KEYWORDS BIM construction companies small sized companies BIM implementation barriers advantages

IMPLEMENTATION OF A BIM SOLUTION IN A SMALL CONSTRUCTION COMPANY

Soraya Mattos Pretti
Researcher at BIM Lab of Technologic Center – UFES
s_pretti@hotmail.com

Darli Rodrigues Vieira
Université du Québec à Trois-Rivières
darli.vieira@uqtr.ca

ABSTRACT

The challenges to produce with more quality, less cost and less leading time, drove the construction sector to find new process and tools to help them achieve these goals. Building Information Modeling (BIM) is a solution for these demands supported by many researchers and companies. Many enterprises had already started the BIM adoption process and many studies have been conducted. Unfortunately, the majority of studies are focused in big companies and developed countries, leaving medium and small companies, especially the ones in developing countries, without data to analyze the feasibility and advantages to enter this process and to guide them through it. In light of this, this paper provides a description of a BIM deployment process in a small construction company in Brazil. The case study presents an implementation process which includes seven steps, some of them still ongoing. Even with an unfinished BIM deployment process that was carried on without any known methodology, benefits derived from using BIM were observed and barriers for its full implementation were identified. Comparing these findings with the literature review, it may be noted that even if the size and country differs, most of the benefits and barriers are similar.

1. Introduction

With the advent of Lean Construction, the civil construction sector all around the world is faced with the challenge of reducing waste of any kind. The problem becomes more complex as time passes by, since other factors that were not relevant were added to the equation. For example, the sustainability issues became very important, as researches discovered that the impact made by the construction industry had huge proportions, generating waste through the whole project life cycle. For example, buildings are responsible for 20% to 40% of energy consumption in developed countries *(Perez-Lombard, Ortiz, & Pout, 2008)*, and, in Brazil, 50% of the waste generated in big and medium cities come from construction activities, be it new buildings or refurbishment of old ones *(Jacobi, & Besen, 2011)*. This whole situation gave the design team the task to carefully analyze how their decisions would influence the building development.

Therefore, buildings became more and more complex, requiring the involvement of more players that, thanks to globalization, may be scattered all over the planet, thus new means of communication became necessary for an effective process. At the same time, the growing competition demanded better products with lower costs. All this scenario led to the development of a series of theories and tools that would help companies achieve the Lean ideal while maximizing their profit, reducing errors and leading time of their products.

In this sense, one of the most eminent tools/process that has been studied and used by researches and companies is BIM – Building Information Modelling. Over the past years, the use of BIM has been considerably increasing *(Checcucci, Pereira, & Amorim, 2013; McGraw Hill Construction, 2014; National Bureau of Standards, 2014; Succar, Sher, & Williams, 2012; Yalcinkaya, & Singh, 2014)*. Statistics from the National Bureau of Standards *(2014)* stated that BIM is now at 54% usage in the UK and SmartMarket Report presents a figure of 71% BIM adoption in North America *(McGraw Hill Construction, 2014)*. However, it should be observed that most available data regarding the use of BIM concerns the developed countries and large firms *(Arayici, Khosrowshahi, Ponting, Mihindu, 2009; McGraw Hill Construction, 2014; National Bureau of Standards, 2014; Wong, Wong, & Nadeem, 2009)*. Therefore, it is important to understand how developing countries, such as Brazil, are handling this innovation and also small and medium companies, since they compose the majority of construction companies *(Checcucci, Pereira, & Amorim, 2013; Dave, 2013; Elmualim, & Gilder, 2014)* and the wrong implementation of this technology could have a great impact on their business.

This paper will present an explanation about BIM, followed by the presentation of a case study about BIM implementation in a small construction company in Brazil, explaining how the process was conducted, the obstacles and benefits found in the way.

2. So, what is BIM?

It has already been mentioned that BIM can be of great help for the construction industry. But what is BIM really?

Many people think of BIM as a tool/technology, but summarize it as only this is rather shallow. It can be said that BIM is, at the same time, a tool/technology, a product and a process *(Jupp, & Nepal, 2014; Kassem, Iqbal, Kelly, Lockley, & Dawood, 2014; Ningappa, 2011; Succar, 2009; Yalcinkaya, & Singh, 2014)*.

