The Brazilian Design Manager Role and Responsibilities after the BIM Process Introduction

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Abstract

The introduction of Building Information Modelling (BIM) in the Brazilian construction industry has raised a discussion about various topics through forums organized by professional associations, unions and universities. The design management topic has been discussed by a group led by researchers of the University of Sao Paulo and senior professionals. This group verified the growth in the number of interfaces between players and tasks related to design production in BIM, which have generated an increase in management responsibilities for the design coordinator. These realizations raised questions regarding the current management and communication practices, required to evolve to a collaboration scenario with the implementation of BIM.

In this context, we present the development of "The Design Manager Responsibilities Guide" (DM Guide) and its structure. The guide is based on IDDS four pillars: Collaborative Process; Enhanced Skills, Integration and Automation Systems and Knowledge Management. The design manager responsibilities are approached in the context of the Real Estate Developer. The development methodology for the DM Guide is a discussion by a panel of specialists comprising construction players, facilitated by the academy through regular meetings.

Keywords: Design Management, Building Information Modelling, BIM initiatives.

1. Introduction

In the last 10 years, papers and discussions about BIM (Building Information Modelling) and its associated technologies have increased significantly, both in academic and industry contexts. However, most of the discussions and references have focused on technological aspects, such as software and interoperability tools, information flow, strict language, parametric objects, etc. Even though all of these themes are relevant, the discussion about process and design management in the BIM context has been set aside.

According to Fox and Hietanen (2010), several researchers focused their studies on interoperability issues for BIM software and tools. However, more recently, there has been a number of researchers realizing the relevance of design process improvement, especially

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inter-organisational work handbooks, in order to make technology application more feasible. Owen, Palmer et al. (2009) advocate that technology exists to support processes, which exist to support the creation and maintenance of coherent and important information, which in turn supports the collaboration in the project team. Therefore, the definition of process protocols and standards is required to achieve full collaboration and BIM highest potential.

To illustrate this discussion, a review is made of BIM implementing initiatives in countries such as USA, Finland, Norway, Denmark, Singapore, Hong Kong and UK. Regarding Brazil, the discussion focuses on the importance of defining policies and strategies to implement BIM in the construction sector.

According to Wong et al. (2010), in Finland, AEC researches found that companies are disappointed with technology adoption due to the high costs of investment and the low immediate benefit return. For the authors, this is verified in contexts in which project processes were not reviewed for the adoption of BIM. In this sense, they conclude that, for achieving a successful BIM implementation, efforts towards technology, people and processes should be equivalent. Another aspect emphasized by these authors is the importance of discussing processes and work handbooks preferably in inter-organisational environments, involving most of the project players throughout the project lifecycle.

In this context, this paper reports the process of writing a “Design Manager Responsibilities Guide” (DM Guide). The aim of the guide is to define all the design manager’s responsibilities and tasks throughout the building project life cycle with BIM application. The guide is currently being developed by the Design Management Workgroup of Escola Politécnica, University of São Paulo, and it is a part of the PhD research named “Guidelines to the Design Management area of Real Estate Developer Companies - structure, people, technology and processes” as of the Master’s research named “Models of Collaborative Contracts for Integrated BIM Projects”. The workgroup comprises AEC professionals from architectural firms, construction firms and clients as well as software developers that discuss the BIM project process as it has been implemented in Brazil, under the coordination of this paper authors.

2. Literature Review

2.1 Integrated Design and Delivery Solutions

For Owen et al. (2010), due to the construction sector inefficiency, from product development to construction and building operation, concepts and tools issued from Lean Construction, Lean Design and Information Technology have been undertaken to improve processes and add value to construction projects. Nevertheless, according to the authors, these practices and technologies have been applied singly, and until 2010, initiatives to integrate them had not been proposed.

As an example of low integration, BIM introduction practices have been similar to the introduction of CAD (Computer Aided Design); however, BIM could change the current practices, since its associated technologies improve building project management practices

along its life cycle. In this context, to potentiate the use of BIM, a critical analysis to the current implementation practices should be performed.

