through a firm's routines of current practice and learning, and is a direct factor on a firm's competitive advantage. These processes include: coordination and integration (e.g. the coordination between delivery teams on site and off-site management teams, and the integration with other firms by strategic alliance); learning (e.g. learning new building technologies, project delivery improvements, and market changes); and reconfiguration and transformation (e.g. the responses to a client's new procurement method, the government's new policies, or emergent markets).

In addition, since a construction firm's competitiveness is conditioned by its historical path development, each firms history is profiled to identify potential strategies of benefit, such as the recognition and development of market opportunities (e.g. new types of contracts or works) or returns on a firm's previous investments on its capacities and routines (e.g. specialised skill trades and production processes).

3. Basis of Model Development

The primary purpose of the dynamic capabilities framework is to assert which factors have enabled a firm to remain competitive. The case studies undertaken by the Reading University research team have highlighted the complexity of the UK construction industry and the difficulty of decision making for individual firms in a complex world of rapid change. Whilst there are some characteristics specific to an individual firms, such as location and specialisation, which have enabled them to gain 'economic rents' (Teece, 1997) from the UK construction industry, there are many aspects common to all construction firms across the country, such as capital position and supplier relations, which create a competitive advantage. These factors identified are of primary interest in the construction of a model which will analyse the cause-and-effect behaviour on a firm's competitiveness by elucidating system relationships and interactions, capturing feedback processes and resultant system behaviour using mathematical modelling. It is argued that the competitiveness of construction firms relies on two key qualities. First, the capacity to understand and identify the competitive forces in play and how they change over time; second, the capabilities to re-configure resources and re-modify routines to interact with their changing business environment. With the use of system dynamics models to expose implicit assumptions and potential system behaviour arising from a range of different scenarios, each model may provide a useful descriptive and potential normative theory on competitive strategy.

It was felt that there are synergies between the adapted Teece framework and SD method. SD considers the causal effects of assets upon the firm in the same way that the adapted Teece framework highlights those assets needed for a firm to be competitive. Another reason for using SD is that it examines the effects that managerial decisions have upon the system. In addition SD considers resource flows including capital, labour, information, materials and energy. This enables SD to explore complex systems; the construction industry being one.

4. The Competitive Index

In order to inform which dimensions of firm-specific capabilities can be sources of competitive advantage, a composite measure of competitiveness is needed in this work and is referred to as a firm's 'competitive index' (CI). It is supposed that a total of '*i*' possible resources make up the competitive index, these are known as 'competitive factors' (CF). Each competitive factor is weighted in accordance to their relative significance on a firm's competitiveness, the sum of these weights equating to 1. The impact of the current state of the resource is rated in the competitive factor also on a [0, 1] scale. An overall competitive index is then computed by taking the product of each competitive factor CF_i with its corresponding weighting W_i and summing each overall resource *i*, which contributes to the competitive index, see equation 1.

$$CI = \sum_i CF_i . W_i \tag{1}$$

where $\sum_i W_i = 1$.

By this measure then a firm with a CI equal to 0 is the least competitive possible and a firm with a CI equal to 1 is the most competitive possible. Each firm can have a CI of any value in the [0,1] range.

5. Setting the Model Boundary

The first step in the system dynamics modelling process is to define the boundaries (Sterman, 2000). There are a number of methods and tools available for this task: here a 'high-level map' was chosen for the initial starting point (figure 1) before a boundary chart was drawn.

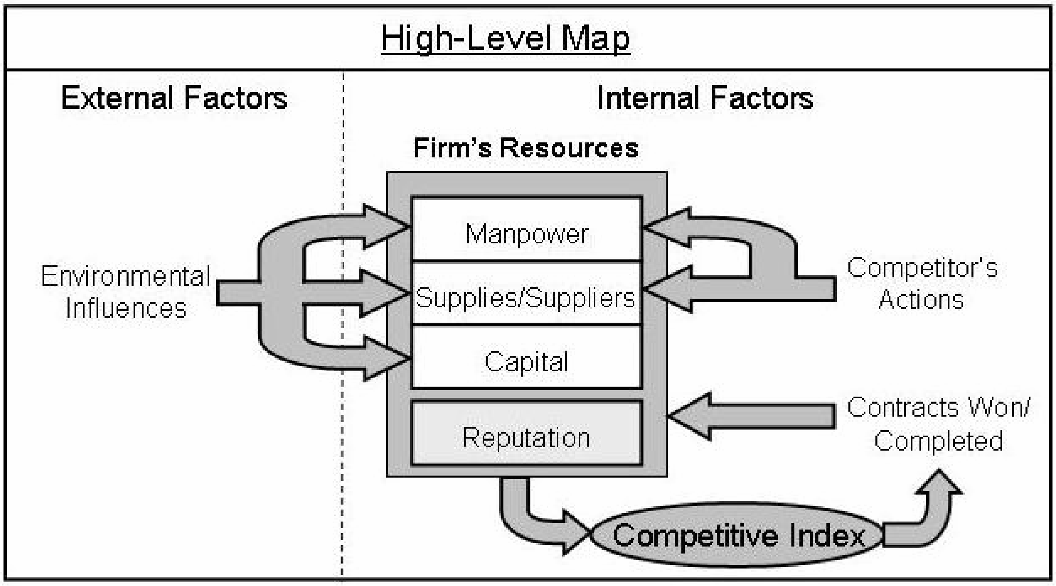

Fig. 1. High-Level Map of How Resources Relate to the CI and are Externally Impacted On

The high-level map is a visual aid that diagrammatically shows the major variables that will be present in the model as well as some of the influences or resource flows, in the system. The high-level map takes a strategic view of the system, with the details of influences and actions being described elsewhere to keep the diagram clear and easy to understand. The objective of this map is to show how a firm's resources impact upon their competitive index and how these resources can be influenced by factors that are both internal and external to the construction industry.

To complement the high-level map a 'Three E's Table' was created, which has been partly reproduced in table 1. A Three E's Table categorises the variables present in the model, with regard to their level of involvement. The Three E's table is an adaptation of a boundary model chart that has previously been used in the construction of system dynamics models regarding policy (Groesser, 2006). The three headings relate to the variables and are endogenous, exogenous and excluded. Endogenous variables relate to the assets seen in the adapted dynamic capabilities framework. When using SD, endogenous means that the behaviour is self generating in the model, through a series of feedback loops, where as exogenous variables feed into the model but cannot be influenced by changes in the model. Two variables that are thought to have relatively inelastic short-term affect on the construction industry are supply and labour costs, (Rawlinson, 1997; Akintoye, 1998). Both of these are seen as exogenous, rather then excluded, variables here as the model runs for a long time period. Excluded variables are variables not present in the model.

Table 1 – Current Proposed Boundary Table for Competitive Index Model

Endogenous	*Exogenous*	*Excluded*
Firm's manpower	Labour market	Weather Patterns
Firm's capital	UK economy	Raw Material Limits
Firm's reputation	Suppliers	
Contracts in the market	Supply Costs	
Capacity of firm's WIP	Contracts in the market	
Delays in Starting Work	Labour Costs	
Delays in Completing Work		
Effects of Delays		

6. Constructing System Dynamics Models

A short review of the development of this SD model is now explained. In the development of the model a singular variable is modelled, before adding further variables. This is to facilitate the understanding of how this variable affects the firm's competitive index over the 20 year model cycle. In this paper the number of contracts won by a firm, given its CI, has been modelled.

For the purposes of this model cycle, the following assumptions were made in terms of the basic flow of a contract:

1. A number of new contracts are released into the market (entering the system).
2. Contracts are won by competing firms, with the allocated proportions being dependent on their respective CI.
3. The contracts are completed, when contractual requirements have been satisfied (leaving the system).

The above steps are known as 'flows' due to each step being over a time period, e.g. the number of contracts completed per year.

6.1 The Stock and Flow Diagram Layout

The system dynamics method can use a number of visual aids, including tree diagrams, influence diagrams and stock and flow diagrams. In this paper stock and flow diagrams are presented, as they simply represent structure and produce graphical and tabular output. This section helps to briefly explain the main characteristics of stock and flow diagrams.

As discussed above, there are a number of resource flows present in the model and it is these flows that drive the model. Flows enter into and exit from 'stocks' apart from those flows that enter or exit the system. The 'clouds' show the points at which flows enter and exit the system. Furthermore, variables can be fed into the system as auxiliary variables. Figure 2 shows a 'stock and flow' diagram explaining each of the different elements described above.

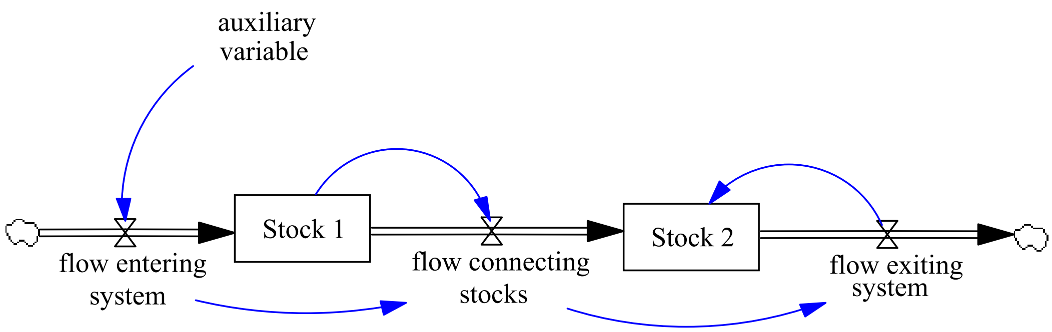

Fig. 2. Stock and Flow Diagram Layout

6.2 Modelling Affects of Contracts Won by a Firm

The model was built from the three flows, contracts released, contracts won and contracts completed, (figure 3) and incorporated the relevant stocks and auxiliary variables.

There are two aspects of this model that need to be stated. The first is that the CI is an auxiliary variable without being affected by internal or external influences, and the second is that this is a 'sub-scripted model' with three firms (labelled A, B and C) running concurrently in the same model.

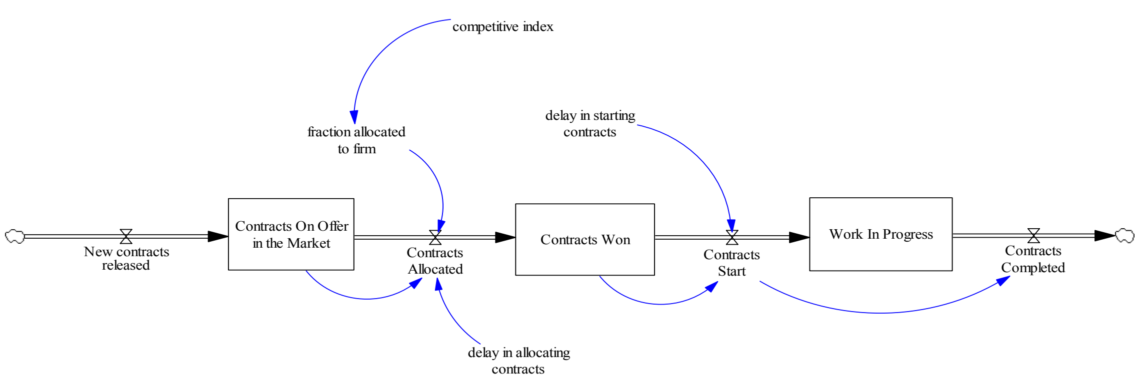

Fig. 3. Stock and Flow Diagram of Contracts Model without Feedback

The model runs the system in a state of equilibrium, without changes to any variables. By incorporating feedback structure, non-linear behaviour is created. It is the non-linearity and feedback attributes that makes system dynamics such a powerful modelling tool. This was achieved by incorporating a work-in-progress capacity limit, with firms being penalised (with a reduction in the CI) if they breached this (figure 4). The penalty is justified because as the firm breaches its capacity limit, it will fall behind and be late in completing contracts.

Any resulting drop in CI will give them a smaller share of the contracts on offer in the market. This means that their WIP will fall and the firm will be able to reduce or remove the delay in completing the contract. The contract reduction will lead to the firm's CI increasing to its original level.

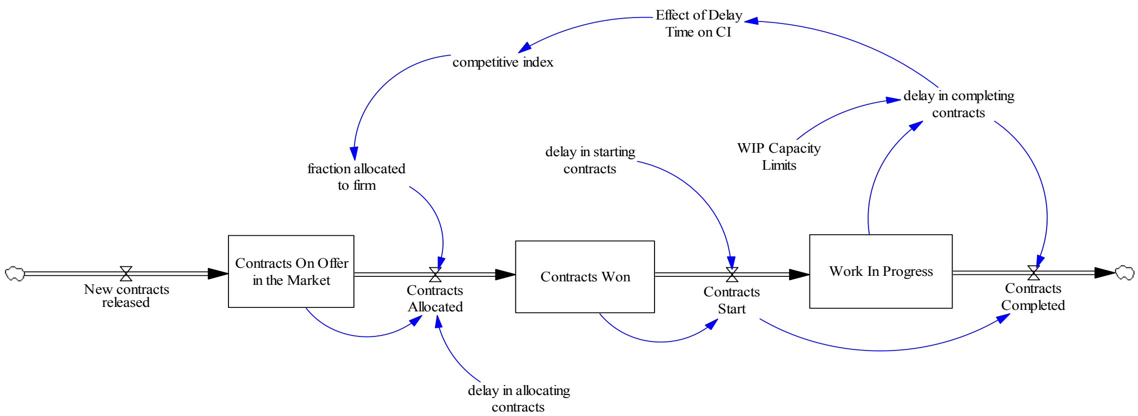

Figure 4 – Stock and Flow Diagram of Contracts Model with Feedback

As an example of how the model reacts, firm B's competitive index was arbitrary increased at time t=5 years. The increase in firm B's CI led to a greater fraction of contracts being allocated to firm B, which in turn increased firm B's work in progress (WIP). Once the WIP, of firm B, exceeded their 'WIP capacity limit' delays in completing contracts appeared, which led to a decrease in firm B's CI.

The decrease in firm B's CI led to firm B being allocated less contracts and therefore reducing their WIP and eventually omitting delays in completing contracts. By omitting delays firm B's CI increases and the cycle repeats. The Vensim® software used in the construction of the system dynamics models can output graphs of the model variables. Figure 5 shows the CI for all three firms, however firm A and firm C have identical plots and therefore only one plotline is visible for both of firms A and C.

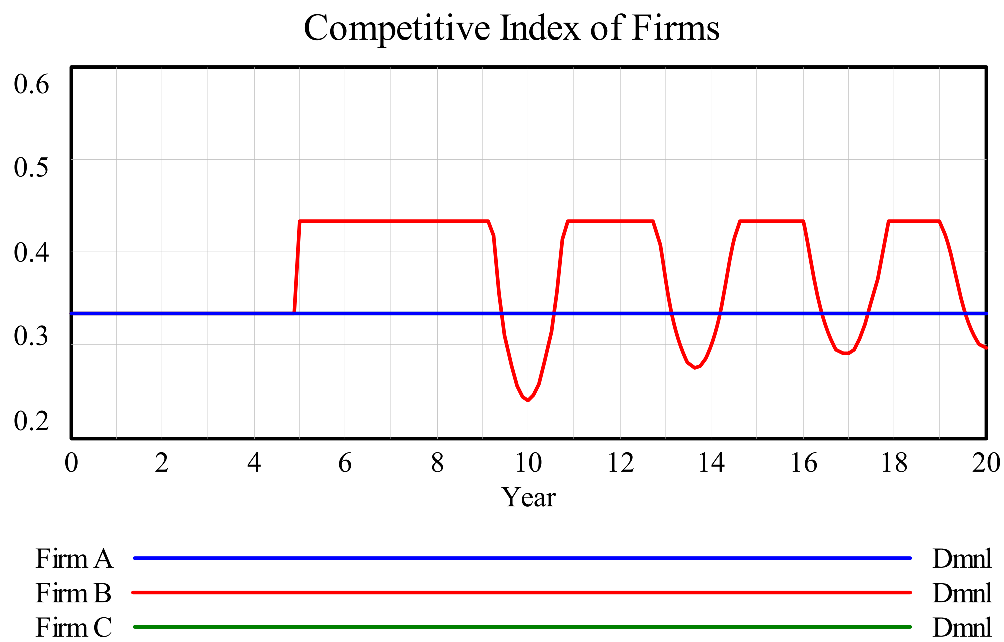

Fig. 5. CI of All Firms after Increase in Firms B's CI

The decreasing oscillations in the graph are due to the balancing nature of the system. By increasing the number of years the model is run for a repetitive pattern will emerge in the oscillations, this will be at the approximate length of a business cycle (4-6 years). It must be noted that at this stage of the research the contracts in the market variable has been used. Other endogenous, exogenous and excluded variables will be incorporated as the research progresses.

7. Future Model Developments

In order to build models that can better simulate the UK economy, as well as gain an increased understanding of how firms react to changes and how firms interact with each other, a number of model developments are required. These developments involve building the suppliers, supplies, capital (of the firms), workforce and external influences into the models. These future developments will continue to be based around the dynamic capabilities framework, which helps in the understanding of how a firm's assets relate to their competitiveness.

8. Using the Competitive Index for Procurement Purposes

The ongoing research described in this paper is developing a competitive index that uses System Dynamics to convert a firm's characteristics into a performance metric called a competitive index. It is suggested that firms within the UK construction sector may subscribe to this competitive index metric as a dynamic indicator of their competitiveness. The metric could be used as a tool to assess the competitive performance of a department or division within a larger organisation. Alternatively it could be used to offer an indication of a firm's competitive performance in the wider marketplace, in this case the UK construction sector. This indication may be of use to other organisations within the firm's transactional boundary such as members of its supply chain or those procuring its services or simply stakeholders who are impacted by the firm's actions. Whether the metric is one that is self regulated by organisations within the industry or is regulated by a third party is a question for future debate, once the metric is further developed.

9. Conclusions

This paper has presented how an adapted version of Teece's 'dynamic capabilities framework' (DCF) is being used by the University of Reading as a lens to potentially understand how firms evolve in conjunction with the broader changing environment. This work is serving to inform research that is being undertaken at Salford University that is using the modelling technique called system dynamics. It is felt that the technique is appropriate for modelling construction as it is particularly adept at modelling complex entities. The technique is capable of modelling and simulating trends and structural factors for a range of diverse scenarios. These scenarios enable insights to be gained into the construction industry's behaviour to enable key policy makers to review existing policies and determine appropriate policies for future implementation. To date, models have been developed that are informing the development of a performance metric called a competitive index. This metric will indicate how firms compare in terms of competitiveness within the UK construction sector. Further research will refine the model further. It is hoped that this paper will stimulate discussion and debate as to the potential applications this metric may have for the Construction Industry.

Acknowledgement

This paper is part of a research project, '*The Big Ideas: Sustained Competitiveness in the UK Construction Sector – a Fresh Perspective'*. The entire research project is a collaborative research venture between Loughborough, Reading and Salford University's Innovative Manufacturing Research Centres (IMRCs) and is funded by The Engineering and Physical Sciences Research Council (EPSRC) in the UK. Their support is gratefully acknowledged.

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Hong Kong Perspectives on Integrating Construction Project Teams

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Abstract: Targeting integration in construction, the study reported here compares the suitability of various factors and related strategies, in developing suitable contractual and non-contractual protocols for building a Relational Contracting (RC) culture and integrated project teams (IPTs). Results from statistical analyses of 83 questionnaire responses from Hong Kong contractors, consultants, clients and academics are presented. All the factors and strategies used in the survey were found to be significant. Despite slight differences of perceptions among different groups of respondents on the relative usefulness of various individual items, it was observed that trust and trust based operational and contractual arrangements can effectively provide the required incentives for the Hong Kong construction industry to exercise various RC-based working arrangements, through extended attention to 'relational' qualities in team selection, where top management support and cliental initiative are critical. Factor analysis results suggest the need for consolidated but interrelated approaches, both for propagating RC and building IPTs for RC.

Keywords: Contracts, Incentives, Integration, Relational Contracting, Teamworking

1. Introduction

For the much desired integration in construction, as in many other countries, the Construction Industry Review Committee report in Hong Kong recommends a wider adoption of partnering and teamworking approaches, where the interests, needs, expectations, constraints and risks of every stakeholder must be given a fair consideration (CIRC 2001). Relational Contracting (RC) principles appear to be appropriate in handling such integration (Macneil 1974). RC principles underpin various approaches such as partnering, alliancing, joint venturing, long term contracting and other collaborative working arrangements and improved risk sharing mechanisms (Rahman and Kumaraswamy 2002). RC principles offer contractual flexibility, supply necessary elements of teambuilding, lubricate transactional barriers, harmonise ongoing contractual relationships, and suggest rationalized selection criteria – in building effective project teams (Rahman and Kumaraswamy 2004a). Moreover, the potential for implementing RC in construction and for RC-based teambuilding protocols, e.g. joint risk management, have also been verified (Rahman and Kumaraswamy, 2004b). Despite such aptness and potential performance gains, industries are apparently hesitant in adopting RC. This is probably due to the perceived uncertainties in unclear responsibility allocations. In particular, public sector clients who hold the major industry share, need to follow specific rules and regulations (Rahman and Kumaraswamy 2004a). It is therefore essential to incorporate RC principles (e.g. trust or trust building elements and non-price based factors) in related documents, through 'less but more effective' regulations, in order to ensure value for money and to build an RC culture in construction (PSIB 2004). A general guideline appears to be useful for propagating the practice of RC and teambuilding in multi-participant construction projects, targeting a relational integration in various professional, organisational, operational, and regional/ national cultures.

Based on the above and in order to provide appropriate RC based contractual and non-contractual incentives in construction, a study was launched from Hong Kong to identify key factors (1) facilitating and (2) hindering RC in construction, and key factors (3) facilitating and (4) hindering the building of integrated project teams for more effective RC. The study was conducted in five different countries. This paper presents the perceptions of respondents from Hong Kong. Only the extracted summary results are presented here, both for conciseness and to meet space limitations.

2. Questionnaire Survey

The detailed methodological approach of the study has been reported elsewhere (Kumaraswamy et al. 2005), also conveying that the questionnaire was developed in Hong Kong on the basis of a broader precursor study on "revitalised procurement strategies". The individual factors were distilled from the above study and tuned to suit the specific purposes of the present study. In four specific sections, the questionnaire requested the respondents to express their perceived importance on a scale from 0–6 (varying from lowest to highest) on: 24 factors facilitating RC, 28 factors hindering RC, 28 factors facilitating the building of integrated project teams, and 31 factors hindering the building of integrated project teams (see Appendix I). Given the nature of the study, the length of total experience of potential respondents was considered critical. A total of 83 responses were received, with an average total experience of 19.1 years in construction and 4.7 years in RC approaches, respectively (see Table 1).

Table 1: Questionnaire distribution and respondent profile

	Contractor	Consultant	Client	Academics	Total
Questionnaire:					
Distribution	200	100	90	10	400
Usable responses	31	18	32	2	83
Response rate	15.5%	18.0%	35.56%	20.0%	20.75%
Total experience (years):					
Persons responded	26	17	28	2	73
Average experience	18.1	20.9	19.0	18.0	19.1
Experience in RC (years):					
Persons responded	22	13	21	2	58
Average experience	4.1	4.2	4.9	12.5	4.7
Experience in RC (number of projects):					
Person responded	20	14	18	1	53
0 – 5 projects	17	11	12		40
6 – 10 projects	3	2	3	1	9
Over 10 projects		1	3		4
Overall range	0 – 10	0 – 15	1 – 200	10 – 10	0 – 200

Except for academics, the mean scores of different groups of respondents on individual factors were ranked and compared. Statistical t-tests of the Mean at significance level 0.05 were undertaken to establish whether each factor is significantly important. ANOVA was carried out at 95% confidence level to determine whether the three groups of respondents had different perceptions on the relative importance of various factors. Finally, "Factor Analysis" was carried out to narrow down the long list of factors into a smaller number of representative "broad factors" or "components". For the purpose of this exercise, the "Principal Component" method of extraction was applied, coupled with "Varimax with Kaiser Normalization" method of rotation. "Eigenvalues" for the extracted components of $\geq$ 1.0 were considered, and "factor loadings" of $\geq$ 0.30 were considered to contribute to different components. However, only the key extracts of the results are summarized here, in order to meet the space limitations.

3. Survey Results

3.1 Factors facilitating RC

Table 2 shows the perceptions of respondents on 24 factors facilitating RC. It is seen that 'client's top management support' is the most important factor for facilitating RC, followed by 'top management support of all contracting parties', 'mutual trust', 'open communication' and 'enlightened client'. 'Effective coordination', 'teamworking and can do spirit', and 'long term commitment' rank 6th, 7th and 8th, respectively. 'Clearly defined' (rank 9) and 'equitable' (rank 10) risk allocation is more important than inclusion of key parties in 'encouraging and motivating risk-reward plans' (equal rank 17). On the other hand 'alignment of project objectives of different parties' (rank 12) is more important than alignment of 'mutual project and commercial objectives' (rank 19) and 'commercial objectives of different parties' (rank 21). 'Learning environment in project team organisation' is the least important factor with a score of 3.81, which is higher than average of the measuring scale (0–6), implying general importance of all the 24 factors. The ranks of individual factors are slightly different within different groups of respondents. But significance levels obtained from the t-Tests showed that all the factors are significant for facilitating RC, both within the total sample and three groups of respondents. Moreover, ANOVA results show that three groups of respondents significantly agree on the importance levels of all the 24 factors.

Table 3 shows the summary of outcomes from "factor analysis" for factors facilitating RC. Five components emerged from this exercise and together they accounted for 65% of the variations. Those are: integrated objectives & risk-reward plan, appropriate risk allocation/ sharing, motivated client & encouraging supporting arrangements, trust & trust-based arrangements, and top management support. All the components are seen to feed on factors that contribute to more than one component. As such, 19 (out of 24) factors are seen to contribute to more than one component, and up to three components. Some of the factors are seen to contribute almost equally to more than one component. For example, the factor 'learning climate in project team organization' contributes to components 1 and 2 with factor loadings of 0.50 and 0.49 respectively. Moreover, the 'secondary' contribution (0.55) of the factor 'a23: encouraging and motivating risk-reward plans' is higher than the 'primary' contributions of several other factors! All these may suggest a consolidated but interrelated approach for RC.

Table 2. Comparison of Means and ANOVA results of factors facilitating RC

Factors*	Total			Contractor		Consultant		Client		ANOVA
	Mean	Rank	Sig.	Mean	Rank	Mean	Rank	Mean	Rank	
a03	5.24	1	0.000	5.10	1	5.28	2	5.34	1	0.613
a04	5.20	2	0.000	5.03	2	5.22	3	5.31	2	0.470
a07	5.10	3	0.000	4.84	3e	5.33	1	5.16	3	0.240
a06	4.87	4	0.000	4.84	3e	4.94	5e	4.88	4e	0.934
a01	4.81	5	0.000	4.68	7	5.11	4	4.88	4e	0.447
a08	4.76	6	0.000	4.55	9e	4.94	5e	4.84	7	0.213
a10	4.69	7	0.000	4.45	15e	4.72	7	4.88	4e	0.298
a11	4.60	8	0.000	4.77	5e	4.67	8	4.41	11e	0.340
a20	4.57	9	0.000	4.65	8	4.44	17e	4.53	9	0.816
a02	4.53	10e	0.000	4.77	5e	4.61	9	4.38	13e	0.246
a21	4.53	10e	0.000	4.48	13e	4.50	12e	4.59	8	0.924
a15	4.49	12	0.000	4.55	9e	4.56	10e	4.41	11e	0.832
a19	4.47	13	0.000	4.52	12	4.44	17e	4.47	10	0.971
a13	4.46	14	0.000	4.55	9e	4.56	10e	4.28	17	0.555
a22	4.43	15	0.000	4.48	13e	4.50	12e	4.38	13e	0.862
a09	4.37	16	0.000	4.45	15e	4.33	19e	4.31	15e	0.839
a24	4.35	17e	0.000	4.39	19	4.50	12e	4.25	18	0.764
a23	4.35	17e	0.000	4.45	15e	4.50	12e	4.19	21	0.457
a12	4.34	19e	0.000	4.35	20	4.50	12e	4.22	19e	0.666
a17	4.34	19e	0.000	4.42	18	4.17	21e	4.31	15e	0.721
a16	4.24	21	0.000	4.26	22	4.17	21e	4.22	19e	0.961
a05	4.10	22e	0.000	4.29	21	3.83	24	4.06	22	0.377
a14	4.10	22e	0.000	4.16	23	4.33	19e	3.91	24	0.344
a18	3.81	24	0.000	3.61	24	3.89	23	3.97	23	0.455

Notes: * See Appendix I; e – signifies equal rank, whereas the next rank(s) is/ are omitted.

3.2 Factors hindering RC

Table 4 shows the summary of perceptions of respondents on 28 factors for hindering RC. 'Lack of top management commitment' is seen to top the list that hinders RC, followed by a lack of 'trust' and 'teamworking attitude' among all contracting parties, and 'lack of client's initiative'. The next four most important factors (ranks 5–8) are: 'inappropriate procurement/ contract strategy', 'improper/ inappropriate risk allocation/ sharing', 'price only selection methods', and 'ambiguous/ unclear contract clauses/ documents'. 'Lack of client's initiative (rank 4) and 'bureaucratic client organization' (rank 11), are more important than 'inappropriate project planning' (rank 14) and 'incompatible public sector rules and regulations' (rank 15). 'Unwilling participation' (rank 9) is seen to deter RC more than a 'lack of confidence among contracting parties' (rank 16). Similarly, 'incompatible organizational culture' (rank 13) is seen to deter RC more than 'cultural clash' at individual level (rank 18). Exclusion of major suppliers in any risk-reward plan appears to be the least important factor with a score of 3.70, which is more than average of the measuring scale. This implies a general importance of all the 28 factors in hindering RC, with some factors more important than others. The significance levels obtained from the one sample t-test show that all the 28 factors are significant, both within total sample and three groups of respondents, except the least important factor within the group of contractors. Although the ranks of individual factors are slightly different within different groups of respondents, ANOVA results show that three groups of respondents significantly agree on the relative importance of all the 28 factors that deter RC.

Table 3: Factor analysis outcomes of factors facilitating RC

Sl. No.	Components	Primary factors*	Secondary factors*	Eigen-values	% of Var. explained (Cumulative)
1	Integrated objectives & risk-reward plan	a11, a12, a16, a17, a18, a23, a24	a02, a05, a09 a15	3.94	16.44 (16.44)
2	Appropriate risk allocation/ sharing	a15, a20, a21, a22	a13, a14, a16, a17, a19, a23, a24	3.66	15.27 (31.77)
3	Motivated client & encouraging supporting arrangements	a01, a02, a06, a13,a14, a19	a08, a12, a18, a22	3.25	13.56 (45.27)
4	Trust & trust-based arrangements	a07, a08, a09, a10	a04, a06, a11, a12, a13, a19	3.15	13.14 (58.41)
5	Top management support	a03, a04, a05	a01	1.81	7.53 (65.94)

Note: * See Appendix I.

The factor analysis exercise extracted seven components and together they explained over 72% of variations (see Table 5). Those are: incomplete risk-reward scheme; persisting behavioural barriers; lack of trust, commitment & initiative; persisting adversarial setting; improper planning; lack of capability & experience; and commercial pressure and legal liability. It was observed that 20 factors contribute to more than one component, even the factor 'improper/ inappropriate risk allocation/ sharing' contributes to four components. It was also observed that (a) secondary contributions from a few factors are higher than the principal contribution from some other factors, and (b) few factors almost equally contribute to more than one component. Thus, like the factors facilitating RC, such multiple roles of different factors clearly indicate an interrelated but consolidated approach of the factors hindering RC as well. Also, two sets of facilitating and hindering factors for RC were seen to play complementary roles.

3.3 Factors facilitating integrated project teams

Among the 28 factors for facilitating the building of integrated project teams (IPTs) for RC, the results indicate a prioritisation of the pioneering role by clients, with 'enlightened and enthusiastic client' topping the list, 'client's initiative' ranking 2, and 'Knowledgeable client' ranking 4. 'Willingness of involved parties' (rank 3) is also very important. A trust-building ‘corporate strategy’ (rank 5) and ‘early mobilization’ of major contracting parties (rank 6) are critical for building IPTs. Respondents favour building a ‘capable and compatible project team’ (equal rank 7), from among ‘short-listed potential project partners’ (equal rank 11), with less importance on ‘experience in RC approaches’ (rank 26). The priority is on inter-personal relations, present skill-sets, and compatible organisational culture, pointing to the importance on pre-contract relationships among contracting parties (rank 16). However, ‘use of single point responsibility’ is the least important factor, with a score of 3.69. This implies a general importance of all the factors. Significance levels obtained from the one sample t-test show that all the factors are significant, both within total sample and three groups of respondents, except the ‘use of single point responsibility’ within contractors group. The ranks of individual factors within various respondent groups are slightly different, but ANOVA results show that all the three groups of respondents significantly agree on the relative importance of different factors.

Table 4. Comparison of Means and ANOVA results of factors hindering RC

Factor *	Total			Contractor		Consultant		Client		ANOVA
	Mean	Rank	Sig.	Mean	Rank	Mean	Rank	Mean	Rank	
b07	5.14	1	0.000	4.94	1	5.22	2	5.31	1	0.355
b12	4.99	2	0.000	4.71	2	5.33	1	5.03	2	0.154
b11	4.80	3	0.000	4.58	5e	4.83	5	4.91	3	0.400
b08	4.75	4	0.000	4.52	7e	5.17	3	4.72	4	0.137
b02	4.66	5	0.000	4.68	3	4.72	6e	4.63	6	0.950
b03	4.58	6	0.000	4.61	4	4.39	14e	4.66	5	0.727
b04	4.57	7	0.000	4.58	5e	4.50	10e	4.59	7e	0.963
b05	4.48	8	0.000	4.26	12e	4.72	6e	4.59	7e	0.301
b26	4.46	9e	0.000	4.42	9	4.50	10e	4.41	12	0.953
b18	4.46	9e	0.000	4.32	10e	4.56	9	4.47	10e	0.767
b27	4.45	11	0.000	4.52	7e	4.33	17e	4.47	10e	0.892
b09	4.43	12	0.000	4.26	12e	4.94	4	4.28	17	0.076
b14	4.34	13	0.000	4.10	18	4.22	21e	4.56	9	0.180
b01	4.33	14	0.000	4.19	15	4.50	10e	4.34	14	0.598
b28	4.30	15	0.000	4.16	16e	4.61	8	4.19	19	0.444
b19	4.29	16	0.000	3.97	21e	4.50	10e	4.38	13	0.186
b25	4.27	17	0.000	4.32	10e	4.33	17e	4.22	18	0.891
b13	4.25	18e	0.000	4.16	16e	4.22	21e	4.31	15e	0.858
b15	4.25	18e	0.000	4.26	12e	4.06	26e	4.31	15e	0.653
b24	4.05	20	0.000	4.03	19e	4.11	23e	4.03	20e	0.947
b16	4.01	21	0.000	3.97	21e	4.11	23e	4.00	22	0.881
b21	4.00	22	0.000	3.74	24e	4.39	14e	4.03	20e	0.111
b10	3.92	23	0.000	3.71	26	4.39	14e	3.84	23	0.161
b06	3.90	24	0.000	3.77	23	4.28	20	3.78	25e	0.256
b23	3.84	25	0.000	3.74	24e	4.11	23e	3.81	24	0.466
b20	3.76	26e	0.000	3.55	27	4.33	17e	3.69	27	0.052
b17	3.76	26e	0.000	4.03	19e	3.72	28	3.53	28	0.232
b22	3.70	28	0.000	3.42	28	4.06	26e	3.78	25e	0.186

Notes: * See Appendix I; e – signifies equal rank, whereas the next rank(s) is/ are omitted.

Table 5: Factor analysis outcomes of factors hindering RC

Sl. No.	Components	Primary factors*	Secondary factors*	Eigen-values	% of Var. explained (Cumulative)
1	Incomplete risk-reward scheme	b20, b21, b22, b23	b03, b06, b12, b14, b26	3.73	13.33 (13.33)
2	Persisting behavioural barriers	b03, b13, b14, b15, b16, b19	b02, b10, b11, b17, b18, b22	3.61	12.89 (26.22)
3	Lack of trust, commitment & initiative	b07, b08, b11, b12, b18	b09, b19, b27, b28	3.59	12.84 (39.06)
4	Persisting adversarial setting	b04, b06, b26, b27, b28	b02, b03, b15, b17, b25	3.27	11.66 (50.72)
5	Improper planning	b01, b02, b05	b03, b16, b12	2.36	8.44 (59.16)
6	Lack of capability & experience	b09, b10, b17	b16, b20	2.08	7.43 (66.59)
7	Commercial pressure and legal liability	b24, b25	b06, b23	1.57	5.59 (72.18)

Note: * See Appendix I.

Factor analysis exercise extracted seven interrelated components and together they explained over 75% of variations. Those are: team selection and mobilization strategy; facilitating responsibility allocation; appropriate preparation for teamwork; enlightened and knowledgeable client; harmonizing the team; corporate strategy and skills; and harmonious participation. 20 factors are seen to contribute to more than one component, with four factors (c15, c20, c05, and c04) contributing to four components, and other four factors (c22, c10, c06, and c11) contributing to three components. Primary and secondary contributions of several (c20, c23, c06, c28 and c11) factors are close. Also, secondary contributions of eight factors (c18, c26, c24, c23, c06, c21, c28, and c11) are either equal or higher than the lowest primary contribution of 0.45 (from c20 to component 1). All these clearly indicate a consolidated but interrelated approach for building IPTs for more effective RC. Thus, two sets of facilitating factors (i.e. facilitating RC and building IPTs for more effective RC) were found to complement each other.

3.4 Factors hindering integrated project teams

Lack of commitment from top management of ‘client’ (d02) and ‘other parties’ (d03) are the topmost two barriers for building IPTs, followed by lack of trust, client’s initiative and unwilling participation. ‘Persistence of master and slave concept’ and ‘price only selection method’ shares the rank 7. Failure to continue ‘open and honest communication’ and ‘share information’ respectively rank 6 and 9. ‘Bureaucratic client organization’ (10th), ‘public sector accountability concerns’ (11th) and ‘stringent/ incompatible public sector rules and regulations’ (12th) are more important than ‘improper planning, design errors and omissions’ (20th). On the other hand, ‘unfair risk-reward plan’ (12th) is more important than ‘absence of any risk-reward plan’ (22nd) and ‘separate/ unrelated risk-reward plans for different parties’ (25th). ‘Lack of relationships’ between different contracting parties (d21–d24) is of lower importance (ranks 26 – 29). ‘Exclusion of (major) suppliers in risk-reward plan’ (d19) is the least important factor with a score of 3.94. This implies a general importance of all the factors in hindering the building of IPTs. Significance levels obtained from the one sample t-test confirmed that all the factors are significant, both in the total sample and individual groups of respondents. Ranks of various factors are slightly different within three groups of respondents, but ANOVA results showed that they significantly disagree on the relative importance of only one factor: lack of client's knowledge.

Seven interrelated components emerged from the factor analysis exercise and together they explained over 74% of variations. Those are: persisting adversarial setting; lack of integrated risk-reward scheme; persisting regulatory incompatibilities; incomplete relationships/ communications; lack of top management commitment; commercial pressure and legal concern; and lack of client's knowledge. On the whole, (a) two sets of facilitating and hindering factors for building IPTs, as well as (b) two sets of hindering factors (i.e. hindering RC and building IPTs) were found complementary.

4. Conclusions

Integration in construction requires all parties to mobilise their collaborative efforts and maintain harmonious relationships during project execution, in order to ensure value for money and optimise usage of their resources. This may be approached through appropriate contractual and non-contractual protocols. As such, various factors and strategies were identified, in order to ascertain their relative importance and to offer any incentives for designing appropriate RC-based project teams. Data was collected from the Hong Kong construction industry and was statistically analysed. Results led to the following observations:

- All the factors and strategies used in the survey were found to be significant, i.e. 24 factors facilitating RC, 28 factors hindering RC, 28 factors facilitating building IPTs and 31 factors hindering the building of IPTs.
- Although ranks of individual factors vary within different respondent groups, the overall trend was that trust and trust based operational and contractual arrangements can effectively provide the required incentives for the Hong Kong construction industry to exercise various RC-based working arrangements, through extended attention to 'relational' qualities in team selection, where top management support and cliental initiative are critical.
- Except for only one factor (d01: lack of clients knowledge), three groups of respondents (viz. contractors, consultants and clients) significantly agree on the relative importance of all the factors and strategies used in the survey. The survey results may therefore taken to indicate a general consensus of the construction industry in Hong Kong.
- Based on the overall responses, it was noted that both the pairs of facilitating and deterring factors complement each other. Moreover, both the pairs of facilitating and deterring categories of factors exhibit a similar broad trend of importance of the various factors, indicating that RC and teambuilding complement each other.
- The factor analysis exercise extracted five and seven components for factors facilitating and hindering RC, respectively. On the other hand, seven components were extracted from each of the sets of factors facilitating and hindering the building of IPTs for RC, respectively.
- On the whole, results from factor analysis suggest the need for consolidated but interrelated approaches, both for RC culture development and building IPTs for more effective RC.

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6. Appendix I

6.1 Factors facilitating RC

a01) Enlightened and enthusiastic client, a02) Knowledgeable client (about project processes), a03) Client's top management support, a04) Top management support of all contracting parties, a05) Experience in RC approaches (e.g. partnering, alliancing), a06) Open communication among all contracting parties, a07) Mutual trust among all contracting parties, a08) Effective coordination among all contracting parties, a09) Combined responsibility of all contracting parties, a10) Teamworking & 'can do' spirit of all contracting parties, a11) Long-term commitment to each other: all parties, a12) Adequate resources of all contracting parties, a13) Mutually agreed issue resolution mechanisms, a14) Mutually agreed performance appraisal mechanisms, a15) Alignment of project objectives of different parties, a16) Alignment of commercial objectives of different parties, a17) Alignment of mutual project and commercial objectives, a18) Learning climate/ environment in project team organisation, a19) Positive attitude towards continuous improvement, a20) Clearly defined risk allocation/ sharing arrangements, a21) Equitable risk allocation/ sharing arrangements, a22) Flexible/ adjustable contracts to address uncertainties, a23) Encouraging and motivating risk-reward plans, a24) Inclusion of all key parties in risk-reward plans.

6.2 Factors inhibiting RC

b01) Inappropriate project planning, b02) Inappropriate procurement/ contract strategy, b03) Improper/ inappropriate risk allocation/ sharing b04) 'Price' only' selection methods, b05) Ambiguous/ unclear contract clauses/ documents, b06) Absence of risk-reward plan, b07) Lack of commitment: top management of all contracting parties, b08) Lack of client's initiatives, b09) Lack of contractor's capability, b10) Lack/ absence of scope for innovations, b11) Lack of teamworking attitude among all contracting parties, b12) Lack of trust/ reliability among all contracting parties, b13) Inter-personal/ cultural clash (individual level), b14) Incompatible organisational cultures (corporate level), b15) Inappropriate issue resolution mechanisms, b16) Separate coordination and monitoring plans, b17) Lack of experience in RC approaches (e.g. partnering), b18) Unwilling/ unenthusiastic participation in RC approaches, b19) Lack of confidence among all contracting parties, b20) Exclusion of consultants in risk-reward plan, b21) Exclusion of major sub-contractors in risk-reward plan, b22) Exclusion of major suppliers in risk-reward plan, b23) Unrelated/ separate risk-reward plans for different parties, b24) Potential legal liabilities (in resolving non-contractual issues), b25) Commercial pressures of contracting parties, b26) Win-lose environment among contracting parties, b27) Bureaucratic client organisation, b28) Incompatible public sector rules and regulations.