There are several definitions of BIM; one of the most well-known is the one used by the National BIM Standard-United States *(NBIMS-US, n.d.)*, which states that "Building Information Modeling *(BIM)* is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition". Even if different definitions exist, almost all of them preserve some common points. Therefore, to summarize, it can be said that BIM is a digital collaborative model in which all information about a building is stored and can be managed through all of the building life-cycle *(InfoComm International, 2010; Jupp, & Nepal, 2014; Liu, Jallow, Anumba, & Wu, 2013; Succar, 2009; Succar, Sher, & Williams, 2012; Takim, Harris, & Nawawi, 2013)*.

The idea is that the building is built virtually before it is actually constructed. This is possible thanks to the use of parametric objects, in which the graphical representation is associated with specific characteristic that define the object *(Ningappa, 2011; Pretti, 2013)*. Doing so, it allows the creation and edition of multiple design portions simultaneously *(floor plans, sections, elevations and three dimensional model)*, but not only the drawings are automatically edited; quantities, costs and schedules can be also equally affected, which means that any change results in the alteration of the whole.

These characteristics of the BIM model can lead to a series of advantages, especially when compared with the traditional Computer Aided Design *(CAD)* work methodology. The advantages can vary, but there is a steady consensus among professionals and researchers about the major ones, which include:

- Reduced effort to generate architectural information (Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Arayici, Khosrowshahi, Ponting, & Mihindu, 2009; Dave, 2013; InfoComm International, 2010; Ningappa, 2011);
- Visualization (Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Barlish, 2011; Checcucci, Pereira, & Amorim, 2013; Dave, 2013; InfoComm International, 2010; Jupp, & Nepal,

2014; Liu, Jallow, Anumba, & Wu, 2013; McGraw Hill Construction, 2014; Ningappa, 2011);

- Reduced design errors (Arayici, Khosrowshahi, Ponting, & Mihindu, 2009; Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Barlish, 2011; Checcucci, Pereira, & Amorim, 2013; Dave, 2013; InfoComm International, 2010; Liu, Jallow, Anumba, & Wu, 2013; McGraw Hill Construction, 2014; Ningappa, 2011);
- Enhancing collaboration and integration (Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Arayici, Khosrowshahi, Ponting, & Mihindu, 2009; Barlish, 2011; Dave, 2013; InfoComm International, 2010; McGraw Hill Construction, 2014; Ningappa, 2011; Liu, Jallow, Anumba, & Wu, 2013);
- Energy optimization and simulations (Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Barlish, 2011; Checcucci, Pereira, & Amorim, 2013; Dave, 2013; InfoComm International, 2010; Ningappa, 2011).

Considering the items above, it is possible to understand that BIM is capable to, if not resolve, at least minimize the pressures that the construction industry is undergoing for better products, with lower cost, more quality and less lead time *(Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Dave, 2013; Elmualim, & Gilder, 2014; McGraw Hill Construction, 2014; Nakamura, 2013; Ningappa, 2011; Takim, Harris, & Nawawi, 2013).*

3. Methodology

This paper's objective is to present how the BIM implantation was carried out in a small company in Brazil. First of all, a literature review about BIM was done, to show what BIM is; then, its characteristics and benefits were sorted out. Secondly, a case study of BIM implementation is presented. The case study approach was the selected methodology, since it helps to understand why the company decided to implement BIM and how the process was conducted, and it is necessary that these questions be understood within their context *(Yin, 2010)*. Expecting to elucidate the research questions through the description of the BIM implantation process in a small construction company, this research can be classified as descriptive one.

The analysis of the case study was done during a one-year, nine-month period *(April 2013 to January 2015)*. Using the information gathered, the company was characterized, the processes and criteria for BIM selection and implementation were presented, and the results obtained until January 2015 were exposed. The benefits and obstacles for BIM implementation were highlighted, in order that they may provide insight for the next steps to be taken by the company researched and also to aid other small companies in developing countries that wish to implement BIM.

