The interfaces and impacts of designs, design management and scope at the facilities management.

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Abstract

In Brazil, the latent demand and competition in the construction market generate an impact on the product conception phase that is developed by only a few disciplines or just one – architectural design. The short deadlines imposed by the contractors due to commercial interests and financial returns, leads to a distortion in the potential product quality it could achieve.

There are many requirements, interfaces and criteria that have to be adopted by the architectural and engineering designers. It is difficult to ensure that the designed product not only complies with standards and regulations, but that it satisfies human needs. It is paramount to consider the expectations and the performance over the building service life since in the conception phase designers consider the real planning needs, services, cost control as regards facilities management at the use and operation phases in the building.

Since multidisciplinarity is not considered in the preliminary development phases, the conception design product phase is focused on the investor financial return, in very general formalist and technological concepts - and they are not completely known in detail, or standardized, given the scarcity of Brazilian technical standards.

Moreover, late hiring and disconnected from project management besides all subsystems necessary to develop the project hinder rationalization, productivity, performance and sustainability. Thus, the service life of the building and its performance is compromised during the use and occupation phase, which ultimately reduces their quality from the users' point of view.

The lack of design process management, as a briefing that really meets the real needs of the final users; scopes defined for each design specialties, a database that contains technical solutions that are already being used by production teams or those assessed or even suggest by the design feedbacks by facilities management teams; as well as a complete and updated set of technical standards affect the quality of the product as a whole.

In this context, the aim is to show the real importance of human needs, the correct moment of hiring design management, designers and consultants, the importance of design scopes and also the paramount interfaces among designers, production and facilities management teams.

Keywords: Design Management, Facilities Management, Design Scope.

1. The Design, Design Management, Production and Operation

1.1 The multi-disciplinary team, the integrated working and the interaction of the team.

According to Fabricio & Melhado (2008), conventionally, the development of a building project is clearly divided into stages. In this divided and sequential process, the possibility for collaboration between the various participants is rarely ideal and often fragmented. Changes to the design could easily result in significant rework and errors due to the complexity of coordinating and checking multi-authored information. Furthermore, participation of contractors, subcontractors, material suppliers and users in the design phase is sometimes very limited, which can lead to a gap between the product design definitions, the production design definitions and also the operation of the building.

Mesquita & Melhado (2006) emphasized the contemporary paradigm of design, production and operation of buildings, stressing its new package, in which business is associated with an 'investment' in service to their users. Therefore, as any other capital, the building must provide adequate performance to their use, contributing to the productivity of organizations based on it, through structural safety, functionality and suitability of spaces, environmental comfort, efficiency and effectiveness in building systems. In parallel is the attention to values such as durability, safety and economy of use over time and sustainability.

In case of improper planning or operation, there are burdens that slow or paralyze the activities performed in the building and even exceed the available resources of the organizations involved, resulting in reduction of benefits sought with it. Thus, it appears that it is not enough to design and to execute the project properly: it is necessary to ensure their proper use, which involves planning the use and building maintenance in its 'Operation' phase.

There is a latent need to consolidate data, even at beginning of the design stage, the production stage and also the inclusion of values related to the operation phase, such as providing documentation of supporting data on this activity.

1.2 Concurrent Building Design and DPD Design

Concurrent Design, as named by Fabricio & Melhado (2008), is a powerful way to manage the Design and Production, mainly if PDP is used as well.

According Fabricio & Melhado (2008), integrated product development is supported by different approaches that emerged and were practised in the late 1980s and the 1990s, the most well-known being concurrent engineering. Concurrent engineering (CE) emphasises parallelism and multidisciplinary collaboration in the product development process and particularly emphasises the need to integrate new product development (product design) with the development of production design technologies (Paashuis, 1998). Initially, concurrent engineering focused on technical and engineering processes, then the development process view expanded to incorporate pre-design activities, linked to marketing and market prospects, aligning the product development process to the corporation's strategic planning. Over time, concurrent engineering was developed to include product follow-up, which helps to obtain knowledge and learning that can be configured into a management approach for the entire product life cycle.

Maneschi & Melhado (2010), quoting Wong et al. (2004), state that design for production (DFP) is a product design methodology that determines if a manufacturing system has sufficient capacity to achieve the desired throughput and estimates the manufacturing cycle time, and performance. The authors define DFP as a 'systematic method that leads to a product design with minimum production cost while satisfying all the functional requirements'.