6.3 Factors facilitating building a project based integrated team for more effective RC:

c01) Enlightened and enthusiastic client, c02) Knowledgeable client (about project processes and RC), c03) Client's initiative, c04) Learning about RC approaches before contracting (all parties), e.g. at a workshop, seminar, or training within the company, c05) Learning working in flexible contract/ teamworking environment before contracting with others (all parties), e.g. through training, c06) Co-operative learning within project organisation, c07) Familiarity/ previous relationships with/ among other parties, c08) Reputation in the industry (each party), c09) Willingness/ enthusiasm of involved parties, c10) Previous experience in RC approaches (each party), c11) Adequate resources and technical skills (each party), c12) Previous performance records on 'hard factors', e.g. time, quality, safety, etc. (each party), c13) Compatible organisational culture of involved parties, c14) Inter-personal relations/ cultural harmony (individual level), c15) Previous performance records on 'soft factors', e.g. joint decision making, joint problem solving, compromises on unclear issues, etc. (each party), c16) Short-listing 'capable' (as in items 11-12) & 'compatible' (as in items 13-15) potential project partners, instead of 'price only' considerations, c17) Disclosing project information to potential partners (as in item 16) at early stages of project for any optional feedback, as appropriate, c18) Seeking specific inputs on constructibility, construction methods, materials, etc. from among potential partners (of item 16), for better project planning, c19) Selecting the best possible "capable and compatible" project team from among potential partners (of item 16), c20) Bringing contractor, major subcontractors and major suppliers into the project team, in appropriate cases, for longer-term interactions to build trust / reliability, c21) More workshops for better interactions to build trust/ reliability, c22) Use of single point responsibility – e.g. only one QS from the contractor representing all contracting parties in the project, instead of different QSs for various contracting parties, c23) Group/ combined responsibility, as against individual responsibility - e.g. responsibility of binding decision making on 'unclear issues' by a pre-selected group comprising one person from each major party, c24) Role of an independent full-time facilitator in building trust, teamworking & 'can do' spirit, and enhancing cooperative learning among contracting parties, c25) Role of

Project Manager (PM) as facilitator as per item 24 above, given that PM has the best understanding and control of the project issues, c26) Requirement for an independent full-time facilitator to supplement PM (Project manager) as per item 24 above, c27) Company training policy to build adaptable individuals for working with diverse partners (each party), c28) Corporate strategy of building trust with potential partners by doing the 'right' things and meeting time & cost targets.

6.4 Factors inhibiting building a project based integrated team for RC

d01) Lack of client's knowledge (about project processes and RC), d02) Lack of commitment from top management: client, d03) Lack of commitment from top management: other parties, d04) Lack of client's initiatives, d05) Bureaucratic client organisation, d06) Stringent/ incompatible public sector rules and regulations, d07) Public sector accountability concerns, d08) 'Price' only' selection methods, d09) Commercial pressures on contracting parties, d10) Opportunistic behaviour of one or more contracting parties, d11) Lack of trust/ reliability among contracting parties, d12) Unwilling/ unenthusiastic participation of contracting parties, d13) Inter-personal/ cultural clash (individual level), d14) Incompatible organisational culture (corporate level), d15) Absence of any risk-reward plan, d16) Separate/ unrelated risk-reward plans for different parties, d17) Exclusion of consultants in risk-reward plan, d18) Exclusion of (major) subcontractors in risk-reward plan, d19) Exclusion of (major) suppliers in risk-reward plan, d20) Unfair risk-reward plan, d21) Lack/ absence of contractual relations between client and major subcontractors, although they carry out major parts of work, d22) Lack of any relationships/ communications between client & major suppliers, although information on & timely supply of some critical materials may improve project planning & works progress, d23) Lack of relationships/ communications between consultants & suppliers, although information on source, price, supply time, etc. of some critical materials may improve design, planning & construction, d24) Lack of relationships/ communications between subcontractors and suppliers, d25) Resistance of contracting parties to integrated project culture, d26) Failure to share information among contracting parties, d27) Persistence of 'master' (e.g. client/ prime consultant) and 'slave' concept, d28) Uneven commitment of contracting parties, d29) Discontinuation of open and honest communication, d30) Improper planning, design errors and omissions, d31) Potential legal liabilities (in resolving non-contractual issues).

Design-Bid-Build Vs Design – Build Projects: Performance Assessment of Commercial Projects In Sri Lanka

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Abstract: Success or failure of any project is greatly influenced by the performance of cost, time and quality aspects of a project. The performance of each project may differ with the type of procurement system used. Therefore, performance of projects under each delivery system should be considered in making the decision to select suitable procurement system. In Sri Lanka, Design-Bid- Build (DBB) and Design-Build (DB) are the most commonly used systems and DBB is the dominant among others. This paper aims to assess the performance of DBB and DB projects in Sri Lanka. Altogether 18 performance indicators in terms of cost, time and quality were used to evaluate the performance of 60 commercial projects procured through DBB and DB systems. Means of each performance indicator were analyzed using 'Analysis of Variance' (Anova) to find out the major differences between the performance of both DBB and DB systems. In addition, few case studies were carried out in the view of interpreting the results of performance. It was found that the DB projects perform better in certain measures such as cost growth, time (schedule growth), and quality (performance specification) and the DBB projects perform better in certain other measures such as interior space, architectural finishes, and client's involvement. The results indicate that DB projects show best performance in terms of cost and time, at the same time quality is achieved in DBB projects. In addition, this study concludes that performance of a project is not only depended on the selection of appropriate procurement system, but also influenced by the capability of the contractor as well as the quality of all inputs including proper design and management. The synthesis of the outcome of this study reveals that there is a need to look beyond the selection of appropriate procurement system to attain the outstanding project performance.

Keywords: Construction Industry, Design-Bid-Build, Design-Build, Performance Assessment, Performance Indicators

1. Introduction

The construction industry is project-based with an ultimate goal to deliver a good quality product which can be either producing a new building or refurbishing existing buildings to its variety of clients. Performance measurement in construction has predominantly focused on project performance in the form of time, cost and quality (Ward *et al*., 1991; Love and Holt, 2000; Kagioglou *et al*., 2001). Performance in construction is generally determined through the success or failure of the projects. When assessing the success or failure of construction projects, a common approach is to evaluate the performance on the extent to which client objectives like cost, time and quality were achieved (Ward *et al*., 1991). Cost, time and quality are seen as the traditional indicators of performance. Ward *et al*. (1991) also suggest that 'looking back on the conduct of a project, what sticks in the mind is often not so much financial success or early completion, but memories of other people involved and abiding impressions of harmony, goodwill and trust or, conversely, of arguments, distrust and conflict'. The client's willingness to pursue a given procurement route to achieve a future project is likely to be strongly influenced by these factors. Therefore, it is clear that the traditional measures of the performance of construction projects are not sufficient to assess their 'true' performance.

With the development of new technologies and innovative systems, several procurement systems have been developed in the construction industry over the past decades. Among those, Design-Build (DB) and Design-Bid-Build (DBB) are the most common project delivery systems used in many countries. Countries like, USA, UK, Australia and Singapore, most commonly use traditional Design-Bid-Build and Design-and-Build systems (Ling and Kerh, 2004). Any project can be considered as successful when the project is delivered at the time, at the appropriate cost with the expected quality standards and provides the client with a high level of satisfaction (Skitmore and Marsden, 1998). Masterman (1992) has found that one of the principal reasons for the construction industry's poor performance is the inappropriateness of the procurement system that has been chosen. Therefore, selection of suitable procurement system is crucial to the success of any kind of project in construction. Performance of a construction project may differ with the type of procurement system used. Selection of any of the delivery systems to use may depend on how well the project could perform under each system.

The current review of procurement systems used in construction industry of Sri Lanka reveals that the traditional DBB and DB are the most commonly used systems and the traditional Measure and Pay is the dominant system among other systems. Majority of public projects are consistently procured through this method due to the influence of government. Further, many private sector clients also use this method as it is very familiar to them. Most of the experienced clients rely on professional advice for the selection process. Therefore, assessing the performance of the projects in each system could be valuable to the clients to achieve their ultimate goals. In this context, the aim of this study is to empirically assess and compare the performance of commercial projects procured through DBB and DB delivery systems.

2. Review Of DBB And DB Systems

A project delivery system has been defined as the set of "relationships, roles and responsibilities of project team members and the sequence of activities required" for the deployment of a capital project (Sanvido and Konchar, 1998). There are a number of standard routes or processes available, particularly with respect to the design, construction and management aspects, which need early consideration when procuring construction. Each route places different demands, risk allocation and responsibilities on everyone involved and different cash flow profiles on the client. Given the fact that project objectives vary on a project-to-project basis, no one project delivery system is sufficient to address them (Construction Industry Institute, 2001).

The DB and DBB systems are commonly used procurement paths in most countries and they differ in several important ways. Therefore, it will be informative to specify what constitutes each procurement system in order to promote a more complete understanding of how to measure the impacts of the procurement system on project performance.

DB project delivery system is one where the client makes contract with a single entity to perform both design and construction under a single DB contract. Contractually, DB offers the client a single point of responsibility for both design and construction services. The design and construction, either partly or fully, may be performed by a single DB contractor or may be subcontracted to other contractors. In DB, designers work under contractors as one team and therefore, there is an absence of adversarial relationship between contractors and consultants which is found commonly in DBB projects.

Further, advantages of DB system includes, transfer of risk to contractor (but not usually all risks), competition in design, maximum overlap of design and construction, availability of construction expertise for design, early commitment to maximum price and less construction information required from the client.

The specific features of DBB system are the rigid separation of design and the construction process and lack of integration across this boundary (Cox and Townsend, 1998). In this system, client appoints an independent team of consultants on a fee basis, who completely designs the project and prepares tender documentation upon which competitive bids are obtained from the contractors. The successful tenderer enters into a direct agreement with the client and carries out the work in accordance with the design and specifications under the supervision of the consultants. These systems offer minimal input of contractors to the design process (Rowlinson, 1999).

The DBB method has survived for so many years because it has several advantages. These include familiarity to participants of the construction process, tested, refined and widely understood contractual relationships, and clear lines of authority, responsibility and liability In addition, owners have complete control over the design because consultants are directly engaged by them. However, DBB contains some limitations which include vertical fragmentation, slow take-up of innovation, low productivity, and a lack of single point responsibility (Ling and Kerh, 2004).

Since each procurement system posses several advantages and disadvantages, assessing the performance will help the client and/or consultants to choose an appropriate procurement system for his/her project.

3. Methodology

The aim of this study is to evaluate and compare the project performance in DB and DBB projects. Altogether 18 indicators were used to evaluate the performance of DB and DBB projects in terms of cost, time and quality. Two sets of questionnaires were designed to achieve the objectives. One set of questionnaire was targeted to collect the specific project related details from DB and DBB projects. These questionnaires were distributed among consultants and contractors. Details of DBB projects were collected from consultants and DB projects were collected from contractors. The second set of questionnaire was aimed to identify and rank the performance indicators based on quality. Further, interviews were conducted among respondents to identify the reasons for the significant differences in the performance of DB and DBB projects.

The sample for this study was limited to commercial projects which mostly include offices and shopping complexes, exceeding 10 million rupees in value and completed within 3 to 5 years. All together 72 projects were selected to the survey. But responses were received from 60 projects: 30 DBB projects and 30 DB projects and the response rate was 83%. Two sets of questionnaires were distributed for each project. The following Table 1 shows the profile of the projects in terms of type, contract sum, gross floor area and type of tendering.

Table 1: Profile of the projects' sample

Profile of projects	DBB		DB	
	Number	%	Number	%
Type of the Building				
Offices & Banks	19	63	18	60
Shopping & Market complex	8	27	10	33
Hotels	3	10	2	7
Contract sum				
Rs. 10 million - Rs.50 million	18	60	22	73
Rs. 50 million - Rs. 100 million	6	20	4	13
Rs.100 million - Rs.150 million	3	10	3	10
Rs.150 million - Rs.200 million	3	10	1	3
Gross Floor Area (m^2)				
Less than 1000 m^2	7	23	12	40
Between 1000 m^2 - 5000 m^2	17	57	15	50
Between 5000 m^2 - 10000 m^2	4	13	2	7
Above 10000 m^2	2	7	1	3
Types of Tendering				
Open tendering	18	60	6	20
Selective tendering	8	27	19	63
Negotiate tendering	4	13	5	17
Total of projects	**30**	**100**	**30**	**100**

Once the completed questionnaires were received, they were checked for accuracy. Mainly the following two analyses were carried out;

1. Calculation of the mean scores of DB and DBB projects
2. Comparing these means using 'Analysis of Variance' (Anova)

The Anova was used to compare performance based on cost, time and quality and to identify the significant differences between the performance of DBB and DB projects. The level of significance was set at 0.05. The test hypotheses were set out as follows;
Null hypothesis Ho: $\mu_1 = \mu_2$; Alternative hypothesis H_1: $\mu_1 \neq \mu_2$
Where μ_1 denotes DBB mean and μ_2 denotes DB mean.

Acceptance of Ho means that the type of the procurement has no significant influence on the project performance. Acceptance of H_1 means that there is significant difference between the performance of DBB and DB projects for a specific performance indicator.

4. Results And Discussion

From the data collected through survey, means of 18 performance indicators for DBB and DB projects were calculated. Anova (Analysis of Variance) was carried out to determine the significant differences between the means at 95% confidence level. Table 2 presents the summary of data analysis and the outcome of the survey.

Table 2: Overall comparison of performance between DBB and DB projects

Code	Performance Indicators	DBB Mean	DB Mean	ANOVA F- value	ANOVA Sig.
	COST				
PI1	Unit cost (Rs/m2)	21,979.72	25,379.78	2.75	0.103
PI2	Cost growth (%)	15.60	7.67	6.73	**0.012***
	TIME				
PI3	Construction speed (m2 / month)	224.80	243.25	0.06	0.801
PI4	Delivery speed (m2 / month)	170.30	206.00	0.91	0.344
PI5	Schedule growth (%)	37.90	13.22	9.95	**0.003***
	QUALITY				
PI6	Commissioning.	3.467	3.600	0.68	0.412
PI7	Quality of inputs	3.533	3.333	2.46	0.122
PI8	Efficiency of communication	3.356	3.485	0.05	0.830
PI9	Performance specification followed by the contractor	3.366	3.766	7.59	**0.008***
PI10	Performance of mechanical & electrical system	3.400	3.266	0.44	0.509
PI11	Performance of interior space	3.900	3.566	4.82	**0.032***
PI12	Performance of building elements	3.830	3.653	2.73	0.104
PI13	Quality of architectural finishes	3.533	3.166	10.05	**0.002***
PI14	Protection given to finish work	3.666	3.267	4.88	**0.031***
PI15	Aesthetic aspects of the building	3.800	3.500	0.400	0.527
PI16	Client's involvement in process	3.766	3.366	4.59	**0.039***
PI17	Defects and problems	3.333	3.399	0.16	0.693
PI18	**Overall Client's satisfaction**	**3.500**	**3.466**	**0.04**	**0.838**

* Significant difference at 95% confidence level.

4. 1 Assessment of overall performance

From the data analysis, it was found that at a significance level of 0.05, the results show that there are some significant differences in the performance between the means of DBB and DB projects. The significant difference was found in appraising the cost growth, schedule growth and other five indicators in terms of quality. The significant differences in terms of quality related indicators includes performance specification followed by contractor, performance of interior space, quality of architectural finishes, protection to finish work and client's involvement. The following section discusses the assessment of performance to which significant differences were found in terms of cost, time and quality.

4.2 Assessment based on cost

The cost growth for DBB projects is significantly higher than DB projects ($F= 6.73$, $p = 0.012$). Cost growth means the increase of total project cost based on the initial contract sum. This may due to several reasons in commercial projects. The main reason for the significant difference is the very high degree of variation in DBB projects, thus increases the project cost. Since the flexibility for design changes are possible during construction stage in DBB projects, the variations are initiated by the clients as well as designers. The variations affect the total cost and delivery speed of the DBB projects. Sometimes, claims may affect the cost growth. From the survey, it was found that the claims based on cost (including price escalation) and time, are comparatively high in DBB projects. Liquidated damages for extended time period play a significant role in increasing the total cost of the DBB projects in Sri Lanka. On the other hand, the tendency for the flexibility for design changes is very less in DB projects, thus the degree of variation is very low compared to DBB projects. Perhaps, bonus claims subsist in some DB projects. Therefore, cost growth is less in DB projects.

4.3 Assessment based on time

The schedule growth for DBB projects is significantly higher than DB projects ($F= 9.95$, $p = 0.003$). Schedule growth means the increase of total time duration of the project based on the planned time. The mean values of the schedule growth for DBB and DB projects are 38% and 13% respectively.

The total time required to complete the DB projects is shorter than the DBB projects. This is because of the following major reasons;

- Possibility of integrating design and construction
- The rate is fixed and additional cost (overheads, financial charges, etc) are borne by the DB contractor, thus risk is high to the contractor
- Degree of contractor’s involvement in design and construction is significantly high
- Single point of responsibility and the integration of subcontractors with design and construction
- Liquidated damage is very high in DB projects

All the above mentioned factors influence the schedule growth of DB projects thus lower the schedule growth. In addition, majority of the commercial clients require the project to be completed as quickly as possible. Some clients are prepared to pay extra costs in order to achieve earlier occupation, since the additional cost could be recovered by earlier revenue from the investment. This may be another reason for the low schedule growth in DB projects. Further, majority of respondents agreed that the use of DB project procurement system can account for up to 20% reduction in overall project time compared to traditional DBB system.

4.4 Assessment based on quality

Assessment of performance in terms of quality proves that quality of DBB projects are significantly higher than that of DB projects in certain indicators such as specification

followed by the contractor ($f = 7.59$, $p = 0.0.008$), interior space, ($f = 4.82$, $p = 0.032$), architectural finishes ($f = 10.05$, $p = 0.002$), protection given to finish work ($f = 4.88$, $p = 0.031$) and client's involvement ($f = 4.59$, $p = 0.039$).
The quality of building depends upon a whole range of inputs from the soundness of the design, a correct choice of performance specification, efficient workmanship, adequate supervision, and the capability of the builder. Management inputs and co-ordination of work packages are also very important to obtain a quality product, in terms of services as well as overall installation. Virtually completed design prior to the commencement of work on site is likely to be beneficial in improving the qualitative aspects of the project rather than the more ad-hoc design approach with inconsistency. A client/consultant can do only little to control the quality of the contractor's work without detailed working drawings and specifications. In DBB project delivery system, all the required drawings and specification should be completed before the commencement of works at site. In addition, large number of standard forms and high quality functional standards enable to ensure the better quality of projects for DBB than DB.

In Sri Lanka, it was found that most of the factory buildings are procured through DB system, due to high delivery speed and the aesthetics aspect is not a major requirement for factory buildings. Most of the clients interviewed agreed that the DB system is best suited to projects, such as office buildings, factories and parking garages. A study carried out in UK has concluded that DB performs better in meeting quality standards in complex or innovative buildings rather than simple and standard traditional buildings. On the other hand in Singapore, it was found that clients and contractors disagreed that aesthetics quality is compromised in DB projects. Similar to the expectations, there was significant difference found in aesthetics quality in the Sri Lankan context. The results show that DBB projects have better performance for interior space and architectural finishes than DB projects. This is due to the engagement of specialized design consultant and degree of client's involvement from the inception stage of the project. Furthermore, in DBB projects, contractors perform the works in accordance with the specification primed by the design consultant and protection given to finished works shows good performance. This is due to the efficient supervision given by the consultants from inception to completion of the project.

5. Conclusions

The aim of this study was to fulfill a need for an assessment of performance in DBB and DB commercial projects based on the project data in order to find out the consequence of procurement system on project performance. At the macro level, it was found that DB projects perform significantly better than DBB projects in some areas such as cost growth, time (schedule growth), and quality (performance specification) and at the same time DBB projects perform better in some other areas such as interior space, finishes, and client involvement. With respect to the benefits, DB delivery system shows best performance both in cost & time and at the same time, performance in quality is achieved in DBB delivery system. Efficient supervision by the consultants enables to achieve the quality level expected by the client. Although the quality level of DB projects is not up to the level of DBB projects, the required quality level can be achieved by selecting the DB contractor based on cost and capability. Further, it can be stated that the performance of a project is not only depended on selection of appropriate procurement system, but also influenced by the capability of the contractor as well as the quality of all inputs including proper design and management. Therefore, it can be stated that the excellent performance of a project is determined by the selection of suitable project delivery system, right consultant and capable contractor. This may lead to successfully achieve the client objectives in terms of cost, time, quality and other major requirements. The synthesis of the outcome of this study reveals that there is a need to look beyond the procurement system to attain the outstanding project performance.

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Getting to No; Managing the Delicate Business of Refusing a Contractor's Claim

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Abstract: A short transcript from a meeting between a contractor and employer's representatives is presented and analysed to reveal some of the conversational methods employed in the negotiation. A key sequence is analysed to show how the refusal to grant a claim for costs incurred due to delay is managed in such a way as to maintain good relations between contractor and client. This analysis is supplemented with additional ethnographic detail, in order to provide adequate context for an understanding of the negotiation. Conversational analysis, a technique developed originally by Harvey Sacks, is introduced and employed. The resulting analysis is compared with that suggested by Fisher, Ury & Patton in their classic text on negotiation, 'Getting to Yes'. While some of the principles enunciated by Fisher *et al* are clearly seen to be in operation, others are not. Moreover, additional techniques are employed that do not find a place in the 'Getting to Yes' method. Thus, negotiators can be observed to explicitly 'separate the people from the problem' and 'insist on objective criteria'. On the other hand, while there is some indication of a focus on interests, rather than positions, this is implicit rather than overt. The invention of 'options for mutual gain' is clearly not viable at this stage in the negotiation. Additional techniques found to be present which are not explored by Fisher *et al* include the use of humour and a focus on the autonomy of relationships beyond the arena of negotiation. The paper finishes with some brief general remarks on the consequences that the naturalistic approach to studying negotiation adopted here has for Fisher *et al's* normative and formal study.

Keywords: Claims Management, Conversational Analysis, Ethnography, Ethnomethodology, Negotiation

1. Introduction

In this paper, conversational analysis is applied to a short transcript from a meeting between a contractor and employer's representatives. The focus is on conversational methods employed in the negotiation. A key sequence is analysed to show how the refusal to grant a claim for costs incurred due to delay is managed in such a way as to maintain good relations between contractor and client.

Conversational analysis is an ethnomethodological approach to the detailed study of social interactions which thus treats these activities as constitutive of the social order (Francis & Hester 2004). A fundamental insight of this approach is based on the recognition of the sequential nature of conversation and the consequential importance of managing turns in talk (Sacks, Schegloff & Jefferson 1974). The approach is naturalistic, in that it displays the analysis of actual real time instances of talk, rather than generating hypothetical or normative generalisations. It satisfies the unique adequacy requirement of methods (Garfinkel &

Wieder 1992; Garfinkel 2002) in that it seeks to present an analysis that is implicit in the activity of the talk

The transcript is taken from a series of negotiations over a claim for delay on a project to widen a short stretch of urban highway. This particular exchange occurred at a monthly site meeting, which senior off-site personnel were in the habit of attending.

The project was governed by the ICE 5th Edition and the claim originated in the failure of statutory undertakers to meet the deadlines set in a tight clause 14 programme drawn up by the contractor. The employer's representatives denied the basis of the claim. It was connected with a delay caused by work on a bridge across the site which restricted the contractor's access for a time. While the consultants accepted the employer's liability for this, they do not accept the full knock-on disruption to a programme that they see as unrealistic in the first place.

Most parties to the negotiation had a previous familiarity with each other, the contractor having worked with these consultants in the past. Cordial relations were preserved throughout the project and the contractor's senior representative (DMD) would regularly take all participants for a meal at the conclusion of the meeting. It is is worth noting that at the conclusion of this particularly difficult meeting the invitation to dine was extended and accepted as usual. On this occasion, the following exchange between senior negotiators took place:

> "I thought you wouldn't invite us this time."
> "Well I have to eat. If I don't take you, I can't claim it on expenses."

The negotiating techniques identified in the analysis are compared with those originally suggested by Fisher & Ury in their classic text on negotiation, 'Getting to Yes' (Fisher, Ury & Patton 1991). While some of the principles enunciated in this text are clearly seen to be in operation, others are not. Moreover, additional techniques are employed that do not find a place in the 'Getting to Yes' method.

2. Analysis of a negotiation

The interaction examined here took place at one critical point in the negotiation. It took place at a monthly site meeting chaired by the Resident Engineer (RE) and concerned the contractor's application for an extension of time. Others taking part are: the Principal Engineer (PE) and the Contractor's Deputy Managing Director (DMD) and Site Agent (SA).

> RE: "Well we might as well go straight into claims then."
> DMD: "What did we say at the last meeting? We were x weeks behind?"
> SA: "Seventeen."
> DMD: "At the moment, you've granted six, haven't you?"
> PE: "It needs to be clearly demonstrated."
> SA: "We appreciate that."
> DMD: "So will you be paying more than the six weeks this time?"
> RE: "I doubt it."
> PE: [giggles] "Sorry. Not the answer you were looking for."

DMD: "It's quite simple for us, if there's a delay it's your fault. Not yours personally of course."

RE: "I might change my mind DMD, after I've looked at x and y and put them together."

DMD: "Obviously, we'd appreciate another six or seven weeks, if you can give them to us."

PE: "Of course, if you can demonstrate them, there's no question of denying you your entitlement."

DMD: "It's different interpretations of a completed clause fourteen programme, we'll have to sit down together."

The way RE introduces the topic of claims seems to display some apprehension about approaching the subject of claims. As may be surmised, but more importantly, can be seen in the subsequent talk, it is a difficult one. There are two features of RE's utterance which may indicate apprehension. The use of the phrase, 'we might as well', displays reluctance. Furthermore, it can be taken to indicate, not only RE's own apprehension, but the difficulty faced by the whole group. Thus, the expression is inclusive, emphasising the solidarity of the group in the face of a difficult problem, rather than the obvious difference of economic interest that divides them.

A second feature of the utterance that may indicate apprehension is that, although the topic is introduced, it is not pursued. This might be taken to display hesitancy. It also has an identifiable effect on the subsequent talk, in that it forms the first part of what Sacks calls an adjacency pair. Adjacency pairs have the following features:

> "They're two utterances long, and the utterances that compose them are adjacently placed to each other. Note that from these two features alone one can derive a third, that being that alternative speakers produce the utterances. [...] characteristically there are names for the components of such pairs, for example, greeting-greeting, [...] complaints followed by an excuse or a request for forgiveness or an apology or a denial." (Sacks 1992 p521)

The importance of adjacency pairs is that the utterance of a first pair part exercises control over the next turn in the conversational exchange, in that this must constitute an appropriate second pair part. The RE's first utterance is an invitation to proceed with the topic of claims. Thus, the next utterance should orient towards this. If it were not to do so, the other participants would have noticeably ignored RE.

Note that the speakers, as in all such negotiations, are organized into teams, in this case contractors and consultants. This influences the allocation of rights to speak. In a two party conversation, the speakers take turns, this applies equally when the parties are teams. This is not apparent however from a simple list of the team identities of the speakers. As Francis (1984) points out, a team's turn can consist in utterances from more than one speaker. He identifies four kinds of multi-speaker turn which teams perform in meetings, including: 'passing'; 'assists'; 'take-overs'; and 'movements'. There are three multi-speaker turns in the transcript. The first is the most interesting, in that it contains considerable ambiguity. While some of this ambiguity may be due to imperfections in the data, some is inherent in the talk itself. The sequence is:

Consultant’s turn	PM: “Well we might as well go straight into claims then.”
Contractor’s turn	DMD: “What did we say at the last meeting? We were x weeks behind?”
	SA: “Seventeen.”
	DMD: “At the moment, you’ve granted six, haven’t you?”
Consultant’s turn	PE: “It needs to be clearly demonstrated.”

Thus, the contractor’s turn in this sequence consists of three utterances. The first of these is a question from DMD. It is not clear from the data whether the question is directed to a member of the consultants team, or to SA, who in fact answers it. (Though sharper observation and/or better field notes, might have supplied this information.) Depending on who is the intended recipient of the question, this can be seen to be a team pass, or a team assist. If the question is directed at SA, then it constitutes a pass. A pass involves,

> “the initially selected speaker (the ‘first recipient’) producing an utterance which selects another participant (the ‘second recipient’) to perform an action which stands in a relationship of second action to the first which was initially directed to himself.” (Francis 1984, p23)

If the question was intended for a member of the consultant’s team, it constitutes an assist. In an assist, a second speaker from a team assists a first speaker by correcting, amending, emphasising, or elaborating his utterance. The assist functions as a ‘satellite’, in that:

> “It is not intended to win the floor for its speaker in a way which will lead members of the other team to direct their subsequent utterances to him.” (Francis 1984, p.29)

Sacks observes that a “fundamental” rule is that:

> “A person who has asked a question can talk again, has, as we may put it, ‘a reserved right to talk again’, after the one to whom he has addressed the question speaks.” (Sacks 1974, p230)

Thus, in formulating his response as a simple answer to DMD’s question, SA passes the initiative back to him.

More importantly, this turn might also be a team movement. This is defined as:

> “a sequence of talk in which the co-members of a team, in the presence of another team with whom they are negotiating, direct their talk to one another rather than to members of that other team. However, their co-team directed talk is so constructed as to be intendedly performing some action vis-a-vis the opposition team, and can be seen to be produced in order to perform that action.” (Francis 1984, pp. 40-41)

One feature of the contractor’s turn is that it displays the roles of the two members of the contractor’s team involved. In his first utterance of the turn, DMD might be taken to be showing reluctance to enter too quickly into the negotiations, he is in effect saying let’s begin negotiations, but it is left to SA to actually begin to outline the contractor’s negotiating position. Whether DMD’s question is directed at SA, or at a member of the consultant’s team, it is displaying his uncertainty about the precise condition of the negotiations. One might wonder if this uncertainty is genuine. After all, as the senior member of the contractor's team, he might be expected to know such an important fact as the number of weeks delay that the project was suffering. On the other hand, he is displaying a characteristic of his negotiating style, that he does not see precise figures as important. This is made clear a few utterances later, when he states "we would appreciate another six, or seven weeks". In supplying the missing number, SA displays that he, in contrast, is able to recall the details of the negotiations. The two roles complement each other; it is plain to any observer that this is an effective team.

These features are not in themselves sufficient to constitute the turn as a team movement, because it seems unlikely that this display of complementary team roles is intended. What might be intended is the effect that this display of team roles achieves. This is to establish an element of a bargaining position without committing to it. It is made clear to the consultants that the contractor is asking for compensation for seventeen weeks delay, but also that this figure is negotiable. Thus, DMD, as the contractor's principal negotiator, has demonstrated his lack of commitment to the figure by openly failing to remember it; while it is left to SA, a lower status member of the team, to state it.
However, whether this turn does, in fact, constitute a team movement must remain uncertain. This is because the intentionality involved in the interaction between DMD and SA cannot be clearly assessed. It seems unlikely that such an interaction would be explicitly planned. On the other hand, DMD's forgetfulness fits too well with his overall negotiating style to allow it to be dismissed as entirely unintentional. It is clear that he knows he can rely on SA to plan the precise details of negotiations, while he concentrates on the relational issues involved.

In any event, when supplied with the figure seventeen, DMD draws attention to the wide discrepancy between the delay experienced and the amount of compensation paid. He does this without referring directly to the larger figure, but in such a way as to indicate that he is expecting an increased offer ("*At the moment,* you've granted six").

In his response, PE doesn't answer the question directly, but orients to it by specifying a principle by which an answer will be formulated. This is a well known principle of negotiation, that it should be carried out with reference to objective criteria (Fisher, Ury & Patton 1991). In stating it, PE may be seen as following standard advice, by making it clear that he is negotiating with reference to such criteria. However, he is also following the lead of RE and DMD by further delaying the negotiations. He is not ready to give the crucial figure: the number of weeks compensation that the consultant is willing to award.

The contractor's following turn consists of two utterances and constitutes a take-over.

Consultant's turn	PE: "It needs to be clearly demonstrated."
Contractor's turn	SA: "We appreciate that."
	DMD: "So will you be paying more than the six weeks this time?"
Consultant's turn	RE: "I doubt it."

A take-over has the same characteristics as an assist, except that it is intended to 'capture the floor'; that is to say, its design, or effect is to lead members of the other team to direct their subsequent comments to the speaker. Both involve an utterance from a team member, placed immediately after, or in the course of, an utterance by a member of the same team. Both are designed to elaborate on, qualify, amend, or otherwise supplement that utterance. In this take-over, SA opens by concurring with PE's statement of objective criteria. In point of fact, this utterance seems to be out of turn. PE's statement was in direct response to DMD, DMD might thus be expected to respond to it, which he does, immediately following SA's intervention. DMD repeats his earlier question in a more pointed form. This time he makes it clear that he doesn't consider the six weeks compensation to be in doubt and explicitly asks for more.

The consultant's subsequent turn also consists of two utterances.

Contractor's turn	DMD: "So will you be paying more than the six weeks this time?"
Consultant's turn	RE: "I doubt it."
	PE: [giggles] "Sorry. Not the answer you were looking for."
Contractor's turn	DMD: "It's quite simple for us, if there's a delay it's your fault. Not yours personally of course."

RE's response to DMD finally states the consultant's position. It is interesting that this task is left to RE. In the case of both the consultant and the contractor, it is left to lower status members of the team to state their respective negotiating positions. This allows higher status members to distance themselves from these positions, leaving them with more freedom to negotiate. It is also true that these two members (resident engineer and site agent) work much more closely together than any other two members of the respective teams.

Notwithstanding the fact that RE does not directly refuse an increase in compensation, his statement that an increase is unlikely seems blunt in the context of the preceding talk. It is at this point that the difference between the two teams becomes explicit; it is the awkward moment that everyone has been avoiding. PE immediately steps in with an assist, to attempt to ameliorate the situation. His laugh and apology display embarrassment. The humanity of this response allows DMD to respond with a joke.

DMD's joke is a reference to the structure of the setting. He is in effect saying that he has no choice, but to argue for the maximum amount of compensation. In this way he emphasises: (a) that he is dissatisfied with the six weeks; and (b) that there is no personal element in this dissatisfaction. In case this last point has been missed, he re-emphasises it ("not yours personally, of course"). Clearly, at this juncture, it is vital that the joke is not misunderstood and taken to be a literal statement of DMD's position.

At this point, RE responds to the cues he has been receiving and softens his original response. He makes it plain that the door is still open to further negotiation and confirms his adherence to objective criteria. ("I might change my mind DMD, after I've looked at x and y and put them together.")

In response, DMD puts forward another bargaining position; asking for "six, or seven weeks", in addition to those already granted. Six or seven, plus the six already awarded comes to twelve or thirteen, considerably less than the seventeen weeks which SA stated to be the delay. This is the strongest commitment which DMD has made in any of his utterances. It is phrased as a request ("we'd appreciate [...] if you can give them to us"). The whole utterance is designed to maximise goodwill on the part of the consultant. In effect, DMD is asking them to work with the contractor to maximise the contractor's income. It contrasts with DMD's earlier caricature of his own position ("if there's a delay, it's your fault”). This contrast, together with the comparison between the figure asked for and the stated delay, emphasises the modesty and reasonableness of the contractor’s position.

PE’s response is to re-iterate points made earlier. The door is still open to negotiation; the decision will be made on objective criteria. There may also be something of a gentle rebuke in his utterance. In saying “there is no question of denying you your entitlement”, he might be taken to be implying that an accusation had been made. He is certainly asserting that DMD’s plea is unnecessary.

At this point, the discussion is almost over. The position of both sides has been made clear to the other. It remains only for DMD to bring the discussion to a close. He does this by referring to the complexity of the negotiations and offering to “sit down” with the consultants, at a later date.

3. Lessons for negotiating technique

In this section, the above analysis is compared with that suggested by Fisher and Ury. While some of the principles enunciated in 'Getting to Yes' are clearly seen to be in operation, others are not. Moreover, it has been demonstrated that additional techniques are employed that do not find a place in Fisher and Ury's method. Thus, negotiators can be observed to explicitly 'separate the people from the problem' and 'insist on objective criteria'. On the other hand, while there is some indication of a focus on interests, rather than positions, this is implicit rather than overt. The invention of 'options for mutual gain' is clearly not viable at this stage in the negotiation. Additional techniques found to be present which are not explored by Fisher *et al* include the use of humour and a focus on the autonomy of relationships beyond the arena of negotiation.

The hesitation displayed by the RE in introducing the topic can be seen to be oriented to the danger that the discussion will have an adverse effect on relationships between the negotiators (separating the people from the problem). It is the first indication of a concern to prepare the ground for the consultant's refusal and the contractor's recovery. In a sense (and in the context of what follows) it can be seen as de-marking an arena in which the difficult claims negotiations can be conducted, separate from the normal business of the meeting without disturbing the cordiality of working relationships.

In replying, the contractor's team use the assist to allow the DMD to negotiate without taking a position. Although the SA states what might be a position (17 weeks) he does this as a technical fact, he is not personally conducting the negotiation. This allows DMD to refer to a possible position without having to own it. This effectively gives the DMD the best of both worlds. Although this activity thus seems oriented to face saving, part of separating the people from the problem, it is the contractor's own face which is being protected. Arguably, the DMD is anticipating a refusal and is avoiding putting the consultants in a position where to make such a refusal will be damaging.

In the exchange that follows, a possible consultants position is referred to, this time by DMD. This again gets a position onto the table, while allowing the consultants to disclaim ownership of it. It is interesting to note the inter-team facilitation that occurs here, in what is ostensibly a competitive negotiation.

The conversational pair which represents the contractor's request for more time and the contractor's refusal is again oriented to separating the people from the problem. The DMD's request is designed to allow the smallest possible concession to be acceptable (more than six weeks), while reserving the right to negotiate further concessions (this time). The RE's refusal is equivocal (I doubt it). Nevertheless, this constitutes the nearest thing to a position that has thus far been stated and it is followed by an immediate assist from the higher status PE, who apologises.

DMD's joke which follows constitutes the clearest indication of the 'arena' mentioned above. DMD is in effect characterising the nature of the negotiation (for us, if there's a delay it's your fault). In doing so, while insisting on its non-personal nature, he emphasises the distance between this arena and the broader context of the personal and working relationships in the room.

Following this, further repair work is done, including: a restatement of the openness of the respective negotiation positions; a subtle concession on the part of the contractor ("another six or seven weeks", rather than the eleven originally implied); and the second appeal to objective criteria.

Thus two interesting points may be noted: [1] separation of people from problem is achieved by creating an arena of negotiation marked out from the normal course of communication; [2] within this arena positions are used as negotiating tools, but never unambiguously adopted.

4. Conclusion: the role of a naturalistic approach to the study of negotiation

Fisher and Ury's classic book on negotiation continues to be a best selling management text for good reason. The text offers clear and practical formulas for conducting honest, non-aggressive, rational and successful negotiation. As the foregoing analysis shows, some of methods used in negotiation studied here are classic examples of the Fisher and Ury approach. However, in offering formulaic advice, certain aspects of the reality of negotiation are inevitably lost. The naturalistic approach adopted here seeks to represent the actual reality of negotiation as it does, rather than as it could or should happen.

As the analysis shows, it is possible to identify additional techniques which are employed in negotiation. Such techniques may themselves be useful in negotiation, while meeting Fisher and Ury's high ethical standards. Thus, it is possible that these techniques could be formalised in a text similar to 'Getting To Yes', for the use of negotiators. However useful such a course might prove in practice, it would inevitably lead to the loss mentioned above. Specifically, two such forms of loss are noted here.

First, the provenance of the advice would be obscured. Doubtless, the authors of 'Getting To Yes' themselves engaged in the close study of actual negotiations. Indeed they occasionally mention such negotiations in passing. However the reader has no access to the precise nature of these negotiations and the thought processes by which the study of these processes were developed into the neatly arranged rational models presented in the text. It is worth noting that the transcript used here is available the academic community for further study and analysis. This is also true of the transcript used in the work by Francis referred to above. This means not only that the formulations derived from the present work can be tested against the original data, but that further and alternative insights may be available to the reader.

Second, certain aspects of the actual performance of negotiation are inevitably lost in the formulation of any normative model. In seeking to offer advice and guidance, we must inevitably close our eyes to some aspects of reality that do not suit our purpose. Thus, the reflexive nature of the talk, which is apparent in the transcript, is subsumed to more pragmatic considerations, even in the present analysis. The talk is reflexive in this sense: that the utterances do not simply constitute actions, but actually specify for interlocutors the nature of the action that they constitute. Sometimes this is relatively explicit, as in the first utterance of the transcript in which the RE can be understood to be saying that as chair he is moving discussion to the topic of claims. At others it is necessarily implicit, as when the DMD replies in such a way as to imply 'I am not concerned with the actual details of the delay'. The relationship of these verbal actions to normative models of negotiation is, as has been demonstrated above, subtle and various. They do not provide a set of unambiguous rules which can be followed mechanically. In real negotiations, such models are at best resources that can be drawn upon selectively and appropriately, depending on the contingent circumstances that pertain.

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Researching decision support: What do we need to know?

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Abstract: The EPSRC funded KIM Grand Challenge project to investigate the use of Knowledge and Information Management techniques in the context of the emerging product-service paradigm in engineering is introduced. The paper focuses on the topic addressed by Task 3.3 of this project, decision support. An outline is offered of an approach to decision support which combines the Unique Adequacy (UA) requirement of methods with Transformation-Flow-Value (TFV) theory. UA requires that reports are [1] grounded in a detailed inside knowledge of the topic and [2] are theory neutral. TFV theory emphasises the importance of flows in the analysis of production. It is suggested that these two approaches may be usefully combined to facilitate: [1] the design of through life decision support; and [2] the creation of the through-life community of practice which makes possible the sharing of information across the whole product-service life cycle.

Keywords: Community of Practice; Decision Support; Product-Service; TVF Theory; Unique Adequacy

1. The Aim of the Research

This paper outlines an intended contribution to Task 3.3 of the EPSRC funded 'Grand Challenge' project, Immortal Information and Through-Life Knowledge Management (KIM). KIM involves eleven UK universities, including eight EPSRC funded Innovative Manufacturing Research Centres and spans a number of industries including aerospace and construction. Its aim is to address a perceived shift among engineering companies towards a product-service paradigm and to explore the implications of this for knowledge management. Thus, the project seeks to identify approaches to information and knowledge management that are appropriate to the through-life support of products. The four Work Packages (WPs) and eleven Tasks into which the project is organised address the evaluation, input, storage, access and use of information and knowledge over extended periods of time and across a diversity of organizational, occupational and other knowledge communities. The four Work Packages address, respectively: [WP1] recording design knowledge in a manner which is sustainable throughout the product-service life-cycle; [WP2] the operational systems and knowledge communities in which knowledge is accessed and used; [WP3] the nature and use of knowledge. WP4 is concerned with the co-ordination of the other three.

The approach of WP3 is based upon two key premises. First, on a distinction between knowledge and information which holds that the former is an act or a process, while the latter is an artefact or a thing (Davenport and Prusak, 1997). Second, that knowledge, decision making and learning capacity are intrinsically related concepts which must be considered collectively. The three tasks in WP3 are concerned respectively with: [T3.1] addresses the role of knowledge in the creation of procurement procedures which encourage innovative improvement; [T3.2] focuses upon the learning processes required to support a shift from product delivery to service provision paradigms; [T3.3] seeks to increase understanding of support for decision-making processes at key points in the product-service life-cycle.

The primary aim of T3.3 is to increase the understanding of decision-making processes and the various methods available to support them within the context of product-service projects. This will facilitate the achievement of a second aim, to provide suggestions for the improvement of decision support systems and related practice. In order to achieve these aims, this contribution aims to answer three questions:

How do we create the conditions in which information will be available for decisions, useful and clearly understood at all points in the life cycle?
How can we provide a common conceptual basis for an understanding at all stages of the product-service life-cycle, such that the right data is assembled, saved and made available in a clearly understandable form to potential users?
Can such a conceptual basis be used also to underpin decisions that facilitate the integration of key systems and interests in the through life product/service and the resolution of potential conflicts?
These will be addressed using an innovative and evolving approach which combines a descriptive research methodology with a generic theory for the development of production improvement solutions. Finally, the contribution aims to integrate with other Universities' initiatives within the project, in a process of collaboration that should ultimately span the whole of the Grand Challenge project.

2. Finding a focus

The first task is to identify key decision making processes in design, construction and service in the built environment. Currently, we understand the life-cycle of the built environment as having seven phases, each phase entailing decision making processes: decision to procure; design, procurement; construction; maintenance and operation; refurbishment/change of use; demolition. Each of these phases involves the decision making processes of a multitude of stakeholders. Thus, even in a single industry, understanding the product service life-cycle is a vast enterprise.

In order to make this more manageable, we propose to concentrate on four central phases: design; procurement; construction; and maintenance and operations.
As a starting point, we intend to talk to facilities managers as key informants on the process of maintenance and operation.
Using Ohno's 'five why's' (Womack, Jones, & Roos 1990) we will attempt to trace knowledge management problems in this phase back to construction, design and procurement phases.
We will also investigate the decisions made by sub-contractors (shop-floor teams) again tracing KM problems back up the incentive and design flows but also tracing decisions forward for their consequences, in the light of what we have learned from facilities managers.

This procedure is organised through the dichotomy of intended policy and operational reality. The mechanisms necessary for effective knowledge management being flowdown of policy to reality and feedback from reality to policy (see Figure 1).