4. Case Study

For better understanding of the case study, it is important to understand how the construction sector is organized in Brazil. Unlike other countries, like England, "in Brazil, a large number of firms tend to be the client organization and the builder/contractors at the same time" *(Pretti, Calmon, & Vieira, 2014, p. 45)*, which means that the same company is responsible for defining the program of the project, choosing and buying the land, selling the units, hiring the designers, buying the materials, and actually building the building. Usually, the whole process is coordinated by the construction company *(Pretti, 2013)*. More information regarding the case studied will be given in the following paragraphs.

4.1 Characterization of the company studied

The company studied works with commercial and residential buildings, with its focus being the latter. It was created in 1995 and only a few years after that, in 1998, it obtained its ISO 9001 certification. As previously mentioned, this company acts as client and contractor at the same time, with most of the necessary manpower being its own, except for the designers and some subcontractors.

As a result of Brazilian construction companies' distinct organization, the size classification was made according to the Brazilian Service of Support for Micro and Small Enterprises *(Serviço Brasileiro de Apoio às Micro e Pequenas Empresas – SEBRAE, n.d.)*, where small companies have up to 99 employees; medium ones have 100 to 499 employees; and large ones have over 500 employees. According to this categorization, the company studied can be categorized as small, since it had 99 employees in December of 2014. At this time, the company had four projects under construction and three in the design stage.

4.2 Steps of BIM implementation

First, it should be stated that the company in question did not undergo a BIM implementation through a defined and tested methodology. The whole process was carried out by its own staff, without the help of a BIM expert that would lead the process and without a deployment plan. However, even if a known methodology was not used in the implementation, a series of steps that led the process can still be identified. For further information, each of these steps will be presented and explained.

4.2.1 Step 1 – Acknowledgement of BIM

With the growth of BIM awareness and use on the international scene, the subject gained attention and a series of governmental, educational and private market actions about BIM was initiated in Brazil. Consequently, encounters, congresses and seminars related to the theme began to occur, e.g. "Caminhos para a inovação e implantação do BIM", Qualicon Espírito Santo 2013, Autodesk University Brazil.

As a company that strives to improve their techniques and products, the company studied began to attend some of the events cited above and developed an interest about BIM. The participation in these encounters was adamant; besides making the theme known, it made it possible to become aware of some successful cases where BIM was implanted, the advantages of its use and also to have contact with professionals that already use BIM.

The board of directors then presented the BIM theme to their managers and some of the coordinators, so that they could analyze the feasibility of its use in the company. After a few meetings, it was decided that it could be possible and began the search for the best program to be used. Thus, it can be said that the first step taken by the company studied was the acknowledgment of BIM and that has driven the company to implement this new process.

4.2.2 Step 2 – Software Decision

The software decision was made based on a series of criteria. Some factors that were preponderant in this decision included:

- Cost: as a small company, the amount of money spent on software solutions can have a great impact on company income, therefore, this was an important factor to be considered;
- Compatibility with designers' software: one of the greatest factors influencing the choice was the compatibility of the software with the ones used by the design partners. Considering that the program would be bought new, the company thought was that, ease of information exchange with the designer partners leads to less errors and better communication;
- Positive feedback from other companies: since the enterprise in question is small, it mirrors itself in bigger companies that are like models, and having one of these friendly companies give its opinion, share its experience and give positive feedback about a specific software, was definitely taken into account in the software decision;
- Ease of access to training: as a new, arising technology, it can be difficult to find qualified professionals to teach company employees. Therefore, the knowledge of someone with this profile that could give an in-company training was determining.

In the end, all these factors were studied and a collective decision, based on the opinion of the directors, managers and coordinators, was made, culminating with the choice of ArchiCAD. Compared with step one that took almost a year, this was a quick decision, made within three months.

4.2.3 Step 3 – Technology Analysis

After the software decision was made, the following action was to identify the existing hardware and software technologies used in the company, if upgrades would be necessary, how much this would cost and when the upgrade could be made. Once the necessary upgrade was identified and authorized by the company board, the company that provides computer maintenance did the updates.

The upgrades took approximately two months, and were relatively simple. The fact that the company studied had a regular computer maintenance service was a facilitator in the process, because, thanks to that, the company responsible for the computer maintenance already had an inventory of the computers and had knowledge of the available hardware. This made it easy to identify the needed improvement when the chosen program system requirements were received.