Maneschi & Melhado (2008), quoting Herrmann (2004), also say it is clear that product design, which requires a specific set of manufacturing operations, has a huge impact on the manufacturing system performance. Hence, understanding the relationship between the two is important to improve the manufacturing system performance for the product.

Product development process (PDP) is an approach from the manufacturing sector that comprises the product design and its production process. This is more comprehensive than the traditional methods adopted by construction companies that mostly focus on the product production process. PDP involves the formulation of needs, design and development of the product formal, functional and technical characteristics, along with design and planning of the necessary production means, including follow-up on the product performance in use. Progressively, the design process involves the participation of more design disciplines in specialized functions, motivated by the growing complexity of products and the need for design solutions of greater technological complexity. In this context, the management of new product development processes tends to be structured in a specialized, hierarchical, sequentially organized way (e.g. Womack et. al., 1990). With the dissemination of the lean production paradigm, the flow of activities and the concept of added value gained prominence in industrial production strategies. Design is increasingly seen as a priority phase for adding value to products (e.g. Koskela, 1992).

1.3 Contracts, Scope Designs and Design Manager

The relationships between Design Phases up to enterprises operation phase due the satisfaction of its users linked with the proper performance of their buildings is something that the Brazilian construction market can no longer ignore taking into account the sectoral competition, operating costs and the actual requirement of the end-user regarding quality, durability and maintainability.

Considering all the interfaces between Design - and their subsystems, Production, and Facilities Management - feedback and input data are relevant in the conception design phase. It is essential not only to satisfy the user, but also for life cycle in building and for its maintenance.

Mesquita & Melhado (2006) state, based on authors such as John & Cremonini (1989), Gomes (1992) and Hendriks et al.(2000), that the concern of those involved remains focused on solving challenges inherent to the planning stages, design and production as well as integration, "design-implementation'. Lack also concerns the systematic analysis of the impact of decisions taken at the design level or production needs ahead of the operation.

Fabricio & Melhado (2008), in an attempt to overcome these shortcomings inherent to a sequential process, have developed and implemented concurrent and integrated working methods, , aided by rapid developments in information and communication technologies. In concurrent engineering, models of work coordination packages can help to foster integration, multi-disciplinary interaction and decision-making. Concurrent design takes the concurrent engineering philosophy and applies it specifically to buildings design.

According to Barrett (2007), the design criteria needs to focus on sustainability, flexibility and adaptability, community needs, safety and security.

Unfortunately, designers are still guided by technology, money and the fashion side of architecture, while they should consider human needs and preview those needs in the design in the first place, considering the environment, the human senses and the functionalities, but always prioritizing the clients' needs and what they judge essential and very important into the space they will live.

In order to have harmonic integration between all those variables, it is relevant to manage the contracts of each professional involved, linked with their functions, the design scope of each designer and also to hire a professional who can establish the design management of the design process – the Design Manager - that is incumbent with organizing all those variables with a process systemic view.

2 Facilities Management (FM)

2.1 Definition and Primary Functions

According Egbu (2009), Facilities Management (FM) is a profession that encompasses multiple disciplines to ensure the functionality of the built environment by integrating people, place, processes and technology. It is also the integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of its primary activities as the integration of multidisciplinary activities within the built environment and the management of their impact upon people and the workplace.

Barrett (2009) defined FM: *"A strategic integrated approach to maintaining, improving and adapting the buildings and supporting services of an organisation in order to create an environment that strongly supports the primary objectives of that organisation"*

The primary functions of the FM professional are to:

- Manage and maintain the efficient operation of the "built environment". Ensuring that services are delivered in a way that contributes to the productivity and profitability of those people who utilize a facility;
- Reduce the impact of the use of facilities on the environment;
- Minimise operational life cycle costs of facilities;
- Conduct repairs and maintenance, security and cleaning as well as more highly technical services required for the efficient operation of a facility.

The Facilities Manager operates at a strategic level, with high level decision, contributing to planning and operational management level, dealing with technical issues, such as repairs, maintenance, security and cleaning.