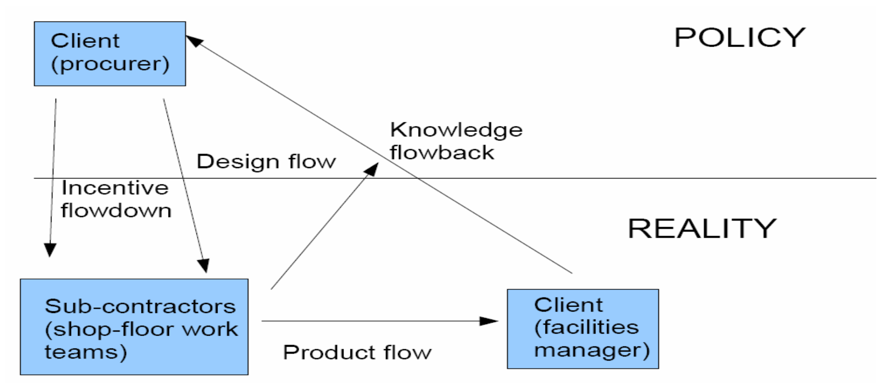

Figure 1: Key elements of the research design.

3. Understanding decisions

The second task is to clearly understand the decision making processes that we have identified. We suggest that such an understanding depends upon us conducting our research to meet the unique adequacy (UA) requirement of methods (Garfinkel 2002; Garfinkel & Wieder 1992). Research conducted to this standard has been shown to be useful in supporting the design of IT applications (Rooke & Seymour 2005) and holds out the promise of innovative approaches to the design of such applications (Button & Dourish 1996; Dourish & Button 1998). The UA requirement has two forms, both of which "are founded on the principle that the activities and procedures of persons in a setting can best be accounted for in terms of the understandings that those persons have of that setting" (Rooke, Seymour & Fellows 2004:656).

In brief, the two forms of the UA requirement stipulate that:

the research achieves a detailed inside knowledge of the research topic;
the research report is theory-neutral.

In its weak form, the UA requirement demands that "the analyst must be *vulgarly* competent in the local production and reflexively natural accountability of the phenomenon" (Garfinkel and Wieder 1992:182). Thus, to analyse a decision making process adequately, we must know what any participant in the process would ordinarily know about that process. This knowledge, expressed as competence, is the kind referred to by Ryle (1963) as 'knowing how'. The question of whether that understanding has been achieved is a matter for the judgement of any other competent participant. In this form the requirement is proposed as a criterion for adequate ethnography, the most certain method for acquiring such knowledge being participant observation. However, it is possible to usefully apply it to other forms of enquiry, such as interviews and questionnaires. Thus, for instance, a questionnaire designed by someone who had no direct knowledge of the process under study is likely to contain irrelevant, misleading or even meaningless questions.

The strong requirement concerns the reporting of research. It demands that the methods of analysis used to describe a process should be derived directly from that process. This assumes that the methods that participants use in the process of making a decision are sufficient to the purpose of producing an account of that decision. This assumption has a particular piquancy with regard to decisions, where 'the decision' might be nothing more than a gloss used to account for an indeterminate phenomenon which is invoked retrospectively to excuse or justify a particular course of action. However, it is proposed as a standard for the description of any social setting, that is to say, any phenomenon which is composed of (and by) conscious beings who are able to produce an account of their own activities. It is proposed that methods of analysis which are alien to the analysed setting (thus introducing a theoretical spin to the description) must involve some distortion. Although the strong requirement was originally proposed as a criterion for ethnomethodology, we suggest that its theory neutrality gives it too a far wider application. Unlike findings that are theoretically constructed, UA findings are available for to a diversity of different theoretical and practical purposes.

UA reports have at least two possible applications in whole life decision support: [1] to inform the design of decision support systems; [2] to promote common understanding between knowledge communities at different stages of the life cycle. However, UA reports are purely descriptive in intent. They do not in themselves offer solutions to practical problems of production, service or knowledge managment.

4. Communities of Practice

The notion of communities of practice (Lave & Wenger 1991) draws attention to the situated and social nature of knowledge. Ryle's distinction between 'knowing that' and 'knowing how' is again relevant here and is illustrated in Figure 2 in terms of information and practices.

The nature of 'decisions' themselves needs to be explored: are they something that is made by an authorised decision-maker; or something that emerges, without necessarily being explicitly made at all. In the light of this, what constitutes effective decision support? How is the task of bringing together relevant information, requirements and viewpoints in a decision-making context to be achieved? Button & Sharrock (2002) have shed some light on these questions, demonstrating the high level of specification of an actually existing decision making process that can be achieved through observation of the UA requirement of methods. However, it will be necessary to build some kind of community of practice across the product-service life-cycle, if adequate decision support is to be achieved. UA descriptions can go some way towards this, by illustrating particular stages of the process for the benefit of decision makers at other stages in the process.

This is unlikely to be sufficient in itself for the development of a community of practice. We propose that a vital contribution will be the introduction of generic production theory concepts intended to inform and develop practice. If these can be shown to offer local improvements at each stage of the product-service process, then this will create the necessary interest in adopting them.

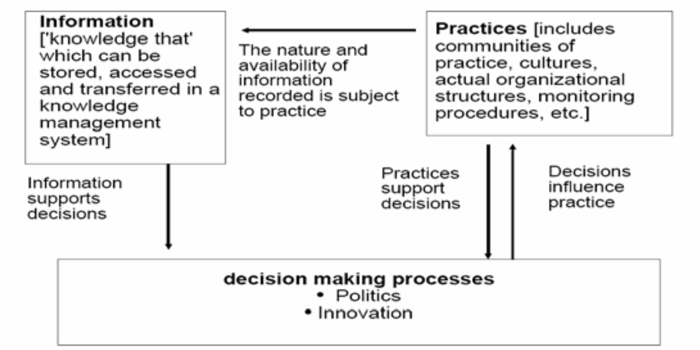

Figure 2.: The relationship between information, practices and decision making

5. TFV production theory as a common conceptual basis

It is implicit in the concept of community of practice that a shared understanding is a pre-requisite of sharing information; thus, a set of shared ideas is necessary in order to create a community of practice that can facilitate decision support across the product/service life-cycle. Our second research question addresses this necessity; how can we provide a common conceptual basis for an understanding at all stages of the product-service life-cycle, such that the right data is assembled, saved and made available in a clearly understandable form to potential users? Such a conceptual basis would underpin both appropriate practices for recording and sharing information and a shared understanding of data thus preserved and distributed.

We propose Koskela's (2000) Transformation-Flow-Value (TFV) theory as a possible source of concepts for such a shared understanding. While traditional production theory is based on an analytic decomposition in which production is seen as a transformation of materials, recent innovations (Quality Management, JIT, Business Process Re-engineering etc.) see production as a flow (of materials and other things) or in terms of the generation of value.
TVF theory provides an account of the importance of the concept of flow in developing new approaches to improving production. Lean construction, as embodied in the work of the *European Group for Lean Construction,* the *International Group for Lean Construction,* and the *Lean Construction Institute,* is an adaptation, development and implementation of the lessons of the *Toyota* production system in the construction industry. Lean construction's main innovatory tool, the Last Planner System (Ballard & Howell 1998) is a prime example of the practical application of the flow concept. A crucial issue is the tension between short & long term thinking which is itself implied in the distinction between product and service paradigms. There is a growing body of evidence of the effective application of lean principles on construction projects (for instance, Thomassen, Sander, Barnes, Nielsen, 2003, Versteeg 2006).

Thus, we aim to apply the principles of TFV theory to the analysis of decision making processes to identify common unifying concepts. We believe this will enable us to provide a viable basis for a common through-life understanding of the product/service life cycle, which in turn will underpin an immortal community of practice. Some ideas which initially suggest themselves as useful in this way are:

The understanding of the product/service life-cycle as a product flow;

The understanding of the product/service life-cycle as the generation of value in the context of a customer-supplier relationship;
The methodology of the Toyota product development process;
The importance of achieving incentive flow-down from procurers to shop-floor teams;
The development of standards which underpin flexibility.
In offering generic concepts that underlie practical improvement initiatives and tools, TFV goes beyond promoting understanding in throughout the product-service life-cycle to encouraging shared thought processes between different occupational groups and life-cycle stages.

6. Conclusion, developing a community of practice to improve the product-service process

The approach to through-life decision support outlined in this paper combines thorough empiricism with tested theory.

The UA requirement offers a standard for empirical research that has proven efficacious in IT design. It has been suggested here that research to this standard can also be used to promote common understanding across the life-cycle.

The adoption of TFV as a conceptual basis for decision support, together with the introduction of UA reporting, opens up the possibility of systems which underpin the integration of key systems and interests and the resolution of potential conflicts in the life of the product/service. Thus, this approach seeks to move beyond the improvement KM systems towards the development of KM systems which support improvement of the whole construction product/service process.

The use of a production theory that has been successfully implemented in practice favours the creation of a through-life community of practice that does not merely promote common understanding and interests but is enabled to promote improvement across the whole product-service process.

Thus, the two approaches work in tandem (see Figure 3). Drawing together the strands of uniquely adequate description and TFV theory analysis as a basis for communities of practice promises to both inform the design and facilitate the adoption of decision support systems.

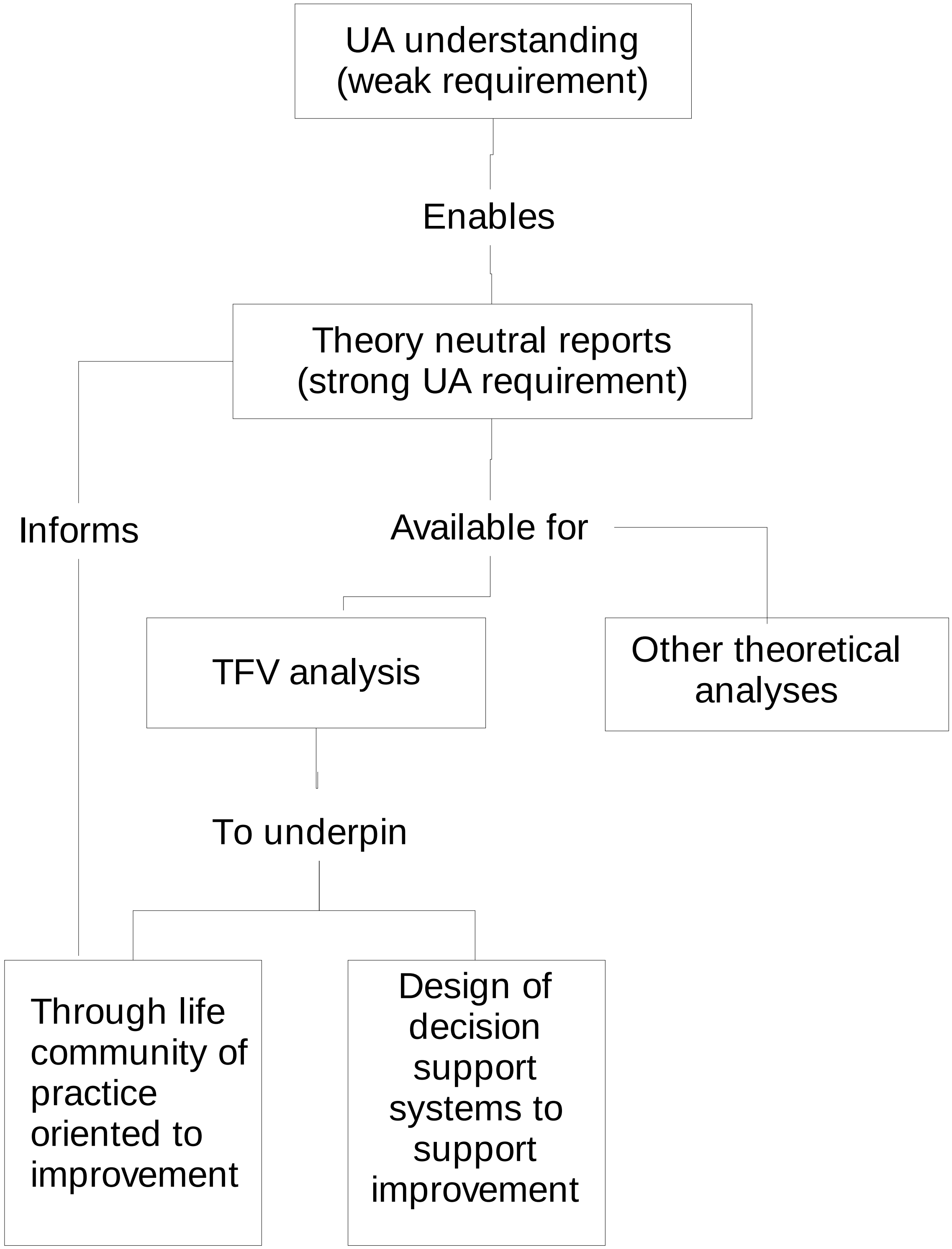

Figure 3. The full research and development process

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A Supply Chain Transactional Based Model For Construction Procurement Arrangement Design

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Abstract: Most approaches available to clients and their advisors for the selection of the optimum procurement approach have focused upon quantitative methods, which are based on how contracts control time, cost and quality. The unit of analysis of these approaches has been how the procurement route manages the transactions between the contractor and client relationship and considers the impact that change of client requirements has upon project outcomes. Crudely stated, if clients require ex post change, in order to protect the price they have gained through competition, the most effective control on the impact that a change has is to have high project information specificity and clearly defined rules as to how change is defined and managed. These inputs to the selection models are usually a set of variables that reflect the client's project priorities such as time, cost, and quality and client attributes such as experience of construction and procurement approaches. The procurement route assessment involves a multi attribute utility approach by weighting these criteria and then assessing how well the various arrangements meet these criteria. This paper argues that this approach is not suited to the more integrated approaches to construction procurement as it doesn't consider the inter relationship that exists between the client project priorities or the interdependency of the procurement subsystems in achieving these priorities it also doesn't take account of the relationship that the contractor has with supply chain organisations in the control of meeting the client's objectives. The paper is based on the premise that the multi attribute utility approach to procurement route assessment is too limited. It an alternative model which assists the project stakeholders with the design of a procurement system and takes account of the inter relationship of the critical project factors. The Quality Functional Deployment model is used on a theoretical case study. This approach is based on the theoretical framework of transaction economics and extends the variables vertically beyond the client/contractor interface. The model is based on an expanded group set of inputs that take account of the informational uncertainty that exists at the commencement of a project, the supply chain organisations specificity and the extent of supply chain performance ambiguity.

Key words: Decision Support Matrix, Procurement Route Design, QFD

1. Introduction

The trend in construction procurement in the UK is away from standard forms of contractual arrangement towards bespoke procurement approaches that aim to meet client objectives. The role of the clients advisor when considering a procurement approach for a building project is one of designing a set of procurement systems rather than selecting a standard approach. The selection of a procurement arrangement to meet clients requirements has been hampered by the inability to measure the optimum performance of one system over another, this is due in part to the complexity of the organisational structures adopted by the design and construction organisations. The best that can be achieved is the identification of contingency factors that are influence the development and performance of the temporary multiple organisations that make up a project team. Cherns and Bryant(1984) suggested that management of a construction project was a function of the temporary multi- organisational team's formation and structure, and that the earliest decisions taken in the context of the clients procurement system have more of an influence over the performance of such a team. The factors that influence the formation of the TMOT's include organisational structures (Shirazi et al., 1996), the influence of project environmental variables (Hughes, 1989), social factors (Jennings and Kenley, 1996) and the role of transaction costs (Winch, 1989). This paper attempts to conflate the approaches of Skitmore and Marsden(1988) and Winch(2001) by considering a quality functional deployment approach to procurement system design and utilises the approach for a case study. The approach to advising clients on procurement systems can be considered to move away from selection from a limited range of alternatives towards designing a bespoke procurement system that has a number of subsystems that independently and interdependently achieve the client's requirements.

Procurement can be defined as an amalgam of activities undertaken by a client in order to obtain a new building (Rowlinson et al., 2000) and includes processes that seek to place risks and obligations on the various parties to the project. There is little consensus on the terminology to be used when defining procurement, procurement systems (Cheung et al., 2001), procurement route (Tookey et al., 2001) and procurement strategy (OGC, 2003) have all been used to describe similar processes. The re-examination of the terms, assumptions and categories that procurement research adopts has been undertaken over the last four years by Palaneeswaran (2005). This study adopted the Office of Government and Commerce's (OGC) (2003) terminology which defined procurement strategy as the means of achieving project objectives and value for money by taking into account the risks and constraints, leading to decisions about the funding mechanism and asset ownership for the project. This is differentiated from the procurement route that delivers this strategy. This includes the contract strategy that will best meet the client's needs. The contract strategy determines the level of integration of design and construction for a given project by considering the risks allocated, incentives offered and control mechanisms used. In the absence of a well-defined taxonomy of terms (Palaneeswaran et al., 2005), this study conflates the constructs of procurement delivery systems and procurement route and uses the latter term in this paper

The change in the procurement environment of construction is illustrated by the figures shown in Table 1 below which identifies that the use of procurement routes with specified products, bills of quantities and complete designs has fallen significantly over the last twenty years.

Table 1: Contracts in Use survey RICS (2001) (figures in %)

Procurement route	1985	1987	1989	1991	1993	1995	1998	2001
Lump sum-firm Bill of Quantities	59.3	52.1	52.3	48.3	41.6	43.7	28.4	20.3
Lump sum- spec and drawings	10.2	17.7	10.2	7.0	8.3	12.2	10.0	20.2
Lump sum – design and build	9.0	12.2	10.9	14.8	35.7	30.1	41.4	42.7
Re measurement-approx BQ	5.4	3.4	3.6	2.5	4.1	2.4	1.7	2.8
Prime cost plus fixed fee	2.7	5.2	1.1	0.1	0.2	0.5	0.3	0.3
Management contract	14.4	9.4	15.0	7.9	6.2	6.9	10.4	2.3
Construction management	-	-	6.9	19.4	3.9	4.2	7.7	9.6
Partnering agreements	-	-	-	-	-	-	-	1.7

The Royal Institution of Chartered Surveyors (RICS) survey in 2001 of professional practices, which obtained information on £3.3bn of project value, indicated that most building projects used a standard form of contract, with the vast majority (91%) utilising a Joint Contracts Tribunal form of contract. The survey also indicated that clients approached the procurement of their projects significantly differently than a decade ago. The change in the use of the lump sum contractual arrangements with bills of quantities (prescribed definitions of the building product) was down from 59% to 20% when measured by the value of contracts placed. The two forms of procurement route that had as a consequence become more popular were the lump sum design and build form and the use of the drawings and specification form. The rationale for procurement route selection has been found to be not well defined, as the industry's clients and their advisors selection of arrangements has been demonstrated to be illogical and rarely systematic (Skitmore and Marsden, 1988). However this can be considered not to be a result of a lack of normative advice, which is plentiful (Egan, 1998,2002; H.M.Treasury, 2000; Holti et al., 1999; Latham, 1993,1994; Reading Construction Forum, 1998, 1995).

2. Project procurement selection tools

Most tools available to clients and their advisors for the selection of the optimum procurement approach have focused upon quantitative methods, which are based on how contracts control time, cost and quality (Ambrose and Tucker, 2000; Love et al., 1998; Skitmore and Marsden, 1988). The unit of analysis of these approaches has been the contractor/client relationship and the impact that change has upon project outcomes. Crudely stated, if clients require ex post change, in order to protect the price they have gained through competition, the most effective control on the impact that a change has is to have high project information specificity and clearly defined rules as to how change is defined and managed. Consequently this favours the traditional procurement route if clients require extensive post contract amendments to design. If clients require an arrangement that allocates a high proportion of risk to a contractor and have a clear conception of their performance requirements, design and build has been perceived as the optimum approach and is advocated as the preferred arrangement by Modernising Construction (HMSO, 2001). The low information specificity and consequent difficulty in managing the result of design changes, however makes this approach susceptible to poor ex post control. Drawings and specification, management contracting and construction management are arrangements that fall between the two extremes of routes represented by the design and build approach and the traditional approach.

The control of change is managed by mediating parties within procurement routes who can be considered as third parties and have been identified as contributing to transaction costs (Chang and Ive, 2002). The third parties to the procurement arrangement have also been referred to as control actors, who Winch (2001) identifies as having three roles; the verification of satisfactory performance, facilitation of negotiation when necessary i.e. if changes occur and thirdly to provide a first line of dispute resolution. Their role can be considered to manage the implications of contractual incompleteness. In traditionally procured projects, the contractual incompleteness is usually manifested in one or more of three categories, either at the contract formation stage as prime cost sums, provisional sums or provisional quantities which are adjusted ex post or as contractual mechanisms that enable variations to be made ex post without effecting contract breakdown or as ambiguities that occur due to errors or omissions in the documentation which require ex post adjustments.

In an empirical investigation of the processes used by contracting organisations (Ross, 2003) it was found that procurement arrangements had a influence of the procedures adopted by a construction organisation in establishing a project team. There has been no empirical research which has compared the effectiveness of project teams and different procurement arrangements due to the number and extent of variables. It is however impossible to design the most effective team, all that can be done is to identify and influence a range of contingency factors that influence the performance of the differing systems. These could be termed procurement arrangement performance attributes

3. Procurement arrangement performance attributes: Theoretical underpinning

To safeguard against opportunistic behaviour organisations use governance structures, (governance "*is a means by which to induce order, thereby to mitigate conflict and release mutual gain*"). They attempt to match the governance structure with the market within which they are procuring the resource. Simple use of governance such as the spot market is inappropriate for complex transactions as the risk is that the contract breaks down whereas complex governance is too costly for simple transactions. The governance structures can be considered to vary in discrete ways in terms of administrative controls, incentive intensity and contract law regime (Turner and Simister, 2001; Williamson and Masten, 1999; Winch, 1989; 2001). It has been argued that it is impossible to compare the costs of one governance structure associated with low transaction costs with another due to the rejection of the idea of an omniscient calculation which is a result of bounded rationality (Hodgson, 1993) however governance forms do have discrete structures. The distinction is due to risk and uncertainty, (risk can be considered as parametric uncertainty, true uncertainty is un-quantifiable). Transaction costs are consequently associated with uncertainty and the firm can be said to exist to take account of this uncertainty when gathering resources. An unstructured examination of the construction industry identifies that there are a wide range of hierarchies, some with more internal resources than others, and it is impossible to assert that one structure is better than others. The transaction can consequently be considered as a unit of economic activity and that an analysis of the processes and events surrounding such a transaction could inform theory rather than the calculation of the optimum governance form.

3.1 Procurement Information

The role of information within a project structure is an essential one and is used for formation of contract, coordination of parties inputs and outputs to processes and also the economic control of organisations should misalignment occur. The role of information to manage uncertainty is not a new one, management theorists such as Galbraith (1973) argued that information processing increased when task uncertainty increased. Williamson (1981) has adapted this into information impactedness considered below under conditions of bounded rationality. Casson (2001) suggests that it is only recently that information had become a central focus for investigation by economists and suggests that many theoretic perspectives will be derived from the economics of information once theory becomes better developed. He suggested that the economy could be considered as a system of structured information flows, the structuring of which is effected by institutions, and in particular, firms, which specialise in information needed to allocate resources properly. The costs of information collection and storage are changing dramatically and consequently information access has been suggested as changing the institutional structure of the industry.

A clear problem related to transactional information identified by Williamson (1996), is that given pervasive informational uncertainty, and complexity that ex ante alignment, created by..."*specifically designed systems*," means that efficient resource allocation is not possible. Emphasis shifts to ex post bargaining. He conflated ex ante and ex post information asymmetries into a general category of information impactedness, upon which an assumption of opportunism is based. These information asymmetries are important as they are linked to power differentials. These relate to information, and the relative value of information to the organisation can be considered similar to other economic resources in that consumption is optimum when the marginal cost of information search and acquisition is less than its expected marginal return. Consequently a central issue informing market making firms information strategies, relates to the amount of information that the firm decides to collect, codify and diffuse amongst its managers.

The recent conceptual work of Winch (Winch, 2001) and Turner (Turner, 2004) considering the relevance of transaction cost economics and the governance of construction projects provides a useful framework for the understanding of relationships between organisations, their communicative behaviour and their treatment of uncertainty. Williamson (1981) identified that goods and services can be produced more efficiently if parties invest in transaction specific assets, which cannot easily be put to other uses if the buyer/seller relationship breaks down. These assets can include human capacity specificity (development of knowledge or skills), physical asset specificity (development of specialist equipment), site or location specificity (location), dedicated capacity (to protect from surge) or brand name (this can relate to franchises), temporal specificity that has been identified as being similar to sequential interdependence. The value of the transaction specific asset depends on the continued existence of the buyer/seller relationship; consequently one party that hasn't invested in the relationship may appropriate value by using the asset in another context. This means that if the investor is unsure as to the safety of the value yielded from the relationship, the investment may not be made. Winch (2001) suggested that the most appropriate choice of governance mode occupies a three dimensional space as a function of contingency factors i.e. learning (related to frequency), asset specificity (related to opportunism) and uncertainty (related to bounded rationality). The operationalisation of this framework was not completed and the work remained abstract. When it was applied in a project context he suggested that projects start with very high levels of uncertainty at inception until the completion of the project when all the information concerning the project is assembled and embodied within the project. Winch identified that this can be considered as similar to Porter's value chain (Porter, 1985) that identified both vertical and horizontal dimensions.

Williamson (1996) identifies a spectrum of governance structures that influence the transactions of organisations, these range from the open spot markets through simple, complex contracts, relational contracting to vertical integration. Turner (Turner and Simister, 2001) used these parameters to develop a three dimensional schema of reward, risk and safeguard to analyse contract types in their ability to align client and contractor objectives by providing incentives. They identified that, as uncertainty was an unavoidable aspect of contracting that incentive intensity, adaptiveness and reliance on monitoring could be considered as dimensions of a schema that could be used to analyse the governance mechanism.

Each governance mechanism has strengths and weaknesses, reliance on open markets has been identified as providing the most incentive to maximise the net value by economising on the units of production, however the low asset specificity means that the seller can be easily replaced and results in low levels of trust. Contracts provide protection to both buyer and seller, however as they are incomplete, parties may pursue potential gains through opportunistic behaviour. In this case, more complex governance mechanisms can be used to manage the uncertainty, settle disputes and adapt to new conditions. As identified earlier, the optimum governance structure is impossible to determine however the asset specificity of a selling organisation may help to understand the relationship that exists between it and the buying organisation.

3.2 Asset specificity

Asset specificity relates to the ability to replace the supplying organisation, this is not usually an issue for a construction client, but it may be for a contractor who regularly enters into post-contract negotiations with subcontractors to reduce their price. It can be considered to differ in nature depending on the contractual relations that exist between the parties. Pre-contract, the specificity relates to the dependence that the organisation places upon the other; post-contract, it could relate to the temporal specificity. Specificity can be considered to be both organisational as suggested by Kale and Arditi, (2001) or project related and is one of the constructs used by this study.

The greater the transactional uncertainty and uniqueness and the lower the transactional frequency, the potentially higher the transaction costs that are placed upon an organisation. A system of Web-based subcontractor rating considering asset specificity and bounded rationality was developed at Stanford CIFE centre. The rationale for using the Web was that a rating system used by all parties would reduce the potential for opportunistic behaviour, as ex post performance could be rated and made visible to other parties. Source credibility theory was used as a framework for the system, which is developed in Table 2 (Ekstrom et al., 2003)

The asset specificity of a supply chain organisation is likely to vary with the extent of organisational specificity, identified by Kale and Arditi (2001) in providing strategic advantage, and also the specificity that is due to the bilateral dependency required by projects. This will form a central component of this study; Table 2 suggests that the level and source of specificity can be defined and that trade will influence typical governance structures adopted by contractors. The influence that procurement routes have upon asset specificity and bilateral dependence were also investigated by the study, the operationalisation of this construct follows in the next section of this paper.

Table 2: Asset specificity and subcontracting after Ekstrom et al (2003)

Type of procurement	Commodities	Subcontractors				
Examples	Concrete	Brickwork	Groundworks	Roofing and cladding	Structural steelwork	Mechanical and electrical
Asset specificity	Low	Low	Medium/low	Medium	Medium/high	high
Source of AS	None	Human	Locational	Locational Human	Locational Human Temporal	Locational Human Temporal
Typical governance	Free Market	Free Market	Free market	Hybrid	Hybrid/ integrated	Hybrid/ alignment

The framework required operationalisation in order to inform the development of the model for procurement system design and evaluation. The aim was to discover some key transactional attributes that differentiate procurement systems and subsystems, relationships between supply chains and the information exchanged and used ex ante and ex post to a contract. The suggested procurement performance attributes is the rest of this paper are incomplete and requires further development, this is highlighted in the conclusions as an area for future study.

4. Alternative decision support models

The number of procurement arrangements available to client's advisors has increased over the last five years with the introduction of the ECC, PPC2000 and a new suite of JCT contracts. These contractual arrangements include a number of alternatives to allocate responsibilities and obligations between the project stakeholders, these include first tier supply chain organisations.

The client's advisor has to select and design a procurement arrangement that meets the client and project attributes. Their have been a number of attempts to develop decision support systems to assist with this process of procurement arrangement selection, one of the first was the use of an expert system, ELSIE, to capture the knowledge of experts and represent them in a series of rules. This was similar to the NEDO(1983) model which referenced the relative performance of procurement arrangements with a set of project characteristic The models developed with the contributions of Skitmore and Marsden (1988) and Singh (1990). These models were based on a number of inputs which were categorised as time (speed of construction, time available prior to commencement on site), certainty(budget and programme), flexibility to take account of post contract changes, the requirement for competition and post contract control procedures for dispute management. The model was based on a multi attribute utility matrix that utilised a scale for clients priorities which were converted into a relative scale and then applied to a utility factors for a number of defined procurement arrangements broadly categorised as negotiated lump sum, competitive lump sum, negotiated design and build, competitive design and build, negotiated turnkey, competitive turnkey, construction management, unit rate and cost plus fee. One problem with the models reported by Love et al (1997) was the difficulty in the objective establishment of weighting factors for each of the differing procurement arrangements. This is a fundamental difficulty in the assessment of the relative performance of differing procurement arrangements.

A further limitation of this approach is that the project delivery systems are considered at a high level and did not break them down into the procurement subsystems that are utilised to manage the transactions between the project stakeholders. Another limitation is that the procedures used to consider clients objectives do not allow the project team to consider the interrelationship between these objectives. For example a client strategic project objective of certainty of price has a strong negative relationship with an objective of a requirement for post contract flexibility to change design once commenced on site.

4.1 The development of a procurement design system

It is suggested that models for procurement route selection should take account of inputs that extend beyond the client contractor interface and should take account of the contingency factors that influence the contractors structuring of project teams and the information used to monitor the physical and financial performance of such teams.

The ability to control the impacts of design and/or production changes on the projects programme or budget depend upon the availability of information, the relative specificity of the supply chain organisation. In summary a model should assist in supporting advisors in addressing the following problems;

- Construction clients frequently fail to identify their precise requirements and constraints

- There is an inadequate assessment framework for assessing the effectiveness of a procurement path.

- The bespoke nature of contracts makes it difficult to develop direct comparisons.

An approach that allowed the decision makers to take account of the above and considered the interdependence of the project and procurement related criteria was the quality function deployment (QFD) framework. The framework that is adopted for this paper is a "house of quality" Wheelwright and Clark (1992).

The basic Quality Function Deployment methodology involves four basic phases that occur over the course of the product development process. During each phase one or more matrices are prepared to help plan and communicate critical product and process planning and design information. This QFD methodology flow has been applied by Kammara et al (1999) to the briefing stage of a project to assist in the development of a clients brief and this paper seeks to extend this work by applying the approach to procurement system design.

The four basic phases of the QFD approach are Phase one : Product planning which can be considered as defining and prioritising the customer needs, analyse opportunities and explore the interrelationship between these needs in order to translate the client requirements into a critical design attributes. Phase two: Assembly and deployment which involves the identification of the critical procurement system components and to translate into critical characteristic target values. Phase three: Process planning which is used to determine critical processes and process flows and to establish critical process parameters and Phase four: Process quality control which aims to determine critical project component and process characteristics, establish process control methods and establish inspection and test methods and parameters

The key stages of the QFD approach are shown below

Block 1 indicates what the customer requires
Block 2 represents the prioritisation of the client requirements
Block 3 represents a correlation matrix of the interaction between the clients needs.
Block 4 represents procurement performance design attributes (PPDA) which represents how the system will deliver the customer requirements.
Block 5 represents the interaction between the system components and is used to identify positive and negative relationships.
Block 6 represents the strength of the relationship between the client requirements and the procurement system components, the relationship is measured by a scale of strong (9), medium (3), weak (1), none and represented by a number of symbols.
Block 7 is used to ain an idea of benchmarks for the client’s requirements against industry standards.
Block 8 was used to show the benchmark targets for the procurement performance design attributes
Block 9 was used to assess the target
Block 10 indicated an assessment of the technical difficulty in achieving the procurement design attributes on a scale of 1-5
Block 11 reflects the importance of the PPDA which is the product of the weighted project critical attributes (PCA) and the strength of the relationships between the PCA and the PPDA.

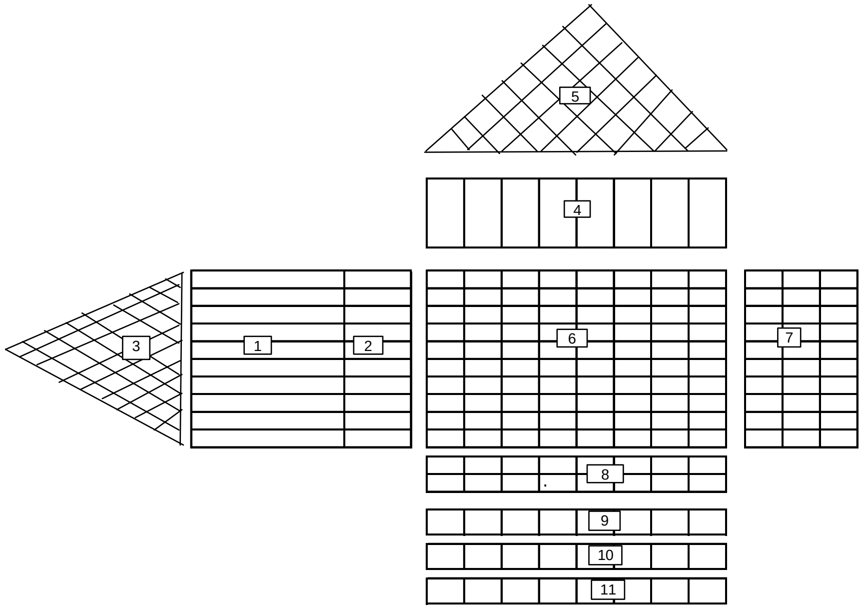

Figure 1: QFD matrix adapted from Kamara et al 1999

The approach follows a series of general steps which are as follows

1. Identify the attributes of a project that are critical to the key stakeholders.
2. What procurement arrangement design parameters are important in achieving the stakeholders critical project attributes
3. What should the procurement design parameter targets be for the project?

The methodology adopted was to identify groups of critical procurement criteria, these were drawn from previous work of Singh (1990), Hibberd ((1991) and Love et al (1998) and the main headings were;

Speed
- Design
- Construction

Certainty
- Price
- Cash flow

Flexibility
- Design changes
- Construction changes

Quality level
- Confidence in supply chain ability
- Aesthetics
- Design quality

Complexity
- Organisational requirements

Responsibility
- Programme
- Product quality
- Design

Construction

Price competition

Value for money

Maintenance costs

Competitive tendering

Dispute Management

5. A case study.

A case study was used to investigate the application of the QFD approach. The private client gave permission for a live project to be used as an exemplar for application of the QFD approach by post graduate students at Liverpool John Moores University. The project was at feasibility stage and was a proposed four storey combined retail and leisure development in Liverpool City Centre.

A number of structured interviews were carried out with project stakeholders which included the client, architect, planning officer and quantity surveyor. The aims of these interviews were to develop an understanding of the stakeholder's priorities. Although the approach of pair wise comparison using a criteria matrix approach would normally be used to allow stakeholders to develop a relative weighting for the priorities it was not done it this case as the interviews were carried out individually.

The primary critical procurement attributes are shown on the table 3 below;

Table 3: Primary and secondary critical procurement attributes

Critical procurement attributes	
Primary	**Secondary**
Speed	Pre design
	Design
	Construction
Certainty	Initial price
	Change price
	Cash flow
Flexibility	Design changes
	Construction changes
	Organisational changes
Responsibility	Programme
	Product quality
	Design

The client's priorities were ranked on a scale of 1 to 5, these are entered into the matrix. The rating of three is given for a normal priority. The stakeholders were encouraged to test the robustness of their prioritisation by considering the inter relationship between the project criteria. This was done by identifying those that were strong positive (9), positive (3), negative (-1) and strong negative (-3). This is shown on the matrix in figure 1 below.

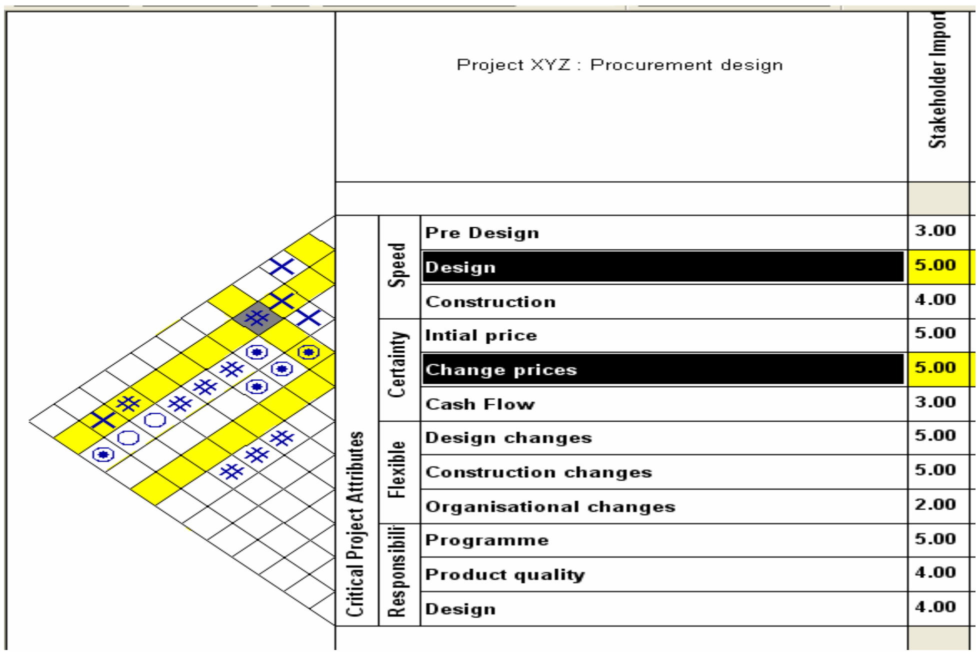

Figure 2: Primary and secondary critical project attributes, the relative ranking and an estimation of their inter relationship.

Targets for the critical project attributes of speed, cost and quality where derived from Industry standard models for time prediction (BCIS, 2002) and cost prediction (BCIS, on line cost data base)

Phase two was more problematic as there is little consensus on project procurement performance attributes and as identified earlier, the stages of identification involved generating primary and secondary performance attributes.

The Table 4 below indicates the primary and secondary procurement performance attributes that were developed through discussion.

Table 4: Primary and secondary procurement performance attributes

Procurement performance attributes	
Primary	**Secondary**
Organisational	Integrated design team
	Specificity of the design organisation
	Specificity of the construction organisation
	Production Economics derived through competition
Capability	Design control
	Design cost control
	Construction cost control
Information	Performance measurement
	Availability
	Comparability

The interrelationship between these attributes was considered and mapped onto the top part of the matrix. The performance attributes are an area where there is a paucity of information. Too many positive interactions suggested potential redundancy in "the critical few" product requirements or technical characteristics. By focusing on the negative interactions it allowed a discussion of the tradeoff's that could be considered in establishing target values

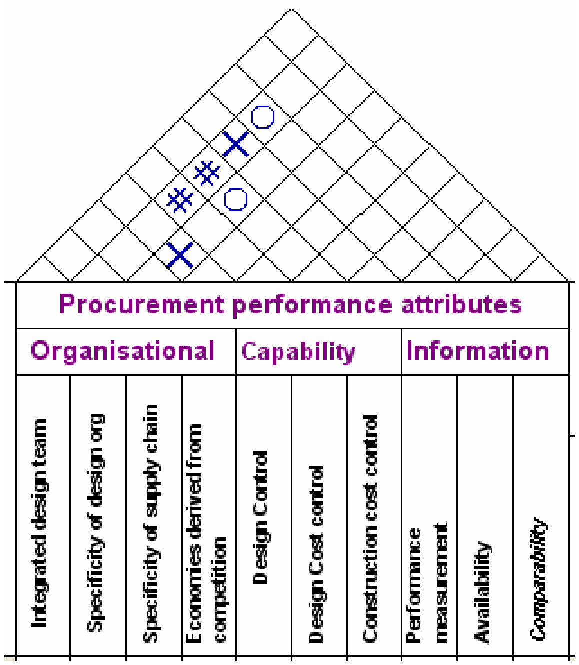

Figure 3: Procurement performance attributes

The next stage of the process was to define preliminary performance targets for the procurement performance attributes, these were difficult to carry out and a data dictionary was considered to ensure the terms were captured and defined accurately. Examples were developed and are indicated in the Table 5 below.

Table 5 Procurement performance attributes

Primary performance attribute	**Secondary performance attribute**	**Target**
Organisational	Integrated design team	50% of design measured by value to be carried out by clients designer
	Specificity of design team	Conceptual design novated by Client
	Specificity of supply chain	Key design work packages to be secured before main contract let.
	Economics derived through competition	Main contract derived through two stage competition, requirement for procurement of supply chain organisations to be transparent
Capability	Design control	Processes defined for scope definition, change control and assessment of impact of change
	Construction cost control	80% of capital cost
Information	Performance measure ment	Time and cost of 80% work packages identified prior to commencement on site. Processes defined to avoid performance ambiguity.
	Availability	80% of price data at unit rate level.
	Comparability	Industry price and performance data available to benchmark performance against.

Finally the relationship between the critical project attributes and the procurement performance attributes were considered. They were assessed using a scale of very strong (9), strong(7), moderately strong(5), mild relationship(3) and weak relationship(10. These were represented using a series of symbols and shown in Figure 4 below.

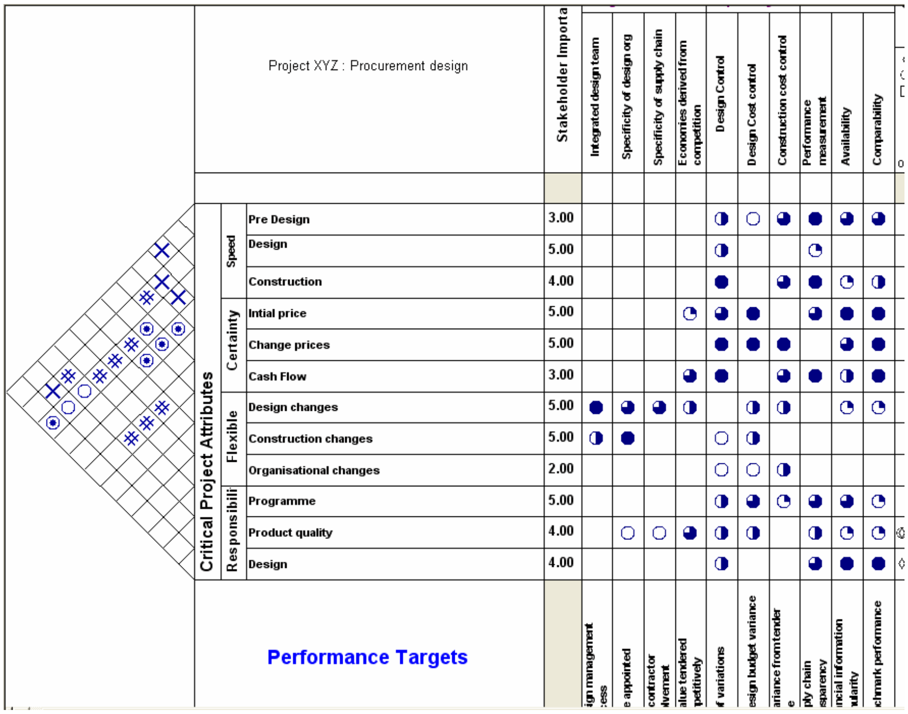

Figure 4 indicating the relationships between the critical project attributes and the procurement performance attributes

In order to support procurement performance attribute prioritisation, the stakeholder weighting multiplied by the level of interaction gave a score; this indicated the critical procurement performance targets that were considered in the procurement arrangement design.

The completed matrix is indicated in Figure 5 below.