Aiming at integrating actions and good practices, such as Lean, BIM, IPD and others, the International Council for Research and Innovation in Building and Construction (CIB) elected the IDDS (Integrated Design and Delivery Solution) as a priority theme, through the framework for an integrated and coordinated merge of people, process and technology issues in order to conduct a radical and continuous transformation in the construction industry.

According to the authors, several elements of the IDDS are currently being explored in largely isolated parts of the academy and of the industry. The IDDS approach also challenges traditional industry structures and contractual process, as it both highlights current inefficiencies and facilitates their resolution, making the most of the workforce collaborative intelligence. The implementation of IDDS will move the industry towards an ongoing and iterative way at each of the projects phase: conceptual planning and making business case, all the design parts, supply chain management, construction, commissioning, operation, retrofit, and decommissioning.

For Gray and Hughes (2001) and Hjelseth (2010), design management complexity increases as the number of specialists grow. Analysing the design process from the information exchanged point of view, the greatest design manager challenge is to provide timely information and within the requested quality, aiming to meet the design team needs and the final client demands, through collaborative approaches and tools throughout the project life cycle.

As an example of low integration in the construction sector, Nederveen and Ridder (2010) emphasize that due to the construction sector fragmentation, building projects are characterized as multifunctional structures, with high level of risk tied to cost management, inefficiencies in communication processes, among others, which often trigger stakeholders' dissatisfaction. To Hjelseth (2010), information exchange in the construction sector has been conducted with a low level of formalization, once in general the building information is scattered in various documents, such as descriptive memorials, blue prints, contracts and legal documents, which raises questions on information quality and availability.

In this context, Nederveen and Ridder (2010) proposed LBC (Living Building Concept) as an approach to the requested paradigm shift. In most cases, the construction product development occurs through demand-driven supply approach conduct, since the initial contact occurs between the client and the architect, who is responsible for translating the clients' needs into construction information. In the LBC approach, the suppliers are active players during the construction product development, since clients choices must be met within the library of components and systems previously developed. These components must be organized into a parametric object library, since the condition to apply LBC is the similarity between virtual and real world. From the components and system choices, a building information model should be built aiming to evaluate the performance and design solutions quality, from the clients' point of view.

3. METHODOLOGY

For the development of this paper, the authors conducted a literature review based on the IDDS (Integrated Design and Delivery Solutions) agenda. Also, having Succar's (2009) BIM Initiative field model in mind, a research through papers and publications in these themes that classified initiatives around the world was developed, and the same classification concepts were applied to Brazilian and the UK scenario.

The second part of the paper presents the work by the Design Management Workgroup from the University of Sao Paulo, on one of its current research themes, the production of a Design Manager Guide for BIM in Brazil. The workgroup methodology is presented in item 3.1.

3.1 Design Management Workgroup Methodology

This research group was an initiative of the design process management research group from the University of Sao Paulo, and consisted in regular meetings with the participation of the researchers and market players, such as designers, design coordinators, software industry representatives, and members of construction building companies.

The meetings took place every two weeks and the discussion was based on the Brazilian Design Manager Scope (2006), and on several international BIM guidelines and handbooks as references, as well as on the participants' experiences. The discussion involved the Design Manager tasks and responsibilities, and the analytic process was guided by a division of management tasks domains in four different fields: product management; design process management; communication management and modelling management.

At a second stage, specialists in specific AEC themes (planning, sustainability, constructability) will be invited to discuss the group production and evaluate its results; workshops in different Brazilian regions and with the academic community are going to be organized by the workgroup.