There was also the need to purchase new machines because some computers were already obsolete. In this case, the purchase and delivery time of these machines was not counted, as some company's machines were relocated across departments to avoid wasting time in the BIM implementation process. Another purchasing time that was not taken in account was the one used to buy tablets that would go to the building sites. These tablets were equipped with the BIMx Pro application that enabled the workers on the site *(usually the engineer responsible for the building)*, to access the 2D and 3D building project and navigate through it.

4.2.4 Step 4 – Training

The machines' upgrade initiated a process to define the departments and people who would participate in the company's BIM implementation, albeit in an incipient form. This selection, however, was only consolidated with the decision that training the employees was necessary; after all, none of them had prior knowledge about the program purchased.

As stated in section 4.2.2 Step 2 – Software Decision, the ease of access to training was an essential point in the software choice; consequently, two good options were available. The trainers were then contacted and budgets for coaching were requested. With the proposals in hand, they were compared and the most interesting of them was selected. The decision was based on the following criteria: length of training, price, scope, location and schedule.

The coach was hired, the team of people who received the training was defined, which consisted of: manager of planning, budget and design *(1)*, project coordinator *(2)*, planning and budget coordinator *(1)*, budget technician *(1)*, design intern *(1)*, total of six *(6)* participants. Thus, the departments initially involved with the implementation of BIM in the company studied were the planning and budget department and the design department, which have the same manager.

It was defined that training would take place at the company, with lessons in the morning, on an average of twice a week. The course had a total workload of 32 hours that was divided into three modules, basic, intermediate and advanced, and occurred between May 15 and June 26, 2014. It covered various themes, from the concept of BIM and modeling elements to creating objects *(without script)*, plots and lines.

Some interesting points that the training included are worth mentioning. The first one was to model, as a training object, a building whose designs were already developed, so that it could be possible to compare the ease of developing and analyzing designs and quantity takeoff, between the conventional way versus the information obtained through BIM. The second point was an introductory meeting suggested by the trainer, where she questioned the company objectives in implementing BIM. Only then were the BIM deployment goals consolidated in the company studied, which included higher accuracy interference analysis and the use of the model to extract quantitative data for budgets.

4.2.5 Step 5 – Choice of a pilot project

The choosing of a pilot project started at the end of the first step, but before the software decision. In 2013, the company had some architectural building plans submitted for approval. Among those, there was one that was more complex, with a series of elements that could lead to a very difficult design and building process, such as underground floors, under pressure slab, etc. In light of the building complexity and the BIM advertisement that was occurring, it was decided to look for designers who could offer more accurate designs, with less errors and better visualization, to ensure a higher quality project and ease of onsite building execution.

The pilot project was determined even before the software decision. The building in question is a commercial one, consisting of three garage floors, two floors of stores, and two office towers, one with five floors and another with six floors. The design budgets were requested considering the modeling of building elements by the designers. It is interesting to note that none of the MEP *(Mechanical, Electrical, and Plumbing)* designers in Espírito Santo worked with modeling; the same happened with the geotechnical designers.

Hence, MEP designers who worked using the conventional method *(CAD)* were hired, together with a designer responsible for formulating the executive designs *(finishes, countertops, masonry detailing, etc.)*, who was also responsible for shaping the elements of other disciplines *(MEP)* in order to allow the analysis and clash detection of all the designs within the model. It is true that developing designs in a conventional manner and then including them in the model, represents a rework and loss of process efficiency, but the lack of professionals able to execute the projects in BIM led to the use of this alternative.

On September 5, 2013, the office responsible for the executive designs was hired and the model started to be developed. The model continues to be adjusted due to design updates to specific situations of the site, to the insertion of data of the executive designs and also because there are necessary changes as the clash detections and design analysis progresses.

4.2.6 Step 6 – Company's BIM Warehouse

With the completion of the training, it was perceived that there was the need to build a BIM warehouse with the construction standards and materials usually employed by the company in order to serve as a reference for the designers and to ensure fidelity to what is executed.

A monthly meeting was then held from July 2014 onwards to discuss what this virtual warehouse should contain and so that the design and budget-planning departments could jointly prepare the "model elements". This joint participation was needed because these new elements would be imbued with relevant information from the two departments, such as budget codes of each material, most often used dimension of profiles, among others.

