

# **Linking quality management, teamwork and integration to define a new model of design management for building construction**

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## **Abstract**

Over the last years, in Brazil, no matter if pushed on by competitiveness or searching for certification, contractors have worked very hard on process standardisation and quality systems implementation. As a result, the request for design management has grown and architects and design engineers have been encouraged to change organisational models aiming to accomplish such new and large market requirements. This scenery allowed a new outlook into client-designer relationship, thus renewing the most usually adopted concepts and practices of the sector.

Based on a comparative analysis stimulated by the study of French construction framework and some additional research, it is presented the basis of a new model to design management involving a group of proposals related to design and to project management, the whole being co-ordinated into this new design management model, which comprises the mechanisms for teamwork collaboration and construction players integration.

## **Keywords**

Building construction; quality planning; design process; management

## **1 Introduction and analysis**

The construction industry is frequently criticised as being unable to achieve the same level of efficiency as that of the manufacturing industry. Surely, the slow technological evolution, the “archaic” culture of project players, construction project fragmentation, the use of old-fashioned management methods and the insufficient barriers to prevent environmentally uncertain conditions are combining causes.

In the last two decades, the Brazilian building construction has been facing to an important and complex process of transformation of national economics configuration and of competitive conditions in the sector.

These transformations are connected to the Brazilian economical context, which has been suffering deep changes due to the economical overture and the stabilisation of the currency, imposing a vigorous process of productive re-structuring to the Brazilian industries, in order to accept the new competitive conditions of the national and global market.

In building construction, in particular, the dynamics of evolution was widened by internal changes in the sector. The lack of housing financing in the end of the 80's and beginning of 90's; the bigger transparency in the public procurement; the improvement of working conditions and the availability of work-force contributed definitely to the raise of the competition in the sector.

Motivated by the rising competition in the construction markets and by the valorisation of the customers' role in the Brazilian national economy, many firms, both contractors and design firms, have been committed to the implementation of technical and organisational innovations in their processes.

One of the main trends in the modernisation adopted by the Brazilian industry of building construction was the implementation of quality management and certification programs.

These programs started in the Brazilian building construction by the leading action of some industrials who, in the first half of the decade of 1990, were quality-certified according to ISO 9001 and 9002 standards, for the processes of fabrication of building materials and components. After 1997, the quality certification movement concerned mainly contractors and estate developers.

Another great impulse to the quality certification in Sao Paulo State was the creation and carrying on of the Programme of Quality in Housing, which regulates the contractor selection in public construction projects of CDHU (Company of Housing and Urbanism Development), an important public "project owner", making it very important the participation in this programme and the issue of QUALIHAB certificates as well<sup>1</sup>. Nowadays it is already possible to account hundreds of firms having quality certified systems all over the country. São Paulo State concentrates the highest number of certified contractors, most of them ISO 9002, but it is possible to find certified contractors in many other states from different Brazilian regions.

More recently, subcontractors and design firms motivated by the pressure of some clients and by the expectancy of being remarkable in the market have been committed to this movement for quality. So that a training programme oriented to quality management and certification specific for subcontractors and design firms came into view as well as the first certified design firms.

Although the relevance of this movement for quality has been recognised by all the involved players some evaluation recently conducted into construction sites revealed deficient results in terms of effective quality management. Some of these deficiencies were related to the formal character of quality systems and lack of planning and most of them implicated design issues.

As the production process in the building construction sector is an one-off process, the evolution of the quality management stresses the lack of transversal systems of management, project-oriented and based on the simultaneous activity of a wide range of players, looking upon to the specificity of each new construction project. Architects

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<sup>1</sup> The Qualihab Certification was inspired in the French system Qualibat. This certification has four levels of requirements, growing from level D to level A, which has almost the same requirements of the ISO 9002 standard.

have an essential role as product designers and that is why his organisation must be oriented towards project and clients requirements. Several times this means that the success of project quality management is strongly dependent on the characteristics of design process management.

This paper has the aim of presenting some conceptual guidelines that are intended to improve the quality systems performance concerning design and development activities as well as their interfaces with production.

## **2 Proposals related to design process improvement**

### **2.1 Design as a service**

Even if a design can be specified and controlled as a product, design management also requires considering the “service component”, another important dimension of this activity. Melhado (1994) proposes this approach: although design quality oriented to product means only standardising and controlling plans and documents, there is something beyond their simple production and delivery. This involves the accurate understanding of the client’s needs and expectations. Thus, architects should be designers, but also consultants and information suppliers to perform project co-ordination. Finally, users’ needs should not be hidden by the client’s requests.