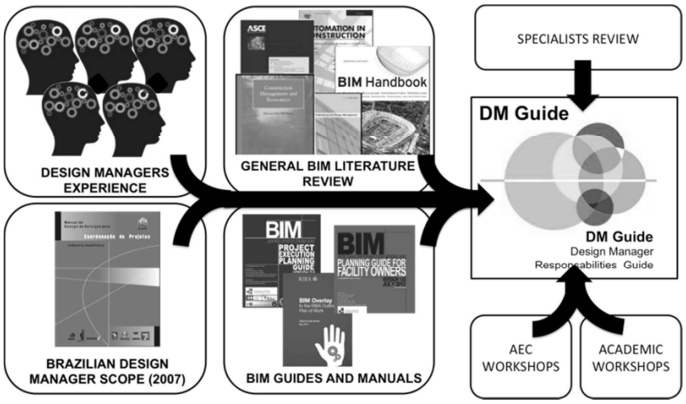


Figure 1: Workgroup Method

4. BIM SECTORIAL INITIATIVES: STRATEGIES AND MOBILIZATION

According to Wong et al. (2010), the BIM knowledge domain is expanding with its implementation in various countries. The authors present a review of BIM implementation process in six different countries (USA, Finland, Norway, Denmark, Singapore and Hong Kong), and classify their initiatives into the fields of policy, process and technology (Succar, 2009), where they identify the players and deliverables for each field. The six countries evaluated have developed more initiatives in specific fields (Wong, 2010), shown in Figure 2.

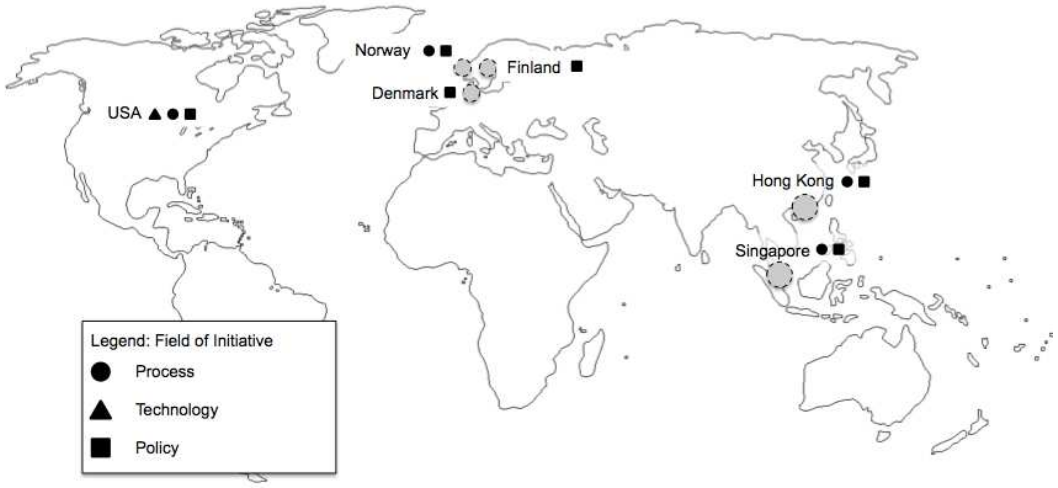


Figure 2: BIM Initiatives in the USA, Norway, Denmark, Singapore and Hong Kong according to Wong, 2010.

The USA have developed BIM initiatives within the three fields, which can be explained by the players from different sectors, such as government associated institutions, such as GSA (General Services Administration, responsible for BIM implementation in the public sector), NIST (National Institute for Standards and Technology) and many others, including research institutes, organizations and associations from the private sector.

In Denmark, public sector clients defined specific modelling standards and guidelines; in Finland, the effort dedicated to the development and use of IFC standards stands out in government initiatives. Also, BIM guidelines emerged as the result of an R&D project developed within industry players, ProIT.

Norway also developed BIM guidelines from a state client pilot construction project using BIM, and also has strong initiatives along the implementation of IFC standards and the definition of information exchange requirements. Within the process field, the building SMART initiative has a number of cross department projects working on converting and implementing BIM in building projects.

In Singapore, the use of an automated code checking system that reads IFC for project approvals has a strong influence in Policy initiatives, and also process initiatives have been implemented since 2007. In Hong Kong, the public sector have applied BIM technology for design, sustainability studies and construction coordination of its public housing projects. In

the process field, several companies have implemented BIM in their projects and have been using the technology for clash detection, design visualisation and evaluation, and also have a number of consultants providing implementation services.