Unfortunately, the meetings proved to be very unproductive, and the manager responsible for the two departments who held them decided that this task should be continued by the design department. However, the high demand of services in the design department and the numerous materials and systems used, made this an ongoing process.

4.2.7 Step 7 – Review of Company Products and Process

As a new process, several authors indicate that BIM requires the review of business processes where it is deployed *(Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Arayici, Khosrowshahi, Ponting, & Mihindu, 2009; Checcucci, Pereira, & Amorim, 2013; Dave, 2013; Elmualim, & Gilder, 2014; Jupp, & Nepal, 2014; Oberoi, & Holzer, 2014; Owen, et al., 2010; Takim, Harris, & Nawawi, 2013)*. During the implementation, the necessity to change a number of process was noted, mainly by the design department that required more accurate information at the beginning of the project in order to provide a model for quantity takeoff. However, no process review occurred until the end of training.

The fact is that the entry of the standard 15,575: Habitational Buildings - Performance *(ABNT, 2013)*, the desire to adopt a differentiated position in the market and BIM implementation, all these elements, together, made the researched company decide, in October 2014, to reformulate its strategic position, including their processes and products. Starting that month, a number of systemic strategic meetings involving the Board of Directors, managers and design coordinators, began. This is a lengthy process that requires a lot of dedication and effort and is still incipient in the company, but it indicates that even if the adjustments for BIM implementation do not occur initially, the use of BIM may end forcing these changes to occur.

4.3 Results and Discussion of BIM Implementation

BIM adoption and implementation at the company studied is ongoing. Considering the way that the process occurs, without much planning or a deployment methodology, a lot of information that could be automatically generated, will only be obtainable in later stages, when it is no longer needed. For instance, the executive designs of the pilot case, which are still in development, will only be available to provide information to the quantity takeoff after the budget is closed. Other problems were discovered during the BIM implementation process and benefits of its use could also be seen, which will be presented next.

4.3.1 Barriers and challenges to BIM's Use

During the deployment process, one of the major problems encountered was the lack of partners willing to invest and to work with BIM. This result is relevant and is in agreement with other studies worldwide *(Arayici, Coates, Koskela, Kagioglou, Usher, & O'Reilly, 2011; Checcucci, Pereira, & Amorim, 2013; McGraw Hill Construction, 2009; Nakamura, 2013)*, which noted great difficulty in finding partners, especially in the MEP area. The fact that architects are also the pioneers in the implementation of BIM, followed by structural engineers, as seen in the case study, is also a global trend *(Holzer, 2014; McGraw Hill Construction, 2009; Oberoi, & Holzer, 2014; Shen, et al., 2010)*. One major problem derived from this situation is the fact that one person, in general the architect, is responsible for launching all the information in the model. While this helps to clarify issues such as who is responsible for the model and its information, it generates a loss of cooperation and integration in the process, wasting one of the great advantages of BIM.

The lack of knowledge about BIM by the team is another barrier to its implementation. Even if the construction company does not develop designs internally, it is important to know the program so that they can ask the hired designers what information is needed and how that information should be inserted and extracted in the model. They will also be able to define the best way to coordinate the building development process with this knowledge. The absence of a person who has the know-how to assist in the implementation process hinders it *(InfoComm International, 2010; Stehling, & Arantes, 2014)*, especially when besides the pilot project, the other construction designs are developed in CAD, which makes it difficult for the employees to develop their skills and to fully engage in this new technology *(Ningappa, 2011)*. It is necessary that the company understand that an initial productivity loss is common *(InfoComm International, 2010)*, since employees are still developing their skills and testing the possibilities of the new methodology.

The struggle to use the new software is amplified by the shortage of blocks, families and standards consistent with the Brazilian construction reality *(Checcucci, Pereira, & Amorim, 2013; Nakamura, 2013; Stehling, & Arantes, 2014)*. The regulation concerning BIM in Brazil is new and is still in development, with only two norms NBR 15965: Construction Information Classification System *(ABNT, 2012)* and NBR ISO 12006-2: Building Construction - Building Information Organization *(ABNT, 2010)*. Despite the creation of a Special Study Commission on Building Information Modeling with government support, and the inclusion of BIM in Plano Brasil Maior *(Conselho Nacional de Desenvolvimento Industrial, 2013)* as one of the government's priorities for the construction sector, while the government does not devote real efforts to this subject, BIM installation in the country will be a slow process *(Wong, Wong, & Nadeem, 2009)*.