Zarifian (1999) defines service as “the more efficient organisation and mobilisation of resources to analyse, understand and achieve the expected transformation of the client’s activity conditions”. From this viewpoint, “considering the need to interpret users’ expectations and to understand the corresponding human and professional skills become critical to achieve services production efficiency. (...) It is not enough only to design the solution intellectually, if the effective transformation of the client’s activity conditions is not achieved. There is often an underestimated component of services production”

### **2.2 Buildability**

The classical project arrangement of building design teams places architects in a command position faced to other design professionals, which means that he will co-ordinate the whole design team in order to detail an architecturally designed product. In actual terms, the priority given by architects to aesthetics and formal design leads to typical difficulties of reaching team co-ordination success, such as eliminating conflicts and motivating collective work with engineers, quantity surveyors, etc.

An important factor to be considered concerns design detailing and to what extent it is oriented to production activities, in terms of real *buildability* value. Only a few architects do adopt concurrent engineering methods to combine architectural and production technology solutions. On the other hand, quality management committed architects seem to be more geared towards it.

### **2.3 Concurrent engineering**

According to Jouini and Midler (1996), in the design process defining the problem to be solved and creating and developing its solution are associated activities. Any separation between these activities would be a source of building deficiencies as case studies developed by these authors have been shown. For instance, if this separation is done building procurement will result in low quality and difficult-to-build projects or

more expensive ones, site conflicts between different teams due to design omission or contradiction etc.

Nowadays, in a building project the cooperation between involved players is a valid endeavour and it can be inspired on the practices adopted by the manufacturing industry like concurrent engineering.

Into the field of building construction, concurrent engineering can be implemented in three basic and non-excluding ways:

- a collaboration between client and design team in order to formulate the product briefing;
- concurrent design, involving data exchange systems and management methods of teamwork in design development;
- integrated product development and realization involving contractors and suppliers as well as transition activities between design and production.

## **2.4 Site preparation**

Finally, a transition activity performed between design and execution phases is recommended. This transition can be provided through site preparation, which is defined as *an activity that is placed after the project's definition phase and establishes the beginning of its effective management, being a transition between the main design activities and the execution phase.*

Site preparation requires a weekly meeting between project players, to analyse the project's particularities, to review design specifications and to discuss each contractor's or subcontractor's contribution to design detailing and technical problems solving. The scope of site preparation includes also as one of its main objectives the development of quality plans, so allowing the participation of non-prepared contractors or subcontractors.

## **2.5 Design contracting criteria**

Clients' role is clearer today than it was before. As the person primarily responsible for construction projects, they should define project briefing and then attribute a mandate to a design team, which must develop solutions answering to given briefing requirements. Architects, hence, are increasingly faced to very demanding and constraining clients' orders, even if some exceptionally non-restraint situations of design still exist, because of imprecise briefing. Instead of introducing a large creative freedom, these situations are sometimes the source of uncertainty, with all the resulting risks.

Alluin (1998) conducted a research about construction projects in France, which identified some contradictions in the relationship between architects and other construction project players, involving the solutions adopted in terms of construction technology, task planning, site logistics, etc.

Considering several construction players' viewpoints, Alluin's report criticises architects' low interaction with technical definitions as well as with on site production. Alluin asserts that a number of architects, thinking that their knowledge was strictly linked to creative design, left on-site work aside, and lost their building knowledge.

Alluin detected two particular configurations where design and production processes are more integrated. These are the cases of some large French architectural design firms that established a network of specialised collaborators, and also of a few medium-sized

architectural design firms, which are involved in all project phases, managing the technical, financial and production aspects of construction.

According to this viewpoint, successful performance requires real co-operation between architects, design engineers, contractors and other players involved in the project. And yet, from a company perspective, the player's activity is a continual achievement, whereas, in the construction project, it is a one-off contribution, to be managed as such. Design must be recognised as *a collective and interactive process, thus requiring the co-ordination of the whole, but it must also assign autonomy spaces to each player's specialised work.*

Related to management, another important aspect of the day-to-day architect's work concerns the effectiveness of his project supervision and communication with his client.