Succar's classification model used in the six countries above, allows the identification of each countrie's strategy for BIM implementation, the probable responsible players and deliverables, and, by exclusion, helps identify the fields that are not being developed equivalently. This review methodology is used in this article to evaluate UK and Brazilian BIM initiatives, as follows.

4.1 BIM INITIATIVES IN THE UK

In 2011, the United Kingdom Government, through its Plan for Growth, highlighted the critical importance of an efficient construction industry for the economy. According to the Cabinet Office Report (2011), the construction industry in UK is highly fragmented, with over 300.000 businesses, of which 99.7% are SMEs and over 2 million workers. The sector has contributed, on average, with 7% of GDP and is worth about £110 billion per annum, through three main sub sectors:

a) Commercial and social infrastructure: (45% - public: 18%, private: 27%): projects are typically traditional construction with a mix of new building and refurbishment;

b) Residential (39% - public:13%, private: 26%): the public sector has a relatively small new building program compared to repairs and maintenance;

c) Infrastructure (16% - public: 6%, private: 10%): is typified by civil engineering works, long overall project durations and major programs are renewal/ maintenance.

As the scenario which forced the UK Government to rethink the construction sector strategies were based on studies which highlighted that the construction sector activities usually under-performs in terms of its capacity to deliver value, and that there had been a lack of investment in construction efficiency and growth opportunities, the prevalent inconsistent procurement practices, particularly in the public sector, aligned with low level of standardization and fragmentation of the sector had led to waste and inefficiency. As a solution, the UK Government proposed a four-year program to modernize the Construction Sector with two key objectives: reducing capital cost and carbon burden from the construction and operation of the built environment by 20%.

One of the strategy objectives was related to Building Information Modelling and was detailed in the Building Information Modelling Working Party Strategy Paper (March, 2011), which recommended a strategy to deliver a structure Government/ Sector capability to increase BIM adoption over a five-year horizon. For this, a Client BIM mobilisation and implementation group to drive the adoption of BIM across government was established to meet the requirement to attain fully 3D BIM collaboration (with all project and asset information, documentation and data being electronic) as a minimum by 2016. This group was named Building Information Modelling (BIM) task Group.

The working group recommended the “Push-Pull” as the strategy to adopt, supporting the “push” supply side of the industry to enable all players to reach a minimum performance in the area of BIM use, balanced by a “pull” from the client side to specify, collect and use the information derived in a value-adding way. The working group team was formed by construction player representatives, academics and software manufacturers. Its objectives were related to adopting BIM methodology benefits in construction as post-occupancy management, identifying the UK Government as a client who would need to encourage a number of BIM approaches as well as assess the potential of the government policy regarding BIM.

4.2 BIM INITIATIVES IN BRAZIL

The Brazilian AEC sector has only recently started BIM implementation , and the companies which have invested in this initiative in the past few years belong to the private sector. A number of Brazilian institutions have been developing study and workgroups aiming to discuss the implementation of BIM, and to promote its concept within the AEC community by promoting events and courses, but the concept of BIM is still not widely spread in the market.

Figure 3 shows a map identifying a number of BIM initiatives per region, identified in Brazilian research institutions with publications on BIM initiatives, some of them connected in a knowledge network for defining parameters and promoting BIM in the country. The data refers to papers published by Brazilian researchers on BIM in the Brazilian Information Technology Conference (TIC) in 2009 and 2011. The papers were organized into the following subjects: Design Process, Academic Diffusion, Technology and AEC Sector Diffusion. A total of 46 papers were analysed and 8 papers (16,7 %) were classified as Design Process, 7 papers (14,6%) as Academic Diffusion, 28 (58,3%) as Technology and 5 (5,4%) as AEC Sector Diffusion.