3 Knowledge Management

3.1 Definition and the importance on the facilities management

According Egbu (2009), the definition of knowledge consist of: *"Truths, beliefs, perspectives, concepts, judgements, expectations, methodologies and know-how."* All these concepts originate in the minds of 'knowers'.

Knowledge is now seen as a resource that is important to an organization as labour and capital were in the old economy. About 20% of the knowledge available to an organization is actually used.

The innovation capacity depends substantially on the knowledge and the staff expertise. It also depends on the staff proportion of the value to the organization as it can be embedded in organisational routines, such as processes, practices, norms and in repositories.
When the knowledge is intrinsic to the professionals, they are able to understand the briefing and also to apply an innovative solution to a problem.

Knowledge sharing leverages expertise and organizational know-how to improve responsiveness, innovation, competency and efficiency, helping the Facilities Manager (FM) to better solve customers' problems.

According the same author, Knowledge Management (KM) is: *"The management of any process or practice of creating, acquiring, capturing, sharing and using knowledge wherever it resides in order to meet existing and emerging needs, to identify and exploit existing and acquired assets and to develop new opportunities".*

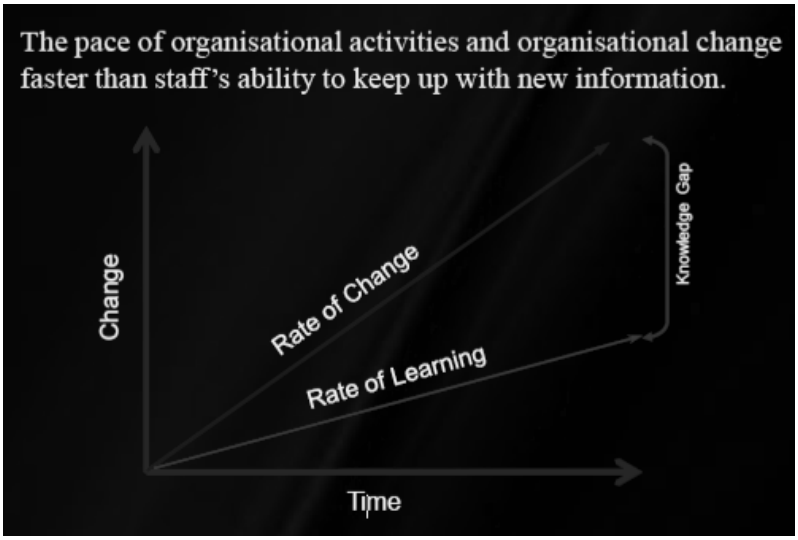

Figure 1: Facilities Managers x knowledge Management (Egbu, 2009)

4 Life–cycle, Design and the Construction Process

Figure 1 shows the Life-Cycle stages linked with the Design Phase, the Production and also the operations Phase.