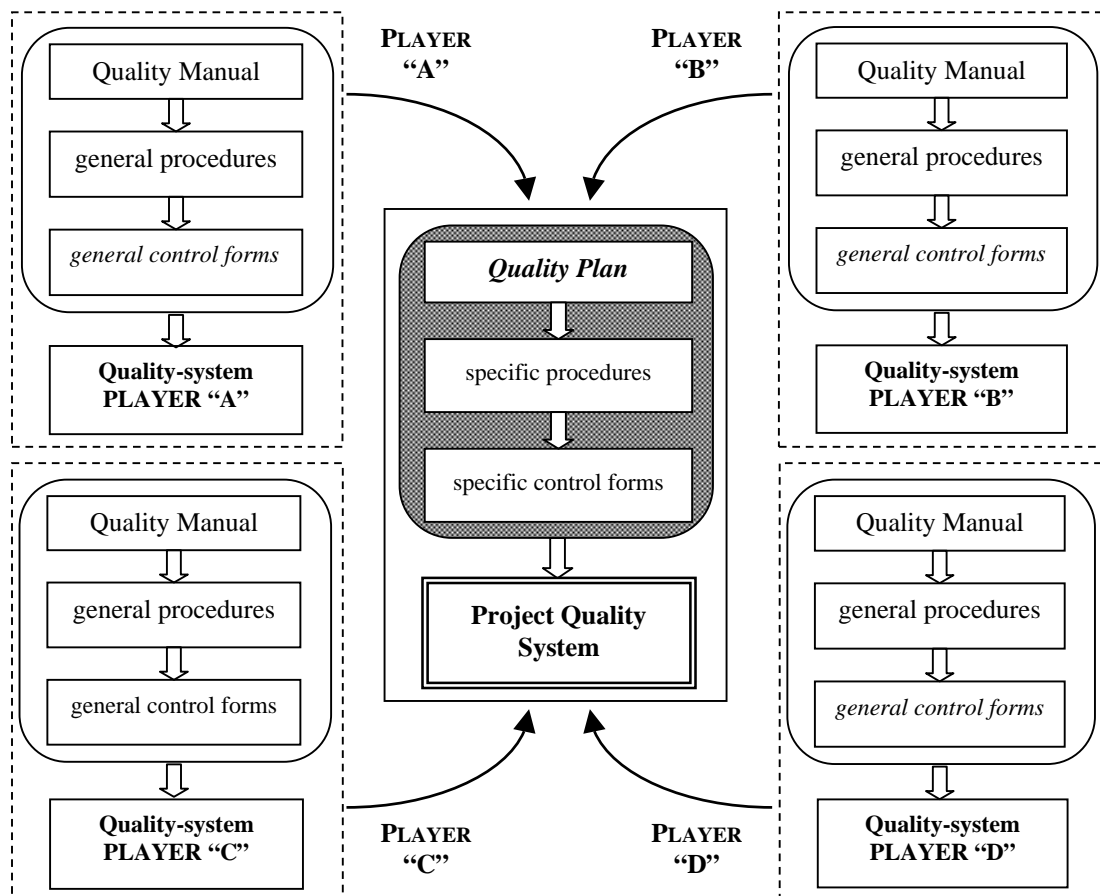
Finally, information technology and its rising importance in the construction professions are leading architects to try to rationalise their management methods. As a result, several activities are being increasingly linked to IT, such as data archiving and document exchanges between design team members: the associated risks of inefficacy and failure must be properly managed. Hence, management methods associated with design development and control must be evaluated and contract criteria fixing how they will be required are essential to improve quality results.

### **3 Proposals related to quality and project management**

The co-operation required by multidisciplinary work highlights the idea that project management is essential in the construction sector, but at same time, it shows the limited character of quality assurance standards. In fact, quality systems certification, one of the greatest drives that justify the growing interest in quality management in the sector, is not project-centred: his approach is focused on customer-supplier relations. Taking the construction project viewpoint, instead of each player's viewpoint, it is made clear that the "superposition" of all players' quality systems do not automatically produce a "whole project" management system, taking into account the insufficiency of players' interaction.

The French proposal of a specific standard for construction project management (MFQ, 1997) was hailed as a welcome answer to this need of co-ordination between each player's quality management (internal) and the project quality management (as a whole). In the proposed model, a prospective aim, the quality plan and management procedures have specific contents that are not the same as in the manufacturing industry; it also clearly sets apart a briefing phase that ISO 9001 simply includes amongst design activities. Moreover, the quality plan proposal stresses the needs on concurrent participation of project players, which requests strong co-ordination.

Aiming to provide a consistent and coherent Quality Plan to the whole project means integrating all the quality systems of all the players involved in the project organisation. This includes implementing new procedures oriented to client needs, as well as their integration to other players' quality systems (especially in the case of engineering design firms and contractors). See scheme at figure 1.