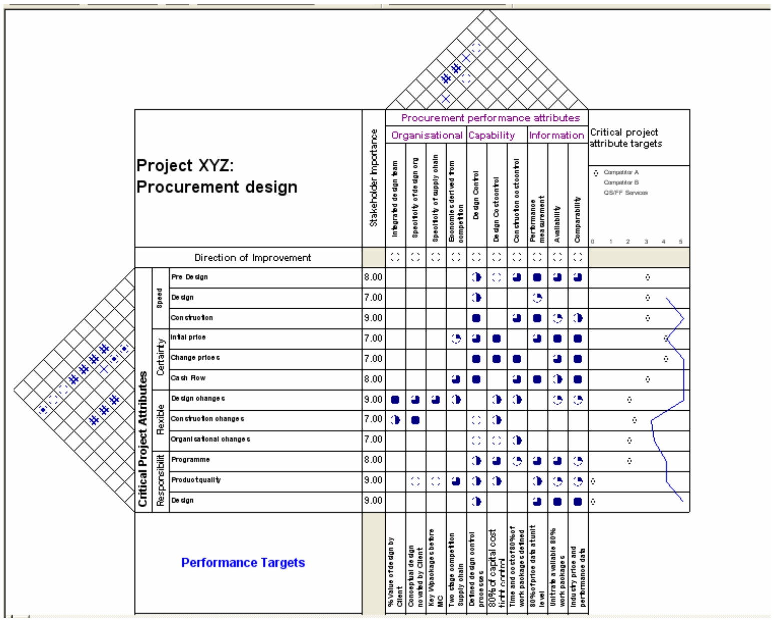

Figure 5 Matrix indicating strength of relationship between the critical project attributes and procurement performance attributes.

Conclusion

The QFD approach was useful in comparing the interaction between critical project attributes; the strong negative relationships indicated areas that required further discussion regarding the achievability of the stated criteria. The target setting for the attributes allowed benchmarking against industry standard models for time and cost. These attributes and their values could usefully form a set of post contract benchmarks that could be used to test the assumptions of causality and strength of relationships between the critical projects attributes and the procurement performance design attributes.

The development of performance attributes for the procurement arrangement was at a high level of abstraction and required further operationalisation in order to be usable to design a procurement system and subsystem to meet the client's requirements. The paper has highlighted a number of important theoretical contributions that could be used however further study is required in order to develop primary and secondary attributes. A shortcoming of the QFD approach is that there is the potential for multiple matrices to be developed for each level of procurement subsystem; further case studies using this approach may help to identify the optimum level of analysis.

The comparison of the relative performance of procurement arrangements in meeting client's requirements is problematic, due to the interdependence of the subsystems and the complexity of the organisational approaches and the lack of knowledge of how procurement systems structure organisational responses. The QFD approach is a method that allows a dialogue to be developed between stakeholders about the interdependence between the project criteria, the relationship with the transactional nature of procurement system and the interrelationship between the procurement performance attributes. Further case studies are required to develop the following stages in the design of procurement processes to establish a set of robust performance measures for procurement subsystems.

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The Role of Procurement in Abetting and Averting Corruption in the Construction Industry

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Abstract: Though most construction disciplines follow some code of ethics that demand honesty and a professional conscience, corrupt practices are still rampant in the industry. The corrupt practices occur at every stage of the construction procurement process. The corrupt practices include bribery, fraud, theft, collusion and negligence. Local conditions and procurement systems seem to shape the form and extent of corruption. The traditional general contractor system, because of its many stages and sequential system, is especially susceptible.

This paper examines, through literature review, linkages between corruption and procurement. It discusses points of prevalence and susceptibility and the role of procurement in abetting and averting corruption. Therefore, in fighting corruption the paper argues, tightening some of the procurement loopholes could assist combat the problem. The paper concludes with recommendations of useful lessons for construction industry stakeholders in developing countries.

Keywords: Bribery, Collusion, Fraud, Negligence, Procurement, Theft.

1. Introduction

While ethical issues have been on the 'radar screens' of most construction stakeholders, corruption has often been an issue not much talked about. This is because for most stakeholders corruption, especially in developing countries, has been viewed as an inevitable if unpleasant part of procurement (Shenkar and Luo, 2004). Corruption in the construction industry has generally been treated like the proverbial 'clouds'; everybody knows where they are but nobody wants to do anything about them. As a result, in many instances, corruption flourishes freely.

1.1 A Definition of Corruption

Corruption defies a simple and precise definition. This is because corruption cannot be understood as a discrete phenomenon. Rather, it must be understood as part of a wider pattern of socio-political behaviour which engenders illegitimate exchange of power into material remuneration (Szeftel, 1998). For it to be termed corruption, the behaviour must deviate significantly from norms, rules and duties governing the exercise of a privileged role or office for private gain, advantage or motive (Szeftel,1998; Shenkar and Luo, 2004). Shenkar and Luo (2004) define corruption as an exchange between two partners which:

a) has an influence on the allocation of resources either immediately or in the future; and

b) involves the use of or abuse of public or collective responsibility for private ends.

In most instances corruption results as people try to circumvent the controls and regulations and take advantage of the loopholes inherent in their operating environments. Thus, the World Bank Sanctions Committee define corruption as the offering, giving, receiving or soliciting of anything of value to influence the action of an official in the procurement or selection process or in contract execution (WorldBank, 2003).

It follows therefore, that if actions of officials in the procurement process can be influenced or 'corrupted' then there must be loopholes inherent in the procurement process which abet corruption (Fleddermann, 1999; Humphreys, 1999; Sigcau, 2000; Zhuwakinyu, 2003). Survey findings in a South African pilot study on professional ethics show that collusive tendering, bribery, professional negligence, fraud and unfair conduct are the main forms of corrupt practices (Harms, 1990; Sangweni and Balia, 1999; Pearl *et al.*, 2005). According to Pearl *et al*, (2005) the forms of bribery and nature of negligence experienced in the South African construction industry are as shown in Tables 1 and 2.

Table 1: Form of bribery experienced

Bribery	Construction Manager	Architect	Consulting Engineer	Quantity Surveyor	Total
Payments	2	4	2	5	13
Gifts	3	2	4	6	15
Trips	1	2	2	3	8
Other	-	1	1	1	3
Total	6	9	9	15	39

Source: Pearl *et al.,* 2005

Table 2: Form of negligence experienced

Negligence	Construction Manager	Architect	Consulting Engineer	Quantity Surveyor	Total
Poor material quality	4	7	3	6	20
Poor workmanship	1	12	5	11	29
Inadequate safety standards	5	9	3	4	21
Bad documentation	3	10	2	9	23
Other	1	3	2	1	7
Total	14	41	15	31	101

Source: Pearl *et al.,* 2005

2. Procurement

Procurement is a series of activities which need to be performed to acquire or deliver an item, material or service to a user. Procurement activity results in the acquisition of goods or services at the best possible total cost of ownership, in the right quantity and quality, at the right time, and at the right place for the direct benefit or use of governments, corporations or individuals generally via but not limited to a contract (Fellows *et al*., 2002; Watermeyer, 2004a). Thus, the construction procurement process creates, manages, and fulfils contracts relating to the provision of supplies, services, or engineering and construction works (Watermeyer, 2004a, 2004b; Evenett and Hoekman, 2002, 2005a, 2005b).

The procurement process may involve a bidding process in which the best fit price bidder who is also deemed competent to provide the product or service is selected as a winner. The standard procurement lifecycle in modern businesses usually consists of seven steps:

a) information gathering – searching for suppliers who can satisfy the requirements;
b) supplier contact – requests for bids/quotes/proposals/information;
c) background review – references for product/service quality are consulted
d) negotiation - negotiations are undertaken, price availability and customisation possibilities are established,
   - a contract to acquire products or services is completed;
e) fulfilment – delivery and payment for the product or service are completed based on the contract terms;
f) consumption, maintenance and disposal – evaluation of the performance of the product or service and accompanying service support;
g) renewal – contract expires/product/service reordered; experience with product or service reviewed.

Construction procurement is an important activity within infrastructure delivery processes. Construction procurement occurs at any point in the delivery process where resources external to the client are required. Therefore, construction delivery must be managed to ensure quality, cost, efficiency and public health and safety. To ensure this outcome over the usually lengthy delivery process payment is phased (CIDB, 2003).

At each of the stages, especially in the traditional general contractor procurement system, the process is open to abuse and corruption.

3. Role of Procurement in Abetting Corruption

There are many features of the construction project procurement process that make it especially susceptible to corruption. First, the nature of construction projects where contracts tend to be huge and yet the companies with financial and technical capability to implement them are few. Second, the traditional general contractor procurement process, which is the most commonly used method in developing countries, has many stages at each of which the potential for corrupt practices is high (Robb, 1996a, 1996b).

According to Robb (1996a, 1996b) and Goldstock (1990) it can be seen that corruption flourishes at each of the following stages:

***At Inception and Feasibility (Technical, Economic and Environmental) Stage*:** Falsification of cost, time and return on investment estimates; invalid requests for proposals.

At Planning and Organisation Stage**:** manipulation of design, specification of overly sophisticated design, inflation of resources and time requirement, obtaining quotations solely for the purposes of price comparison.

At Prequalification and Tender Stage: bid rigging; low-balling; price fixing, bribery to obtain main contract award; bribery to obtain subcontract contract award, fake declaration of capability, corruptly negotiated contract, and submission of false quotations.

At Implementation and Execution Stage**:** Padding of expense accounts; use of substandard materials; compromising health and safety, concealment of financial status, supply of less equipment, false work certificates, excessive repair work, inflated claims for variations, issue of false delay certificates, false extension of time application, false assurance that payment will be made, delayed issue of payment certificates, concealing defects.

At Closing Phase**:** Compromising final accounts; compromising employee reassignment; covering up project failure.

Corruption in construction procurement takes a variety of forms, each of which may be a by-product of combinations of factors. Local conditions seem to shape the form and extent (Clapham, 1985; Shenkar and Luo, 2004).

The conditions engendering corruption in construction procurement include:

a) lack of adequate legal framework and weak enforcement in developing economies:
   - some developing economies lack controls, processes and institutions required for economic and social change (Transparency International, 2006);
   - there is inefficiency, ineffectiveness and abuse of procurement as a result of inadequate legislative framework (Strombom, 1998).

b) High level and scope of government involvement in economic activity:
   - Where government involvement in economic activity is high but public pay is low corruption is viewed as legitimate remuneration (Shenkar and Luo, 2004).

c) Lack of transparency:
   - Lack of public disclosure of financial information is associated higher corruption levels ((Shenkar and Luo, 2004).

d) Culture:
   - Culture e.g. high uncertainty avoidance and high masculinity have been correlated with unethical decision making and high power distance, i.e. the cultural profile of a corrupt country is high uncertainty avoidance, high masculinity and high power distance. This profile implies that corruption is associated with high uncertainty avoidance because corruption is an uncertainty reductionist mechanism. It is high on masculinity because masculinity implies preference for material things. It is also high on power distance because it is associated with paternalism, a system where superiors grant favours to subordinates in return for loyalty, permitting arbitrary judgement and hence corruption (Clapham, 1982; Shenkar and Luo, 2004).

It can be seen from the foregoing that some of the corrupt practices are fostered by the nature of the construction procurement process. Therefore, in fighting corruption, it could be argued that tightening some of the procurement loopholes could assist in combating the problem. The following section deals with the role of procurement in averting corruption.

4. The Role of Procurement in Averting Corruption

The characteristics of a good procurement system are that it should be able to deliver goods or services economically and efficiently. To achieve this, Transparency International (2006) suggests, procurement systems should entail that:

a) contracting opportunities are widely publicised;
b) awards are made to those who meet the contractual requirement and make best offers;
c) the rules are clear and fair;
d) the process is transparent with predictable results; and
e) public officials are accountable.

In order for the procurement process to achieve the above mentioned characteristics, posits Transparency International (2006), the competitive and bidding process should adhere to the following best practice principles:

a) give public notification of bidding opportunities;
b) documents should be clear;
c) documents should clearly:
    - set out the needs;
    - describe the bidding process and contract terms and conditions; and
    - give criteria for choosing the winner.
d) secretly sealed bids submitted should be opened in the presence of the bidders at a specified time and place;
e) impartial evaluation and comparison of bids by competent evaluators without influence of or interference by bidders or other parties;
f) award of contract to bidder complying with all requirements and offering the best bid defined by the published selection criteria;
g) establish sound procurement codes that require open bidding and tenders to act as a preventative on corruption;
h) requirement for third party monitoring of large procurements; and
i) requirement for sound independent audits of procurement processes.

Recently the UK Anti Corruption Forum called on all those with interests in the infrastructure, construction and engineering sectors to take effective and co-ordinated action to reduce corruption (ACF, 2006). The Forum recommends preventive and enforcement actions including increasing awareness of corruption and its consequences through publicity and training; improved international co-operation; the adoption and enforcement by organisations of anti-corruption codes of conduct and management systems; fair, reasonable, objective and transparent procurement and project management procedures; the introduction of effective anti-corruption monitoring and reporting procedures on projects; and fair and effective prosecution and blacklisting procedures (ACF, 2006).

5. Effects and/or Impact on the Construction Process

Corruption, whether incidental, systematic or systemic and whether endemic or planned is profoundly damaging to the political, social and economic well being of a country. Corruption impacts negatively on the construction industry's capacity to address development imperatives (Vee and Skitmore, 2003)`. Corruption, Szeftel (1998) argues, alters the character of institutional performance in the context of administrative efficiency. Moreover, it undermines managerial efficiency. Further, Szeftel (1998) points out that the redirection of resources from global policies to individual interests creates serious problems of management.

A major implication of corruption is that it dramatically increases the cost of construction by undermining competition. Goldstock (1990) points out that corruption on residential projects means less middle and low income housing. Corruption on industrial and commercial projects means higher commercial rents, and therefore, higher costs of goods and services. Ultimately the high cost of construction makes investment in building unattractive. Transparency International (2005) argues that corruption may result in losses and reputational risk for the project owner whilst simultaneously exposing other parties to significant disadvantages such as fines, blacklisting and criminal prosecutions.

Corruption affects health and welfare when it compromises the quality of construction i.e. when buildings fail to meet safety requirements and specifications due to fraud in building materials and workmanship or to bribery of public inspectors.

The bottom line of corrupt practices – collusion, money laundering, price fixing and kickbacks in the construction industry is that construction costs increase and owners and tenants are footing the bill (Farren, 2003).

Fluor Corporation's Alan Boeckmann summarises the effects of corruption as having a corrosive impact on market opportunities and general business climate. It deters investment, curbs economic growth and sustainable development, distorts prices and undermines legal and judicial systems (Boeckmann, 2003).

6. Conclusions

Despite the calm façade that the construction industry portrays, there is deep-rooted corruption in the process. Much of the corruption is as a result of the nature of projects and the sequential nature of the construction process itself. Corruption in the construction industry is engaged in by project participants at every level and every phase of the process.

To reduce corruption, this paper contends that it is necessary to resolve the issues making the construction procurement especially susceptible in the first instance and to investigate the issues raised in the section on the role of procurement in averting corruption. The issues raised in Sections 4 and 5 could go a long way in assisting construction industry stakeholders in developing countries combat corruption.

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Tracking a Decade of Procurement Reform in the South African Construction Industry

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Abstract: Since 1994 the South African government has enacted a significant amount of legislation aimed at fulfilling its commitment to the objectives of development and growth emanating from the reconstruction and development programme. The vision has been for a construction industry policy and strategy that promotes economic growth, creates sustainable employment and addresses historic imbalances as it generates new industry capacity for sustainable economic development.

This paper reports on the decade of implementation of procurement reforms to meet the government objectives. It highlights the reforms that took place between 1994 and 2006 and implementation of empowerment protocols in the targeted procurement system. In particular the policy provided for accelerated small and medium enterprise (SME) access to business opportunities through deliberate targeting of affirmable business enterprises.

The paper concludes with recommendations of particularly useful and beneficial lessons that policy developers and construction industry stakeholders could learn from the decade of procurement reform.

Keywords: Affirmable Enterprises, Affirmative Procurement, Procurement Reforms, SMMEs, Social Economic.

1. Introduction

In April 1994, South Africa entered a new stage of non-racial democracy. Following the transition to democracy, the new South African government inherited a well-developed economy characterised by sharp socio-economic inequalities (Gelb, 2003). The advent of democracy created a crisis of expectations among the majority of the previously disadvantaged communities. In an effort to reduce not only socio-economic imbalances but also meet the high expectations among the majority of the population, the government pledged itself to rapid socio-economic development by placing alleviation of poverty and inequality at the centre of its development agenda (ANC, 1994).

To correct the many inherited policies and practices the government embarked on the social and economic transformation of the country. One of the methods that were espoused as having significant potential for socio-economic transformation was procurement reform (Gounden, 2000). Thus between 1994 and 2006 the government has used procurement reform as a method of resolving socio-economic imbalances and addressing problems of unemployment, housing and economic transformation (Watermeyer, 2000). A number of policy documents have thus been developed since 1994 in furtherance of the reform agenda.

This paper reports on development and implementation of procurement reforms to meet the government's objectives of socio economic transformation. In particular the paper highlights the reforms that have taken place between 1994 and 2006 and implementation of empowerment targets and protocols in the targeted procurement system.

2. Procurement Reform: The Highlights

Since 1994, the Department of Public Works has championed a range of initiatives and has co-ordinated the development of a comprehensive construction industry development policy as part of its contribution to the national project of reconstruction, growth and development (CIDB, DPW and CETA 2005). The strategic aim of the construction industry policy is to establish an enabling environment in which the objectives of reconstruction, development and growth are realised in the industry whilst assisting government meet its socio economic objectives (Arrowsmith, 1995). To achieve this aim, the Department of Public Works has moulded programmes to support industry wide transformation including procurement policy and human resource strategies that would increase the participation of the previously disadvantaged people (DPW, 2003).

One such policy developed is affirmative/preferential procurement. The affirmative procurement policy was designed to transform industry practice and to impact on the socio-economic environment. Affirmative procurement, as a lever of change was also expected to achieve improved industry performance and the promotion of standards relating to health and safety, productivity and quality, training, employment practice and environmental protection CIDB, 2004). The concept of preferential procurement in South Africa stems from the constitution of the Republic of South Africa (RSA) Act 108 of 1996. Section 217 (1) of the constitution provides that when an organ of the state in the national, provincial and local government contracts for goods and services it must do so in accordance with a system that is fair, equitable, transparent, competitive and cost effective. Section 217 (2) provides for preferencing policies in the allocation of contracts (South Africa, 1996). This is the fundamental premise that allows the development and application of preferential procurement (targeted procurement in construction).

The use of preferential procurement as an instrument to effect socio-economic change formed one of the central strategies of the reconstruction and development programme (RDP). The RDP was formulated by the RSA government as a social re-engineering policy aimed at socio economic change (ANC, 1994).

2.1 Reconstruction and Development Programme

The Reconstruction and Development Programme (RDP) provided an overarching policy for sustainable development, which sought to transform South African society. RDP was expected to engineer growth, through increased public expenditures on social service provision. The RDP put emphasis on programmes to meet basic needs and enhance human resource development (ANC, 1994). It also placed a major emphasis on social infrastructure and development programmes that address poverty and inequality. The goals of the RDP included:

- The creation of 2.5 million jobs over a ten-year period;
- The building of one million houses by the year 2000;

- The connection to the national electricity grid of 2.5 million homes by 2000;
- The provision of running water and sewerage to one million households; and
- The encouragement of massive infrastructural improvements through public works.

The above provisions of the RDP were enshrined in the 1995 RDP White Paper.

2.2 The White Paper on the Reconstruction and Development Programme

The White Paper on the Reconstruction and Development Programme refined the 1994 RDP direction and identified five goals that needed to be addressed in order to achieve socio-economic transformation of South African society (ANC, 1994). The fundamental provisions of the White paper on Reconstruction and Development were as follows:

- To create a strong, dynamic and balanced economy in order to eliminate poverty and meet the basic needs of every South African;
- Develop human resource capacity of all South Africans;
- Ensure that no one suffers racial or gender discrimination in hiring, promotion or training situations;
- Develop a prosperous, balanced regional economy in Southern Africa; and
- Democratise the state and society.

However, there were difficulties in meeting the goals of RDP because of slow economic growth which impacted on elimination of poverty and meeting of basic needs of the population (Gelb, 2003). To resolve the slow economic growth the government had a fundamental rethink of the macro economic policies of the country and introduced a new growth, employment and redistribution strategy (GEAR) (Gelb, 2003).

2.3 Growth Employment and Redistribution Strategy, 1996

The Growth Employment and Redistribution Strategy (GEAR) did not completely depart from the earlier government RDP policy but committed government to accelerating aspects of existing policy, albeit with a very significant compromise to the neo-liberal policy. The GEAR package of policies were designed to achieve high rates of economic growth, expand the private sector, improve output and employment, achieve fiscal reform and encourage trade and investment. Consequently, some of the policies initiated in the RDP were subsequently incorporated in the GEAR strategy which was launched in 1996 (South Africa, 1996; Gelb, 2003). The goals of the GEAR package of policies are:

- a competitive fast-growing economy which creates sufficient jobs for all work-seekers;
- a redistribution of income and opportunities in favour of the poor;
- a society in which sound health, education and other services are available to all; and
- an environment in which homes are secure and places of work are productive.

To ensure that there was clarity in how the new GEAR policies achieved preferential procurement as provided in the constitution the green paper on procurement reform was released.

2.4 The Green Paper on Public Sector Procurement Reform in South Africa, 1997

The fundamental provisions of the green paper on procurement reform were as follows (South Africa, 1997):

- achieving good governance in procurement; and
- achieving the governments socio economic objectives:

  - To make public procurement accessible to all by simplifying the process, and by encouraging fairness and transparency.
  - To encourage greater competition in the public procurement process through the creation of an enabling environment for small, medium and micro enterprises (SMMEs) while retaining quality and standards.
  - To support participation of a broadened range of enterprises with appropriate inland revenue registration and labour practices in order to ensure sustainability.
  - To revise the concept of value-for-money in the procurement process in terms of the new objectives to be applied.
  - To set out targeting policies in order to create opportunities for the broadest possible participation in the public procurement process.
  - To increase the volume of work available to the poor and enhance the income generation of marginalised sectors of society.

The green paper on public sector procurement highlighted the major impact that public sector procurement has on the South African economy, through both consumption and investment spending. It expressed government's intention of using public sector procurement to realise broader development goals (South Africa, 1997). In the green paper, the government also indicated the need to develop an effective and efficient procurement system in order to deliver the quality and quantity of services required in accordance with RDP principles (South Africa, 1997).

To formalise the recommendations of the green paper on public procurement reform with regard to socio economic objectives the Preferential Procurement Policy Framework Act was enacted.

2.5 Preferential Procurement Policy Framework Act 2000

The Preferential Procurement Policy Framework (PPPF) Act 2000 was intended to form the basis through which affirmative action would be implemented. The aim of the act is to provide socio-economic opportunities to enterprises and individuals who either historically or otherwise had been unfairly excluded from equitable participation in the socio-economic life of the country (South Africa, 2000).

The PPPF Act 2000 provides for the creation of categories of preference in the allocation of contracts, and the protection or advancement of persons, or categories or persons, disadvantaged by unfair discrimination. It is one of the government's practical initiatives to stimulate access to the market by historically disadvantaged enterprises (CIDB, 2004).

Public sector procurement interventions while simultaneously enabling government to realise some of its broader socio-economic objectives can be used to promote efficiencies within the construction industry as indicated in the White Paper on Construction.

2.6 White Paper on Construction, 1999

The primary vehicle for implementing preferential procurement in the construction industry was through the Department of Public Works (DPW). The DPW was to achieve preferential procurement through the White Paper on construction. In 1999, a White Paper on *Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry* provided guidelines on how the industry might develop the capacity to meet the country's infrastructural needs (DPW, 1999). In the White Paper, the South African governments' policy towards the industry was expressed as '*a construction industry policy and strategy that promotes stability, fosters economic growth and international competitiveness, creates sustainable employment, and addresses historic imbalances as it generates new industry capacity for industry development*' (DPW, 1999). This statement reflects the government's desire and recognition of the strategic role that the construction industry can play in the reconstruction and development of the country.

Preferential procurement was to be incorporated into infrastructure delivery and procurement of goods and services through an innovative tool known as targeted procurement.

3. Targeted Procurement

Targeted procurement enables preferential procurement policies to be implemented in the construction industry. It is usually carried out within conventional construction procurement systems to enable social objectives to be linked to procurement in a fair, transparent, equitable, competitive and cost effective manner and also allows these social objectives to be quantified, measured, verified and audited (Watermeyer, 2000).

Targeted procurement has been developed since 1995 by the South African Procurement Task Team adopted and piloted by the Department of Public Works as from 1996. Its major aim has been promotion of employment and business opportunities for the previously disadvantaged population.

Targeted procurement as an innovative procurement system enables socio-economic components to be specified, monitored and audited within the contractual environment of the public sector procurement set up. It therefore provides a means to address specific development objectives such as creating employment opportunities to marginalized communities (Gounden, 2000; Watermeyer, 2000). Targeted procurement is an effective tool for preferential procurement policies and results in opening up opportunities to emerging enterprises and to deliver socio-economic benefits to the target groups.

In addition, targeted procurement recognises the role of small medium and micro enterprises (SMMEs) in the economy by insisting that the development of small enterprises should form an integral part of the national economy and economic policy. Therefore, South Africa's public sector procurement reform has focussed on SMMEs in the construction sector to redress skewed patterns of business ownership.

To promote improved procurement and reform and develop methods for monitoring and regulating the performance of targeted procurement in the construction industry, among other things, the Construction Industry Development Board (CIDB) was formed.

4. Construction Industry Development Board

The Construction Industry Development Board (CIDB) was established to stimulate sustainable growth, reform and improvement of the construction sector's role in the country's economy (CIDB, 2004). The CIDB was intended to be a catalyst for change and transformation. The CIDB's mandate is to:

- provide strategic leadership;
- promote sustainable growth;
- promote improved procurement and delivery management;
- promote improved performance and best practice; and
- develop systematic methods for monitoring and regulating the performance of the industry and its stakeholders, including the registration of projects and contractors.

One of the aims of the CIDB therefore was to promote socio economic transformation in public procurement (DPW, 2004; CIDB, 2004). Socio economic transformation within the public sector reform programme was to be achieved through the emerging contractor development programme (ECDP).

4.1 The Emerging Contractor Development Programme

The Emerging Contractor Development Programme (ECDP) was designed to provide direct and comprehensive support to small-scale and emerging construction enterprises. An important role of this programme was to influence construction-industry transformation in a manner that purposefully encourages the emergence of small and emerging enterprises (DPW, 2004; CIDB, 2004).

The role of the ECDP is to:

- provide leadership and promote understanding and support of the emerging sector for growth and development programmes;
- develop a shared vision and act as a catalyst for the organisation and marketing of small and emerging construction enterprises;
- canvas the emerging sector and review strategic issues critical to its development, and identify issues requiring policy intervention;
- develop and prioritise programme objectives, targets and performance indicators;
- provide and co-ordinate structured support to emerging businesses and private-sector initiatives which foster the development of the emerging sector;
- advocate the interests of small and emerging enterprises and ensure that policies and procedures in the industry promote an environment conducive to the development of the small and emerging enterprises; and
- monitor performance of these policies through a database of small and emerging construction-related enterprises.

Another strategy used by government in furtherance of the socio economic objectives is the Expanded Public Works Programme (EPWP).

5. The Expanded Public Works Programme

The Expanded Public Works Programme (EPWP) is one of an array of government strategies aimed at addressing unemployment. The programme involves reorienting line function budgets and conditional grants so that government expenditure results in more work opportunities, particularly for unskilled labour. The EPWP programme is expected to draw significant numbers of the unemployed into productive work, so that workers gain skills while they work, and increase their capacity to earn an income. It is expected that the programme will create additional work opportunities for a minimum of one million people (at least 40% women, 30% youth and 2% disabled) in South Africa between 2004 and 2009 (EPWP, 2003) .

It can be seen from the above discussion that since 1994 there have been a number of policy documents that have been developed in furtherance of the government's socio-economic transformation agenda. To encapsulate all the procurement reforms and provide for a single point of reference the government recently enacted a Broad Based Black Economic Empowerment Act (BB BEE Act).

6. Broad Based Black Economic Empowerment Act, 2003

Black economic empowerment is a growth strategy, targeting the South African economy's weakest point: inequality. "Broad-based Black Economic Empowerment (3B 2E)" means the economic empowerment of all black people including women, workers, youth, people with disabilities and people living in rural areas through diverse but integrated socio-economic strategies that include, but are not limited to (South Africa, 2003):

- increasing the number of black people that manage, own and control enterprises and productive assets;
- facilitating ownership and management of enterprises and productive assets by communities, workers, cooperatives and other collective enterprises;
- human resource and skills development;
- achieving equitable representation in all occupational categories and levels in the workforce;
- preferential procurement; and
- investment in enterprises that are owned or managed by black people.

The BB BEE Act is implemented through codes of practice.

6.1 Broad Based Black Economic Empowerment Act (2003) Codes of Practice

The BB BEE Codes of Practice are issued in terms of Section 9 of the Broad Based Black Economic Empowerment Act of 2003, with the aims of:

- transforming South Africa's economy to allow meaningful participation by black people;
- changing the racial profile of companies' owners, managers and skilled professionals;
- increasing the ownership and management of companies by black women, communities, workers, co-operatives and others, and helping them gain access to more economic opportunities;

- promoting investment that leads to broad-based and meaningful participation in the economy by black people;
- helping rural and local communities get access to economic opportunities; and
- promoting access to finance for black economic empowerment.

The Codes of Good Practice provide a standard framework for the measurement of broad-based BEE across all sectors of the economy. This means that no industry will be disadvantaged over another when presenting their BEE credentials. The intention of the Codes of Good Practice is to level the playing field for all by providing clear and comprehensive criteria for the measurement of broad-based BEE. The codes provide a framework for the measurement of BEE, including the generic BEE scorecard, which gives a general weighting to companies' BEE status in terms of ownership, management, employment equity, skills development, preferential procurement, enterprise development and residual elements and guidelines for the development and gazetting of industry charters (South Africa, 2003)..

6.2 Construction Sector Transformation Charter

The Construction Sector Transformation Charter:

- Constitutes a shared approach reflecting targets that are visionary and contain significant stretch to facilitate the rapid transformation of the construction sector, which all sector stakeholders hold, and establishes the principles upon which BB BEE should be implemented in the construction sector;
- Establishes targets and qualitative responsibilities in respect of each principle;
- Lays the basis for the development of a Code of Good Practice for the construction sector, as envisioned in the BB BEE Act; and
- Applies to all stakeholders within the construction sector.

Up to this point the paper has highlighted the legal and socio economic transformation that has taken place in the South African construction industry in furtherance of the government’s desire to achieve economic growth and redistribution of wealth. The next section looks at the challenges and lessons policy developers and construction industry stakeholders.

7. Challenges and Lessons for Construction

The RSA government has since 1994 recognised the need to intervene in the economy in order to contribute to growth and equitable redistribution of resources. This it has done through the enactment of various legislations and policies. Central to this has been the recognition that procurement reform measures can be used as a lever of change through the introduction of the affirmative procurement policy in the construction industry (Gounden and Merrifield, 1994; Gounden, 1997). While government efforts have been commendable, there are binding demand and supply side constraints to the realisation of the socio-economic objectives.

The challenges/constraints include the following;

- Access to entrepreneurial training;
- Access to finance;

- Sureties and credit;
- Lack of cash flow and project management skills;
- Capacity constraints of affirmable small businesses;
- Fiscal constraints inhibiting direct government investment;
- Prohibitive regulatory environment; and
- Slow economic growth.

7.1 Lessons for policy developers and construction industry stakeholders

There are several lessons that policy developers and construction industry stakeholders in South Africa and elsewhere can learn from the tracking of procurement reform in the last decade. Some of the more pertinent lessons include that:

- SMMEs play an important role in providing employment and thus can contribute to poverty alleviation;
- The South African government recognises that socio-economic constraints cannot be resolved through normal market forces and private sector action;
- Government's role in construction is in promotion of an enabling environment for greater private sector participation. This it is doing by development of policies such as affirmative procurement and industry wide procurement policy transformation;
- Through the preferential procurement policy, the government has used public procurement as a tool to meet socio-economic development objectives;
- Public procurement, if used as an instrument of policy can have significant impact on the economy as a whole; and
- Targeted procurement enables social economic objectives to be achieved in a fair, equitable and transparent, competitive and cost effective manner.

8. Conclusion

This paper has highlighted procurement reform that has taken place in South Africa in the last decade. Through the preferential procurement policy, the government has used public procurement as a tool to meet socio-economic development objectives. In addition, through targeted procurement, social economic objectives can be achieved in a fair, equitable, transparent, competitive and cost effective manner. In the main, the paper shows that procurement reform; targeted procurement in this case, can be used to deliver wider social economic goals of a country. However, there are binding social, cultural and economic inequalities that need to be addressed in order to achieve the government's socio-economic objectives. If the constraints relating to poor access to entrepreneurial training, finance, sureties and credit can be resolved then the South African government's desire to achieve economic growth and redistribution of wealth through construction procurement reform could be realised.

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Realising product-service paradigms: towards a foundation for researching 'incentive flowdown'

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Abstract: The EPSRC Grand Challenge research project (KIM) focuses on the paradigm shift from product delivery to through-life service support for complex engineering projects through immortal information and through-life knowledge. In this regard, the importance of incentive flowdown is introduced. A critique of the traditional procurement approaches is presented and the potential benefits of relational contracting are discussed. The implications of the two main metaphysical standpoints namely, "process" and "substance" are presented and the need for a broader and deeper study of the production process and its implications to the product-service paradigm is highlighted. The paper is a result of the on-going literature review and synthesis.

Keywords: Construction, Incentive Flowdown, Process Metaphysics, Production, Product-Service, Relational Contracting

1. Introduction

This paper outlines an intended contribution to Task 3.1 of the EPSRC funded 'Grand Challenge' project, Immortal Information and Through-Life Knowledge Management [(KIM) - http://www.kimproject.org]. KIM involves twelve UK universities, including eight EPSRC funded Innovative Manufacturing Research Centres and spans a number of industries including aerospace and construction. Its aim is to address a perceived shift among engineering and construction companies towards a product-service paradigm and to explore the implications of this for knowledge management. Thus, the project seeks to identify approaches to information and knowledge management that are appropriate to the through-life support of products. The four Work Packages (WPs) and twelve Tasks into which the project is organised address the evaluation, input, storage, access and use of information and knowledge over extended periods of time and across a diversity of organizational, occupational and other knowledge communities. The four Work Packages address, respectively: [WP1] recording design knowledge in a manner which is sustainable throughout the product-service life-cycle; [WP2] the operational systems and knowledge communities in which knowledge is accessed and used; [WP3] the nature and use of knowledge. WP4 is concerned with the integration of the other three.

The approach of WP3 is based upon two key premises. First, on a distinction between knowledge and information which holds that the former is an act or a process, while the latter is an artefact or a thing (Davenport and Prusak, 1997). Second, that knowledge, decision making and learning capacity are intrinsically related concepts which must be considered collectively. The three tasks in WP3 are concerned respectively with: [T3.1] addresses the role of knowledge in the creation of procurement procedures which encourage innovative improvement; [T3.2] focuses upon the learning processes required to support a shift from product delivery to service provision paradigms; [T3.3] seeks to increase the understanding of support for decision-making processes at key points in the product-service life-cycle.

The purpose of this paper is to highlight the need to concentrate on "incentive flowdown" as part of Task 3.1, and to present two main aspects that we believe will have a significant impact on the shaping the future work of this research. Following this introduction, the paper will add more evidence to the need to focus on researching into 'incentive flowdown'. The paper will present the two aspects namely, the impacts of contractual arrangements and the metaphysical standpoints of production, which are expected to influence the direction of the research. The paper concludes with the suggested way forward and future actions of the particular research.

2. Incentive Flowdown

We consider 'incentive flowdown' as the effective cascading of high level (contractual and other) incentives through various layers, to the actual workface incentives, within the business context of firms engaged in long-term provision of complex product/service projects. In this context, the US Department of Defence (2001) provides explicit recognition by stating that the effective application of incentives is key to building successful business arrangements that jointly maximise the value for all parties. Although incentives have been the focus of research for a long time, the premise within the context of this research is the recognition that incentives envisaged at the strategic management level of organisations need to be realised appropriately at the operational levels if the desired results are to be achieved. Apart from the evidence that prompted the formulation of the research proposal, the following can also be cited as reasons for the need to focus on incentive flowdown:

- As part of the SPICE (Structured Process Improvement for Construction Enterprises) research project, SPICE3 research (2002-2004) concentrated on developing a process improvement infrastructure to facilitate organisational-wide process improvement. (Jeong et al, 2004). Organisational level process improvement requires developing and integrating internal and external knowledge-base across all levels of the organisation and across its supply chain. The case studies highlighted the necessity to increase communication and visibility of process improvement activities. Without appropriate feedback to those who are actually engaged in process improvement initiatives, the potential benefits of process improvement would be severely limited (Jeong et al, 2006). Even though organisations are relatively adept at facilitating learning at management level, the absence of clear mechanisms to capture knowledge at operatives' level meant that the lower echelons of the integrated project team became reactive to any change or development within the organisation. The study also provided additional empirical evidence to Haigh's (2004) contention that not all respondents share the same view on effectiveness and efficacy of processes and related initiatives for improvements, and re-affirmed that process improvement at an organisational level is a multi-faceted problem involving a range of stakeholders. (Jeong et al, 2004). Therefore, it became further apparent that process improvement entails not just top-down assessment and change but, more importantly, also collective sense making to share contexts and needs of process improvement, which are deemed to be essential for collective learning at an organisational scale (Dixon, 1999).

- To add to the above findings, Sull and Spinosa (2005) states that "surprisingly, many companies lack the institutionalised processes through which their internal customers can provide feedback when projects are completed" (Sull and Spinosa, 2005, p 80).

- US Dept. of Energy (1998, revised May 2000) provides explicit recognition of the need to ensure incentive flowdown. Incentive flowdown is intended to effectively focus and motivate the contractor's performance in areas where different levels of performance are possible, and the extent to which those levels are attained is within the control of the contractor. The normal practice is to provide incentives to the contractor and leave it to the contractor's discretion as to the extent the incentives are flowed to the managers and employees within the company and to the subcontractors. However, where possible incentives should be flowed to those doing the work.

- Stukes and Apgar (1994**)** states that despite all planning and control activities implemented by the buyer and the prime contractor, Design To Life Cycle Cost (DTLCC) goals could be missed because of the sub contractor commission or omission. Prime contractors need to "flow down" through the subcontracting process suitably tailored requirements and incentives.

In our quest to understand and improve incentive flowdown, the following three (3) research questions / phases are proposed:

Firstly, it is necessary to understand incentives as a phenomenon. In this regard, we need to find out what the current organisational approaches to formulation of incentives are, and what incentives exist within and between organisations? (We recognise the intra- and inter-organisational nature of design, delivery and use of complex product-service engineering paradigm).

Secondly, we will evaluate the effectiveness of the mechanisms (if any) to achieve incentive flowdown.

Thirdly, we will attempt to construct a framework which we can use for achieving successful incentive flowdown.

These will be addressed using an innovative and evolving approach which combines a descriptive research methodology with a generic theory for the development of production improvement solutions. Finally, the contribution aims to integrate with other Universities' initiatives within the project, in a process of collaboration that should ultimately span the whole of the Grand Challenge project.
Prior to researching the above mentioned questions, we would like to present two aspects of complex product-service paradigm, which we believe will have profound impacts on the proposed research. The aspects are outlined as below:
The adversarial nature of procurement arrangements dominated by the traditional contracting has come under immense criticism, and hence the need for further investigation is warranted; and the theoretical shortcomings in the understanding of production especially complex products / services such as construction, calls for a deeper understanding and theorising.
The next two main headings of this paper provide an elaboration of the above.

3. Contractual Arrangements and Their Effects

3.1 Criticisms of the traditional contractual arrangements

Colledge (2005) points out that criticism of the construction industry as a whole in the past has focused on the inability of contracting stakeholders to engage co-operatively in the delivery of the client's objectives and an apparent inability to deliver in time, cost and quality. Colledge further comments "It would appear that adversarial contracting approaches and the pursuit of individual company gain has resulted in a less efficient industry and lower levels of productivity and innovation (see for example Latham, 1993, 1994, Egan; AAA, 1994)" (Colledge, 2005, p32). Matthews and Howell (2005) state that maximising value and minimising waste at the project level is difficult when the contractual structure inhibits coordination, stifles cooperation and innovation, and rewards individual contractors for both reserving good ideas, and optimising their performance at the expense of others.

Many have also pointed out the negative impacts of the traditional contractual approaches. Sakal (2005) commenting on how change is viewed in traditional contracting states "the environment in which construction projects are accomplished today often involves complex, uncertain projects within tight budget and time constraints. In this environment 'change' is a defining characteristic and is inevitable. Unfortunately, most traditional contracts do not embrace change, but instead treat it as an anomaly by trying to specify every possible contingency and assign liability in the event of change occurs" (Sakal, 2005, p 67). Holding back good ideas, limiting cooperation and innovation, coordination difficulties and the pressure for local optimisation are some of the major systemic problems with the traditional contracting approach (Matthews and Howell, 2005). Commenting on the through-life impacts of traditional contracting Cullen et al (2005) state that traditional procurement has focused primarily on the initial cost of acquisition and the technical specification of the product to be delivered. Once acquired the product then has to be supported, often under complex contractual arrangements derived from the original procurement. Typically, there was no attempt to asses and minimise the overall life-cycle costs of the acquisition, making the procurement process both costly and inefficient. They also express doubt on the widely claimed benefits arising out of competition. "It can also be argued that some aspects of the traditional approach to competitive tendering and contracting can actually add waste to the process. The traditional approach can result in multiple sources of supply which clearly duplicates resources and erodes economies of scale" (Cullen et al, 2005, p 91).

Many have also commented on the heavy dominance of litigation associated with traditional contracting and its negative consequences. Campbell and Harris (2005) state that a substantial body of empirical and theoretical literature now exists which purports to show that the explanation of long-term contracts by means of the classical law of contract is most problematic. The classical law, and its economic corollary in relatively unsophisticated forms of neo-classical economics, assume contractual promises to be the legal expression of intentions of rational, utility maximising individuals making discrete exchanges in perfectly competitive markets. Sakal highlights "Another problematic issue with using traditional contracts for dynamic projects is that instead of focusing on maximising project outcomes and creating a good framework for developing a collaborative environment between the parties involved, they are generally legal shields, written in a biased manner to protect the drafter" (Sakal, 2005, p 68). Ashworth (2006) quotes that there are many individuals within the construction industry who will, at some time in their careers, become professionally involved in either arbitration or adjudication.

The following table provides a comparison of the economic models and the features of the resulting governance structures in this regard.

Table 1: Economic Models and governance structures (Colledge, 2005, p 33)

ECONOMIC MODEL	GOVERNANCE STRUCTURE	FEATURES
Markets	Classical Contracting	• Reliance on the market; discrete transaction • Adherence to legal frameworks • Use of legal remedies • Standardised contract planning
Networks	Neo-Classical Contracting	• Longer-term relationship begins to assume more importance • Development of relational tendencies • Contract provisions cater for flexibility
Hierarchies	Relational Contracting	• The commercial relationship assumes equal or greater importance compared to the legal agreement • Significant sharing of benefits and burdens • Greater independence • Bilateral governance (e.g. Strategic Alliance, Partnering) • Unified governance (e.g. Joint Ventures, Mergers)

3.2 Relational contracting

Colledge (2005) introduces relational contracting as a transaction or contracting mechanism that seeks to give explicit recognition to the commercial 'relationship' between the parties to the contract. In essence, responsibilities and benefits of the contract are apportioned fairly and transparently, with mechanisms for delivery that focus on trust and relationship. At a project level in construction, this can improve working relationships between all project stakeholders, can facilitate efficient and effective construction, can enhance financial returns and can minimise the incidence and make easier the resolution of conflicts.

Cullen et al (2005) state that the notion of relational contracting was coined by Macneil (1974a; 1974b) following the pioneering empirical study by Macaulay (1963). Macneil suggested that when parties expect to work together again in the future, they approach and manage their current transactions in such a manner in which they perceive their relationships might proceed. In expanding his theme Macneil (1978a, 1981) suggested that peoples' behaviour and the social context in which they function influences the outcome of the transaction. Cullen et al also (2005) state that Macneil perceives that contractual relations resemble small, nuclear societies, with their own internal system of evolving norms. Campbell (2004) presents an elaborated guide to the work of Ian Macneil's work on relational contracting. Cullen et al (2005) commenting on a comparison among construction, aerospace and defence sectors point out that for all three sectors studied, the form of contract heavily influenced the parties' relations, from the *ex ante* to *ex post* phases of the transaction.

Cullen et al (2005) also state that Macneil (1974a; 1974b; 1978) proposes that contracts are complex bundle of relations that evolve from informal norms that include the:

- Relationship between competition and co-operation;
- Implementation of planning;
- Preservation of the relationship;
- Parties' reputation;
- Interdependence;
- Morality and altruism;
- Shared benefits and burdens;
- Problems anticipated as a matter of course;
- Adjustments to accommodated changes in circumstances; and
- Ongoing, flexible relations.