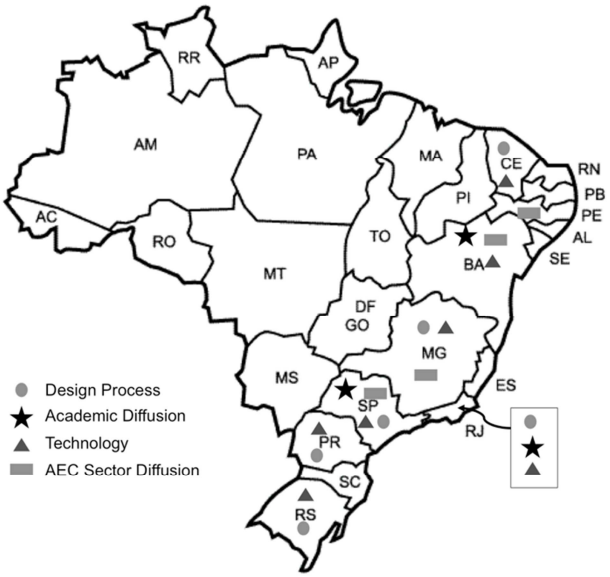


Figure 3: BIM initiatives in Brazil

There are five specific initiatives which have connected a significant number of researchers and AEC associations with specific purposes of BIM development in Brazil. They are described in Table 1.

Table 1: BIM Initiatives in Brazil

BIM Initiative	Initiative Description
BIM Interdisciplinary Group	In 2009, a regular discussion group was created on the initiative of AEC associations, opened to research institutions participation, AEC associations, institutions and private companies. This group was responsible for the development of those private companies knowledge of BIM and its processes, which led to the first real BIM project cases known in Brazil, further developed within the companies with consulting from members of the Interdisciplinary group.
BIM BRASIL NETWORK	This network is financed by CAPES, the Brazilian Federal Agency for the Coordination for the Improvement of Higher Education Personnel, and counted on the participation of four Brazilian Universities (USP, UFF, UFBA and UFPR). It was responsible for the inclusion of BIM disciplines in those universities graduate programs, and for promoting BIM research projects through scholarships. The production related to this group will be available for public access in their website, redebimbrasil.org.br.
SINDUSCON – SP (Sao Paulo State Contractors Union)	Sinduscon - SP is responsible for the annual BIM seminars, hosted in their headquarters since 2010. This event is known for bringing together representatives of all roles in the AEC chain, from designers to suppliers, clients and construction companies, investors and consultants. Its themes are compatible with the BIM scenario in Brazil, and companies implementing BIM often present cases with results, the positive and negative aspects of their implementation processes. The participation of international researchers and BIM consultants is also regular. These seminars are considered an annual event for every company and professional interested in BIM, a valuable opportunity for creating connections and sharing knowledge, and also discussing real case studies of implementation, preventing them from making the same mistakes as the companies who started the innovation curve.
BIM Standard Committee	The growing discussion and dissemination of BIM concepts led AEC institutions to identify the need of developing national standards, leading to the formation of a committee for developing BIM first standard in Brazil, NBR 15965-1 – Construction Information Classification System – Part 1.: Terminology and Structure, and Part 2.: Construction Objects Characteristics. These Standards define the vocabulary, the principles of the classification system and groups of classification for planning, design, management, construction, operation and maintenance, and should be observed in the elaboration of other standards which may rule and concern Building Information Modelling. The first part is in force since August, 2011, and the second part since August, 2012.
FINEP's TICHIS	FINEP – Project and Research Financer is a public company associated to the Brazilian Ministry of Science, Technology and Innovation (MCTI). In December 2010, a cooperative research network was formed with seven of the largest public universities in Brazil (USP, UNICAMP, UPM, UFRGS, UFPR, UFBA and UFC), financed by FINEP, called TICHIS: Information Technology and Communication Applied to Social Housing. The cooperative research network aims at developing innovative solutions for improving the quality and productivity of social housing constructions, focusing on BIM solutions, comprehending six main themes: (1) Web management, (2) Open standards for interoperability, (3) Digital design and conception, (4) Information technology and communication in construction management, (5) Integrated project management and IPD and (6) Information technology and communication for usage. These themes are reflected in the research subprojects, described in Table 2 herein and classified into BIM fields.