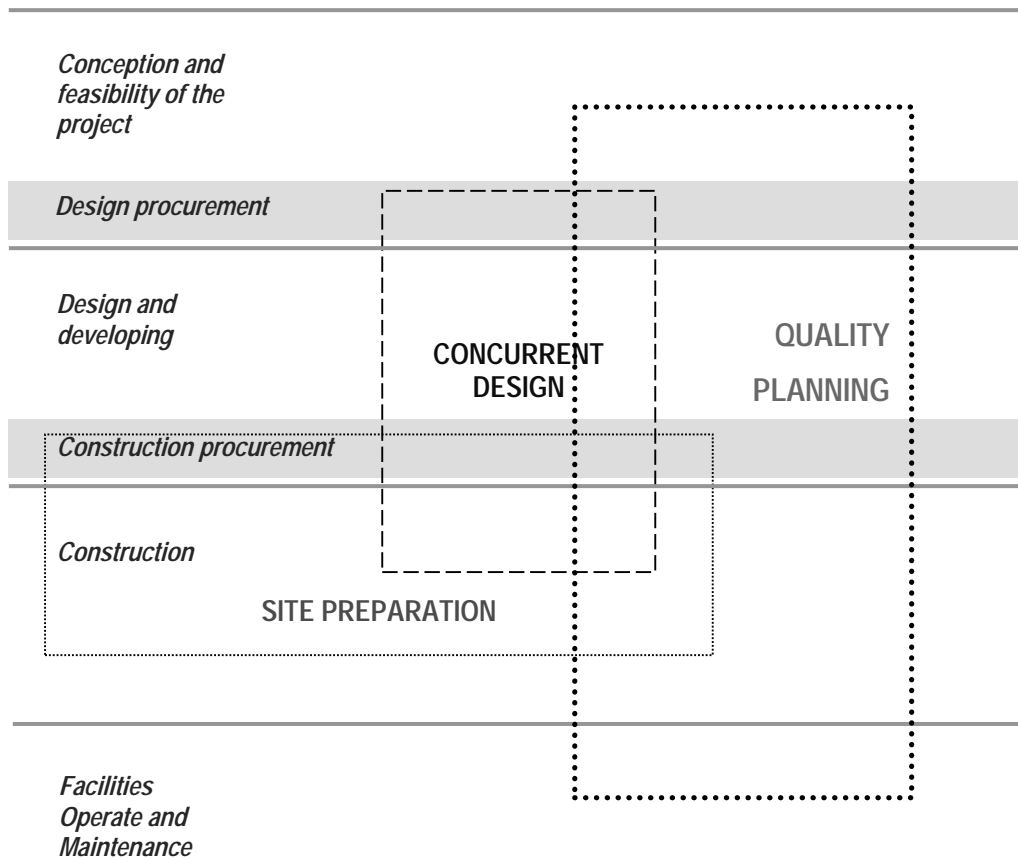


**Figure 1 – The proposal of a project quality management system (Melhado and Henry, 2000)**

However all the components of project management must be integrated all through the project activities progressing. As the main stages of a building project, that constitute the basics flow of project activities, it can be considered the following: project conception and feasibility, design procurement, design and developing, construction procurement, construction and facilities operate and maintenance.

Figure 2 shows this simplified flow of project activities and the placing of quality planning, concurrent design and site preparation. This constitutes the conceptual model of design management for building construction that is proposed to improve the fitting of quality management to the specific nature of the building projects.

In this conceptual model, quality management is intended to work as an integration system involving all the main project players, which is established as soon as possible (depending on the contractual nature of each project) in order to match design and production requirements and take advantage of quality planning. The adoption and effectiveness of concurrent design will also be dependent on contractual aspects.



**Figure 2 – The proposed conceptual model of design management for building construction (Melhado, 2001)**

## 4 Conclusion

The Brazilian building construction industry has been increasingly committed to the implementation of the management and certification of quality in its processes.

This can be justified by the strong competition in the market and also by the move forward the rising in value of clients' role into all Brazilian industrial sectors.

Amongst architects and design engineers, this attitude changing is more recent and restricted to a small number of design firms.

Considering that co-ordinating several stakeholders is the central task of project management in the building sector, the client's organisation should appoint a number of players from permanent organisations to work as a temporary team on the specific project. In view of this, the architect's role and its management methods are strategic to perform project quality objectives.

The interest in multidisciplinary team co-ordination is especially important to all architects that aim to be quality-certified according to the year 2000 version of ISO 9001 standard, which gives strong relevance to design co-ordination. This standard

establishes in particular that design reviews and validations must be programmed and registered systematically, involving all project players.

It is of paramount importance to introduce management tools oriented to the assurance of coherence among the quality management systems of all players that contribute in a project. Building construction should enhance the use of the proposed conceptual model aiming to co-ordinate and integrate the quality management of each one of the players to the project specificities, as a more efficient way of assuring the quality in the building projects.

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