Colledge (2005) states that the shift towards more relational contracting relationships has been evident in the increase of project partnering agreements as a tool, together with the development of construction process relational tools such as project team goals, meetings and reviews. More importantly, Colledge identifies the development of team-based incentives or reward mechanisms are often a feature of relational contracts placing value on successful outcome rather than in cost, or quality reduction by one of the parties.

The potential of relational contracting to add value beyond the project is also a noteworthy feature. Colledge (2005) states that the benefits such as the relationships between the parties in the in the longer term, can lead to construction industry productivity and profitability. Also highlighted are the benefits to the wider community. "Less well disseminated is the value that relational contracting can create or the wider community or the society. The adoption of relational contracting approaches can make a significant contribution to the development of social capital, and the four pillars of sustainable communities, for those of connectedness, citizenship, creative citizens and competitiveness" (Colledge, 2005, p 30). Taking the discussion further Nahapiet and Ghoshal (2005) point out that "under certain conditions the social capital embedded in individual relationships can lead to significant increases in the knowledge base or the intellectual capital of the firm, in ways that are unlikely to happen in a market-based system of exchange" (Nahapiet and Ghoshal, 2005, p251).

Colledge (2005) also states that the value of relational contracting derives from the way in which strong commercial relationships are developed and sustained for the mutual benefit of all parties. Whilst often related to specific projects or transactions, relational contracting has parallels with the concept of connectedness or the development of social capital (Putnam, 2000). Accordingly, fostering the defining features of social capital being trust, shared norms and networks, can lead to the creation of collaborative environments that are required for incentivsation as perceived in this research.

4. Conceptual Standpoints of Production and The Resulting Impact

Auramo and Ala-Risku (2005) observe that manufacturing companies are increasingly offering services related to the products that they supply and building capabilities to exploit better the installed base. This downstream move requires new skills to understand and manage the demand and supply networks of industrial services. However, using empirical data they point out that, although companies are providing industrial services, many aspects related to the supply and demand of the services are still poorly understood. Hence, this highlights the need for a better understanding of the production process, especially in the product-service context.

Although production is intrinsically a process oriented endeavour, Koskela and Kagioglou (2005) argue that a closer scrutiny of current conceptualisation and methods shows that it is the "thing-oriented" view on the world that has dominated the research and practice of production management, as opposed to the "process-oriented" view of the world. The resulting mismatch between the assumed nature and true nature of production has arguably led to major generic failures of production management, hence the need to seriously address the metaphysical issues confronting both practitioners and scholars has been highlighted.

Koskela and Kagioglou (2005) quoting Roochnik (2004) state that since the pre-Socratic period of philosophy, there have been two basic metaphysical views, one holds the view that there are substances or things, that is, atemporal entities in the world. The other insists that there are processes, that is, intrinsically temporal phenomena. They state that these metaphysical assumptions tend to strongly influence how the subject of inquiry or action is conceptualized. The thing-oriented view seems to lead to analytical decomposition, the requirement or assumption of certainty and an ahistorical approach. The process-oriented view is related to a holistic orientation, acknowledgement of uncertainty and to a historical and contextual approach.

Koskela and Kagioglou (2005) point out that the general direction of research, underpinned by substance metaphysics, is in going into even smaller parts of the whole and searching explanations at the lowest possible level. The basic direction of research, in the spirit of the process metaphysics, is to look for the context, the larger processes where the context, the larger process where the unit of consideration is part and, and to search for explanations at that level. Another consideration is that phenomena are not necessarily universal, but rather attached to specific time and space. Table 2 and Table 3 below indicate the implications of the 'substance' and 'process' dichotomy towards some of the conceptual underpinnings.

Table 2: Pairs of concepts based on substance / process dichotomy
(Koskela and Kagioglou, 2005, p 39)

Concepts related to substance metaphysics	**Concepts related to process metaphysics**
being	becoming
product, outcome	Process
state	behaviour
reductionism	holism
mechanistic	organistic
structure	agency
atomicity	continuity
noun	verb

Table 3: Pairs of alternative knowledge domains, based on substance/process dichotomy
(Koskela and Kagioglou, 2005, p 39)

Knowledge domains related to substance metaphysics	**Knowledge domains related to process metaphysics**
roman law	common law
contract	relation(al contract)
planned strategy	emergent strategy
rational decision making	cohenrentist decision making
knowledge as a thing	knowledge as a relation
action as plan realisation (push)	action as response to context (pull)
learning organisation	organisational learning

Elaborating the deeper impacts of the metaphysical standpoints on the conceptualising production, Koskela and Kagioglou (2005) state that although the conventional view of production considers production management as transformation (and hence related to change and becoming), a closer examination of the current views indicate that that transformation is considered as input and output. In this context, both input and output are usually understood as things or matter, and the transformation itself is considered as a black box. Combined with the idea of decomposition, this view has dominated the current practice with examples such as work breakdown structures (WBS) as accepted practice. However, such approaches have been criticised for providing weak project management tools (Ballard, 2000). To add to this, Koskela and Kagioglou (2006) argue that management thinking based on 'thing metaphysics' hinder learning, understanding and implementation of process based correctives. This can also be seen as an instance of the wider call for a good theory of management (Ghoshal and Morgan, 2005).

Koskela and Kagioglou (2005) also point out that a key consideration in production is the issue of time. Process metaphysics at its core considers that time invariantly exists, regardless of what we do, in an endless continuum (Rescher, 2000), Hence, they propose the conceptualisation of production as a process which is not the sum of activities but a continuum where the product (in its broad sense) change states, which are defined by human expectation, ability and technological capability. By conceptualising production in such a way, the focus is not only on the activity, but also on the interactions between activities, people and technology which form a pattern that is governed by a multitude of factors.

At the operational end of the above discussion, Labovitz and Rosansky (1997) provide supporting evidence. Recognising the importance of alignment between people, customers, strategy and processes to develop a shared culture and processes, they point out that alignment can be thought as both a noun and a verb – a state of being and a set of actions. As a noun it refers to the integration of key systems and processes and responses to changes in the external environment. But no organisation can stay in a state of alignment for long, since almost every business lives in an environment of constant change. However, they highlight that the real power of alignment comes when we review it as a set of actions – as a verb. These actions represent the new management competence, a necessary skill set that will enable managers to:

- Connect their employees' behaviour to the mission of the company, turning intentions into actions;
- Link teams and processes to the changing needs of customers;
- Shape business strategy with real-time information from customers; and
- Create a culture in which these elements all work together seamlessly.

4. Towards a Framework for Researching 'Incentive Flowdown'

Achieving incentive flowdown requires the consideration of principles related to production as well as procurement, of complex product-service assets. Based on the issues highlighted in this paper, it can be contended that conceptual underpinnings related to procurement / contracting, and production, forms two main pillars of the intended research. From the literature quoted in the above sections, it appears that the use of "process-oriented view" as a basis for understanding the overall production (product-service), and the "use of relational contracting" as a conceptual basis for the commercial integration of supply chain, may lead to the formulation of a strong basis for the conditions needed to achieve a collaborative environment. However, how this occurs in practice and also how it leads to achieving incentive flowdown, requires further research, in both conceptual and empirical forms.

The immediate future actions of this research, includes further developing the understanding of the nature of procurement and production surrounding product-service paradigm, and identifying an appropriate basis for mapping incentives (both top/down and through-life). Furthermore, the link between commercial incentivisation and decision making [T3.3 of the KIM project] will be further examined for close collaboration and coherent conceptualization.

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Contractor Selection for Performance-Based Maintenance Partnerships

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Abstract: Dutch housing associations use new procurement methods such as performance-based maintenance partnerships for maintaining their housing stock. Such partnerships promise a range of advantages as compared to the traditional tendering of maintenance projects. For contractors a performance-based approach implies major changes in methods and work processes. A major change within this performance-based approach is that, the contractor acts as a maintenance-engineering consultant to the client. This requires new activities to be considered, such as providing advice on maintenance strategies, the design of maintenance scenarios, performance measurements and conducting customer satisfaction surveys. The execution of these activities demands additional capabilities from the contractor.

This paper focuses on contractor selection and quality assurance for performance-based maintenance projects and partnerships. It highlights engineering-consultancy services that are delivered to enable design-build combinations in maintenance. The research explores the resources and capabilities that maintenance contractors need to enable them to act as maintenance-engineering consultants to housing associations in performance-based maintenance partnering. It also explores the way that housing associations can be assured of these resources and capabilities. The central case is VGO KEUR, which means Quality Mark for Real Estate Maintenance and is a newly developed independent quality mark for maintenance firms.

Keywords: Contractor Selection, Maintenance, Partnering, Performance-Based Procurement, Quality Assurance

1. Introduction

Dutch housing associations are not-for-profit organisations, that are obliged to operate in the interest of housing, by providing the lower income households decent and affordable housing. They account for approximately 99% of the entire social rented housing stock. In 2004, 508 Dutch housing associations owned more than 2.4 millions of the rented dwellings (Centraal Fonds Volkshuisvesting, 2004). This means that social rented housing sector account for 37 percent of the total housing stock, and 75 percent of the total rented stock.

In the 1990s, the Dutch national government has granted housing associations considerable freedom of policy but at the same time diminished its financial support. Since then the world of housing associations has been engulfed with many mergers. The number of housing associations declined from 824 in 1990 to 701 in 2000. Concurrently housing associations began to adopt business-like approaches in their housing management. They became more market-driven and client-driven (Gruis and Nieboer, 2004). They chose to re-focus on their core business, and many now regard maintenance as a secondary process for which outsourcing, provided it is organised responsibly, is preferable.

The professionalism of housing associations has led to a noticeably greater attention towards new maintenance processes and partnership forms in the procurement of maintenance. The growth in the size of the properties for which an individual housing association is responsible was an important factor in considering the adoption of performance-based maintenance contracting. Nowadays some larger associations manage as many as 40,000 dwellings, which makes it essential for them to explore alternatives that enable maintenance processes to be managed more efficiently and effectively.

1.1 Contractor selection and quality assurance

Performance-based maintenance partnering is concerned with the dyadic relationships between the housing association and its key maintenance contractors. For performance-based partnerships to be successful, the selection of maintenance contractors is extremely important. Traditionally, the responsibility for procuring maintenance work rested on the staff of a technical department of a housing association, i.e. the maintenance project managers. Partnering involves that the choice of maintenance contractors is made at a key level in the organisation, e.g. a central procurement department.

For housing associations that want to adopt performance-based approach in the maintenance of their buildings, quality control of contractors' processes is valuable and helps in making a decision of whether to enter into a partnership with a contractor or not. Quality assurance means keeping up the methods and procedures of quality control, i.e. systematically checking that they are efficient, that they lead to the desired objectives, and that they are applied in a correct way (Van Weele, 2002). Quality assurance of maintenance contractors processes, therefore, provides valuable insights into the availability of the resources and capabilities required delivering satisfying maintenance work and high quality consultancy-services to their clients

1.2 Research question

The paper focuses on contractor selection and quality assurance for performance-based maintenance projects and partnerships. It highlights engineering-consultancy services that are delivered to enable design-build combinations in maintenance. In this paper performance-based maintenance is concerned with planned preventive maintenance (i.e. condition-based maintenance) of the building envelope.
The research question is: What resources and capabilities do maintenance contractors need to enable them to act as maintenance-engineering consultants to housing associations in performance-based maintenance partnering, and in what way can housing associations be assured of these resources and capabilities?

A literature study and interviews with directors of maintenance firms as well as purchasers and technical managers of housings associations gave data about the current selection processes of maintenance contractors and the need for maintenance contractors acting as maintenance engineering consultants. Data on quality assurance of maintenance contractors is derived from an extensive literature analysis. The central case is VGO KEUR, which means Quality Mark for Real Estate Maintenance and is a newly developed independent quality mark for maintenance firms (Stichting Certificatie Technisch Vastgoedbeheer, 2005). For a major part the approval system consists of the verification of the competences that are required to execute performance-based maintenance. This paper includes the assessment of opportunities that the VGO KEUR offers. The quality mark was introduced not until recently. In the future outcome measurements will provide empirical results.

2. Selection of maintenance contractors

Dutch housing associations procure the majority of maintenance projects by selective tendering, i.e. inviting, three to five competitive bids and choosing the lowest one. Direct one-to-one-contracts based on unit prices or full cost reimbursement contracts as well as regular contracts are also often used (Vijverberg, 2004). Because European legislation for public tendering is not mandatory for Dutch housing associations, this type of tendering is rarely used. The actual tender is usually awarded to well-known, pre-selected parties. This process effectively results in two lists of contractors: those on a 'white list' and those on a 'black list'. The contractors are considered black-listed contractors when they fail to meet the requirements of housing associations.

2.1 Pre-selection

In pre-selecting contractors, common selection criteria of Dutch housing associations are related with the technical abilities, the financial position and the integrity of the contractor. References from colleagues and purchasers' own experiences are also used in determining the suitability of suppliers. Innovative clients may also demand capabilities of suppliers on matters such as the innovative ability, the added value in the longer run, environmental aspects, the dependability of the customer for the supplier, and the supplier's position in the supply chain.

Every organisation holds its own independent 'approved list'. In the UK the Government-backed Trustmark was set up, allowing several trades, e.g. painters, to demonstrate a commitment to quality and allowing the users to select quality conscious painters (Suttie and Thorpe, 2003; Trimmer and Kidston, 2003). National pre-qualification systems do not exist in the Netherlands. However, contractors set up a wide range of quality assurance systems.

2.2 Contractor selection

Zavadskas and Vilutiene (2006) make an extensive review of techniques for contractor selection used in different countries. They conclude that there are only a few studies in which the selection process of maintenance contractors is analysed. The selection of construction contractors is based on a number of criteria associated with the contractors' characteristics, such as financial position, past experiences and tender prices. Zavadskas and Vilutiene (2006: 624) argue that maintenance and construction are processes of different natures: "In a maintenance field, clients are concerned not only with the final result, but with the maintenance process as well. Therefore a set of selection criteria for maintenance work would be substantially different from that of construction work". Clients, which are tenants, are particularly concerned with daily maintenance. In planned preventive maintenance the efficient performance of contractors is crucial, sustaining the value of the assets and acquiring tenants' satisfaction. In performance-based maintenance partnerships, contractors have the responsibility for performance and customer satisfaction during the entire contract period.

3. Quality assurance of maintenance contractors

The Dutch construction and maintenance industry is characterised by many small firms and some large companies and by heterogeneity in the types of firms (Bremer and Kok, 2000). The degree of specialisation varies considerably. A lot of (small) maintenance companies specialise in only one kind of work, for example paintwork. Another group of companies combines expertise from various fields and exercise 'total maintenance'. The firms that specialise in paintwork and small construction work can be divided into two groups: a large group of very small firms (1-10 employees) and a small group of medium-sized firms (up to 150 employees). All members of the association of medium-sized employers, the WVB, have adopted the 'Excellence model' as provided by the European Foundation for Quality Management (EFQM) as their generic management quality system. Some firms are assessed for ISO 9000 series and/or ISO 14001 (environmental management systems).

In 1995, the branch organization of painting firms introduced an approval system for painting firms, the 'AF-erkenningsregeling'. The firms need certificates of proficiency to become certified/approved. Quality control of the maintenance service is done by means of a performance measurement of a painting job every three years. For non-professional clients this approval is important, because the quality of painting work is guaranteed for two years. Besides, the firms observe the consumer terms of the Dutch consumers' organization. For professional clients like housing associations, it is essential that the contractors working for them have implemented the voluntary quality assurance system referred to as Safety, Health and Sustainability Checklist: VCA. This VCA applies for small firms that have less than 35 employees (VCA*), usually working as a subcontractor, and in a more comprehensive version also for larger firms (VCA**). VCA* includes the direct safety control of working processes at site and VCA** further includes the management and organisation of the firm. Requirements are interrelated with requirements of ISO 9001 (Federatie van Afbouw Bedrijfsschappen, 2002). VCA-certification of contractors is used very often as a pre-qualification criterion of clients in the Dutch construction industry (Caniels, 2005). The integrity of building companies has become an important issue after inquiries of collusion practices in the Dutch building industry (Dorée, 2004). For this reason, building contractors can be registered as integer companies, observing the codes of the Corporation for the Assessment of Integrity of the Construction Industry (Stichting Beoordeling Integriteit Bouwnijverheid, 2003).

The maintenance contractors can also become certified for several working processes and technical skills, according to Dutch and/or international standards. Some members of the WVB, for example, are certified/approved contractors for various techniques for concrete repair and/or approved contractors for maintenance of exterior woodwork. The workmanship of workers who in fact execute the job is quite important for quality of the maintenance work. That is why workers may also get themselves approved or certified. Generally, knowledge and experience of workers is part of the quality management system and/or the process quality system of certified/approved firms.

Table 1 shows different types of quality systems for Dutch maintenance contractors specialized in planned preventive maintenance of the building envelope.

Table 1: Quality systems for Dutch maintenance contractors

	General	*Aspects*	*Activities*
Management and organisation	*ISO 9000 series* *EFQM*	*SBIB* *VCA***	*Approval system for painting firms (AF-erkenningsregeling)* *Approval system for roofers (Dakmerk)*
Working processes at building site		*VCA**	*Concrete repair Standard* *Woodwork maintenance Standard* *Dakmerk*
Workmen skills			*Concrete repair Standard* *Woodwork maintenance Standard* *Approval system for painting firms (AF-erkenningsregeling)* *Approval system for roofers (Dakmerk)*

4. Performance-based maintenance procurement and maintenance engineering consultancy

Traditionally, housing associations tender maintenance services use a descriptive and detailed specification of the work to be performed. The objectives are to achieve the lowest price or the best price-quality ratio by means of a competitive tender. The specifications are drawn up using the available knowledge and experiences of the housing association, possibly with assistance from external maintenance advisors. By contrast, the performance-based approach is based on a set of desired performances or service levels, set down by the housing association.

Generally, the objectives of housing associations for performance-based maintenance partnering are:

- achieving budget certainty and cost savings,
- improving product quality,
- simplifying the maintenance management process,
- and, promoting innovation by maintenance contractors.

Maintenance contractors no longer act as suppliers of maintenance work capacity, but as active participants in the overall maintenance process. They give advice on maintenance strategies, maintenance scenarios, performance specifications and activities (Straub, 2005). In other words, they start to act as engineering-consultants.

In a previous research project, conducted for seven housing associations and the Dutch Building Research Foundation (SBR), partnership forms for condition-based maintenance services have been developed (Straub et al., 2005). Figure 1 illustrates the process model of long-term co-operation. Together with the client the contractor specifies decisive performance requirements and determines the starting point for the maintenance process and maintenance planning. Other consultancy activities conducted by maintenance contractors for housing associations are shown in shaded boxes in Figure 1, which are executing condition assessments, the design of maintenance scenarios and activity plans and executing periodic performance measurements.

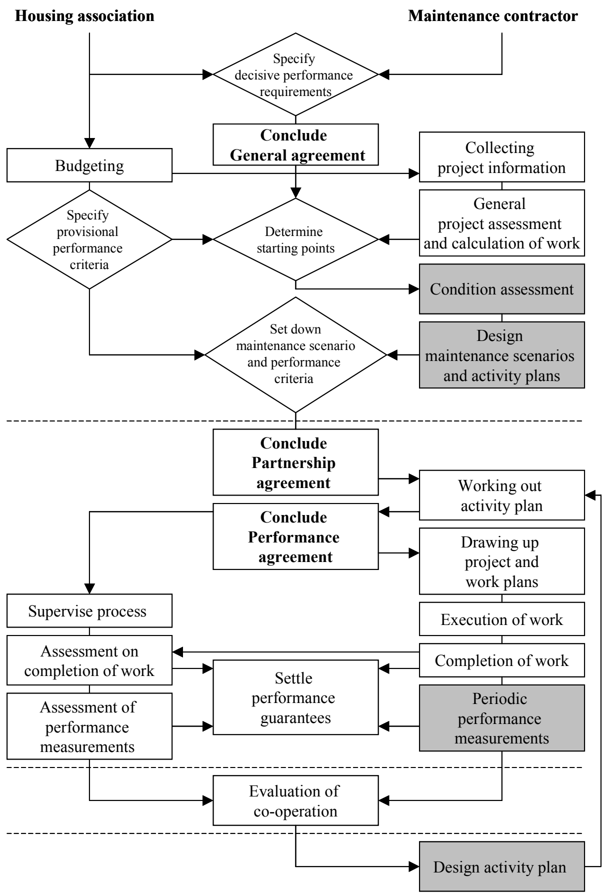

Fig. 1. Flowchart process model of long-term co-operation (Straub et al., 2005)

4.1 Design of maintenance scenarios and specifying maintenance activities

In performance-based maintenance partnerships, contractors act as maintenance-engineering consultants. The contractors are selected at an early stage and this enable them to contribute to ideas about maintenance strategies within the constraints of performance requirements, the exploitation period, and the financial aspects that apply to each housing complex. The housing association and the maintenance contractor jointly specify decisive performance requirements for housing estates, which is concluded in a general agreement. In this model the key issue is re-design of the relevant building components. Re-design is an integral part of the specification phase. The technical solutions are set down in maintenance scenarios and activity plans, presenting net present values of life cycle costs and performance criteria. A partnership agreement is then concluded that covers a maintenance scenario consisting of several maintenance intervals that may last for the entire exploitation period of the housing estate. The first activity plan is set down in a performance agreement.

4.2 Performing performance measurements and conducting customers' satisfaction surveys

The contractors themselves monitor the deterioration processes of building components by performing performance measurements. The main purpose of control and supervision by the housing association is to review the performance achievements and to identify problems and subsequently, take the necessary action. Contractors also monitor the entire maintenance process and especially customer satisfaction, during maintenance interventions. They are responsible for laid down performances and customers satisfaction during the contract period.

5. Selection of maintenance contractors for performance-based maintenance partnerships

Within performance-based partnerships, the selection of maintenance contractors with whom the client wishes to work is very important. Performance-based maintenance partnerships influence the internal organisation of the client and contractors and the selection of contractors. Parties to the relationship should have similar views and approach the partnership arrangement with similar perspectives. Partnering literature, e.g. Bresnen and Marshall (2000), Saad et al. (2002), emphasises the need for a thorough understanding of such a new concept as partnering, and the ability to create, manage, and reshape relationships. Also, it is essential that contractors are motivated to increase performance (Kashiwagi and Byfield, 2002).

5.1 Needed competences maintenance contractors

For contractors a performance-based approach means major changes in working processes, methods, and the need for information. Several authors examined which competences are required of contractors working as consultants in design-build projects, especially in the area of contractor selection (e.g. Potter and Sanvido, 1995; Palaneeswaran and Kumuraswamy, 2000).

The core competence of maintenance-engineering consultants should be their ability to apply scientific and technical knowledge (in a combined form of technical calculations and tacit knowledge of design, based on extensive experience) to a maintenance project. To exploit this core competence, the consultant, however, is dependent on resources and capabilities. Barney (1991) categorized resources into three groups: physical resources such as plant equipment, location and assets; human resources such as manpower, management team, training and experience; and organizational resources such as culture and reputation. Capabilities are defined as "architectural abilities or bonding mechanisms whereby resources are combined in new and innovative ways" (Duncan et al., 1998: 10).

The required capabilities of maintenance-engineering consultants can be compared to those required by management consultants. Simon and Kumar (2001) have conducted studies to the strategic capabilities of management consultants, as identified by clients. Although the strategic capabilities of management consultants do not necessary reflect those required by performance-based maintenance consultant, it could be assumed that they bear many similarities. The importance of communication and empathy skills towards the client is obvious for all consultancy activities. For engineering consultancy, the quality of the result of the service will dependent heavily on the technical knowledge. Together with the integrity and honesty of the consultant, these seem to be the most important strategic capabilities from the viewpoint of the client.

The resources of engineering consultants rest firmly on the skills accumulated by their professionals as individuals and in project groups. For example, it can be argued that every new design or construction project involves innovative elements such as the adaptation of existing technology to local conditions, or unique combinations of technical components. Of particular interest for maintenance-engineering consultancy, is knowledge of and experience with condition assessment and performance measurement, methods for diagnosing the cause of deterioration, planning and calculation methods (e.g. net present values, life-cycle costing), and knowledge of the life span of building components. Contractors should substantiate the (financial) risks associated with the various maintenance scenarios. For example, contractors must be able to assess whether damage is likely to reoccur or whether damage to other parts of the exterior envelope will increase, given certain maintenance work. In co-operation with manufacturers, e.g. for coatings and roofing systems, they have to provide guarantee for the life span of (new) materials and construction elements.

To a large extent, the real competitive assets of engineering consultants are thus contingent on their human resources (Baark, 2001). In addition to this, the quality of memorization of knowledge within the organisation affects the sustainability of these resources. Concurrently, as the consultant in performance-based projects and partnerships is part of the maintenance firm, a most important capability of this firm lies in combining resources and the degree it succeeds in obtaining synergy by combining design and execution of maintenance work

6. VGO KEUR: Quality Mark for Real Estate Maintenance

The WVB, the SBR and approved scheme operator INTRON Certification have been working on a system of quality assurance. Major part of this approval system is a verification of performance-based competences of maintenance companies. It is primarily directed to maintenance, and in particular paintwork of the building envelope. In near future an independent institution with members from contractor as well as principal side, will manage this system. Then all maintenance contractors can be certified as contractors that are able to work according to performance-based maintenance methods and procedures.

The application by maintenance contractors to the VGO KEUR starts with submitting the application form. After a superficial check on requirements, an in-depth assessment follows. If a maintenance contractor succeeds in meeting the requirements, it is granted the quality mark VGO KEUR. See figure 2.

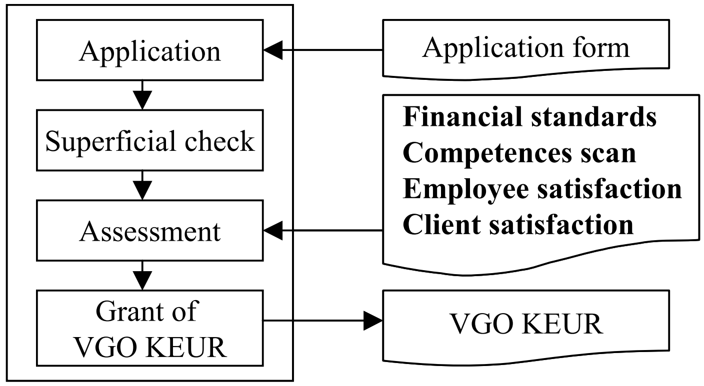

Fig. 2. Application process for VGO KEUR

VGO KEUR includes a wide range of requirements: financial standards, competences and contractors' performance outcome. Financial performance standards contain net profit and solvency figures from past. Contractors' performance outcome is assessed by employee and client satisfaction. Employee satisfaction is measured by absence through illness. Requirements are assessed each year. Client satisfaction is measured through an inquiry of randomly selected clients of the contractor. The principals have to judge their satisfaction with the contractor on a ten point-scale. The average total score should be at least seven. This is assessed every three years.

For the assessment of performance-based competences an extensive questionnaire has been developed. See table 2. Based on this questionnaire, knowledge, expertise and experience with regards to maintenance processes and consultancy activities are assessed every three years. For example, to what extent is the contractor capable of developing maintenance scenarios? For most of the questions the proof is provided by written documents as personnel and project files of the firm. Generally, a well-documented process demonstrates the competences. Most of the questions are related with the human resources and past experiences. Just a few questions deal with the management and organization of the firm and the management and organization of performance-based partnering. Questions about innovative solutions, contractor's viewpoints on maintenance strategies, management of subcontractors, communication with the client, communication with employees of the client at site and communication with tenants are lacking. Questions about knowledge dissemination are also lacking.

Table 2: Questions and proof Competences scan VGO KEUR (examples)

	Questions Context	***Proof***
Firm	*Financial turnover of current long-term relationships*	*Financial statements*
	Disciplines of available in-house employees	*Files personnel*
	Relationships with subcontractors	*Financial statements*
Leadership and management	*Knowledge of and experience in business administration, financial management, risks management*	*Certificates, diplomas*
	Information supply to employees about company strategy, including the performance-based approach	*Minutes meetings, inquiry personnel*
Performance-based maintenance process	*Knowledge of and experiences in condition assessments, performance measurements*	*Certificates, diplomas, personnel files, project files*
	Knowledge of and experiences in drawing up maintenance scenarios and activity plans	*Certificates, diplomas, personnel files, project files*
	Knowledge of and experiences in planning and calculation methods	*Certificates, diplomas, personnel files, project files*
Realisation	*Knowledge of and experiences in process control*	*Certificates, diplomas, personnel files, project files*
After care	*Analysis of performance measurements*	*Project files, minutes work consultations*

7. Conclusion and discussion

Within performance-based partnerships, the selection of maintenance contractors is very important for the client. Parties getting in the relationship should have similar views and should approach the partnership with similar perspectives. Indeed, maintenance contractors develop quality management systems with similar basis/assumptions as housing associations. All members of the association of medium-sized employers WVB have adopted the EFQM Excellence Model. In addition to this, many quality assurance systems exist for overall management processes and technical processes of maintenance contractors. However, the fact that the contractor has to act as a maintenance-engineering consultant to the client is vital for a performance-based maintenance approach. The consultancy activities conducted by maintenance contractors for housing associations include: providing advice on maintenance strategies and design of maintenance scenarios, specifying maintenance activities, executing periodic performance measurements and conducting customer (tenant) satisfaction surveys.

The introduction of the quality mark VGO KEUR in the Netherlands is a first step in quality assurance of maintenance contractors. It guarantees principals that contractors are able to work according performance-based methods and procedures. VGO KEUR includes a wide range of requirements: financial standards, competences and contractors' performance outcome. Financial standards are important aspects in contractor selection, but most principals, housing associations in particular, have their own more extensive selection criteria to cover the financial strength of a contractor. The competences scan should measure performance-based maintenance competences of contractors. However, the competences scan primarily measures resources. Conversely, client satisfaction in maintenance-engineering consultancy is heavily determined by capabilities, like communication and empathy skills. Together with the integrity of the consultant, these seem to be the most important strategic capabilities of consultants from the viewpoint of the client. The key question is how to measure these capabilities?

Client satisfaction is determined by contractors' performance outcome. The relationship between maintenance-engineering and consulting activities and contractor's performance outcome is not made very clear in the VGO KEUR. Just a well-documented process demonstrates the performance-based competences. Contractors' performance outcome is assessed by employee and client satisfaction. Linking a quality assurance system for performance-based maintenance to performance outcome requires outcome measurements of products and services. Contractors' performance could be measured in terms of technical performance of the maintained building components, contractors' prices during the co-operation period and tenant satisfaction.

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Addressing the Challenges Associated with Construction Partnering Projects: Leadership of a Cultural Change

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Abstract: In recent years there has been a growing interest in the use of partnering in construction. Since partnering is seen as changing behaviours and attitudes, cultural transformation cannot be forgotten in the process. Much of the literature tends to presume that cultural alignment is a prerequisite for partnering. Furthermore, the existing research fails to adequately address the complex relationship between individual or group behaviour and organisational culture which, nevertheless lies at the heart of many prescriptions for improving collaboration within the industry. This paper initially reviews the benefits, critical success factors and major cultural and behavioural challenges in construction partnering projects. Many commentators place considerable emphasis upon the importance of changing attitudes and cultural transformation to address various challenges in construction partnering. Together with the understanding of current state of culture, management has the most significant role to play in the transformation of attitudes. As such, paper explores the leadership perspective of cultural transformation in construction partnering.

Keywords: Cultural and Behavioural Challenges, Cultural Transformation, Leadership, Partnering

1. Introduction

In recent years there has been a growing interest in the use of partnering in construction (Bresnen and Marshall, 2000a; Dainty et al, 2001; Wood and Ellis, 2005; Ingirige, 2004). Partnering and the related forms of collaboration have been seen as a way of dealing with the fragmentation and lack of integration that have bedevilled attempts to improve project performance over the years (Bresnen and Marshall, 2000a). Many commentators argue that partnering can have a substantial positive impact on project performance, not only with regard to time, cost and quality objectives, but also with regard to more general outcomes such as greater innovation and improved user satisfaction (Latham, 1994; Bennett and Jayes, 1998; Bennett et al., 1996; Bresnen and Marshall, 2000c).

Partnering has been defined as ‘a long term commitment between two or more organisations for the purpose of achieving specific business objectives by maximising the effects of each participant’s resources (Bresnen and Marshall, 2000a). While there is an agreement about this overall philosophy of partnering, there are varying views on its features. This includes wide range of concepts capturing culture, behaviour, attitudes, values, practices, tools and techniques. Despite the fact that commentators place considerable emphasis upon the importance of changing attitudes, improving interpersonal relationships and transforming organisational cultures, very little of the research has explored in the social and psychological aspects associated with the successful integration of partnering (Bresnen and Marshall, 2000a; Wood and Ellis, 2005). According to Schein (2004), leadership is originally the source of the beliefs and values and successful proposals of leader's gradually come to be shared assumptions of an organisational culture. Therefore management has the most significant role to play in the transformation of attitudes. The discussion in this paper revolves around the challenges of construction partnering and the necessity of leadership for cultural transformation.

2. Concepts of Partnering

According to Naoum (2003) partnering is a concept which provides a framework for the establishment of mutual objectives among the building team with an attempt to reach an agreed dispute resolution procedure as well as encouraging the principle of continuous improvement. Thus partnering is intended to reduce the adversarialism which is said to be typical in the industry and which has confounded previous attempts to encourage better integration and cooperation between contractual partners (Latham, 1994; Egan, 1998; Bresnen and Marshall, 2000b). Similarly, partnering has also been defined as management approach used by two or more organisations to achieve specific business objectives by maximising the effectiveness of each participant's resources based on mutual objectives, an agreed method of problem resolution and an active search for continuous measurable improvements (NAO, 2001).

Furthermore, mutual trust and understanding of each others' commitments appears to be the prerequisites of changing traditional relationships to a shared culture in partnering (Barlow and Cohen, 1996; Bresnen and Marshall, 2000c; Naoum, 2003). Bresnen and Marshall (2000a) reinforce the requirement for the change in attitudinal and behavioural characteristics to achieve mutual trust. Barlow et al. (1997 cited Naoum, 2003) succinctly argues that, to achieve mutual trust, organisations must ensure that individual goals are not placed ahead of the team alliance. He also supports the idea of ''gain-sharing'' which effectively relates improvements back to all the participants. All these point out that, partnering is built upon the attitudinal and behavioural characteristics of participants which lead towards mutual trust to move away from traditional adversarial culture of construction industry.

3. Benefits Attributable to Partnering

Several studies indicate that there is little doubt about the positive aspects of partnering arrangements (Wood and Ellies, 2005). Bennett and Jayes (1998: Bresnen and Marshall, 2000a) suggests that performance, in terms of cost, time, quality, build-ability, fitness-for-purpose and a whole range of other criteria, can be dramatically improved if participants adopt more collaborative ways of working. Furthermore they illustrate the ways to create undefined win-win relationships which involve a sophisticated strategy and require a willingness to improve the joint performance. Their research cites a remarkable potential savings of 40–50% in both cost and time (Wood and Ellies, 2005). However the benefits were often cited in terms of cost and time (Naoum, 2003) ignoring the other benefits to the team players, which are more difficult to assess. This section briefly identifies and illustrates the common benefits of partnering cited in various partnering related literature.

Most of the research lists cost savings as the main advantage in employing partnering in construction. Chan et al. (2003) suggests that partnering has great potential to improve cost performance and reduce the risk of budget overruns. There are many reasons quoted for better cost performance, such as: alleviating rework; reduction in variation; lower change order rates; maximised value engineering; reduction in costs of developing and supporting productive relationships; lower administrative and paper work; reducing scheduled time; reduction in scope definition problems, effective problem solving, and shared project risk (Albanese, 1994: Hellard, 1996: Chan et al. 2003). As mentioned, better time control and reduced dispute and litigation contribute towards improved cost performance. Furthermore, Black et al. (2000) believe that medium to long-term relationships compress the normal learning curve and thereby reduce the normal costs of developing and supporting productive relationships between the parties.

According to Chan et al. (2003), an effective partnering agreement improves project quality by replacing the potentially adversarial traditional relationship and case building with an atmosphere that fosters a team approach to achieve a set of common goals. Partnering also provides a way for all parties to develop continuous improvement. With this joint effort and long-term focus barriers to improvement are eliminated. Hellard (1996) suggests that partnering can increase the potential for innovation by encouraging partners to evaluate advanced technology for its applicability. These in turn produce high quality construction and service and reduce engineering rework (Black et al., 2000; Li et al., 2001). As one of the other quality benefits, the safety performance can be enhanced as partners better understand each other, taking joint responsibility to ensure a safe working environment for all parties (Chan et al., 2003).

Working with suppliers can improve the capacity of the organisation to meet the client's programme, quality, flexibility and cost requirements. According to Black et al. (2000), one of the key benefits of partnering is the resultant synergy between project participants, enabling constant improvement in the key variables. In particular, the early involvement of contractors in the design stage can assist in constructability input and maximising value engineering, thus improving both cost and schedule (Bresnen and Marshall, 2000a). Also, a fair and equitable attitude from project participants jointly resolves many disputes, discrepancies and changed conditions which arise during construction. Gransberg et al. (1999) found that fewer numbers of liquidated damages were imposed on the partnered projects than the non-partnered ones.

As the partnering literature points out, a mechanism for problem solving is an inherent part of the concept (Chan et al., 2003). Thus partnering aims to reduce adversarial relationship that will allow focus on mutual goals to the benefit of both parties (Black et al., 2000; Naoum, 2003). This encourages mutual trust and gain sharing which results in closer relationship, providing a better environment for the project (Green, 1999; Chan et al., 2003). Improved culture enhances open communication between the project participants resulting to the elimination of blame shifting. Improved customer focus, augmented involvement of team members and joint satisfaction of stakeholders are achieved through this.

Since partnering is seen as a recipe for potential benefits, its success factors are worthy of in-depth investigation. There is a lack of attention to these critical factors that need to be addressed if partnering is to be successfully implemented as a strategy for performance improvement (Cheng et al., 2000).

4. Critical Success Factors of Partnering

Critical success factors are the key areas that are essential for management success. Cheng et al. (2000) suggested that partnering can become successful by using pertinent management skills and developing a favourable context. It is essential to create an appropriate environment in which inter-organisational relationship can flourish. Management skills are vital for effective control of the relationships. They form the basis for initiating and facilitating the partnering process. Similarly some partnering characteristics can affect the partnering relationships. In consequence, it is important to identify these critical characteristics which form the favourable context conducive to partnering success.

Breakdowns in communication and disruptive conflicts are always been a problem in construction and as a result it has become very adversarial in nature. Partnering requires timely communication of information and it encourages open, direct lines of communication among project participants (Hellard, 1995). Effective communication skills can help organisations to facilitate the exchange of ideas and visions, which can result in fewer misunderstandings and stimulate mutual trust. Similarly, effective coordination can result in achievement of stability in an uncertain environment by the creation of additional contact points between parties to share project information (Cheng et al., 2000). The other critical management skill is a 'productive conflict resolution' which can be achieved by joint problem solving in order to seek alternatives for problematic issues. Conflict resolution techniques such as coercion and confrontation are counterproductive and fail to reach a win-win situation (Cheng et al., 2000). Furthermore, regular monitoring and early implementation of partnering process are essential to ensure the success of partnering (Chan et al., 2004).

Similarly, some of the critical characteristics form the favourable context conducive to partnering by establishing interdependence and self-willingness to work for the long-lasting cohesive relationship. Most of these contextual characteristics are soft critical success factors such as, top management support, long term commitment, mutual trust, willingness to share resources and commitment to win-win attitude (Cheng et al., 2000, Chan et al., 2004, Li et al., 2005). Support from top management is always a prerequisite to initiate and lead a successful partnering arrangement. While long-term commitment is expected from involved parties to integrate continuously to weather unanticipated problems, mutual trust is critical to open the boundaries of the relationship as it can relieve stress and enhance adaptability, information exchange and joint problem solving (Cheng et al., 2000). Commitment to win-win attitude represents the open airing of problems among parties and encourages risk sharing, rewards and willingness to exchange ideas (Chan et al., 2004). This leads towards sharing of resources which can be used to strengthen the competitiveness and construction capability of a partnering relationship.

However, there is a tendency within the partnering literature to concentrate on success stories (Wood and Ellis, 2005). Conflict and failure could occur by a fundamental deviation in goals, especially in relation to accountability, thus hindering all cooperation that may have been attained by the partnering process (Thomas et al., 2002). There is case evidence of the failure of partnering to meet performance expectations in construction (Bresnen and Marshall, 2000c). Thus it is important to adequately address and evaluate the challenges and potential problems in construction partnering.

5. Partnering Challenges and Problematic Issues

The concept of partnering, overhauls the ethics of traditional contracting with the paradigm shift towards cooperative and caring environments. According to Naoum (2003) successful partnering could attain win - win solution and gain sharing. In general, with a cultural shift in attitudes project partnering can be successful and bring benefits to the stakeholders involved in the project partnering process (Thomas et al., 2002). However, changing traditional relationships to shared culture requires mutual trust and dedication to common goals (Dainty et al., 2001; Wood and Ellies, 2005). An absence of mutual trust and scepticism within participants may result in various problematic issues.

According to Lendrum (1998: Thomas et al., 2002) a lack of open and honest communication may lead to degradation in the stakeholders' ability to efficiently resolve any problems. Thomas et al. (2002) identified lack of empowerment and technical knowledge from client's side and usage of competitive tendering, failure to include key suppliers and subcontractors together with lack of training as some of the main problematic issues in partnering projects. They successfully argued the role of client as the head facilitator of the partnering arrangement to take a leadership role, and ensure full commitment and correct facilitation throughout the entire duration of the projects. It was identified that the majority of problematic issues experienced in project partnering arrangements was related to the commitment provided to the attitudinal change and procedural implementation required in efficient project partnering (Thomas et al., 2002).

As discussed, central to any successful partnering arrangement is the change in attitudinal and behavioural characteristics towards mutual trust and understanding. Green and McDermott (1996) argue the attitudes and the behaviour evident in the construction industry are deeply ingrained and that it is difficult to engineer any rapid movement away from such an embedded culture. According to Li et al. (2001) partnering requires a long-term strategic plan with cultural change intervention in order to move beyond a traditional discrete project nature. In effect, the development of trust between organisations is seen as a function of the length of the relationship between them, and the mechanisms that led to this alignment are viewed largely as informal. On the other hand, researchers believe that it is possible to bring about change over the timescale of a single project suggesting the view that partnering can be engineered and does not have to evolve naturally (Bennett et al., 1996; Bresnen and Marshall, 2000a). Despite the separation between informal developmental and formal instrumental views to alter the behaviour, behaviour is considered as the result of conscious choices and actions and a complex interplay between structural imperatives and their subjective interpretation and enactment (Bresnen and Marshall, 2000a).

Since partnering is seen as changing behaviours and attitudes, cultural transformation cannot be forgotten in the process. Much of the literature tends to presume that cultural alignment is a prerequisite for partnering. However, it is certainly not easy to bring about cultural change to adopt a new set of behaviours as a consistent way of working among the people. Atkinson (1990) identified fear, perceived loss of control, difficulty in learning to do the things differently, uncertainty, addition in work and unwillingness to commit as the reasons for people to resist change. Hill and McNulty (1998) portray fear and uncertainty as the main barriers to change. Conceptualisation of the relationship between partnering and culture (Bresnen and Marshall, 2000a), resistant to change from traditional, adversarial and exploitative ways (Bresnen and Marshall, 2000b), Lack of corporation based upon fundamental differences in interests between the parties to contract, profitability and uncertainty issues, unwillingness to commit fully to close, long term relationships together with the construction industry perception of mistrust (Cheung et al., 2003) can be considered as some of the reasons to resist cultural change towards collaborative relationships.

6. Discussion: Leadership of Cultural Change

The above literature synthesis has shown the factors affecting the success of construction partnering. While partnering can offer potential benefits, it requires careful organisation of critical success factors. Concurrently, failure to address identified challenges may hamper the performance of a project. Therefore it is important to identify the manner in which the partnering challenges can be addressed by the appropriate use of critical success factors (Figure 1).