There are also isolated BIM implementation and development initiatives identified in professional associations and private companies. These initiatives, despite having a minor range, have helped the formation and shaping of Brazilian AEC professionals and, therefore, the implementation of BIM in the country. In this category, there are a few professional associations such as Agesc (Association of Design Managers and Co-ordinators), AsBEA (Brazilian Architectural Firms Association), SindusCon (Contractors Union), and software developers, such as Autodesk, Bentley and PINI. These associations and companies are responsible for several initiatives, such as BIM workshops and courses, promotion and sponsoring of BIM congresses, and contributing to the development of BIM national practices.

Table 2: Brazilian university research themes and BIM fields

University	Research project themes	BIM Field
USP – University of Sao Paulo	Construction site prototyping, multi-dimensional performance analysis, masonry modulation generative techniques for BIM, handbook for creating BIM components, BIM project management and collaborative contracts	Process, Technology and Policy.
UNICAMP - State University of Campinas	Augmented Reality, 4D simulation, project cost vs. performance analysis model, participatory design, BIM technology for decision making, design prototyping, model control parameters.	Process and Technology
UPM – Mackenzie Presbiterian University	Digital fabrication, model for multi-dimensional analysis of risk areas occupation, generative systems for design modulation, components library production, collaborative process methodologies	Process and Technology
UFRGS – Federal University of Rio Grande do Sul	Modelling of client requirements, augmented reality, construction control automation, 4D simulation implementation	Process and Technology
UFPR – Federal University of Paraná	Multi-dimensional performance analysis, environmental performance tool analysis, semi-immersive collaboration environment development, handbook for construction of BIM components by suppliers, augmented reality for simulating construction site, BIM and Lean for public projects, communication management through BIM.	Process and Technology
UFBA – Federal University of Bahia	Business model/project management model for social housing, procedures for complex geometric shaping in BIM, thermal performance analysis methodology development, laser scanning, collaborative project methodology model.	Process, Technology and Policy
UFC – Federal University of Ceará	Post-occupancy evaluation through BIM models, strategies for improving integrated management in social housing.	Process and Technology

4.2.1 Design Management Workgroup

The Design Management Workgroup is an initiative of the Research Group on Construction Technology and Management of Escola Politécnica (USP). It is an integral part of the PhD research named “Guidelines to the Design Management area of Real Estate Developer Companies: structure, people, technology and processes” as of the Master research named “Models of Collaborative Contracts for Integrated BIM Projects”. The workgroup gathers AEC professionals from architectural firms, construction firms and clients, as well as software developers, aiming to discuss the BIM process as it has been implemented in Brazil, under the coordination of this paper authors.

The first meeting was held in March 2012 and aimed to discuss the responsibilities of the Design Manager in the BIM context with a panel of design management specialists. Aiming

to attain the Design Management Workgroup objective and its context, the Brazilian Design Manager Scope (2006) was chosen to base group discussions.

This Scope service had been part of an initiative to develop a set of Design Services Scope, in the context of Brazilian Construction Policies which had aimed to improve the services quality into the construction chain as well as to maintain an ethic and reliable relationship in design contracts.

Since the first meeting, the Design Manager Workgroup has met 10 times and developed a document called “The Design Manager Responsibilities Guide” (DM Guide). The guide is structured throughout the Building Project Life Cycle and uses the four IDDS pillars to define design managers’ tasks. It is worth emphasizing that the DM Guide structure is addressed to the context of Real Estate Development projects.

5. The Design Manager Responsibilities Guide in Brazil: DM Guide

Before presenting the DM Guide, it is important to understand The Brazilian Design Manager Scope (2006) development context and its structure. In this handbook, BIM is slightly approached, since when it was developed, there had been few discussions about BIM in Brazil, most of it only in the academic field.

The Brazilian Design Manager Scope (2006) is a handbook structured upon design building life cycle phases: a) Product Conception; b) Product Definition; c) Design Interfaces Identification and Solution; d) Post-Design and e) Post-Construction. Each phase was divided into three services categories: i) essential services, which are applicable to all types of building projects; ii) specific services – applicable only to some specific building projects; iii) optional services, which are not part of the design manager basic responsibilities, but can be hired in order to add value to the project.