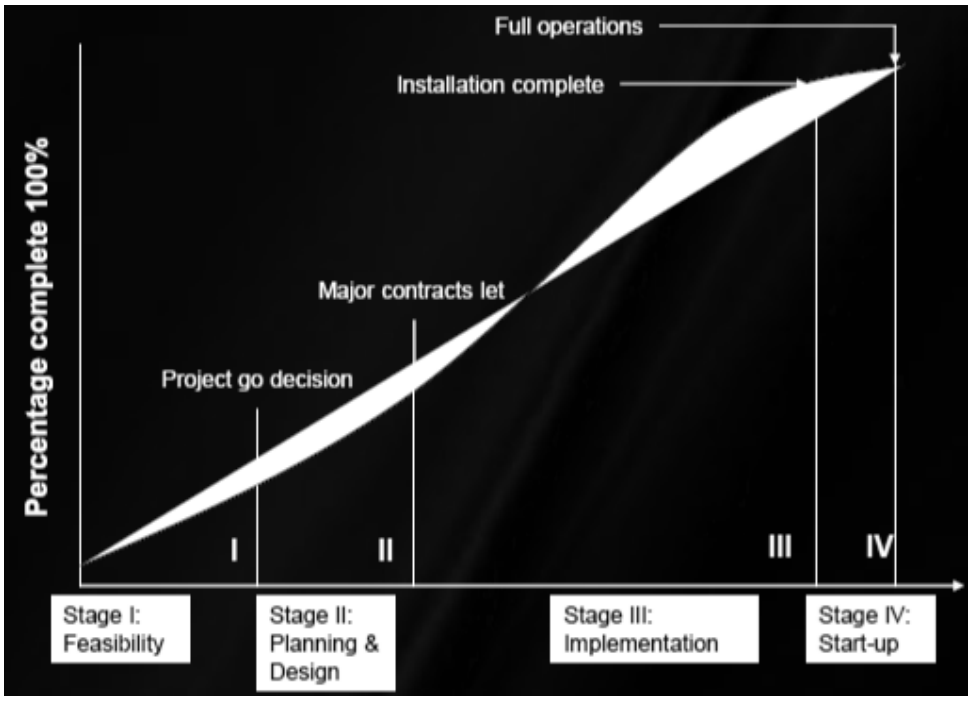

Figure 2: Project life-cycle (Egbu, 2009)

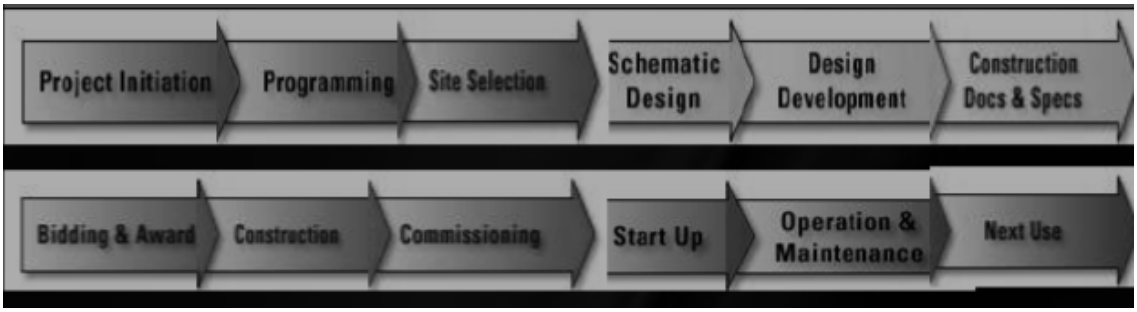

Figure 3: Building Design and Construction Process (Egbu, 2009)

In Figure 2, each Stage, I, II, III, IV, is linked with building design and also to the construction process:

- Stage I- Project Initiation, Programming, Site Selections
- Stage II – Schematic Design, Design Development, Constructions, Docs & Specs
- Stage III- Bidding & Awards, Construction, Commissioning
- Stage IV- Start up, Operation & Maintenance, Next Use

Following these 2 figures, one can realise the whole process of the life-cycle, the development Stages and also figure out the professionals involved at each Stage.

To succeed in the enterprise, it is paramount to be aware of both macro and systemic view so as to manage all the possible problems and solutions at each Development Stage in order to anticipate possible corrective actions at the operational stage.

5 Findings

Quoting Mesquita & Melhado (2006): Those accounting for the performance of the building at the operational stage are the management and building maintenance teams, implementing actions conditioned by a methodology for land management (Gomes, 1992). Also active, consumer and user agents are, respectively, the ones who actually buy and use the product, and ultimately bear its operation and maintenance costs.

In the operation phase, the performance level that meets users' needs is clear, while the phases prior to use affect the performance of subsequent stages. Thus, performance in use derives from decisions taken at design and implementation. Preventing the occurrence of disorders, pathologies such as constructive or excessive consumption of resources, even during the design costs little. Fixing the problem in the implementation phase is more expensive. If the problem is transferred to the user, the cost will be much greater generating problems for the FM professional to resolve them while they could have been resolved at the conception design phase.

The FM professional operates at a strategic level and should stay at that level and not to solve low-level problems, but should contribute to a strategic and major planning.

In this sense, the facilities managers, while they need to solve urgent operational problems and decisions, they have to plan their operations differently, seeing to the most common, low-level issues, which should have already been considered since the conception-design phase.

The integration of Design-Production-Operation, with feedbacks and also a data bank with those solutions and inputs, such as a careful contract management - considering the scope of each professional at each development phase, a DFP develops design that can consider all the processes and procedures and the hiring of a design management that will have the systemic view to optimize the FM workers and also involve them in the resolution of high-level complexity problems.

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