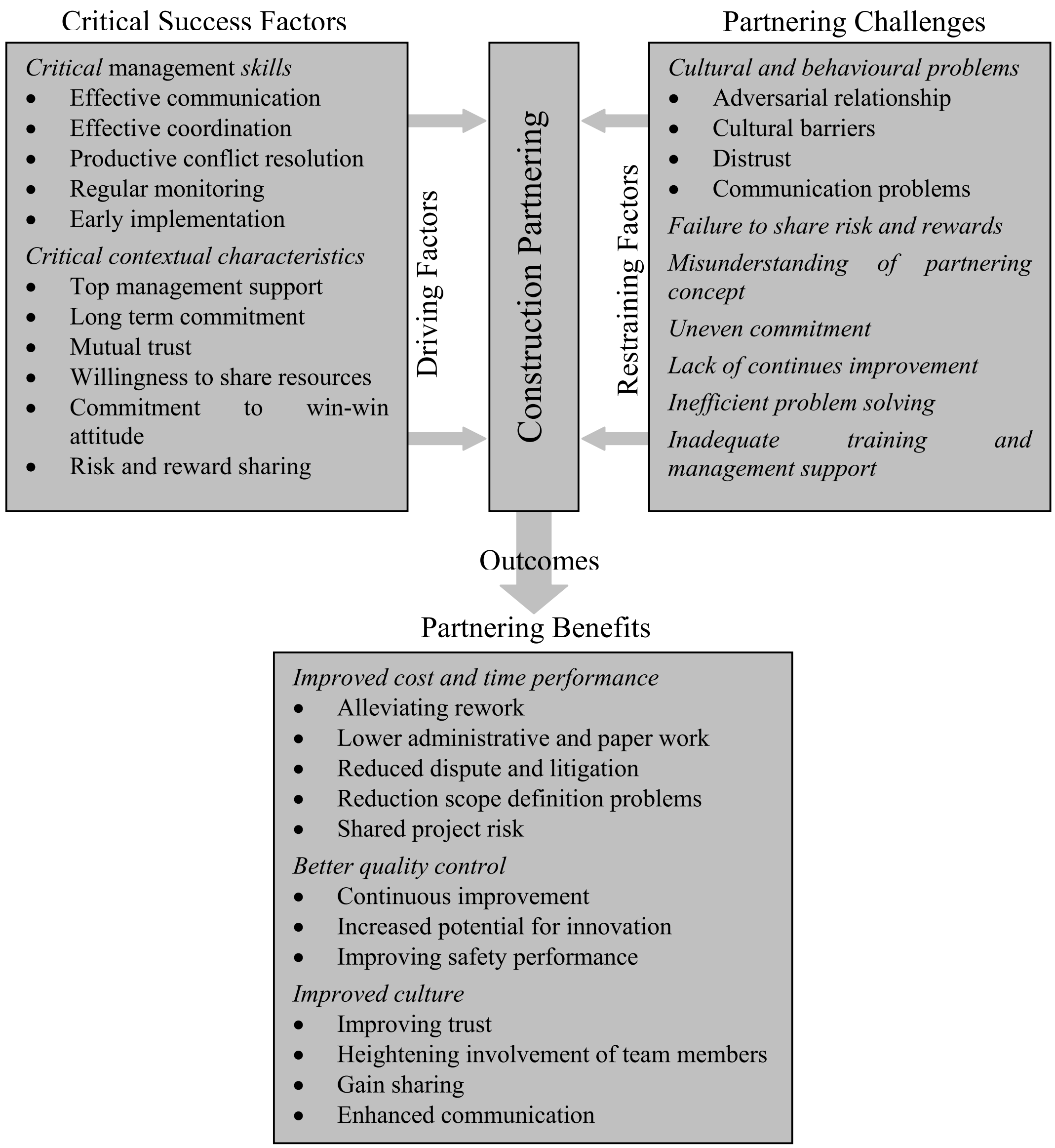

Figure 1: Overview of partnering benefits and challenges

Literature synthesis on partnering challenges and problematic issues shows the significance of cultural and behavioural challenges inhibiting the adoption of partnering arrangements. Furthermore, common to all partnering relationship is the formulation of mutual objectives, trust and an understanding of each other's commitments. However, it is less than clear about the way in which these essential cultural and behavioural characteristics are encouraged in construction partnering projects (Bresnen and Marshall, 2000a). Therefore it is essential to bring about cultural change, encouraging project participants to transgress the conflicting interests and to build shared culture.

Schein (2004) defines organisational culture as the 'basic assumptions and beliefs that are shared by member of an organisation, that operate unconsciously and define in a basic taken for granted fashion an organisation's view of itself and its environment'. So expectations and strategy are rooted in 'collective experience' and become reflected in organisational routines that accumulated over time. Culture is also shaped by 'work based' groupings such as an industry or profession (Johnson et al., 2005). Organisations within an industry such as construction tend to cohere around common norms and values. Several industry commissioned reports shares this view, where problems such as low and unreliable demand and profitability, lack of research and development, inadequate investment in training, its current approach to the usage of tender price evaluations, an adversarial culture and fragmented industry structure, are widely recognised (Latham, 1994; Egan, 1998; Santos and Powell 2001; NAO, 2001; Fairclough, 2002). Successive independent reviews of construction have emphasised the need to improve the culture, attitude and working practices of the industry. As argued above, it is very important to understand the construction organisations and their underlying assumptions to make these attitudinal and cultural improvements in the construction industry.

However trying to understand culture is not straight forward. The day-to-day behaviours not only give clues about the 'taken-for-granted assumptions' but are also likely to reinforce these assumptions. However to get a deeper level of understanding or to predict the future behaviour correctly one must attempt to get at its shared basic assumptions and taken for granted perceptions. Leadership is originally the source of the beliefs and values that get a group moving with its internal and external problems (Schein, 2004). Once leader's proposals continue to work, they gradually come to be shared assumptions of organisational culture. Together with the understanding of current state of culture, management has the most significant role to play in the transformation of attitudes. Two imperatives in the management of cultural change are the leadership's ability to think culturally and to conceptualise, via a working model, the change process (Brooks, 1996). In order to effect change powerful support is required from an individual or group combining both power and interest. To achieve this, a reconfiguration of power structures may be necessary, especially if transformational change is required.

Johnson et al. (2005) propose manipulation of organisational resources, relationship with powerful stakeholders and elites and activity with regard to subsystems in the organisation as the mechanisms to build a power base and to achieve commitment to a course of action. Furthermore, it is argued that changing symbols can help reshape beliefs and expectations because meaning becomes apparent in the day-to-day experience people have of organisations (2005). Changes in physical aspects of work environment, rituals, organisational structure, control mechanisms, stories and especially changes in the behaviours and language used by strategic leaders themselves are considered as powerful symbols of transformation. However, well established routines can be serious blockages to change. Routines are closely linked to the core values of the paradigm, so changing routines may have the effect of questioning and challenging deep rooted beliefs and assumptions of an organisation. This requires persistence and political acumen.

This seems very complicated in the context of partnering since the cultural alignment requires to be extended to the parties of partnering charter. It is certainly not easy to bring about cultural change to adopt a new set of behaviours as a consistent way of working among the people. Bresnen and Marshall (2000a) stress the importance of decentralised, flexible structures, where the team is expected to operate with considerable autonomy and discretion to convert formal partnering arrangements into real differences in behaviour at operational levels. They insist on top management support, commitment and enthusiasm in generating and sustaining changes in collaborative approaches. Furthermore, Deal and Kennedy (1998) encourage managers on conveying two-way trust in all matters of change and training as a part of change process to take on challenge of change. Cultural change is therefore a sensitive issue and it is very important to lead the whole process all the time.

7. Conclusion

Mutual trust and understanding of each others' commitments appears to be the prerequisites of changing traditional relationships to a shared culture in partnering. However, it is certainly not easy to bring about cultural change to adopt a new set of behaviours as a consistent way of working among the people. Lack of corporation based upon fundamental differences in interests between the parties to contract, profitability and uncertainty issues, unwillingness to commit fully to close, long term relationships together with the construction industry perception of mistrust can be considered as some of the reasons to resist cultural change towards collaborative relationships. It is very important to understand the culture and values of the industry to overcome these barriers to change. Together with the understanding of current state of culture, management has the most significant role to play in the transformation of attitudes. Focus on power and politics of acceptance, management of symbolic processes and the concurrent management of organisational routines are the three main approaches which need to be combined to form an integrated and purposeful leadership endeavour. Also this mechanism should encourage leaders on conveying two-way trust in all matters of change and training as a part of change process to take on challenge of change. Cultural change is a sensitive issue and it is very important to the change agents to lead the whole process, all the time.

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Footprints of newer procurement strategies in Sweden

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Abstract: Traditional procurement procedures have in Sweden, especially by contractors, often been criticized for being outdated and unsuitable for facilitating project success. This due to the trend towards increased complexity, uncertainty and time pressure in construction projects. Many have since decades also been arguing that an essential prerequisite, for getting a more effective construction process, is the use of newer procurement models promoting transparency and cooperation. For instance, arguments for application of new cooperation concepts as partnering are mostly raised by contractors while it is quite obvious that clients have been very reluctant to apply new concepts in practice. So traditional procurement and project governance models are in Sweden still used by a majority of the clients. However, it is quite evident that there is, during the last years, a change on the way towards application of newer procurement strategies.

In this paper, at first, is presented an empirical investigation of Swedish construction clients' recommendations regarding procurement strategies in different project contexts, in order to explore if a change towards more cooperative procurement processes are called for by the clients themselves. The study indicates that clients, at least in an advisory situation, admit that different project related prerequisites should highly affect the choice of performance, remuneration and cooperation models when contracting. In consequence, regarding remuneration and cooperation models, for complicated projects clients more often recommend the establishment of relationships based on transparency and cooperation than of traditional transactional oriented relationship. Secondly, in this paper, is briefly presented a study regarding application in practise of newer procurement strategies by an industrial client when executing new projects where the achievement of high set targets regarding time, functions and economy are a very central issue for the client.

Keywords: Contracting,Ccooperation, Construction, Partnering, Relational Contracting.

1 Introduction

The Swedish construction sector represents about 10 % of the Swedish GNP and employs about 10 % of the total amount of employees in Sweden. Said sector represents accordingly an important part of the Swedish national economy. The sector is currently under pressure from the community, clients and mass media following occurred construction failures, unfavourable cost development and even unveiled cases of improper competition. These events have led to the set-up of public committees and research projects for scrutinizing said sector.

The main conclusions are that there is a need of changes in the construction sector as it is obvious that the productivity progress has been very slow compared to other manufacturing sectors. The fulfilment of client expectations regarding time, economy and quality have in many cases failed. It is also quite obvious that traditional models for managing the building process, in a lot of cases do not match the nature of today's building projects. The actual development of the community requires a changed and a more dynamic construction process with shortened lead times while better fulfilling the demands from the clients (SOU 2002 : 115).

2. Construction contracts and models

2.1 General

Most projects in Sweden are still contracted in traditional ways, based upon transactional oriented contract models. A lot of energy and efforts are spent on specifying administrative and technical matters in detail in order to get an administrative base for the transactional oriented construction process. This process is often time and money consuming and gives seldom the involved stake-holders incentives for innovations and cooperation in order to improve the project execution phase. The partnering patch for more relational oriented cooperation by project execution has up to now been very little applied in Sweden if compared for example to the development in UK (Bennet and Jayes, 1998). However, there is a noticeable and growing interest within the Swedish construction sector to apply to new theories and ideas, such as Lean Construction, in order to achieve a more effective construction process.

In the article "Contracting for Lean performance: contracts and the Lean construction team", Miles and Ballard (1997) discusses the needs of developed contracting models facilitating and supporting the need of achieving a more behavior oriented construction process (relational contracting). The authors have also the hypothesis that complex and uncertain projects under time pressure require a development towards relational contracting in comparison with simple, certain and slow projects, see Figure 1. This has implications on production task, the production system, the organization structure and also for the contracting models (Miles and Ballard, 1997).

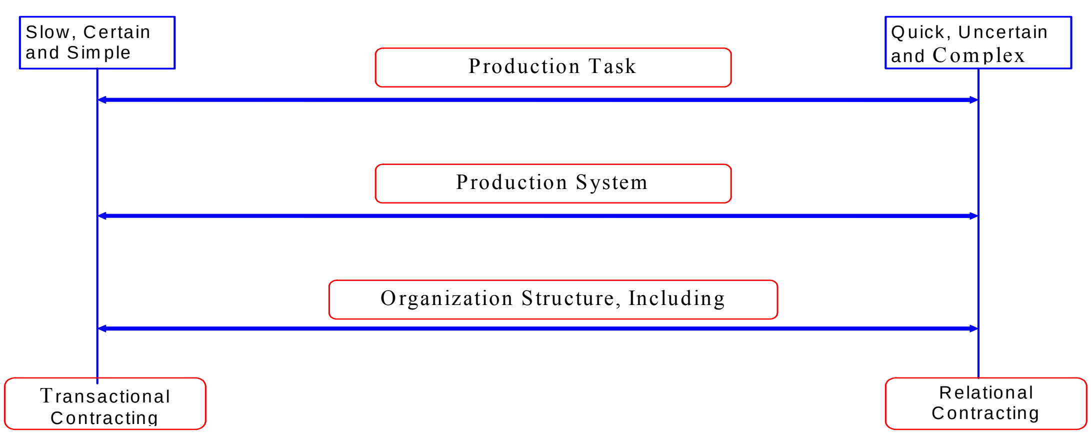

Figure 1: The Project Spectrum (Miles and Ballard 1997).

A well thought usage and further development of existing contracting models by project execution is a central issue for the possibilities of achieving a more relational oriented and effective construction process. The importance of the contracting models on the project execution can probably never be overestimated as the possibility of achieving a more effective and lean construction process depends on the rules of the game. Contracting models should accordingly be grouped according to how different combinations of performance, remuneration and cooperation models are interacting by project execution in order to achieve an optimised process design (Toolanen, 2004).

2.2 Performance models used in Sweden

In Sweden there are three generic contract forms:

- Main contracting models (DBB: design – bid – build)
- Design and build models (DB: design – build)
- Construction management (CM)

These generic contracting models are subdivided into six performance models. The Swedish abbreviations and the meaning of the different performance models are presented in Table 1. The main difference between the different models is primarily how the responsibility of the design is distributed between the client and the contractors and how subcontractors are procured. In DBB and CM contract forms the client/owner representative is responsible for the design while in DB forms most of the design work is distributed to the contractor.

Table 1: Swedish performance models

Swedish performance models	Type of contract			Main characteristics
Abbreviations used in figure 2	DBB	DB	CM	
FE (funktionsentreprenad)		X		Systematically performance based
TE (totalentreprenad)		X		Traditional design & build
GE (generalentreprenad)	X			The main contractor selected by the client procures and coordinates the subcontractors
SGE (samordnad generalentreprenad)	X			The client procures special contractors and selects one of them to be a coordinated main contractor.
DE (delad entreprenad)	X			No main contractor, special con-tractors will be coordinated by the client itself
MDE or **CM** (mycket delad entreprenad)			X	No main contractor, subcontractors are coordinated by a clients representative

Most of the projects in Sweden are procured as DBB contracts, mainly due to conservative and cultural reasons. In DB contract forms the contractors usually gets the most of the responsibility of designing the product while following some performance based demands set out by the client. The traditional type of DB contract form in Sweden is TE and this has since decades been favoured by some clients for certain types of projects where the clients have tried to specify their demands through functional requirements, literally or by technical specifications and drawings. FE is a newer type of DB contract form where the techniques for performance based demands are more systematically handled and supported by knowledge obtained from research projects.

2.3 Remuneration models

The by far greatest part of the construction contracts in Sweden have fixed price basis (FP) for remuneration. This is probably one of the biggest sources for litigation when handling quick, dynamic and complex projects where the initial project program, upon which the selection of the contractor is based on, often has to be revised due to dynamically occurred changes.

Cost reimbursable forms (transparent) for remuneration are either with some incentives (LRI) or without (LR). The LR form for compensation is mostly used in smaller projects within reconstruction and maintenance where the scope of work is not always well defined. For bigger projects the incentive based cost reimbursable form (LRI) predominates. The incentive is mainly based upon sharing savings and overflows of a target price.

2.4 Cooperation models

Explicit partnering concepts for cooperation according to models set up mainly in UK have been very little practised in Sweden up to now. The reason for that can be discussed and argued but is probably due to cultural and conservative attitudes among the clients. However a parallel model, based upon mutual strategic considerations (business partnership) to partnering has been used by project execution since decades in Sweden. In said projects, the partners can make a lot of deals in order to improve the working climate and trust in order to find prerequisites for long term business cooperation. This facilitates problem solving as the involved parties get a longer time horizon to balance losses and gains.

3. A field survey of contracting models in relation to project complexity

3.1 Methodology

In order to study how different project types and the actual set of other preconditions in connection to a project are affecting the contracting model a field survey was carried out among Swedish construction clients. In an inquiry study, 32 professional clients were asked to act as advisors in different contracting situations. Totally four project types representing different levels of technical complexity were studied under seven different overall situations (decision environment) regarding lead time, market situation (resources), uncertainties and strategic considerations (Toolanen, 2004).

In table 2 is shown an overview of the different variables used in the inquiry study. The different decision environment situations, briefly described in Table 2, were presented to the respondents in order to get a common vocabulary. The purpose was to study how the distinctive features of the different environments affected the choice of contracting models. The contracting models have in this study been predicted to consist of three important parts. First the distribution of responsibilities (performance form), secondly how the contractor is compensated (remuneration form) and finally how the cooperation is structurally organized (cooperation form). The respondents had for every unique combination of project types and decision environment (Table 2) to decide which combination of performance, remuneration and cooperation forms they found to be most recommendable. The importance of studying the combination of these parts of the contracting was hypothetically set out when planning for the field study. The result of the study showed that the three parts influenced considerably the outcome and was important in getting a better understanding of the client's reasoning in the contracting situation.

Table 2. Description and characteristics of the different decision environment situations

Decision environment		Characteristics					
Abbr.	Description	Lead-time		Resources		Uncertain.	Strategic
		slow	quick	not critical	critical	Conditions	considerations
N	Normal, *design and construction can be time-wise separated, no lack of bidders*	x		x			
R	Resource critical, *design and construction can be time-wise separated, risk for lack of bidders*	x			x		
T	Time critical, *short lead-time, design and construction has to be parallel, no lack of bidders*		x	x			
R&T	Resource and Time critical, *short lead-time, design and construction has to be parallel, risk for lack of bidders*		x		x		
U	Uncertain, *risk for late changes and redesign, uncertainty in the building program*					x	
S	Strategic, *client interested to promote innovations, long-term thinking*						x

3.2 Choice of performance model

Figure 2 shows the influence of prerequisites such as lack of resources, lead time, uncertainties and strategic considerations on the choice of performance model. The *Normal* (N) decision environment reflects the situation when the client regards the project be slow, certain and simple. In this case 55 % of the respondents recommended the DBB form as the preferred performance model. Contrary, in a situation when *Strategic* (S) considerations dominated most of the respondents (75 %) were in favour of the DB contract forms. So, when the prerequisites for the project deviated from the *Normal* situation to quicker (T), more uncertain (U) and complex prerequisites the results shows that the DB performance models are more favoured. It is quite obvious from this study that clients are strongly favouring DB contract forms in a situation of dynamic and uncertain conditions. This indicates also that the distribution of responsibility for design to the contractor is somewhat a question of a forced action of trust when the unreliability in the decision environment increases (Toolanen, 2004).

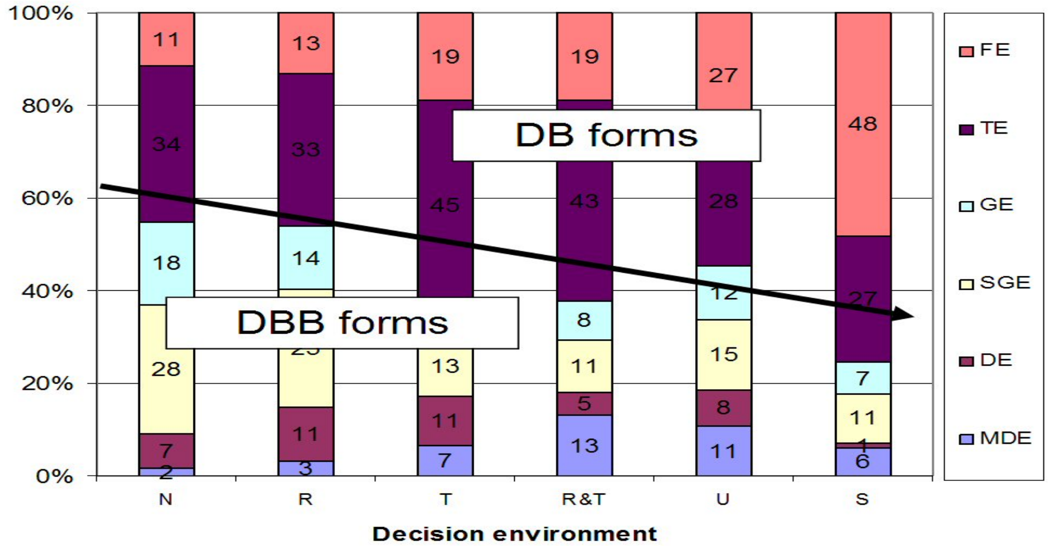

Figure 2: Interaction between the performance model (Table 1) and decision environment (Table 2)

3.3 Choice of remuneration form

Figure 3 shows how different factors in the decision environment (Table 2) are affecting the choice of the remuneration model by contracting. In a normal situation when the project can be called slow, certain and simple, the fixed price (FP) compensation model was favoured by 82 % of the clients. Contrary to this, transparent compensations models were strongly favoured when projects are quick, uncertain and complex. When the client considers the project to be in uncertain condition (U) and when he has strategic considerations (S), 80 – 85 % prefers transparent remuneration as an essential part of the contracting model (Toolanen, 2004).

This part of the study carried through by Toolanen (2004) indicates that clients in a situation of quick, uncertain and complex projects are afraid of hidden agendas if using fixed price models of remuneration. A transparent model for compensation should also be combined with some bonus agreement (LRI) according to the majority of clients.

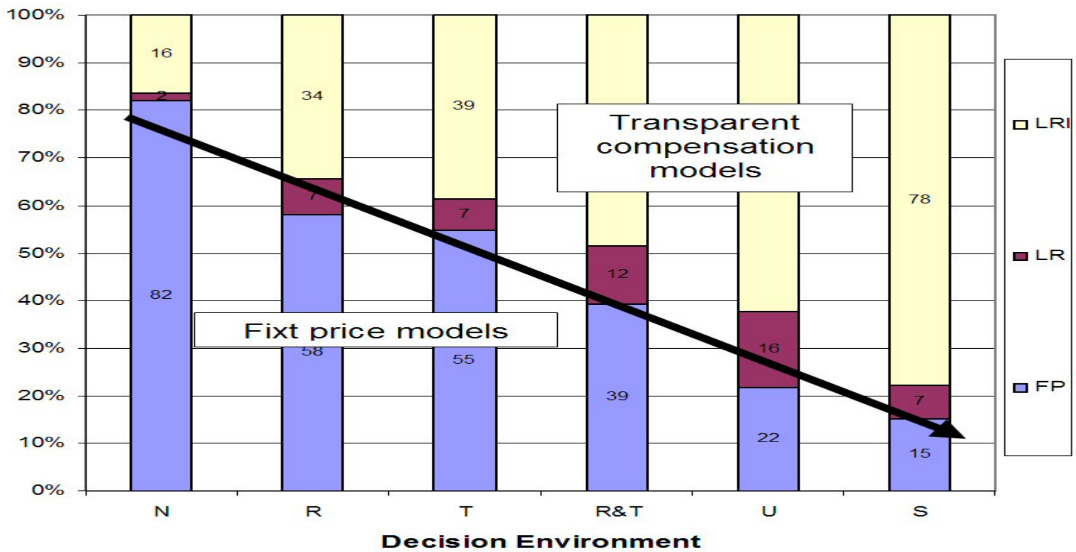

Figure 3: Interaction between remuneration models and decision environment (Table 2).

3.4 Choice of cooperation form

Figure 4 shows the influence of prerequisites such as short lead time (T), uncertainties (U) and strategic considerations (S) on the choice of cooperation model. The different models of cooperation used in the study were strategic partnering (S IV), project partnering (S III), business partnership (S II) and traditional transaction oriented relationship (SI).

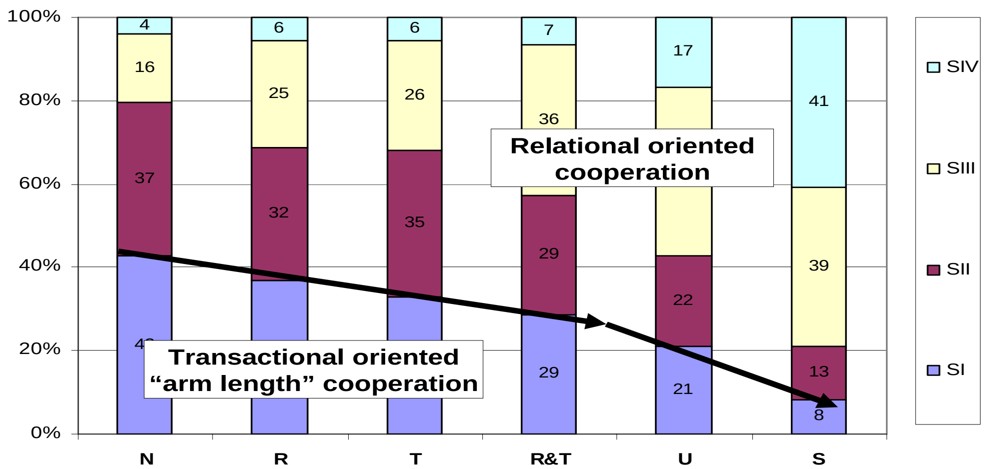

Figure 4: Interaction between cooperation model and decision environment (Table 2).

The decision variable normal case (N) is reflecting a situation when the client regards the project be slow, certain and simple. In that case 80% of the respondents were choosing traditional transaction and traditional business oriented cooperation models (SI + SII) and only 20 % preferred partnering forms of cooperation (S III + S IV). However in a situation of poor competition on the market and short lead time for the project the share of respondents preferring partnering concepts was over 30 %. If the situation is stamped by uncertainties (U) and strategic considerations (S), 60 – 80 % of the totals preferred partnering concepts. It is interesting to note that relational oriented cooperation forms are preferred in all decision environment alternatives.

4. Footprints of newer procurement strategies in Sweden

4.1 General

Traditional procurement procedures have in Sweden, especially by contractors, often been criticized for being outdated and unsuitable for facilitating project success. This due to the trend towards increased complexity, uncertainty and time pressure in construction projects. Many have since decades also been arguing that an essential prerequisite, for getting a more effective construction process, is the use of newer procurement models promoting transparency and cooperation. For instance, arguments for application of new cooperation concepts as partnering are mostly raised by contractors while it is quite obvious that clients have been very reluctant to apply new concepts in practice. Traditional procurement and project governance models are in Sweden still used by a majority of the clients.

However, it is quite evident that there is a change on the way in Sweden towards application of newer procurement strategies. This especially when executing projects where the achievement of high set targets regarding time, functions and economy are a very central issue for the client. An illustrative example of said development is the new procurement models used by LKAB, a Swedish mining company with a lot of ongoing investments in new plants.

The procurement of the LKAB – MK3 project and the process design of said project have been studied by a group of researches from Luleå University of Technology and the findings from the study will be presented in December 2006. According to the preliminary outcome of the study it is quite obvious that the procurement and strategy for the project has been very successful, as the project will be finalized in time foreseen and also as the functional and economical demands are met. Following the success of the MK3 project LKAB has already adopted this new procurement strategy for other projects started during 2006 (Olofsson, et al., 2006).

4 2. Procurement of the LKAB - MK3 project

LKAB decided in December 2004 to build a new pelletizing plant (MK3) in the north of Sweden. The MK3 project is a large and technically complex project with an overall budget of about 350 million USD. It consists of a dressing plant, a pelletizing mill and a loading/unloading depot for a yearly capacity of 2.5 million tons of pellets. Table 3 presents the quantities of some strategic construction parts (ibid.).

Table 3: Rough quantities of some strategic construction parts of the MK3 project.

Construction parts	Quantity		Truckloads
Steel Construction	7 500	tons	210
Reinforcing bars	2 000	tons	80
Concrete, in situ casted	56 600	tons	3 700
Concrete, prefabricated	18 000	tons	540
Roofing and walling material	5 500	m^3	195
Wood material	550	m^3	36
Process equipment	9 700	tons	1 370

The MK3 project context has components, according to Table 2, of resource and time limitations (R&T) and uncertainties (U) in the design. Due to considerations regarding procurement and project execution issues for an effective execution of the MK3 project, and also of other future projects, there are also strategic (S) considerations to be regarded by the client.

LKAB initiated the procurement procedure by producing an inquiry consisting of layout drawings, descriptions and estimation of quantities to get a basis for the procurement and also for the internal LKAB decision procedure. Thus, a request for bidding was sent to invited contractors in September 2004. In it was stated that the procurement model was to be based on DB performance form, on cost reimbursable remuneration with incentives (LRI) and that the project was planned to be executed as a *partnering* project, i.e. the project was procured according to the recommendations according to figures 2, 3 and 4.

A conditional contract for the construction was finalized with the main civil contractor NCC four weeks after the distribution of the inquiry. The civil works at site were started immediately after the LKAB board decision to invest in the project in November 2004. The target lead time for the MK3 project from the decision by the LKAB board to the first production of iron ore pellets is about 22 months, which is roughly 6-8 months shorter than for comparable projects conducted in the past. Highly due to the procurement model used, it is now quite evident that the high set targets regarding time, functions and economy are met in a satisfactory way (Olofsson, et al., 2006).

5. Summary

The use of different contract models is highly dependent on the actual decision environment as shown by the extracts from the Swedish enquiry study carried through by Toolanen (2004). Traditional performance, remuneration and cooperation models are favoured when the project is not under time pressure (slow projects), is not technically complicated (simple) and when the market conditions are in favour of the client. This is probably highly due to conservative and cultural influences. However when the complexity in the decision environment (Table 2) is increased, a larger part of the projects will be procured by models giving the contractor the responsibility of design (DB forms), using transparent remuneration forms and also by applying more relational oriented cooperation forms. Technical project complexity itself also contributes in different manners to the use of transparent remuneration forms and relational oriented partnership. How a short lead time (quick project) for project execution is affecting the choice of procurement models is an interesting and actual question as the lead times are getting shorter in the building sector of today. The study is quite clearly indicating that this has a very high influence as up to four of five respondents are favouring DB contracts in this case, half of them are choosing transparent compensation forms and one of three cooperation in partnering forms as best solutions even if the project is technically simple. In a special situation when the competition on the market is regarded to be unfavourable for the client due to lack of interested bidders, the study indicates different contracting strategies depending upon the project complexity. For smaller projects, most of the clients recommend DBB models without a main contractor as they hope to get more bids since also smaller contractors can participate. In technically more complex projects the DB models are favoured despite the risk of few bids (Toolanen, 2004).

The study also clearly indicates a movement away from fixed price contracting. Especially when the project contains some uncertainties as risk of reprogramming, transparent compensation is preferred by four of five respondents. Also as many as three of five recommends partnering as cooperation model in these circumstances. This is probably due to the risk of adversarial relationship between the stake-holders and also to the negative impact on trustful and effective cooperation in a project. It is also obvious that the use of transparent compensation models and of relational oriented cooperation models (partnering) are highly connected to each other. So, transparency and relational oriented partnership seems to be favoured by a large majority of the respondents, especially when the risk for changes is high (ibid).

Thus, the majority of the clients in the Toolanen (2004) study, proposed sets of contracting models which will probably enable a better and more efficient implementation of quick, uncertain and complex projects that are today becoming more frequent. This indicates a need of change towards relational contracting models in Sweden as also demonstrated in some huge projects procured by the Swedish mine company LKAB. So, it is quite evident that the footprints of newer contracting behaviour will be more and more obvious at the Swedish construction market in the future.

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Development of a Sustainability Framework to Promote Business Competitiveness in Construction SMEs

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Abstract: This paper reports on a funded project, which aims to develop a Sustainability Framework that is designed and focused specifically for construction Small and Medium Sized Enterprises (SMEs) to enhance their business competitiveness and promote their innovative capacity. The output of this project will be a Sustainability Framework. The framework will include a set of performance indicators and associated IT-based toolkits to ensure the efficient use of natural resources resulting in increased productivity and sustainable procurement of goods and services resulting in best value for money. The framework will also include comprehensive guidance on environmental good practice within construction processes and social corporate responsibilities of the companies. The project is led by the Sustainability Centre Glasgow at Glasgow Caledonian University, in partnership with Laing O'Rourke, Dearle & Henderson, and the Centre for the Built Environment.

Construction SMEs in the West of Scotland significantly contribute to the local and regional economy. Their economic performance and business competitiveness lags behind other regions in the UK and EU. This project provides free assistance to 30 to 40 existing and new construction SMEs in the West of Scotland, which will include developing tailored assistance for each participating SME to promote their business competitiveness. This may involve establishing a reporting system to evaluate their sustainability performance, exploring knowledge management practices, providing assistance in the use of clean technologies, green design, sustainable procurement, efficient use of ICT, and supporting compliance with sustainability legislations. The project deliverables are expected to result in positive impacts on organisational competitiveness of participating construction SMEs. The identification of key issues and gaps in sustainable business practices and how this will input to the Sustainability Framework will be reported.

Keywords: Sustainability Framework, SMEs in Construction Industry, Sustainability Toolkit, Sustainability, Sustainable Construction

1. Introduction to the Research Project

This paper reports on a Scottish Executive Expertise, Knowledge and Innovation Transfer Fund (SEEKIT) and the European Regional Development Fund (ERDF) funded project, which aims to develop a Sustainability Framework that is designed and focused specifically for construction Small and Medium Sized Enterprises (SMEs) to enhance their business competitiveness and promote their innovative capacity. The identification of key issues and gaps in sustainable business practices and how this will input to the Sustainability Framework will be reported.

This project aims to enhance business competitiveness and promote the innovative capacity of construction SMEs in the West of Scotland through developing a sustainability framework to improve the performance within the construction industry. This project seeks to assist participating construction SMEs in pursuing sustainable construction practices, which will include efficient use of resources, sustainable procurement of goods and services, sustainable business strategies and incorporation of social and corporate responsibilities. The project will provide a bespoke sustainability strategy and action plan for participating construction SMEs. Overall, this project will develop a prototype sustainability framework that will include a set of performance indicators which could be measured. The core objectives of the project are indicated below:

- Investigate the current sustainability performance of Scottish construction SMEs;
- Identify sustainability knowledge gaps within Scottish construction SMEs;
- Improve sustainability performance of construction SMEs:
- Develop a sustainability framework that includes indicators, which could be used to evaluate the sustainability performance of construction SMEs.

2. The Issues and Gaps in Sustainable Business Practices

Sustainable Development is commonly defined as "Meeting the needs of the present generations without compromising the ability of future generations to meet their own needs" (The Brundtland Commission, 1987). The construction industry can contribute in putting Sustainable Development into practice by being more profitable and more competitive, delivering buildings and structures that provide greater satisfaction, well-being and value to customers and users, respecting and treating its stakeholders more fairly, enhancing and better protecting the natural environment, minimising its impact on the consumption of energy (especially carbon-based energy) and natural resources (DETR, 2000).

SMEs are a very important sector of the Scottish economy, accounting for 99% of the 243,000 businesses active in Scotland and representing 50% of non-government employment (Scottish Executive Social Research, 2003). The data in this survey shows the overall situation of SMEs in Scotland, however, there is not much difference in SMEs in the West of Scotland. In Scotland, construction SMEs account for approximately a sixth of all of its SMEs (Scottish Executive Social Research, 2003). The growth of construction SMEs is continuing in Scotland. For example, in Glasgow, construction investment across a wide range of sectors will expand significantly over the next decade, as a result of the investment programmes associated with: Housing Stock Transfer; M74 extension; school and hospital buildings; and major developments such as Glasgow Harbour, the Financial Services District, private house building and other commercial developments (Scottish Enterprise Glasgow, 2004). Significant contribution to the local and regional economy is one of the key reasons why this project focuses on the sector of construction SMEs.

However, the economic performance and business competitiveness of companies in the West of Scotland, of which vast majorities are SMEs, continues to lag behind many other regions of the UK and the EU. SMEs in the region find it harder to sustain themselves and to handle various pressures as independent firms.

Evidence found in SLIMS (2003) shows that the death rate of companies in the West of Scotland is higher than the UK and Scotland average; and further, the company death rate in the region has now overtaken the company birth rate. In addition, business survival rates in most parts of the region are below the Scottish and UK levels. Moreover, the figures found in SLIMS (2003) also gave an insight into the productivity of businesses (productivity is widely believed to be the principal motor of business success. This can be measured by the calculation of output per worker, represented by gross value added (GVA); business performance and competitiveness in construction SMEs in the West of Scotland are lower than the Scotland and UK average. The West of Scotland has a lower level of GVA per head in its construction SMEs than Scotland as a whole, amounting to £30,700 compared with the Scottish level of £32,200; furthermore, its capital investment per head was only £1,100 in 2001, compared with the Scottish average of £1,500.

In addition, the *Omnibus Survey of Small Businesses in Scotland* carried out in 2002 (Scottish Executive Social Research, 2003) also shows the same concern on the performance of SMEs. The survey identifies a number of obstacles to business competitiveness of SMEs, including difficulty in raising capital, poor awareness of available resources (e.g. Linc Scotland and Business Angels), reluctance of using external advice and low access of ICT. In particular, the survey finds that disappointingly, only 20% of constructions SMEs in Scotland are aware of the importance of the environment; 73% are family owned businesses; 58% of them can access the Internet but only 32% have a website.

In the area of construction skills, Scottish Enterprise Glasgow (2004), in particular, identified a number of market failures, including a high percentage of unskilled employees in construction SMEs, under-representation of women and ethnic minorities in industry, high turnover of trainees, restricted routes for adults into skilled trades, unattractive image of the workplace, limited accreditation, and polarisation of skills within the industry. These factors considerably impede the evolution of business competitiveness of construction SMEs and are explored in this project.

3. A Requirement to Enhance Business Competitiveness

This evidence demonstrates a pressing need to enhance business competitiveness of construction SMEs in the West of Scotland. Promoting best practice of sustainable construction is an effective and efficient way to help construction SMEs enhance their competitiveness and productivity, improve industrial profitability, provide greater satisfaction, well-being and added values to customers, allow them to respect and treat their stakeholders more fairly, and increase opportunities for finance raising (DETR, 2000; Bennett & Crudgington, 2003).

Therefore, in order to promote SMEs' business competitiveness and productivity, this project will collate and synthesise the best practice of sustainable construction not only in the UK but also worldwide into a sustainability framework specifically developed for this project. Subsequently, such a framework will be carefully tailored and embedded into the management structure, organisational culture and decision-making process of construction SMEs.

4. Background on SMEs and their Impact on the Construction Industry

The EU definition of Small and Medium sized Enterprises (SMEs) are firms/organisations employing up to 250 employees and having an annual turnover of less than £26 million (European Commission, 2005).

The UK construction industry contributes to some 10% of the overall GDP and employs nearly 3 million individuals. Most importantly, the product of the industry, the built environment – affects us all. For example, a material balance study by CIRIA identified that the construction sector receives around 360 million tonnes of raw materials, of which 90 million tonnes reappears as construction and demolition waste, of which only half is recycled. The industry uses 8 million tonnes of oil equivalent energy each year, which is approximately 5% of UK final energy consumption, or some 30% of industrial energy consumption.

Noticeably, SMEs have a particularly important role within the construction industry. In the UK, there were 3.7 million businesses in 1999 which in turn, could be regarded as actively small businesses, accounting for 99% of overall businesses and 58% of all employment. In Scotland, nearly 250,000 SMEs are the backbone of the economy, accounting for nearly half of all private sector employment. It should be noted that 18% of the UK SMEs base is within the construction industry and around a sixth in Scotland, and overall 18.5% of construction sectors are SMEs (Scottish Executive Social Research, 2003). This emphasises the importance of SMEs to the construction industry.

The present government has encouraged sustainable construction in Building a Better Quality of Life (DETR, 2000). This was further strengthened in a string of publications, e.g. Accelerating Change by Sir John Egan of the Strategic Forum for Construction (2003) and The Social and Economic Value of Construction (Pearce, 2003). The UK government state that the construction industry should contribute to the achievement of sustainable development by the following:

- being more profitable and competitive;
- delivering buildings and structures that provide greater satisfaction, well-being and value to customers and users;
- respecting and treating its stakeholders more fairly;
- enhancing and better protecting the natural environment; and
- minimising its consumption of energy (especially carbon-based energy) and natural resources.

Therefore, there is a pressing need for a sustainability toolkit that could assist construction firms in an effective and efficient way in order to enhance their competitiveness and improve their business performance. The study shows that such a need could be successfully fulfilled by promoting best practice of sustainable construction within the industry and embedding these practices into the corporate routine, management structure, organisational culture and decision-making process (DETR, 2000; CIEF, 2001; Fairclough, 2002; Bennett & Crudgington, 2003; CIRIA, 2003).

5. The Research Programme and Methods Employed

This research project has a two-year duration and its implementation is divided into five distinct phases. The project is currently at phase three.

Phase one involved the project preparation… This phase included developing a marketing strategy for the project which included undertaking a SWOT analysis within construction SMEs to identify opportunities and gaps within the construction industry. This phase also involved identifying criteria for the participating companies involved in the project; publicising the project in appropriate medias; collecting materials/information; conducting site visits to ensure each participating SME satisfied the criteria; and organising seminars/workshops to help SMEs understand the project background, concepts, methodology, and commitments.

This phase also investigated knowledge gaps and good practices of the participating companies in terms of sustainable business practices. This investigation was based on the following criteria; resource efficiency, compliance with environmental legislation, social and corporate responsibilities and the use of ICT.

At a later phase, a sustainability framework will be developed after working with a number of construction SMEs and incorporate other available studies and tools. The framework will be evaluated by individual participating companies in assistance with the supply chain of private industrial partners; Laing O'Rourke and Dearle and Henderson.

The deliverables for phase one are:

- Development of a marketing strategy for the project
- The recruitment of construction companies
- A workshop/seminar for construction SMEs
- A questionnaire study targeted at construction SMEs
- Guidelines for the development of a Sustainability Framework

Phase two involved the development of action plans for companies… A sustainability action plan will be developed for participating companies. This plan will be specially designed for construction SMEs to promote business competitiveness through sustainability good practices, including a set of performance indicators and associated toolkit, as well as comprehensive guidance on best practice of sustainable construction. The action plan will identify the barriers existing in the organisational culture and corporate structure against business competitiveness, and provide a comprehensive and operational scheme for improving their profitability and sustainability performance. This phase will additionally identify the services required to be delivered by the project team to achieve the SMEs action plan. Discussion will take place between the project team and individual SMEs on what and how these services will be effectively carried out and delivered to the firm.

The deliverables for phase two are:

- The construction of action plans for the participating companies
- Setting performance indicators for the participating companies to benchmark

Phase three involves delivering bespoke assistance to SMEs… This phase represents the major part of the project. It will provide assistance on actions identified during Phase two. Bespoke services will be provided through this project to help the firm promote business competitiveness and enhance profitability, based on their specific needs identified in light of improving their profitability and competitiveness. Those services could include; staff training, introduction of clean technologies, sustainable procurement, innovative management skills, and knowledge transferring skills, environmental reviews of site operations, database designing, compliance with environmental legislation and supporting and providing information for locally available service providers for the use of ICT, E-commerce and E-business. This will be delivered through in-house professional advice and knowledge transfer. The project team will ensure sufficient professional support is available in order to provide assistance.

The deliverables for phase three are:

- Introduction of new processes within companies
- Introduction of new products within companies
- A workshop/seminar for construction industry stakeholders
- In-house assistance to the companies to incorporate new technologies and products
- A report on change management within construction SMEs

Phase four will involve monitoring sustainability performance... The project team will work with individual participating SMEs and design a mutually agreed monitoring scheme to gauge the performance against an agreed action plan. In addition, the experiences and lessons demonstrated from monitoring results will enable the participating SMEs to develop performance indicators for their company. This information will then be collated for Phase five to re-adjust the sustainability framework designed for construction SMEs.

The deliverables for phase four are:

- Development of a monitoring protocol
- A report on construction SMEs after receiving assistance from the project

Phase five will involve evaluating and disseminating the sustainability framework... The sustainability framework developed will be evaluated by individual participating companies and disseminated through a number of workshops. Private industrial partners will assist in evaluating the framework through their supply chain.

The deliverables for phase five are:

- Evaluation criteria for the sustainability framework
- Dissemination workshop

6. The Sustainability Framework

6.1 What is the Proposed Sustainability Framework for Scottish Construction SMEs?

A sustainability framework will be developed and specifically designed for construction SMEs to promote their business competitiveness, including a set of performance indicators and associated IT-based toolkits, as well as comprehensive guidance on best practice of sustainable construction. To develop this framework, a wide range of good practices, which have helped construction firms to achieve sustainable successes, will be incorporated in this framework. This framework will incorporate relevant strategies, policies and instruments, e.g. the 24 Scottish sustainability performance indicators, Local Agenda 21, and private performance indicator (PPI). The development of the sustainability framework will also be supported through advice and expertise from consultancies, industries, government bodies, professional units and academia to ensure its comprehensiveness and practicability.

The above framework will be carefully tailored, based on the nature, size, legal status and financial situation of the participating SME. As a result, individual participating SMEs will develop their own sustainability strategy and action plan with the help of the project team. Services required by individual SMEs will be identified in their sustainability strategy.