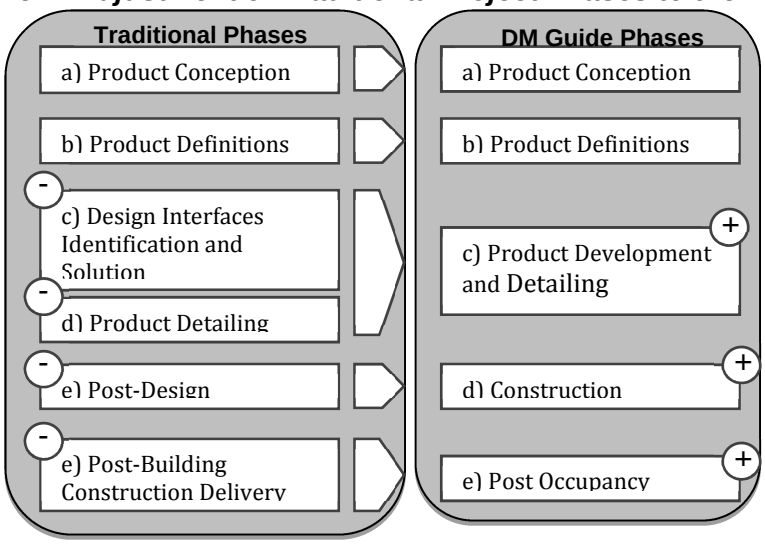
The development of the DM Guide is not a review of the Brazilian Design Manager Scope (2006). It is the result of a research that re-organises the Design Management tasks based on practitioners’ experiences, BIM literature review, and the analysis of international guides, such as the BIM Project Execution Plan Guide and BIM overlay to the RIBA outline Plan of Work.

5.1 DM Guide Structure

The DM Guide aims to define and to organize the Design Manager responsibilities in a context in which the design is developed by modelling processes. Additionally, the tasks are structured for planning and organizing the necessary information to design activities, making it available in time and with the quality required. It also aims to maintain information integrity along the building project life cycle. The guide is structured into 5 phases: a) Product Conception; b) Product Definition; c) Product Development and Detailing; d) Construction; e) Post-Occupancy.

Considering the design process evolution, some of the design phases proposed by the Brazilian Design Manager Scope (2006) were supressed (Design Interfaces Identification and Solution and Product Detailing), as demonstrated in Figure 4.

Figure 4: Adjustment of Traditional Project Phases to the BIM context



Product Conception tasks aim to support the Real Estate Developing Company to conceive the Building Design. For this, the Design Manager must understand what the developer's resources and needs are, including performance, quality costs, time and sustainability objectives, among others. This phase tasks help define product briefing and support the multidisciplinary design team conceptualize physical and occupational characteristics through geometric conceptualization. The identification of stakeholders as well as their demands and expectations is part of the design manager responsibilities.

After Product Conception, Product Definition tasks aim to support the feasibility studies. Once the Business Plan is approved, it supports modelling development to extract documentation for legal approval purposes, since the Brazilian government agencies responsible for building design and construction approval still work on a paper/document basis. Also, tasks referring to multidisciplinary design management support technological analysis and building construction system choices, considering cost, time, risk, quality, communication, sustainability and procurement.

In the Design Product Development and Detailing phase, the tasks aim to consolidate all the information required for building execution through the model and to support the modelling process in decision making as to construction strategies and methods. For the Preparation for Construction Execution phase, the Design Manager must support the construction team at operational and production plans, procurement process, and quality process plan, defining the resources and team responsibilities.

During the Construction phase, the DM Guide tasks support resolving construction managers' doubts, management of design changes and production simulation. The Preparation for Operation tasks aims to support the model preparation for facilities management.

Finally, Post-occupancy tasks support the post-occupancy evaluation and allow the feedback for the knowledge management system of the Real Estate Developer Company as well as the knowledge asset of the AEC players involved.