The long-term ambition of this project is to apply the experiences and results obtained from this project to those SMEs in other sectors, e.g. manufacturing, retail and tourism.

It is, within this context that the Sustainability Centre in Glasgow (SCG) based within Glasgow Caledonian University has developed this project and incorporated a multidisciplinary approach for construction businesses to be sustainable. This includes combining economic growth, managerial issues, knowledge gaps, environmental issues and social aspects in construction SME businesses in an integrated sustainability framework.

6.2 Development of the Sustainability Framework

The sustainability framework will be developed for construction SMEs in a Scottish context for the targeted region; the West of Scotland. The framework will be prepared in conjunction with participating SMEs and the project partners; Centre for the Built Environment, Laing O'Rourke and Dearle and Henderson, as well as other relevant experts from the School of the Built and Natural Environment at Glasgow Caledonian University. The framework will be developed through introducing a number of initiatives such as:

- Providing bespoke assistance in the use of clean technologies, green design, sustainable procurement, effective business management, auditing and monitoring;
- Supporting construction SMEs to comply with different governing / environmental / sustainability legislations to improve business opportunities;
- Developing a reporting system for participating SMEs to evaluate their sustainability performance and identify key issues and gaps which need to be addressed;
- Assisting SMEs in incorporating best practice of sustainable construction in their environmental, social and corporate responsibility; and
- Supporting in modernising Scottish construction SMEs through the effective use of ICT, E-commerce and E-business.

It is proposed the 'Sustainability Framework' will be a benchmarking tool for businesses to measure, evaluate and improve their performance against 'three standard' dimensions of sustainability, i.e. economic, environment and social. However, the proposed framework will include a fourth dimension - 'processes'. The identification of 'processes' as a fourth dimension will assist companies to bring about change in terms of economic, social and environmental sustainability within their businesses.

The four dimensions of the proposed 'Sustainability Framework' will be divided into 16 further components as shown in Table 1.

Table 1 – Dimensions of the Sustainability Framework

Economic	**Social**	**Environment**	**Processes**
Investment	Corporate Social Responsibility (CSR)	Raw material consumption	Change Management
Profitability	Environmental and Social justice	Climate Change	Generic skills required to bring about change
Productivity	Green jobs	Waste generation	Policies and Regulations
Resourcing	Inclusiveness	Energy and water efficiency	
		Land use	

For all participating companies, each of the 16 components will be assessed to determine their benchmark performance. Each benchmark can be used thereafter as a measuring tool for the business.

This investigation will involve all components in terms of a) introducing best practice b) providing assistance to incorporate best practices c) setting targets for the companies according to their capability and capacity, and d) measuring performance.

This tool will give a 'one stop' approach to tackle the sustainability agenda and also covers the 24 Scottish Indicators of sustainability. It must be noted that the 16 proposed components might be subject to modification following industry feedback.

6.3 Purpose of the Sustainability Framework

The purpose of sustainability indicators is to help measure a company's economic, environmental, and social performance and to provide information on how it contributes to sustainable development (Azapagic et al., 2000). Sustainability reports are emerging as a new trend in corporate reporting, integrating into one report; the elements of financial, environmental and social performance (GRI, 2002).

The 'sustainability framework' aims to assist decision makers within the construction industry to explore and record the processes and critical success factors that will be associated with the sustainability agenda. In addition, the framework will assist companies to incorporate associated processes which are crucial to their business competitiveness and assist the mainstream sustainability agenda into their business environment.

6.4 Testing and Piloting the Framework

The framework will be tested and piloted with all participating companies to ensure that the functionality of each key performance indicator matches the industrial specification. The testing will be carried out by the project team, in addition to questionnaires and interviews with both decision makers within companies and their supply chain. The functionality of the framework will be comprehensively tested and validated through a series of case studies.

7. Summary and Conclusions

The project aims to enhance productivity and business competitiveness of construction SMEs through promoting sustainable construction practices within the industry. This is identified as a pressing need for the construction SMEs in West of Scotland, because it has been shown that construction SMEs are an important sector of the Scottish economy and its economic performance and business competitiveness continues to lag behind many other regions of the UK and EU.

This project will contribute to the local economy as well as improving quality of life via social progress and environmental protection. In summary, this project clearly reflects and complements both area-based strategies and sector-based strategies in general as well as in particular for the construction industry.

8. Acknowledgements

The work described in this paper was funded by the Scottish Executive Expertise, Knowledge and Innovation Transfer Fund (SEEKIT) and the European Regional Development Fund (ERDF).

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Using real options in evaluating PPP/PFI projects

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Abstract: The appraisal of PPP/PFI projects relies on financial evaluation methods such as the Net Present Value analysis. However, this method sometimes fails to model uncertainties, irreversibility of decisions and managerial flexibility and may, therefore, lead to wrong decisions. Newer methods, such as the real options analysis may assist in this direction by taking into account that a project may be delayed, abandoned or sub-divided strategically into components. Some or all of the above changes may, in turn, reduce uncertainty or otherwise benefit the project realization process. These arguments are further elaborated in this paper by the use of a hypothetical toll road project which is studied comparatively by both traditional and options methods. It is concluded that real options, despite the difficulty in their proper application, may provide better decision-making for evaluating PPP/PFI projects at the appraisal stage.

Keywords: PPP, PFI, Real Options, Evaluation.

1. Introduction

Public Private Partnerships (PPP) or Private Finance Initiative (PFI) projects have gained popularity worldwide because of the shortage of public sector financial resources and the acknowledgement of certain private sector advantages. At the same time, these projects are difficult to design, implement and operate due to the complexities, interdependencies and uncertainties involved and the different perceptions of the related issues between their stakeholders. A large amount of initial investment is required whereas the payback period is long and uncertain.

For this reason, PPP projects must first prove their financial viability so that their implementation is endorsed. Traditional evaluation methods, such as the Net Present Value analysis fail to evaluate them properly, since their special characteristics, namely risks, government guarantees, negotiations and project financing cannot be taken into account (Ho and Liu, 2002).

Various evaluation methods have been developed to enhance the traditional methods. One of them is "*real options*". Real options analysis facilitates flexibility in management decisions, especially in later stages of implementation which are due to unexpected events.

The use of real options gained popularity in the construction industry. Some of the researchers who used the real option approach are mentioned hereafter. Sing (2002) appraised the value of time-to-build option in a commercial development project. Yeo and Qiu (2003), acknowledged the need for managerial flexibility and used real options analysis. Nordvik and Liso (2004) applied the real option methodology to show the interdependencies between the climate change and the behaviour of building owners. Ekstrom and Bjornsson (2005) used the real option approach to evaluate architecture, engineering, and construction information technology investments. Yiu and Tam (2006) applied the real option concept in the bidding process.

However, research has also been conducted in the use of real options for the evaluation of both PPPs and conventional projects. Rose (1998) examined and evaluated two options for a toll road, the "concession period" option and the deferral of the concession fee and acknowledged that the options can help in the proper estimation of the value of project. However, it was also observed that the interactions of the options have an impact on the value of the project. Ho and Liu (2002) developed a real option pricing model taking into account the uncertainties concerning the project net cash flow and the construction cost. They arrived to the conclusion that their model constitutes a basis for PPP project financial evaluation. Ford et al. (2002) used a binomial option pricing model to represent alterations in design and arrived at the conclusion that the option can enhance managerial flexibility. Garvin and Cheah (2004) illustrated the potential of the option to defer evaluation of an infrastructure investment. According to them, options are easy to apply but their assumptions must be seriously taken into account. Huang and Chou (2006) combined the option to abandon and the minimum revenue guarantee in the pre-construction phase of a BOT infrastructure project, and arrived at the conclusion that real options analysis may offer distinct benefits. In any case, options combination may have a negative impact on their values. Mattar and Cheah (2006) introduced a new category of risks, which they called private risks and investigated the effect of this new risk category on real options. They ended up that their category of risk could be considered as the premium of the real option analysis.

The intention of this paper is to examine how the real options analysis can improve the financial evaluation of a PPP project. For this reason, a comparison has been made between the traditional evaluation methods and the real options analysis. A difference between the current work and the previous ones is that the comparison is not made purely between Net Present Value (NPV) and real options but sensitivity analysis and scenario analysis are also performed. Another difference is that two out of three real options presented in this paper are not based on mathematical formulae, but on a way of thinking. It is revealed that real option analysis is not always mathematical, it is also, and this is more important, a conceptual process.

Table 1: Previous work on real options for PPP project evaluation

	Research	Conclusions
Rose (1998)	Evaluation of two options: "concession period" option – deferral concession fee option	Options can help in estimating the project value, but their interactions have an impact on it
Ho and Liu (2002)	Development of an option pricing model, incorporated two variables: project net cash flow and construction cost	The option model provides an adequate framework for the PPP financial evaluation
Ford et al. (2002)	Evaluation of a binomial option pricing model to design flexibility	Real options can boost the project flexibility
Garvin & Cheah (2004)	Evaluation of an option to defer, an "economically corrected" decision-tree	Option models provide simplicity and applicability but their assumptions must be taken into account
Huang & Chou (2006)	Combination of two options: option to abandon – minimum revenue guarantee	Option approach "looks promising" but the options combination decreases their values.
Mattar and Cheah (2006)	Real option and private risks	"Private risks" can be considered as the premium of the real option analysis.

2. Traditional evaluation methods

The traditional evaluation methods rely on the discounted cash flow series for the calculation of the Net Present Value (NPV). Their considerable advantages are the clear, consistent decision criteria for all projects, which are relatively simple, widely taught and accepted. Also, they are not influenced by the risk preferences of the investors. Finally, their results are easy to understand and interpret. A positive NPV means that the project is financially viable.

On the other hand, these methods do not take into account the dynamic environment of a project and the continuously changing reality of business; therefore they are outdated (Yeo & Qiu 2003). Using these methods, the investor has no other choice than "take it or leave it". However, it is very hard to make a decision when there are uncertainties and risks involved. This is the case with the PPP projects. As time progresses, new information is available through market research or feasibility studies. These changes may require flexible project design. The traditional evaluation methods do not properly depict these changes. Additionally, the NPV method is sensitive to the discount rates. A small increase or decrease in the discount rate will have a considerable effect on the final output of NPV.

Many of the above mentioned disadvantages of the NPV are mitigated through the sensitivity analysis as well as the scenario analysis.

3. Real option analysis

Contrary to the common belief, real options concept is not new. The first reference to real options is found in the Aristotle's writings. He described how Thales the Melesian, an ancient philosopher, concluded from tea leaves that there would be an olive harvest in six months time. Then, he agreed with the owners of olive presses to buy the right to rent their presses at the usual rate. When the harvest was collected, he rented the presses at above the market rate to the growers who were in need, while he paid the normal rate to their owners.

From the above reference, it is clearly illustrated the concept of real options. Options are known from the financial world where they represent the right (not the obligation) to buy or sell a financial asset at a predetermined price (the exercise price) at the end of a predetermined period. The selling or buying of an asset at the predetermined price is termed "*exercising the option*". For a European type of option, it is only possible to exercise the option at the end of the option period. On the contrary, it is possible to exercise the option at any time using the American type of option.

Real options are based on the same principles as financial options. Having a "real option" means to have the possibility for a certain period to choose either for or against something, without binding up front. This possibility provides flexibility in the decision process. But real options differ from the financial ones, in terms that the real options are concerned with the strategic decisions of an organization. Consequently, they need to be considered from a wider viewpoint, while financial options can always be used independently. The most common real options are the option to defer, to abandon, to alter, to switch and the growth option.

Real options gained popularity through the work of Black and Scholes (1973). Their formulas for the prices of a European call option (c) and a European put option (p) on a non-divided-paying stock at time zero are:

$$c = S_0 N(d_1) - Xe^{-rT} N(d_2) \quad \text{(Equation 1)}$$

$$p = Xe^{-rT} N(-d_2) - S_0 N(-d_1) \quad \text{(Equation 2)}$$

where:

$$d_1 = \frac{\ln(S_0 / X) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln(S_0 / X) + (r - \sigma^2 / 2)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

while N(x) is the cumulative probability function for a variable that is normally distributed with a mean of zero and a standard deviation of 1.0, S_0 is the stock (current) price at time zero 0, X is the strike price, r is the continuously compounded risk-free rate, σ is the stock price volatility and T is the time during which the option is exercised.

4. The hypothetical toll road project

A hypothetical toll road infrastructure project is used to compare and evaluate the traditional evaluation methods against the real option analysis. A public authority, wanting to develop a region's infrastructure, has decided to construct a toll road under the PPP scheme. The concession period is decided to be 30 years, while 5 years is estimated to be the construction period and 260.000.000 € the cost of the works. It is assumed that the initial traffic volume will be 50.000 vehicles per day, and it is expected to grow at a rate of 10% in years 7-11 and 5% in years 12-30. The initial toll is anticipated to be 2,00 € and it will grow in accordance with the inflation. Specifically, due to the expecting good course of the economy, the inflation estimation is 3,1% for years 7-10, 3,0% for years 11-14, 2,9% for years 15-18, 2,8% for years 19-22, 2,7% for years 23-26 and 2,6% for years 27-30. The operating expenses are estimated to be 65% of the income for the first year of operation (year 6). The operating expenses are estimated to grow due to the maintenance works, 5% for the years 7-11, 7% for the years 12-16, 9% for the years 17-21, 10% for the years 22-26, 12% for the years 27-30. The discount factor is estimated to be 15%. The estimations and assumptions mentioned above are summarised in Table 2.

Table 2: Estimations and assumptions of the hypothetical toll road for NPV method

NPV				
	Initial estimation	**Fluctuation**	**Variations**	**Period**
Concession period	30 years			
Construction period	5 years			
Investment cost	260.000.000 €			
Discount factor	15 %			
Traffic volume	50.000 vehicle/day	Increase	10%	7-11 years
		′′	5%	12-30 years
Toll	2 € (year 6)	Decrease	3,1%	7-10 years
		′′	3,0%	11-14 years
		′′	2,9%	15-18 years
		′′	2,8%	19-22 years
		′′	2,7%	23-26 years
		′′	2,6%	27-30 years
Operating expenses	65% of the income (year 6)	Increase	5%	7-11 years
		′′	7%	12-16 years
		′′	9%	17-21 years
		′′	10	22-26 years
		′′	12	27-30 years

4.1 NPV analysis using Discounted Cash Flow.

Using this analysis, the resulted NPV is - 45.465.705 €, thus it is proved that the project is not financially feasible. The NPV calculations of the hypothetical toll road are tabulated in Table 3.

Table 3: Estimations and assumptions of the hypothetical toll road for sensitivity analysis and scenario analysis

Sensitivity analysis		
	Variations	
Traffic volume	± 20 %	
Operating expenses	± 20 %	
Discount factor	± 20 %	
Investment factor	± 20 %	
Scenario analysis		
	Probability	**Variations**
Normal	50 %	
Optimistic	30 %	Traffic volume + 30 %
Pessimistic	20%	Traffic volume – 30 %

4.2 Sensitivity analysis

After the calculation of NPV, a sensitivity analysis is performed. Four variables, namely traffic volume, operating expenses, discount factor, and the investment cost are selected to fluctuate 20%, so the sensitivity of calculated NPV to these changes is noted (Table 3). Table 5 presents the possible NPV for each variable alteration. It is observed that the critical variable is the discount factor. It is confirmed the above-mentioned disadvantage of the NPV. Moreover, all the calculated NPV is negative with only two exceptions, which means that the project is still not financially viable.

4.3 Scenario analysis

The next step was the creation of scenarios. In a toll road, the critical variable is the traffic volume that is the generated income. So, three possible scenarios were created and a subjective estimation of the occurrence of each scenario was made. Specifically, an optimistic scenario is estimated to be that the initial traffic volume will be 30% higher than the calculated and the probability of this occurrence is assigned to be 30%. A pessimistic scenario is considered to be that the actual traffic volume will be 30% less than the calculated one with 20% probability of occurrence (Table 3). NPV for each of the scenarios are calculated and an Expected NPV is calculated to be -40.261.836 € (Table 6). Therefore, the project still does not seem to be viable.

Table 4: NPV calculations of the hypothetical toll road

	Average Traffic Volume	Toll	Gross Revenues	Operating Expenses	Operating Income	Investment Cost	Discount Factor	Discounted Income	Discounted Investment Cost
1	0	0,00	0			52.000.000	0,8696		45.217.391
2	0	0,00	0			52.000.000	0,7561		39.319.471
3	0	0,00	0			52.000.000	0,6575		34.190.844
4	0	0,00	0			52.000.000	0,5718		29.731.169
5	0	0,00	0			52.000.000	0,4972		25.853.190
6	18.250.000	2,00	36.500.000	23.725.000	12.775.000		0,4323	5.522.985	
7	20.075.000	2,06	41.394.650	24.911.250	16.483.400		0,3759	6.196.721	
8	22.082.500	2,13	46.945.673	26.156.813	20.788.860		0,3269	6.795.915	
9	24.290.750	2,19	53.241.087	27.464.653	25.776.434		0,2843	7.327.271	
10	26.719.825	2,26	60.380.717	28.837.886	31.542.831		0,2472	7.796.905	
11	29.391.808	2,33	68.411.352	30.279.780	38.131.572		0,2149	8.196.123	
12	30.861.398	2,40	73.986.878	32.399.365	41.587.513		0,1869	7.773.004	
13	32.404.468	2,47	80.016.808	34.667.320	45.349.488		0,1625	7.370.560	
14	34.024.691	2,54	86.538.178	37.094.033	49.444.145		0,1413	6.987.875	
15	35.725.926	2,62	93.500.174	39.690.615	53.809.560		0,1229	6.612.898	
16	37.512.222	2,69	101.022.264	42.468.958	58.553.306		0,1069	6.257.286	
17	39.387.833	2,77	109.149.505	46.291.164	62.858.340		0,0929	5.841.167	
18	41.357.225	2,85	117.930.582	50.457.369	67.473.213		0,0808	5.452.181	
19	43.425.086	2,93	127.294.270	54.998.532	72.295.738		0,0703	5.079.883	
20	45.596.340	3,01	137.401.436	59.948.400	77.453.036		0,0611	4.732.402	
21	47.876.157	3,10	148.311.110	65.343.756	82.967.354		0,0531	4.408.112	
22	50.269.965	3,18	160.087.012	71.878.132	88.208.880		0,0462	4.075.302	
23	52.783.463	3,27	172.629.829	79.065.945	93.563.884		0,0402	3.758.875	
24	55.422.637	3,36	186.155.376	86.972.539	99.182.837		0,0349	3.464.881	
25	58.193.768	3,45	200.740.650	95.669.793	105.070.857		0,0304	3.191.804	
26	61.103.457	3,54	216.468.680	105.236.773	111.231.907		0,0264	2.938.228	
27	64.158.630	3,63	233.201.709	117.865.185	115.336.523		0,0230	2.649.264	
28	67.366.561	3,73	251.228.201	132.009.007	119.219.193		0,0200	2.381.259	
29	70.734.889	3,83	270.648.141	147.850.088	122.798.052		0,0174	2.132.820	
30	74.271.634	3,93	291.569.242	165.592.099	125.977.143		0,0151	1.902.640	
Total								**128.846.361**	**174.312.065**
								NPV	**-45.465.705**

Table 5: Sensitivity analysis

	NPV		
	+20%	**Normal**	**-20%**
Traffic Volume	4.499.153	-45.465.705	-95.430.562
Operating expenses	-69.661.290	-45.465.705	-21.270.119
Discount factor	-75.154.845	-45.465.705	9.834.448
Investment cost	-80.328.118	-45.465.705	-10.603.292

Table 6: Scenario analysis

	NPV		
Normal	50%	-45.465.705	-22.732.852
Optimistic	30%	29.481.582	8.844.474
Pessimistic	20%	-120.412.991	-24.082.598
Total NPV			**-37.970.976**

4.4 Real option analysis

Although the NPV, the sensitivity and scenario analyses show a significant negative amount, it is expected that the investment decision can be better improved through the real option analysis. Hence, a real option analysis is performed. Three real options to abandon are examined because these types of options can create substantial values in a project (Huang and Chou, 2006).

4.4.1 Option to abandon (1)

In many cases, the investor is provided with the possibility to abandon the project in a specific time. In this study, the investor can abandon the project after 1 year. That is, the investor has the right (not the obligation) to abandon the project without cost after 1 year. This procedure can be simulated with a European call option. Using the above-mentioned Black-Scholes formula (equation 1), the price of the option is calculated. The calculations and the assumptions are presented in Table 7.

S_0 is the present value of gross revenues and X is the present value of total costs, where total costs are the sum of the operating expenses and the investment cost. The variable r is estimated to be 3% while the volatility is anticipated to be 25%. Finally, the time to exercise the option is 1 year.

The price of the calculated option is 12.201.435,83. Comparing to the traditional NPV analysis, the actual value of the process is [12.201.435,83 + (- 45.465.705)] = 57.667.140,83€. Comparing to the scenario analysis, the actual value of the process is [12.201.435,83 + (-37.970.976)] = 50.172.411,83 €. Equivalent calculations can be made between the sensitivity analysis and the real option.

Table 7: Real options assumptions and analysis

Present Value Of Turnover (S_0)	249.824.287
Present Value Of Total Cost (X)	295.289.991
Riskless rate	0,03
Volatility (σ)	0,25
Time (T)	1
Option Price	12.201.435,83

d1	-0,42
d2	-0,67
N(d1)	0,34
N(d2)	0,25

4.4.2 Option to abandon (Passive process)

As mentioned before, the real options analysis is not based only on a set of equations but it also involves a decision making process. For instance, the investor may decide to wait for one year in order that the uncertainties become resolved and the market revealed. If the optimistic scenario occurs, the investor will go ahead, without any cost; otherwise he may abandon the project. Hence the payoff of the options is given by

$$payoff = \begin{cases} optimistic \quad scenario \rightarrow NPV \cong 29.000.000\, EURO \\ normal \quad and \quad pessimistic \quad scenario \rightarrow abandon \end{cases}$$

4.4.2 Option to abandon (Active process)

Instead of waiting passively for the uncertainties to become resolved and the market revealed, the investor can decide to adopt a more rigorous process and conduct a market research. Market research is supposed to take 6 months to be conducted. In this case, if the market research signifies a favorable condition, that is the optimistic scenario will take place, then the payoff of the options is given by

$$payoff = \begin{cases} optimistic \quad scenario \rightarrow NPV = 29.000.000\, EURO - \\ \qquad - \cos t \quad of \quad market \quad research + 6 \quad months \quad of \quad operation \\ normal \quad and \quad pessimistic \quad scenario \rightarrow abandon \end{cases}$$

The downside of this process is that there is a market research cost (it can be said that it represents the premium paid to obtain the option), while the profit is that the project will start 6 months earlier than in the previous case.

5. Conclusion

The financial viability of a PPP project is vital for its implementation. The traditional evaluation methods, such as NPV, cannot properly assess the dynamic environment of these kinds of projects. This paper presents a comparison between three real options and the NPV traditional evaluation method by the use of a hypothetical project. Sensitivity analysis and scenario analysis were also performed to overcome the demerits of NPV. The comparisons show that the real options method can indeed enhance the value of a project.

Nevertheless, real options cannot be seen as a panacea. Some of the drawbacks found in the NPV process are also incorporated, such as the accuracy of the cash flow. The actual advantage of the real options analysis is that it can depict in a more clear way the decision making process which takes place in a PPP evaluation procedure. That means, that this kind of analysis cannot be based exclusively on mathematical equations; it requires analytical thinking as well.

The use of a hypothetical project instead of a case study could be considered as a limitation of the current work. However, the primary purposes of this study were to indicate how the real option approach enhances the value of a project and to show the related analytical mental process. These purposes have been fulfilled. The use of a case study in future research could be a more stable and rigid basis for conclusion drawing. Further research could also incorporate the game theory so as the interaction between participants can also be taken into account. Thinking in terms of real options and game theory is believed to boost the decision making process which takes place in a PPP evaluation procedure.

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Sustainability in small Construction companies in Australia: Implications for procurement strategies

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Abstract: This paper discusses different approaches to sustainability and their implications for procurement strategies. The discussion is based on a study of barriers to the take-up of sustainable practices in fifteen small and medium sized companies (SMEs) within the construction industry in Queensland, Australia and thirty five comparison companies in the same area. The companies presented their own definitions of sustainability, how they approached sustainability and the hindrances and possibilities they saw with successful sustainability efforts. Two different sustainability approaches emerged; one approach where sustainability was considered to be linked to environmental, social and economical ambitions, one where sustainability was considered to be linked to maintaining a business strongly emphasizing financial goals. It is argued that the choice of procurement strategy will depend on how sustainability is approached. Awareness of different approaches to sustainability facilitates understanding of why certain procurement strategies are chosen.

Keywords: Change, Entrepreneurship, Procurement, Sustainability,

Introduction

Sustainability has become one of the most important issues today for companies to relate to. Even though large companies have been working with sustainability for quite some time now, small and medium sized companies (SMEs) don't seem to have adapted the concept to the same extent. There is a need to learn how these companies approach sustainability and to study how these approaches are concretised through strategies and activities. This paper is based on a study of SMEs' approaches to sustainability and how these approaches are concretised through company strategies. Especially procurement issues are being focused.

To collect information about approaches to sustainability a questionnaire was developed. The aim with the questionnaire was two folded: to understand attitudes towards sustainability and to explore the current take-up of sustainable practices. The questionnaire consisted of three general questions and sixteen multiple choice questions. This second part was done differentiating between ecological, economical, and social sustainable practices. The final version of the questionnaire was web based. The questionnaire was sent two times via email to SMEs with a link to a web page. The software of the questionnaire enabled collection of full responses of the questionnaire excluding questionnaires that were not completed from start to finish collectively. We received 50 full responses after the two emails were sent out and we had almost 400 non completed responses which has not been included in the survey. We received 15 responses from Small and medium sized construction companies and the rest from other industries. Among the other industries Manufacturing was represented with 15 responses. Other industries were for instance Health and Community Services and Education

(5 each). The questionnaire asked companies to describe sustainability using keywords. The keywords would then be used to map the mental images of sustainability, providing us with indirect definitions of the concept. The companies were also asked to describe how they approached sustainability (on basis of their keywords) and if they recognized any opportunities/pitfalls while working with sustainable practices. The responses were then compared with contemporary research about sustainability. We wanted to know how the companies viewed sustainability and if sustainability was considered useful. We also wanted to understand which were the most important questions related to sustainability and how these question could be linked to strategies and practices.

The aim of the paper is to describe how small and medium sized companies in Queensland, Australia approach sustainable ideas and practices and to discuss how these approaches affect company strategies. Procurement strategies are chosen as focus.

The paper continues with a description of how sustainability was comprehended and approached. The opportunities and pitfalls that the companies linked to sustainability are also described. A discussion about how procurement strategies can be explained as departing from different sustainability approaches concludes the paper.

Defining Sustainability

Whilst contemporary research to a high degree departs from ecological standpoints (Brundtland 1987, Priemus 2005) the responses from the Queensland companies tend to depart from both ecological and business standpoints and sometimes holistic approaches are described linking environmental, social and business related issues together. The responses often had a process focus and the concept of sustainability was defined in terms of actions one needed to take.

The responses from the construction companies were similar to the ones from other organisations with two common themes expressed by all companies, one definition was holistic and the other one had an emphasis on making business. The most common theme among the definitions was that sustainability needed to depart from a business perspective. Business or business related keywords were the basis of the descriptions given in 82 percent of the responses. Business related keywords were for instance; market share, financial aspects, profitability, liquidity, competitive, and development of better products. More than 50 percent of the responses explicitly mentioned maintaining the business as the first priority but the other half linked their business operations to environmental and social concerns, making it similar to the Triple P concept (People, Profit, and Planet). These two approaches were dominant.

The respondents seemed to have a general idea of what sustainability is. Only two of the respondents were unsure of the meaning of the concept. Some of the responses dealt with legal requirements or other regulations imposed on them by the government. In these cases, sustainability was seen as something imposed by the government and thus another thing to consider in the operation of their businesses. The distinction made here is that though some of the respondents viewed sustainability as a driving force to be acted proactively upon, others regarded sustainability as an external imposed requirement that they needed to adapt to. Another interesting thing is that the definitions seem to depart from different understandings of sustainability. For instance, some focus on making business, some on holistic approaches (sustainability as integrating economical, environmental and social concerns), and a few have an environmental emphasis. Below is a list of the most frequent themes that were mentioned while describing the concept of sustainability, number of times the theme was mentioned (construction companies within parenthesis) and different approaches to sustainability

Table 1: Defining sustainability themes and approaches.

Sustainability theme	Number of times mentioned	Approach
Thinking of not only business but also environmental and social aspects	20 (7)	Holistic
Maintaining the business	18 (7)	Business
Maintaining market share	2 (1)	Business
Adopting business practices	2 (-)	Business
Understanding how the business interact with their stakeholders	2 (-)	Business, Social

It seems as if the companies have a sense of sustainability as something departing from making business – maintaining the business and thinking of business as well as environmental and social aspects were the most common answers. This gives us a business based holistic approach to sustainability. The responses also aim towards both actions and mindsets. This indicates that sustainability is considered to be not only about taking measures but also to think in a sustainable way.

Sustainable practices would thus need to be backed up with certain attitudes and values. In this respect the empirical material is in line with dictionary definitions and research: One dictionary definition of sustainability is “to keep in existence; to maintain; to nurture; to keep from failing; to endure” (Evenson et al 1974, American Heritage Dictionary). Oxford English Dictionary defines sustainable as “Capable of being maintained at a certain rate or level”. From a business point of view sustainability can be defined as “the ability of a company to make profits while sustaining the environment.” (2002, A Dictionary of Business)

One way of dealing with Sustainability has been to avoid defining its core meaning and instead to call it “…a signpost pointing to a general direction we must take, while the debate is engaged about the best path to lead us forward” (Dunphy et al., 2000:5). Clearly defining sustainability requires consensus on what to sustain, what to develop and for how long. It also requires discussions about how to make a transition from behaviors that trend toward the unsustainable to ones that are more likely to be sustainable. (Parris 2003)

Approaching Sustainability

The second question dealt with what the companies actually do in terms of sustainability. Contemporary research often emphasizes the need to concretize sustainability ambitions. Integration of sustainable practices needs to aim not only directly towards behavior but also values, attitudes, motivation, culture and communication. Business research has mostly covered management control related aspects of sustainability within certain industries (e.g. measurement of sustainable practices integrated in balanced scorecards and measuring activities aligned with sustainability indices in for instance schools, nursing care, IT, and construction industries). Other themes that have been investigated in relation to sustainability in some depths are eco innovation and new product development (Devashish 2006). The argument that is being put forward in business related journals is that it is important to approach sustainability not only with traditional business measures but also with ecological measures and social measures. There have been several attempts to study the relationship between sustainability performance and business competitiveness. (Schaltegger & Wagner 2002, Marshall & Brown 2003) While there are several proofs of how negative ecological sustainability performance can affect competitiveness (for instance the Exxon Valdez oil spill in Alaska) or negative social/business sustainability (for instance the Enron scandal), there is less evidence on how positive ecological and social performances affect competitiveness. Even though revisionist economics argues that improved environmental performance is a potential source of competitive advantage, more empirical studies are needed to establish this statement. One important precondition for companies that want to gain competitive advantages is that they need to invest in the ability to innovate and develop new technologies and production approaches (Wagner & Schaltegger 2003).

SME approaches in Queensland

The survey revealed several approaches to sustainability ranging from an emphasis on social support to adopting business related technologies such as balanced scorecard methodologies. The approaches also differed in terms of structural measures versus process commitments. With structural measures we mean measures that typically are occasional, aiming to create certain organizational structures that support certain routines or standard ways of operations. Process measures on the other hand typically involve ongoing events including activities that are carried out within an organizational structure. The responses from the construction companies did not differ much from the other companies except from that whilst other organizations emphasized recycling and promotion and use of environmental friendly products the construction companies did not mention it. Perhaps this is so obvious in the daily operations for these companies that they do not consider it when asked about it. Most of the companies emphasized process or ongoing sustainability activities. Three major approaches have been identified below.

1. Responses within the *Environmental/Social approach* focused on measures aimed towards external interests or measures taken due to legislation. Some examples within this approach are recycling, social sponsorship and community involvement, collaboration with governmental bodies, use of environmentally friendly means of production and offers.
2. Another approach departed from a business perspective and consisted of traditional *business measures* such as strategic planning, managing a strong corporate culture and striving towards corporate growth. No or minor links were made to environmental or social concerns.
3. The third approach was *holistic*. The issues listed by these companies consisted of both business and environmental and/or social aspects. Measures are taken in order to reach financial goals but in doing that additional considerations are taken. Both environmental and social obligations are being mentioned as affecting business decisions.

A list of sustainability related practices that the companies mentioned is shown below (number of times mentioned within first parenthesis and number of construction companies within the second).

Table 2: Sustainable practices and activities.

Business practices and activities	Environmental/social practices and activities	Holistic practices and activities
Concentrate on operational and financial activities (4) (2)	Recycling (8) (1)	Collaborations with external parties with sustainability aims. (3) (1)
Promote and respect core values (4) (1)	Promotion and use of environmental friendly products (7) (1)	Working towards ISO 9000:2000 or similar accreditation (2) (0)
Training and staff development (4) (2)	Community support and involvement (4) (1)	Education forums and seminars (1) (0)
Use of auditing tools, ongoing control of systems (3) (2)	Environmental research and development (3) (-)	Integrated strategic activities, look to the future (1) (1)

One of the findings from this part of the study was the number of different issues that were suggested by the respondents. It comes as no surprise that several practices and activities dealt with recycling and use of environmental friendly products. As shown earlier this has to do with the history of sustainability. If we view all responses as a whole we will also notice the significant amount of traditional business related practices that are being put forward.
One interesting thing with the measures that departed from a business perspective was that no task dominated another. Sustainability differs from other management concepts in this respect. For instance in a company which is to promote the concept of customer orientation there would be an internal emphasis on evaluating customer relations, measurement of client contacts and so forth. If Total Quality programs were to be implemented one would expect to see internal measurement of certain quality parameters and workshops were quality was discussed and assessed. Thus one would have expected to find a general connecting "sustainability" thought, however such is missing.

Sustainability: opportunities and pitfalls

The third question investigated perceived possibilities and risks with the sustainability theme. This of course is dependent on how the concept is defined. The emphasis of business and business-environmental issues were exposed by the respondents in the first two questions, therefore it was not surprised to find that these themes also dominated when the companies discussed opportunities and pitfalls. Research in this area often emphasizes financial concerns when pitfalls are focused upon (Clift & Wright 2000). Sometimes these concerns are linked to company performance and the needs for innovations are stressed. (Porter & van der Linde 1995) Scientists also emphasize the need not to view sustainability as an end but rather as an ongoing process (Wagner & Schaltegger 2004). This suggests that the way sustainability is viewed by people in the organizations may be crucial to its possibilities to make a difference.

When opportunities are discussed the possibility to achieve long term financial gains are mentioned (Porter 1991, Porter & van der Linde 1995). Interestingly the risks or benefits from working with social sustainability are seldom dealt with.

The opportunities mentioned in the questionnaire were strongly linked to long term financial gains and corporate growth. One would expect that most of the replies focused on the business opportunities and so they did. Sustainability was viewed as a way for striking a balance between short and long term profits. In the everyday operations the companies did not have time to think in the long term and sustainability was viewed as a tool to be used for compensating this neglected task. Some opportunities were thought to be found among costumers and other external stakeholders; whereas some opportunities were found within the organizational structure. The replies from the construction companies were similar to the responses from the other organizations. No significant differences were observed.

Table 3 lists the opportunities in terms of themes, how often they were mentioned and if the focus mainly is business, environmental, social or holistic. We have also listed whether the issues raised are externally, internally or generally aimed:

Table 3: Sustainability opportunities.

Theme	Number of times mentioned	Focus and aim
Develop the business	11 (5)	General Business
Preparedness for new possibilities and circumstances	9 (4)	General Business
Develop network relations	8 (2)	External Business
Reduce environmental costs	4 (1)	Internal Environment
More efficient HR	4 (1)	Internal Business

Taking up sustainable practices was considered to support a general ambition to develop the business and to create a readiness for unexpected events in the future. What is especially interesting is that in aligning to sustainable practices, companies believed relations with external stakeholder could be strengthened and new relations could be developed. Some comments mentioned explicitly that taking up sustainability could improve government relations whilst others had a stronger view on improving relations with clients and other entrepreneurs. Table 3 also shows that very few comments were pointed towards environmental opportunities (4) and social opportunities were not mentioned at all. Obviously the replies that mentioned HR development could be said to have social elements, but the emphasis in the replies was on the business aspect. Sustainability pitfalls were described in more precise ways and business was heavily focused upon. Four different themes were discussed: mindsets, regulations, money and organizational structure. These four areas all consist of possible problems that the companies thought they could encounter.

Staff mindsets were regarded as the single most difficult issue to deal with. Cultural resistance to change and difficulties in attaining and keeping quality staff were mentioned by several respondents. Some people were afraid that sustainability would be "merely seen as saving trees or oil or recycling". The cost for sustainable practices was also mentioned as a possible pitfall. There was a concern that worries about these possible costs would support short term thinking and activities rather than the preferred long term commitment that was being sought for. When comparing construction companies with other organizations no significant differences were observed.

Table 4 below lists the perceived pitfalls in terms of themes, how often they were mentioned and if the focus mainly is on business, environment, social or holistic approaches. We have also listed whether the issues raised are externally, internally or generally aimed (construction companies within parenthesis):

Table 4: Sustainability pitfalls.

Theme	Number of times mentioned	Focus and aim
Different mindsets, resistance to change	13 (4)	Internal Business External Business
High costs	9 (3)	Internal Business
Lack of organisational flexibility, bureaucracy	8 (2)	Internal Business
Sustainable practices may not be in demand	6 (0)	External Business
Giving in to short term gains	5 (2)	Internal Business

Sustainability and procurement strategies – concluding remarks

Sustainability means making business and the construction companies view sustainability in the same way as other organisations do. This study suggests that there are no significant differences between construction companies and other companies in terms of how they approach sustainability. Research on sustainability within the construction industry may benefit from studies of other industries since the differences seem to be small.

Based on the replies from the organizations it seems as if they have a notion of sustainability as something departing from making business – maintaining the business and thinking of business as well as environmental and social aspects were the most common answers. This gives us a business based holistic approach to sustainability. The responses also aim towards both actions and mindsets. The business based approach can be divided into two general sub approaches leading to consequences for choices and development of procurement strategies. These two sub approaches are Business for sustainability and Sustainable business/organization.

1. *Business for sustainability.* This approach is normative and departs from an ambition to acknowledge environmental and social concerns. In practice this approach implies the use of environmental friendly means of production and products together with supporting, maintaining and developing social engagement. Sustainability is an end reaching beyond the scope of the organisation. Sustainable practices are environmental and social concerned organisations should use and develop. When procurement decisions are made interaction with organisations emphasising ecological ambitions will be preferred. In this vein environmentally certified organisations will be the first choice securing coherence with the aim to reach sustainability. The governing question is what is ecologically a good choice of partner for our business?

2. *Sustainable Business/organisation.* This approach is mainly concerned with traditional business management. Since sustainability is primarily dealt with as *the business or organisational* goal, the concept is used to denote an ambition to find means that will make the organisation or business last. This can be done by achieving sustainable advantages through different measures. This approach turns traditional management measures into sustainable practices but because of the traditional mindset of the concept, it also opens up possibilities to link environmental and social issues as input to managerial decisions on which measures one should take to make the organisation or business last. The overarching question is what is economically a good choice of partner for our business?

This second approach can therefore be described in two different ways, differentiating between organizational directed and business directed measures.

Organizational directed measures aim to maintain and manage the organizational structure. This approach emphasizes a structural focus. Questions will deal with specialization, standardization, formalization, centralization, configuration and traditionalism. (Senior 2002) With a structural focus management would be interested in measuring how well the organization performs and to benchmark how well others perform. To able to do these comparisons the organizations may need to align themselves to indices or similar. They would be inclined to use sustainability incorporating index systems such as ISO 14001, Dow Jones Sustainability Index and similar to compare with stated goals or to measure and benchmark against competitors. These systems have a function similar to that of a thermostat. If events occur that diverts from the plan the structure aims to stabilize the system. The function of indices is to provide information for deciding whether the events are inline with the original plan. The incorporation of indices shared by others facilitates collaboration with external parties using the same index system and measurement tools. Networks of organizations using the same ways to measure results not only facilitate comparisons but also collaborative efforts in terms of procurement relationships.

Business directed measures on the other hand aim to maintain a process approach emphasizing entrepreneurial activities. Questions will deal with for instance learning, intrapreneurship and innovation. Management would be interested in developing powerful strategic tools that can support them in organizing operations. These tools do not function as thermostats but rather as thermometers since they provide pictures of ongoing activities, where one wants to measure process continuously. It is up to the user to decide how to deal with the result it shows. Tools as Balanced Scorecards would be of interest for these managers. Thus business directed measures differ from organizational ditto where the former emphasize on learning, change and varying, moving, altering goals and the latter emphasize on giving goals and goal accomplishment. Both approaches however may lead to an interest in triple bottom line reporting. In terms of procurement choices organizations are chosen that support the organization in the ambition to grow, to increase the profit or similar aims. This may result in procurement choices not at all linked to environmental agendas. Long term relationships in focus if profitable in the long run – otherwise short term relationships may be equally interesting.

Sustainability, as we have shown earlier in this paper, has many different meanings and can be applied within different contexts. Our viewpoint is in line with Hjort & Bagheri (2005) who states that "sustainability is neither the state of a system nor is it a target to be achieved. Instead we view it as an ongoing process that needs to be regarded as part and parcel of everyday work. It inter-relates different aspects of economy, environment and society". This condition is obvious when different approaches to sustainability are accounted for and they are related to procurement strategies.

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Addressing the economic realities of Partnering arrangements within the UK construction industry

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Abstract: Partnering aims to achieve specific business objectives by maximising the effectiveness of each participant's resources. A considerable number of clients and contracting organisations are now adopting a partnering strategy within their commercial relationships. Previous studies indicate that there is little doubt about the positive aspects of partnering arrangements but its successful integration into an industry which is, according to some authors, intrinsically flawed does raise questions. A review of the literature suggests that one of the potential barriers to successful partnering can be the economic reality of a buyer-seller relationship. Through a series of semi-structured interviews, it explores the views and experiences of senior individuals involved in formulating and operating partnering relationships, and the practical measures they are adopting to overcome the potential difficulties. In particular, the paper will focus on the issues of risk allocation, pain / gain sharing and leverage. The study focuses on the relationship between the principal parties, namely the client and the main contractor and presents the results of interviews with 10 major UK clients, including large food retailers and utilities organisations, and 10 national contracting organisations.

Keywords: Commercial Relationships, Partnering, Supply Chains.

1. Introduction

1.1 Partnering

Numerous authors have tried to analyse the critical success factors for partnering relationships including Tyler and Matthews (1996), Cheng *et al.* (2000) and Black *et al.* (2001). Despite some variation in emphasis, the results of such studies tend to re-affirm Bennett and Jayes' (1998) assertion that the concept of true partnering relies on co-operation and teamwork, openness and honesty, trust, equity and equality, if it is to succeed. Lui and Fellows (2001) provide a useful synthesis of these views by concluding that partnering can enhance project performance subject to both (1) work assurance – that partners will work together for the synergistic whole, and (2) benefit assurance – that gains will be distributed equitably. There appears to be a reasonably widespread belief therefore, given the right circumstances, that this method of procurement more than any other can deliver 'win-win' solutions for all involved. Some authors claim that there is a desire to move beyond narrow self-interest towards a spirit of co-operation and trust (Wood and McDermott, 1999) and that partnering can indeed lead to benefits for all parties (Hamza *et al.*, 1999). In some instances the alleged success is remarkable. Groups such as Rover, Esso, Sainsbury's and BAA are reported to have reached savings of 40% on costs and 70% on time (Barrick, 1998), whilst others maintain that people feel genuinely empowered as a direct result of partnering and thereby work more effectively together (Lamont, 2001). Indeed, as Bresnen and Marshall (2002) observe, the literature is replete with case study examples of successful partnerships and alliances. These are often anecdotal and focus on the experiences of exemplar organisations. In addition, there is an inclination to gloss over the harsh economic realities of commercial buyer/seller relationships.

However, some authors do draw attention to the inevitable inequalities that exist within any supply chain relationship. Cox (1999) contests that, amongst others, the major UK supermarket chains have obtained a dominant control over particular supply chain resources. He argues that once this is achieved, companies are able to aggressively leverage their suppliers and thereby maximize value appropriation for themselves. Research by Robson and Rawnsley (2001) supports this view and claims that, indeed, coercive practice is at work in the supply chain relationships within the food industry. Such findings are germane to the construction industry since the national food retailers are major clients and are identified as leading exponents of partnering in construction (Building, 2003).