In each phase, management tasks were organized into four categories: a) Product Management; b) Design Process Management; c) Collaboration and d) Modelling Support.

Product management tasks aim to support the decisions referring to the building product from the aesthetic, functional and technical point of view, based on the developer and stakeholders constraints and cost requirements, time, quality, usability, operation, sustainability and constructability criteria. As to design process management, the tasks refer to the setting, contracting and evaluating the multidisciplinary design team, managing the design team activities, following costs and quality controls and other KPIs (product and management).

Collaboration tasks must enable communication and provide information integration for the decision-making marks along the design process and among all the agents from the design team and real estate developing company to the construction and facilities managers.

Design knowledge management tasks are part of the collaboration process along the project life cycle; even in the post-occupancy phase, the design manager must collect and organize the lessons learned through post-construction research, involving all the teams who participated in the project cycle different phases. The knowledge accumulated along the design phase must be fed into the Real Estate Developing company knowledge system. Modelling Support tasks aim to provision the BIM manager with all the necessary information for the modelling process.

At this point, the development of the Design Manager Responsibilities Guide is still in phase 1, and the tasks and process workflow defined so far are available at (http://www.iau.usp.br/pdconhecimento/melhorespraticas/?categoria=3).

The workgroup intends to continuously publish its results and production in academic meetings and scientific journals.

6. DISCUSSIONS

Analysing the BIM initiatives in Brazil, it is verified that there is low articulation among them. The discussion about BIM in Brazil, both in the Academy and in the Industry, started less than 10 years ago, and the existence of isolated initiatives is reasonable. However, it is important to highlight that, although the initiatives are not articulated, they are all relevant. Compared with the data presented by Wong et al. (2010) and the UK Government Strategy, the approach of these countries started with construction policies establishment as well as government requirements - as a major client of BIM implementation -, which does not correspond to the Brazilian reality.

The second interesting aspect of BIM initiatives in Brazil refers to academic researches. According to data shown in Part 4 and Figure 3, the Brazilian academic production in BIM is concentrated in the South, South-West and North-West states, and in four priority themes: Design Process, Academic Diffusion, Technology and AEC Sector Diffusion. Most of the papers (58.3%) published by TIC (2009 and 2011) were about technology.

For Fox and Hietanen (2010) and Owen, Palmer et al. (2009), processes and technology are co-dependent. In the BIM context, process protocols and standards are fundamental to achieve collaboration. Following this logic, it is important for the Brazilian Academic Community to re-evaluate their research strategies to include processes as well as AEC Sector Diffusion and Academic Diffusion themes.

The DM guide was developed under these assumptions and that in Brazil the BIM Manager and Design Manager responsibilities and skills must be better understood and defined. Through the DM Guide development, we perceived that both professionals are part of the Project Building Manager staff and they should work together in the BIM context process management to comply with stakeholders and clients constraints and requests.

7. CONCLUSIONS

The development of the Design Manager Responsibilities Guide is an important BIM initiative in the Brazilian scenario, given the few cases in which processes have been approached for the implementation of BIM in this country. As discussed in item 4, most Brazilian initiatives are towards the implementation of BIM technology, creating an unbalanced score for process and policy initiatives, recreating the Finn experience, which has shown high levels of disappointment by AEC companies.

Both academic researches that incited the creation of this workgroup emphasized the importance of defining the role of the design manager in the design process. They also emphasized the definition of project phase tasks and of the players involved, proposing a detailed workflow for the design process that can be used as a generic model for BIM implementation by Brazilian AEC companies.

Aiming to apply the DM Guide as a resource for BIM process implementation in Brazil, the next steps of the workgroup grow in importance, as they will validate the document as a referential set of guidelines for the AEC sector. After the discussion and first draft of the design process and design management tasks (Phase 1 of the DM Guide), the workgroup will promote three other phases for analysis and validation of the Design Manager Responsibilities Guide: Phase 2) Discussion with AEC specialist at each process phase; Phase 3) Promotion of workshops in different Brazilian regions; Phase 4) validation of the reviewed Guide with the academic community.

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