In a similar but more direct vein Bingham (1998) suggests that clients often get greedy and exploit their position of power. Indeed Taylor (1998) declares that partnering is a long way from returning the contractor benefits claimed by commentators such as Bennett and Jayes (1998). He alleges that clients are still driven by the deep-rooted, narrow-minded objectives, simply to reduce costs or to pass costs and risks on to those further down the supply chain. Research by Ng et al. (2002) also confirms the failure on the part of clients to genuinely pursue win-win outcomes. Empirical research by Spekman et al. (1998) reinforces a number of these observations. Their study examines supply chain management practices across five broad industry groupings in chains aggregated across North and South America and Europe. They conclude that despite good intentions, buyers easily revert to cost-driven behaviours in which suppliers are viewed as substitutable, and that supply chain partners still do not share a common vision or react to the same set of metrics. Green (1999) summarizes the main tenor of these views succinctly in his assertion that “the seductive rhetoric of partnering too often serves only to disguise the crude exercise of buying power”.

1.2 Aim and objectives

What the literature demonstrates is that the economic realities of supply chain relationships inevitably lead to an unequal balance of power between the parties and corresponding inequities in pain/gain sharing and that these may act as barriers to achieving genuine win-win procurement solutions.

Accordingly, there is a recognised need for more empirical qualitative research within this important field (Li *et al.*, 2000; Lazar, 2000; Bresnen & Marshall, 2000). The aim of this study is therefore to examine how these potential barriers are being addressed in practice and, consequently, whether partnering is actually delivering win-win outcomes for all.

1.3 Data collection and sample

In order to satisfy the research aim the study explores the views and experiences of senior individuals involved in formulating partnering relationships, and the practical measures they are adopting to overcome the potential difficulties. The use of semi-structured interviews is an appropriate primary method of research in this instance since it allows issues to be explored in depth. However, it also has drawbacks. As Oppenheim (1992) argues, because the interview is a public rather than private event the interviewee's response may be affected; for example: they may be reluctant to discuss topics that might put their organisations in a poor light. The views expressed, therefore, need to be treated with some caution but they do provide a valuable insight. Transcripts were independently coded to prevent any Procrustean effect on the organisation of information and opinions which emerged and the responses were then analysed using QSR NVivo data management software. The text of transcripts was subject to some quasi-quantitative content analysis in order to detect common themes, issues, opinions and the degree of consensus or otherwise amongst the body of respondents. Manifest items, i.e. those which are physically present in the content (Robson, 2002), were also identified to avoid any reliance on latent content which is a matter for inference or interpretation. Thus, direct quotations are used extensively in the presentation of findings, and are indented and italicised in the script for clarity.

In order to make the research manageable the interviews were restricted to an examination of the relationship between the principal parties, namely the client and the main contractor. It is, of course, recognised that this does impose some limitations on the study since the themes identified resonate right the way down the supply chain.

The purpose of this exploratory research is to produce qualitative, rather than quantitative data. The sample selected seeks to give the study credibility by providing the experiences and views of those that shape opinion and influence the way in which it the industry functions. Therefore, the research intentionally focuses on senior figures within the industry operating at a policy level who are thoroughly familiar with the field, and whose organisations have been well publicised for their reported commitment to partnering. Interviews were conducted with 10 major UK clients including large food retailers and utilities organisations, plus 10 national contracting organisations. Prior to the interviews a pilot study was undertaken with a single contractor to test the design of the agenda and evaluate the responses generated. This also allowed the commercial sensitivity of the research areas to be tested i.e. whether the participants would feel willing or able to respond candidly to direct enquiries as to the nature of their business operations.

2. Findings

2.1 Background

Client organisations included within the study have a combined annual construction capital spend of approximately £2,025M. The amount procured by individual clients through partnering agreements varied from 50% to 100% of the total expenditure; the aggregate amount spent through such arrangements is £1,600M (approximately 80%). The number of year's experience of partnering varies significantly: a small number of clients had only recently established a firm and coherent policy related to their procurement strategies, whereas others had several (up to 7) years experience.

Contractors taking part in the survey have a combined annual turnover for construction work of approximately £4,350M, of which an aggregate of £1,500M (35%) is delivered through partnering arrangements. Again the extent of experience differs: the percentage of workload undertaken through partnered projects for individual organisations ranges from approximately 10 % to 90%; the number of years from 1 to 7.

The majority of participants describe their relationships as on-going and strategic rather than one-off or project based. Whilst most are comfortable with the term partnering, others refer to their arrangements as alliancing, and others to framework agreements. In the absence of strict definitions or more importantly distinctions between these terms, it became obvious early in the research process that the ethos and objectives are very similar: long term relationships with a few selected contracting organisations devised in order to pursue improved performance in its broadest sense.

2.2 Basis of partnering arrangements

The vast majority of construction work under consideration in this study is arranged through an initial agreement covering the fee payable for the contractor's overheads and profit, plus negotiated sums based on client models for preliminaries. Usually the fee portion is protected; hence the contractor is guaranteed that ring-fenced sum even if the overall project budget is reduced. Some clients negotiate the fee level at the time of selecting preferred contractors and pay the same figure to all partners on all projects, whereas others allow differential levels of fees between contractors and across projects.

The price for the remainder of the work is then agreed in different ways, seemingly dependent upon the nature of the client. Commercial organisations tend to expect all subcontracts to be competitively tendered and proceed on an open-book accounting system. In some cases where clients have relationships with subcontract organisations, these packages are tendered or negotiated either directly or indirectly. In such cases the contractor is in effect acting as a management contractor. In contrast, the quasi-public clients or utilities tend to negotiate the remainder of the work on the basis of historical costs, market prices or schedules of rates originally submitted or agreed at selection stage.

2.3 Risk allocation

All respondents hold the text book view that risks ought to be placed where they are best managed. In spite of this, a number of responses reveal that the theory is not always applied in practice. Most do report that risk is considered in a more formal and explicit way in their partnering arrangements than under previous procurement procedures, but also concede that risk management is now common on non-partnered projects.

However, there is manifest evidence in the views expressed by clients that they are still seeking to minimize their own risk exposure, or at least they have not made any significant change in policy towards dealing with risk.

The contract allocates risk.

We won't take any risk. Risk is very firmly with the contractor (with the exception of something like contamination).

A lot of the client risks like the old ICE clause 12 – ground conditions, flooding, weather etc. – they are now under our conditions of contract – those risks are with the contractor – so we pay a premium to have those fully covered.

These views are reflected by the comments of contractors, a number of whom consider the degree of risk transfer to be inappropriate.

It's not what you'd call the ideal partnering arrangement because all the risk is placed with you as the contractor – rather than both teams working together and eliminating the risk and both managing the risk as best they are able. They tend to dump it down the contractor and that is their idea of partnering.

Some of the partnering [agreements] *we see out there are just unfair commercial trading terms with risk dumping.*

Partnering should be sharing everything including the risk – very often it's not – we still take all the risk – and the client just wants the benefits – that still exists.

There are clients in some parts of the industry who still believe in passing as much risk onto the client as possible – so in some instances it's not really fair.

. . . particularly property developers. All they are interested in doing is offloading all the risk

2.4 Pain / gain sharing

All respondents confirm that their arrangements do include some kind of pain/gain sharing mechanism. Sometimes the pain/gain is shared at a ratio of 50:50 (client: contractor) within a specified percentage range of any under spend or overspend. However both the ratio and percentage can vary considerably and one contractor suggests a lack of fairness on some projects.

The pain/gain mechanism for both projects wasn't fair – they were set up with 100% pain to us and only 10-20% gain. That we accepted commercially for the type of project that it is – but I really don't believe that it's in the partnering spirit.

Indeed, one client does not allow any gain share if project costs are reduced.

If it comes in lower – they [contractor] *still get their profit margin – which is actually in percentage terms a higher profit margin – but we would get all of the saving. We get the saving – they keep their profit.*

Most clients though do have a more generous approach because of the potential to replicate any savings, specifically those achieved through the creativity of the contractor, on many subsequent schemes. This is considered to be a way of incentivising the whole supply chain.

It's hugely important that they[contractors] *can see that by . . . being innovative they get a reward - and the percentage of the saving I think should be very high . . . I've got my money back in 2 or 3 jobs, let alone 200.*
[xxxx] *went through a huge specification and process review about 3 years ago and everybody* [contractors, sub-contractors, suppliers] *was encouraged to look at individual specification improvements . . . we took 30% out of the costs over an 18 month period.*

2.5 Leverage

Clients generally acknowledge that the adoption of partnering arrangements within the procurement of their buildings means that they are able to obtain leverage over their supply chain. With the commercial clients in particular, this is not offered as any kind of admission, but as the natural state of things given the business environment within which they operate.

There's no point being a big construction client and not using the opportunity that gives to develop a supply chain that can do what you actually want them to do. If by using our strength we can make people work the way we want them to and . . . the relationship is considerably less painful – then I think that's good.

There's no doubt that we squeeze every last penny we can out of it – we're a commercial businesses – that's what we're all about.

We want extra leverage – that's where there's plenty to play with – we've only just penetrated the 1st layer of the supply chain.

Some clients, however, do attempt to temper this instinctive and seemingly aggressive approach.

I'm levering my buying power – that is what it's about. But if somebody just means they're going to mow their supplier into the floor and take everything [that is a] c*ost driven non-sustainable exercise – that isn't partnering – it's not collaboration – it's sharp commercial practice.*

Most contractors accept that clients will obviously expect better performance in cost terms, but their experiences are not always positive.

They want extra leverage – but then again they are normally very good payers.

[Some] c*lients are simply coming in to screw you year on year – always market testing the partner and letting you know there's somebody cheaper out there – that's the wrong mindset to come into partnering.*

2.6 Assessing improvement

Success in economic terms is generally assessed by the use of various benchmarks or KPIs but, perhaps not unexpectedly, the common metrics for clients are build cost and project duration. A number of clients also regularly test the market through competitive tendering of sample projects to ensure they are getting the best price available at that point in time.

That's why we do 10% [competitive tendering] - *just to test the market.*
The performance results cited by respondents as attributable to the partnering approach however are inconsistent. Some suggest substantial improvement in both cost and time performance.

Five years ago we were building for £156 / ft2 and now it's down to £100.

Go back 10 years we were probably taking 36–40 weeks to build a [project]. *The same* [project] *now we'll build in about 16* [weeks].

Our model costs for building a [project] *have come down 30% . . . programme wise we're about half the programme.*

It is worthy of note that these observations represent the views of the commercial clients included in the survey or their contractors. Others participants have seen only marginal improvement in project costs or programmes and are sceptical about the potential.

The last one cost £1600 per m2; this one was now at £1550. There was a demonstrable reduction in those costs. But nothing like 30% - it was just a consolidation exercise.

I know there are all these reports that say partnering can save 30% on your costs and 60% on your programme – I don't believe much of that – I don't think that sort of thing is happening.

In contrast to the successes identified above, one client did offer the following cautionary example.

From the point of view of paying market rates, we realise often that we are paying more than market rates. We had a scheme the other day – the contractor was trying to agree a target cost with us of £800,000. A lot of our schemes are done against tight deadlines, [but] *we had the time on this one – we tendered it . . . lowest bid £410,000. It's sometimes a shock – and that's why we are tendering more and more.*

The issue of whether contractors can obtain greater economic returns through partnering arrangements is explored more fully in following sections.

2.7 A real and lasting change?

When asked whether the apparent change within the industry is authentic and likely to endure respondents made a number of interesting observations. There is a unanimous feeling that the development of partnering arrangements is a positive thing for each of their own organisations and for the industry as a whole. Nobody expressed any desire to revert to more 'traditional' procurement systems.

There is recognition that vigilance within partnering arrangements is important if complacency is to be avoided. Clients are particularly concerned that relationships do not become so comfortable that their contractors' commitment to continuous improvements wanes.

Although the clear majority of respondents hope that the change is bona fide and permanent, their views are not unequivocal. Some openly express reservations about the degree of sincerity on both sides.

They [contractors] *have put a frontispiece on that they know will get them some work because alliancing is the buzzy thing at the moment. We can live with that – we can understand that because in many ways we are probably going through the same thing. I can't think that here we could claim that our culture – our deep-seated culture has changed.*

There's still a feeling in some quarters that partnering is not a good thing – that we're being ripped off – that it's easy money for the contractors.

We've been bought by [overseas company]. *He can't understand alliancing at all, or the need for it – it's madness to him – you grab your contractor and squeeze him hard and get what you want out of him and put him back.*

Most contractors tend to take a pragmatic view of the current situation. They do have some concerns and are not always entirely convinced of clients' motives. Nevertheless, they feel that the industry is moving in a direction with which they are comfortable.

Quite often when you're pointing out pitfalls you're wishing for yesterday and I'm not saying that – we're happy where we're at. But don't let people believe it is all sweetness and light. It is a major transfer of risk under the heading of partnering. For that you get regular work, regular turnover, you don't have to tender for the work, you do have a rapport with the client and that can lead to other things – why dissent?

Looking to the future, the general view is that the momentum behind the transformation in what might be loosely termed 'public sector' procurement (central and local government, utilities, transport sectors etc.) is considered to be irreversible in the short to medium term.

I think it will be a surprisingly small percentage that will go back to the old traditional procurement route. I think the public sector is on a roll – that's not going to stop.

However, opinions of what might happen within the commercial sector, particularly if there is a downturn in demand, are noticeably more cautious.

I think that no client will pay more than he has to for his building. If his QS tells him that he can now buy it cheaper outside the partnering arrangement he will go and buy it cheaper – he will not pay more than the market price because he thinks he's got an allegiance to the framework agreement or to his partnering contractors.

I think if there's a downturn there'll be a lot of competition out there and clients will be looking to take advantage of that.

3. Discussion

There appears to be a general agreement amongst participants of this study that there is a more structured and analytical approach to dealing with risk than under previous traditional procurement systems. However, this is not directly attributable to partnering but perhaps reflects the general trend towards incorporating Risk Management as an important tool in the management of construction projects (Wood and Ellis, 2003).

Significantly, there is general agreement amongst the sample that some clients do still seek to transfer unacceptable levels of risk onto contractors, unless it is wholly beyond the control of the contractor *and* the concomitant premium is prohibitive. This is perhaps a cause for concern since it does not truly reflect partnering philosophy, or indeed risk management theory. The suggestions then by Barlow et al. (1997) and Taylor (1998) that high levels of risk transfer without commensurate reward are occurring within partnering arrangements are substantiated, though the evidence here is that it is limited to 'some cases'.

Pain/gain sharing mechanisms are commonplace within partnering arrangements though the precise details, usually linked to a target cost, vary from project to project. Interestingly, there are divergent views on what percentage reward contractors should be allowed, ranging from 'very high' to 'none'. There is, no doubt, a hint of Bingham's (1998) allegation of greed on the part of some clients here.

Furthermore, some of the comments by clients do have a resonance with Green's (1999) claim that they are merely using their position to exercise buying power. Whilst this does indicate that clients are activating some shift in the way business transactions are conducted within the construction industry, arguably it can be viewed as something of a one-way street. When Latham (1994) suggested that the implementation of change ought to begin with clients, he surely meant that they should also modify their own approaches and not merely use their strength to impose change on contracting organisations. However, it must also be recognised that in a market economy this is how large commercial organisations improve their own business performance; hence the power, leverage, value appropriation sequence described by Cox (1999) becomes a valid part of a robust purchasing policy. Indeed if certain clients don't adopt such strategies, then they might well jeopardise their own market position. So whilst this could be viewed as greedy by some, it can equally be seen as a healthy appetite. Objectively, according to Cox and Ireland (2002), this is simply the contextual (power) circumstance that exists between buyers and suppliers. In any event, it does not amount to coercion in the way that Robson and Rawnsley (2001) claim it is at work in the food industry, since there was no such implication in any of the views expressed by the participants in this study.

The very use of risk management/analysis and pain/gain sharing mechanisms could in themselves be seen as means of overcoming economic hurdles, whilst not losing the advantage of competitive tendering at sub-contract level. There is some evidence though that clients are not applying such techniques entirely equitably, or as some describe it, in the spirit of partnering. It also raises the question of whether the management contracting type approach simply shifts the problems one step down the supply chain: to subcontractors and suppliers. This would appear to confirm Bresnen's (1996) suggestion that clients may not wish to fully commit to close, long term relationships because they might be prevented from taking advantage of price competition and the possibility of more favourable deals from alternative suppliers.

Buyers do sometimes revert to cost-driven behaviours, through market testing etc. and view suppliers as substitutable as Spekman (1998) observed. However, it is important to have a realistic appreciation of the nature of exchange relationships in a capitalist economy. The structure of the UK construction industry means there is a real tension between developing trust and the economic context which, according to Bresnen (1996), predisposes partners to adopt (for very rational economic reasons) a ‘traditional’ adversarial stance. Hence, the possibility does remain that clients may resort to traditional lowest cost tendering if demand falls and the market becomes more competitive.

The client benefits identified in this study do, to some extent, substantiate the positive claims made by several authors (Bennett and Jayes, 1998; Barrick, 1998). Savings of up to 35% against benchmarked costs and reductions in programmes of up to 45% are being realized by some clients. Others, however, report more modest achievements and one client even offers evidence of paying a substantial premium through partnering arrangements. The degree of success in these respects is clearly linked to the nature of the work and the details of the economic arrangements. Not surprisingly, the greatest successes are on large, new build, repeat type projects; the poorer results are reported on either smaller fit-out type work (even when repetitive) or one-off utilities / infrastructure work. The management contract type approach, with ring-fenced profit and overheads, competitive tendering of sub-contracts and open book accounting appear to produce the greatest savings, whilst agreements negotiated on the basis of schedules of rates or agreed benchmark costs are less rewarding. Nevertheless, there is a consensus that cost predictability is much better across the board.

The consistent message from respondents in this study is that the real benefit for contractors is a predictable and consistent workload, which helps to stabilise turnover and profit. This concurs with the first condition of Lui and Fellows (2001) that work assurance may help enhance project performance. However, the results of this study are ambiguous with regard to their second condition of benefit assurance (that gains are distributed equitably. Contradictory views are expressed related to the fairness of risk allocation under partnered projects and the balance of pain/gain share. In addition, there are mixed messages regarding contractors margins and whether they are, or ought to be, higher, lower or about the same as on non-partnered projects.

4.0 Conclusions

The conclusions of this study are limited to the views expressed by senior figures within the 10 client organisations and 10 contracting organisations included in the survey. As such, they cannot claim to be representative of thinking throughout the construction industry. Nevertheless, the size and experience of the companies within the sample, together with the seniority of the individuals interviewed, do mean that it provides a valuable insight into the reality of partnering relationships currently in place.

The economic hurdles identified in the literature are largely substantiated. Risk allocation remains a contentious issue and pain/gain sharing mechanisms are not always equitable. However, the encouraging sign is that both of these aspects are being openly addressed within partnering arrangements in a way that does not happen in traditional procurement systems. No doubt the risk and reward negotiations between clients and contractors will continue. A sense of economic realism in this respect is essential. The claim in much of the literature that partners should be equal is perhaps over-optimistic. From the perspective of clients, it is evident that their buyer dominance is the most advantageous position for them to be in and they have little intention of shifting. But as Cox and Ireland (2002) propose, it is only by understanding these objective contextual (power) circumstances that exist between buyers and suppliers that practitioners will ever be able to understand what are the most appropriate ways of managing business situations.

It is also apparent that partnering is not a single, all-embracing solution and is it not an easy path to follow. Unsurprisingly, not all experiences are similar and the levels of success are inconsistent. One might conclude therefore from this study that the claims made for partnering are not consistently justified. There is therefore a need for a pluralistic approach to partnering, as suggested by Bresnen and Marshall (2000), which acknowledges that the parties to a relationship may have very different aims in mind and be approaching it from very different perspectives.

So what is the 'win-win'? The results indicate that there are undoubtedly a number of benefits for both parties. To characterise it as 'lower cost for client - guaranteed work for contractor' would be simplistic, though the analysis does indicate that these are the strongest and most consistent messages expressed by respondents. If either one is not evident, or if the benefit ratio is unbalanced, then the whole basis of the relationship would undoubtedly be brought in to question.

Acknowledgements

The author gratefully acknowledges the kind co-operation of those who took part in the survey, and the support of the RICS Education Trust in funding this research.

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Sustainability Evaluation in the PFI industry: Analysis of a questionnaire survey

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Abstract: This research is part of a PhD study which aims to develop a sustainability framework for the Private Finance Initiative (PFI) project and its practice. PFI as an effective procurement system has been broadly accepted by most governmental departments and local authorities in the UK. Because of the nature of PFI's long-term contract and the Value for Money (VFM) principle, PFI seemed to be a good mechanism to deliver sustainability and provide massive benefits for both public and private sectors. However, in practice there is a lack of a recognised framework for integrating sustainability objectives in PFI schemes. As such it is necessary to evaluate sustainability performance in the current PFI industry.

The study was carried out as a nationwide questionnaire survey in the UK from March to May 2006. The results were collected by using a questionnaire with partly structured questions and one open question.

Based on the national survey, this paper analyses the results in three divisions: 1) the client's attitudes and their experiences in sustainability; 2) sustainability performance level in four dimensions (social, environmental, economic and technical); and 3) the future development of PFI projects in terms of sustainability. Finally, it concludes that sustainability, as one of the key evaluation criteria, has been integrated into the PFI procurement process, and a national standard framework is urgently needed to assist the key stakeholders make decisions about sustainability.

Key words: PFI, Public Procurement, Survey, Sustainable Development

1. Introduction

Sustainable development takes account of the past, the present and the future as a whole system and gives equal emphasis to human, social and economic development and protecting the natural environment system. Every state or regional area government has a vast responsibility to lead and fight in this revolution storm. Their behaviour has a major impact on their citizens and on the future development of their counties or areas. In the UK, since the first sustainable development strategy was published in 1999 (DEFRA), sustainability has become a basis of state policy for the central government. This strategy requests that every level of government not only sets up policies or regulations, but also aims to be a leader by example in this field. In the following strategies (NAO, 2005 and HM Treasury, 2005, 2006), it was approved that public procurement was an effective and powerful tool for governments to achieve their goals. Therefore, the private finance initiative (PFI), as a modern dynamic model, has much potential to deliver sustainable development in public estates, and could be a good public example to demonstrate the benefits of sustainable development. The nature of the PFI contract and its widespread use could provide the scope for the government to stimulate sustainable development in practice. Conversely, adopting sustainable development principles could offer many benefits for PFI projects; reduce whole life cost and add value to the estate (Zhou and Lowe, 2004).

However, there is a gap between commitment and implementation in practice (Zhou and Lowe, 2004 and NAO, 2005). As such it is necessary to evaluate sustainability performance in the current PFI industry. The study was carried out as a nationwide questionnaire survey with partly structured questions and one open question. Based on the national survey, this paper analyses the results in three sections: 1) the client's attitudes and their experience in sustainability; 2) sustainability performance level in four dimensions (social, environmental, economic and technical); and 3) the future development of PFI projects in terms of sustainability. Finally, it concludes that sustainability, as one of the key evaluation criteria, has been integrated into the PFI procurement process, and a national standard framework is urgently needed to assist the key stakeholders to improve their understanding of the principles of sustainable development and its implementation in practice.

2. Sustainable Development and UK Approaches

2.1 Definition of Sustainable Development

In 1987, *Our Common Future* (the Brundtland Report) was published by the World Commission on Environment and Development. This report presented a very popular definition of sustainable development:

"*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*"

This definition places human beings at the centre and sets out the two fundamental principles of intergenerational and intra-generational equity, and contains the two "key concepts" of needs and limits. Clearly, the Brundtland Report is the most significant milestone of sustainable development. It rejects the crude anti-growth arguments of the 1970s, asserting that "Growth has no set limit in terms of population or resource use beyond which lies ecological disaster" (WCED, 1987, p45), and also shapes the priority of the physical environment remedially within civil society via economic growth and social equity, giving a long-term view of human development.

2.2 UK Approaches

In the UK, the government has defined sustainable development as "*ensuring a better quality of life for everyone, now and for generations to come*" (UK Government, 1998). In this context, "quality of life" reflects an increase in per capita real incomes, better health and education, improved quality of natural and built environment, and more social stability. In November 2001, an interdepartmental Sustainable Procurement Group (SPG) was established to look at the scope for improving the way in which sustainable development considerations are incorporated into purchasing. In 2003 the UK government announced that all central government departments must apply the minimum environmental standard in new contracts when purchasing certain types of product, which cover aspects such as energy efficiency, recycled content and biodegradability. Moreover, the UK has set a significant goal for sustainable public procurement. This is reflected in the following statement by Sir Neville Simms: "*our new goal is to be recognised as amongst the leaders in sustainable procurement across EU member states by 2009*" (HM Government, 2005). Furthermore, the government appointed in spring 2005 a business-led Sustainable Procurement Task Force to deliver a national action plan for sustainable procurement across the public sector by April 2006. Government targets force central departments, local authorities and the construction industry (GCCP, 2000) to face the sustainability challenge and to seek an effective mechanism to deliver sustainable development.

2.3 Construction Industry's Responses

In Britain, sustainable development is a critical issue for the construction sector. On one hand, the construction industry is one of the pillars of the national economy (8% of GDP). On the other hand, it has a massive impact on the national environment and resource use. DETR (2000) states that construction sites and demolition produce 72 million tonnes of waste each year, representing 17% of the UK's total waste burden. Commercial waste from construction adds up to 30 million tonnes, a further 7% of the UK total. Poor design and site management leads to 10 million tonnes of non-used materials each year that are delivered to vacant sites (Crossely, 2002). Consequently, the government published a series of policies to request that the construction industry implements sustainable construction principles in current and future projects. The key policy document, *Building a better Quality of Life: a Strategy for more Sustainable Construction*, was published in April 2000 (DETR, 2000). This strategy focuses on the significant contribution of the construction industry in the UK, and also presents 10 action points in order to achieve more sustainable construction:

- The re-use of built assets
- Design for minimum waste
- The aim of lean construction
- Minimising energy in construction
- Minimising energy in use
- Avoiding pollution
- Preserving and enhancing bio-diversity
- The conservation of water resources
- The respect of people and their local environment
- Target setting

In 2000, the Sustainability Action Group of the Government Construction Clients' Panel produced its action plan, *Achieving Sustainability in Construction Procurement*. This document summarises the actions of various governmental departments and agencies who are commissioned to construction projects, including Highways Agency, NHS Estates, the Environment Agency, English Heritage, Defence Estate and the Office of Government Commerce. Furthermore, the sustainable construction task group published a research paper which establishes the relationship between sustainable construction and business. This paper concludes that senior executives of construction organisations should pay attention to the growing influence of sustainable construction on business, and recommends that they integrate a sustainability agenda into their business strategies.

3. Private Finance Initiative (PFI) and Sustainability

3.1 The Context of PFI

The origins and development of PFI in the UK have been successfully reviewed in a number of articles (Allen, 2001; The Scottish Parliament, 2001; Allen et al., 2002). It was politically born in 1992 with the Labour party, and formally introduced in 1997. The International Project Finance Association (2002) defined PFI as:

"*The procurement of public services and assets by government and local authorities where the private sector is responsible for the design, construction, finance and operation of an asset or service for a specified period of time after which it is transferred back into the public sector. The public sector purchases the services from the private sector and pays a fee based on specified output criteria and usage. The private sector consortium uses the fee to repay loans taken out to finance the construction or refurbishment of the asset/service*."

PFI has two major principles: value for money (VFM) and risk transfer. The first principle, VFM, requires that project costs be used efficiently and safely. The private sector is required to deliver the project under budget (agreed in the consortium) and to provide a good quality of performance. The second major principle of PFI is the transfer of risk from the public to the private sector, where the private sector is best placed to manage that risk (Grimsey and Graham, 1997).

Up until March 2006, 747 projects had been signed as PFI contracts, amounting to a total capital investment of over £47.56 billion. Almost every central government department and local authority is now using PFI contracts. They include most types of public estates, for example, roads, prisons, hospitals, schools and office buildings, etc. Furthermore, £26 billion of PFI investment across 200 projects is currently in the pipeline to close by 2010 (HM Treasury, 2006). This investment is expected to deliver significant new or refurbished public infrastructure over the next few years, including over 60 health facilities and 104 schools.

3.2 The Advantages of PFI to Deliver Sustainability

PFI can offer real scope to promote sustainable construction (Addis and Talbot, 2001; Hill and Collin, 2004; Logan and Mills, 2003). It incorporates whole-life costing, as opposed to lowest initial price, and should encourage a more sustainable approach. The transfer of risks such as energy consumption to the private sector may provide an incentive for investment in more efficient energy usage. PFI clients generally specify outputs rather than input. Clients can use this opportunity to specify a required sustainability performance (e.g. energy usage per year) rather than specifying the use of low energy equipment or facades. It is then the contractor's responsibility to find the most cost-effective way of delivering the performance-level demand. Furthermore, the long-term and integrated nature of PFI contracts offers incentives for the contractors to consider the synergies between the design of an asset and its ultimate operating cost (OGC, 2002). Table 1 outlines the benefits of implementing sustainability into PFI projects.

Furthermore, PFI is one of the most important tools for the UK government to achieve their objectives to provide world-class public service to present and future generations. For example, PFI is making an important contribution to the government's aim of bringing all social housing into a decent condition by 2010, and in the provision of additional social rented homes.

Table 1: Benefits of implementing sustainability into PFI projects

Public sector	Private sector
• Best value for money • Good publicity • Achieve government target • Protect local environment • Improve productivity • Better quality of service • Add value to the estate	• Better client understanding • Sustainable construction experience • Reduce whole life costing • Greater competitive advantages • Reduce energy bills • Opportunities for innovation

3.3 Sustainability-Related Issues in PFI projects

Regarding the principles of sustainable construction (Kibert, 1994; Hill and Bowen, 1997; CIB 1999), the sustainable issues of PFI projects could be divided into four dimensions: social, environmental, economic and technical.

- Social sustainability highlights improvements in the quality of human life and human living environment, which includes health and safety issues and community aspects, etc.
- Economic sustainability includes the use of full-cost accounting methods and real-cost pricing to set prices and tariffs for goods and services and achieve more efficient use of resources.
- Environmental sustainability includes the notion that sustainable construction needs to protect the natural environment rather than pollute it, encourages the use of renewable resources, and reduces the use of water, energy, materials and land in each stage of a project.
- Technical sustainability requires high performance, durability, quality and mixed use of a building.

Table 2 illustrate these issues within a theoretical framework, which would be tested in the questionnaire survey.

4. Survey and Data Analysis

4.1 Questionnaire Survey

A questionnaire was developed to ascertain the sustainability performance level in existing PFI projects. The survey was undertaken by sending an email or letter to the PFI projects' client organisation or project directors. Recipients were given three weeks to complete the questionnaire. The questionnaire included a catalogue of 23 questions, divided into four sections:

Table 2: The theoretical framework of sustainable PFI

Social issues	Environmental issues	Economic issues	Technology issues
Health and safety	Construction energy consumption	Capital cost	Green materials
Public image	Operation energy consumption	Whole life costing	3 Rs in material use: reduce, recycle and reuse
Care of end users	Water use	Low maintenance cost	Natural ventilation
Equity	Land use	Extra investment in sustainability	Grey water collection
Education aspect	Eco-landscape	Financial incentives for sustainability	Photovoltaic system
Ethical issues	Construction waste	Support local/national economic growth	Building intelligent system
	Noise		
	Bio-diversity		
	Transport		

- Section A: the background information about the project (e.g. project name, type, year, capital value, main contractor and location);
- Section B: a number of questions about the client or participant's attitudes and experiences related to sustainability concerns;
- Section C: asking the participant to weight sustainable indicators in four dimensions (social, economic, environmental and technology);
- Section D: addressing questions associated with future application of sustainability principles in the project.

The survey was conducted from March to May 2006 among UK PFI schemes. A total of 480 questionnaires were sent out by post or email; 80 responded, and 65 were useful responses. This response rate is 13.5%.

4.2 Data Analysis

Because this survey is designed to evaluate the individual PFI projects' sustainability performance level, most of the respondents are project directors (26%) or project managers (40%), and other clients or their representatives constitute 12%. Only 1 facility manager, 1 contract manager and 1 operational manager answered this questionnaire. Other professionals (e.g. designer, quantity surveyor or engineer) did not commit to this survey due to the lack of overview experience of the whole project. Although this is a national survey, most of the responses are from England (56 of 65); another 8 responses are from Wales, and only 1 response is from Scotland. None is from North Ireland. There are three main types of projects in the survey – 28 education projects, 25 healthcare projects and 5 transport schemes – and the rest include libraries, office buildings, housing and leisure centres. The detailed survey results are shown in Figures 1–7.

Figure 1: Sustainability strategy/policy in client's organisation

Figure 1 shows that 64 respondents answered this question, and 1 omitted it. The distribution of the answer demonstrates that 53 participants agree that there is a sustainability strategy or policy in their client organisation, while 11 are without a sustainability strategy or policy. This demonstrates that since the UK government national strategy was published in 1999, most central department or regional governments have their own strategy or related environmental and sustainable policies or guidance.

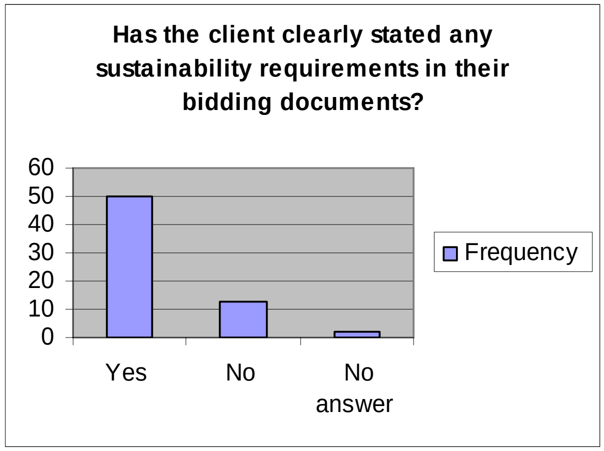

Figure 2: Has the client clearly stated any sustainability requirement in their bidding documents?

Figure 2 shows that 63 people answered this question: 50 participants agreed that they have integrating sustainability in their bidding documents, and the remaining 11 projects did not use sustainability as one of the criteria in their bidding stage. This demonstrates that sustainable development was not a new issue in the PFI procurement process. Sustainability has become integrated into the bidding document as one of evaluation criteria to select the prefer bidder.

In section three of the questionnaire, the participants need to weight the different issues in four sectors, as indicated in Table 2.

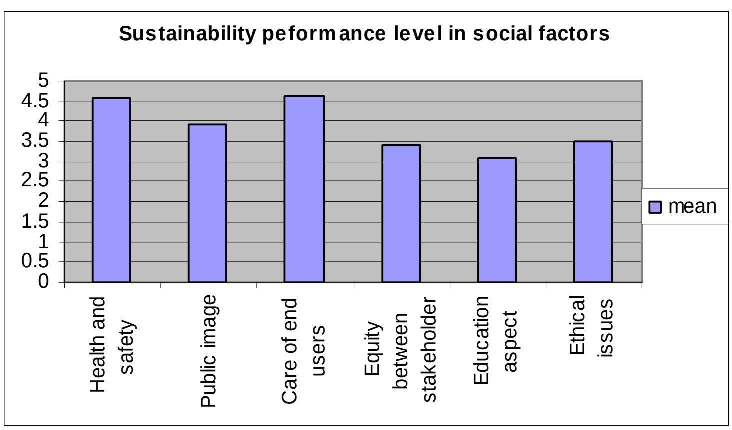

Figure 3: Sustainability performance level in social factors

The statistical results show that 63 people answered this section, and 2 omitted an answer. Figure 3 compares the results of each sub-issue's mean. Both 'Health and safety' and 'Care of end users' are seen as the most important issues in the social sector. The lowest is the education aspect of the sustainable PFI project. The average rate of the mean is over 3.

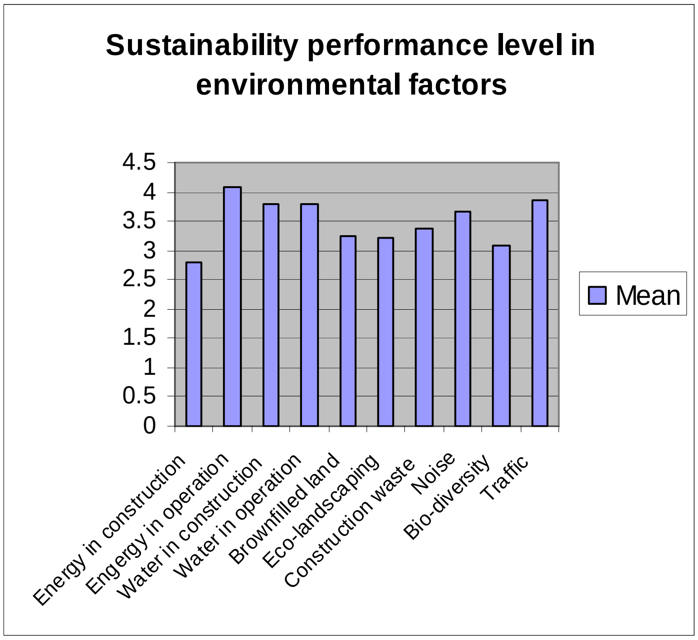

Figure 4: Performance level in environmental factors

In the environmental section, energy consumption in operation has the highest rate of 4.08, while the energy consumption in construction stage has the lowest rate of 2.81.

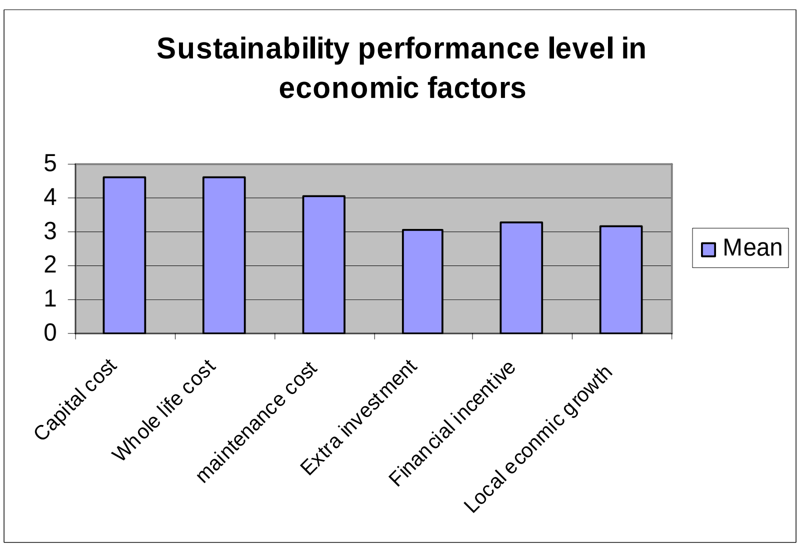

Figure 5: Sustainability performance level in the economic factors

In this section, both capital cost and whole life costing are the most important factors to influence key stakeholders' decision making. Their means are both higher than 4.50 (capital cost is 4.59 and whole life costing is 4.60). The least considered issue is extra investment. This is because of the nature of PFI projects, whose financial situation is based on the private sector's investment, so their aim is to use the lowest investment to gain maximum profit. So, there is no opportunity to obtain extra investment if there is no visible and immediate financial return.

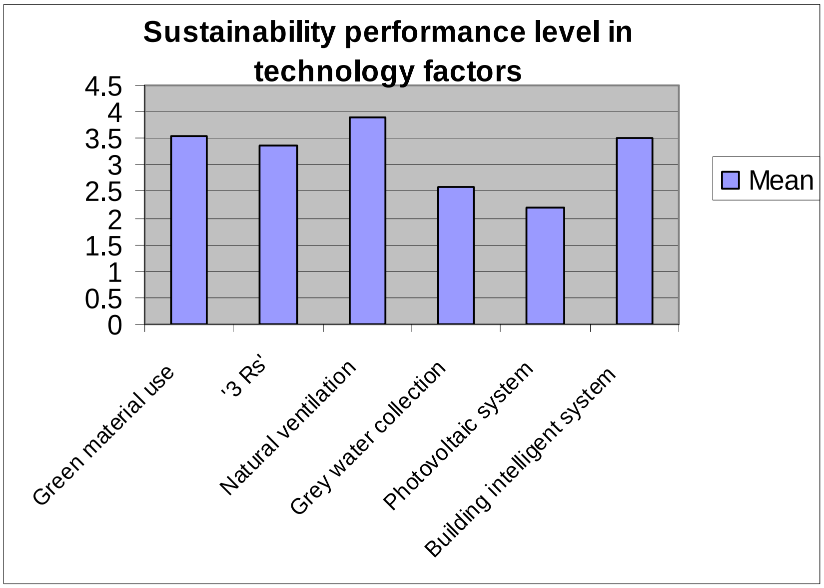

Figure 6: Sustainability performance level in technology factors

In this section, all response rates are lower than the other three sections: there is no sub-issue rate higher than 4. The response rates show that the most frequent use of technology is natural ventilation, with a mean of 3.89. The popularity of natural ventilation is because it can reduce the capital cost of the project and lower the technique skills requested. The lowest rate of use in PFI projects is of photovoltaic systems, with a mean of 2.19. The main reason for this is the high cost of photovoltaic systems.

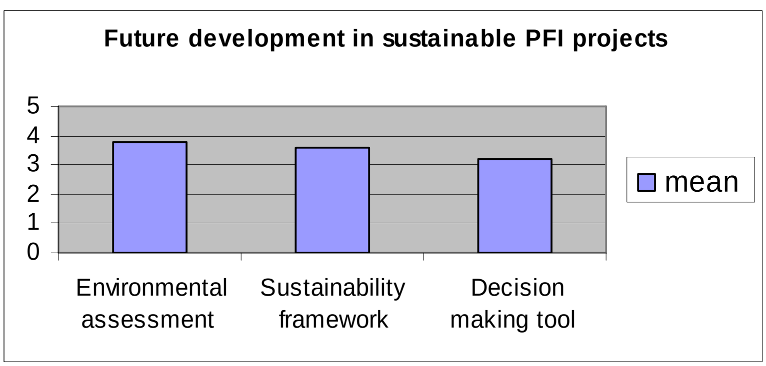

Figure 7: Future development in sustainable PFI projects

Figure 7 illustrates the future development of sustainability in PFI projects. The survey results show that sustainability is still not a critical issue in PFI projects, although they are all important. The average rate of these three main issues is higher than the medium rate of 3. The most important issue is to request an environmental assessment for the project, for example using BREEAM or Eco-Home, etc. PFI project clients are also still interested in the sustainability framework and the decision-making tool to help them make better sustainability decisions.

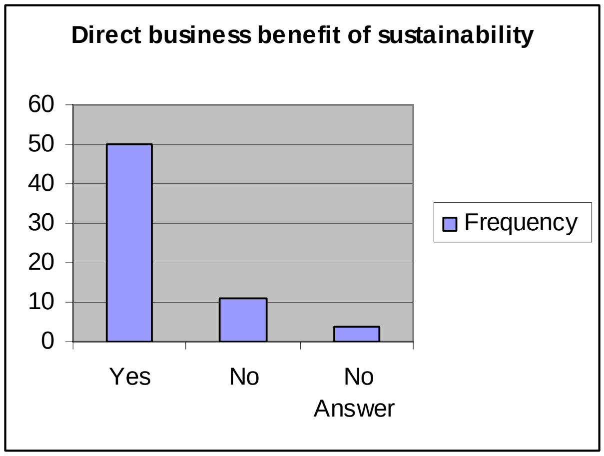

Figure 8: Direct business benefit of sustainability

Although the most survey responses agreed that implementing sustainability principles could bring direct business benefits for them, many considered that these benefits would not appear in the short term. Many responses considered that sustainability could help to reduce their energy bill, promote good publicity, lower maintenance costs, and offer competitive benefits for PFI firms. However, because sustainability is not in the centre of a PFI project, it would need to be emphasised

5. Conclusion

The research has indicated that PFI, as one of the major public procurements, is the key for the government to demonstrate their commitment to sustainability and promoting a good mechanism to delivery sustainability in practice. It is necessary to evaluate the existing sustainability performance in PFI industry. For this reason, a survey has been conducted.

The results of the survey of sustainability performance of PFI projects in the UK have been reported. Twenty-three questions have been asked, and a theoretical framework has been tested. The survey responses show that sustainability performance has positive results in the UK PFI industry. Over half of the responses agreed that their client has their own sustainability strategy or policies, and has committed to sustainable issues in their PFI process. Social and economic impacts have been considered to be two major factors to take into account for their project in terms of sustainability. The survey responses approve that a practical framework and decision-making tools are necessary and useful for PFI project directors/managers to develop a better understanding of sustainable development and to assist in their daily procurement process.

The ongoing research work on sustainable PFI will follow with a number of in-depth interviews, case studies and focus group studies to establish a practical framework for PFI projects, and a decision-making tool designed to help key stakeholders (both public sector and private sector) to drive the PFI industry towards sustainable development.

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