Another major impediment to BIM full implementation is the resistance to process review, identified in step seven of the case study. This problem is common in the construction industry, which is averse to changes and innovations *(Arayici, Khosrowshahi, Ponting, & Mihindu, 2009; Checcucci, Pereira, & Amorim, 2013; InfoComm International, 2010)*.

Finally, it is important that small, medium and large Brazilian companies understand that BIM is not only a 3D drawing. The model is a natural consequence of the process and to use it only for this purpose, is to underuse a whole process. It is necessary that BIM be understood as a system that enables the fabrication and assembly *(Barlish, 2011; Dave, 2013; Holzer, 2014; McGraw Hill Construction, 2009; Ningappa, 2011; Oberoi, & Holzer, 2014; Owen, et al., 2010;)*, and allows the whole life-cycle management of a building and is a key for its maintenance *(Barlish, 2011; Codinhoto, Kiviniemi, 2014; Dave, 2013; Elmualim, & Gilder, 2014; InfoComm International 2010; Jupp, & Nepal, 2014; Liu, Jallow, Anumba, & Wu,* *2013; McGraw Hill Construction, 2009; McGraw Hill Construction, 2014; Ningappa, 2011; Owen, et al., 2010; Shen, et al., 2010; Yalcinkaya, & Singh, 2014).* In order to achieve this, all the construction stakeholders and the supply chain need to perceive the BIM benefits and be involved and committed to its implementation.

4.3.2 Problems Solved Based on BIM

The BIM implantation is still ongoing in the company studied and this new process still needs to mature, so better and more significant results can be achieved. Even so, some problems were solved or lessened thanks to the use of BIM. The greatest benefit that could be seen was the visualization. As it was previously mentioned, the building chosen to be the pilot project was very complex, therefore, a model with all the building characteristics helped to understand what would be built and to build it better. This new dynamic allowed the field engineer to actively participate in the design meetings and state her opinion about what would be possible or what would be difficult to accomplish at a site that she, better than any designer, knew.

Another great improvement was the reduction in design errors. Even if the process of BIM implementation was still in an early stage, the model created with all the different designs inserted already proved its usefulness. The model allowed the early identification of clashes and constructability issues, that, otherwise, would be responsible for rework, delays and increase in the cost of the project *(Dave, 2013).* Also, even though the quantity takeoff and budgets were manually finished before the model was started, and this particular BIM advantage could not be used or perceived in the pilot project, BIM benefits found were helpful and showed a great improvement in comparison with the CAD technology.

The company studied hopes to achieve greater benefits as it gains more knowledge of the tool. In the near future, the goals are to have the design partners responsible for inserting their own information into the model, to extract quantity takeoffs and have quickly revised budgets that are updated at the same time that the design undergoes a change.

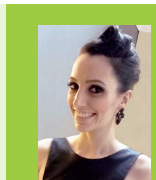
5. Conclusion

The BIM implementation in the case study is still an ongoing process, but it can be seen that it is advancing. The impact of BIM adoption in the company can be noticed; BIM was already responsible for a better understanding of the project *(visualization)*, a more collaborative environment, less design errors and constructability issues. So, it can be envisaged that as BIM implantation progresses and the company maturity level of the process grows, the benefits will increase and better products, with less cost and delivery time, can be achieved.

Problems do exist: the absence of professionals that use BIM to elaborate their designs, the lack of knowledge and difficulty in using the program by the company team, the absence of standards and objects adapted to the Brazilian reality, the scarcity of government action demanding BIM use, the resistance to review the business process and especially the conservative culture of civil construction. These issues hinder the process and are barriers that need to be resolved for a full implementation of BIM, and surely will take a considerable amount of time and effort. Hence, the company studied needs to keep working in its process review, search for designers that are willing to invest together in this new way of work, while its own employees work to develop their skills and to create components/materials according to the ones used by the company.

What can be perceived about the barriers or the benefits is that the findings are in agreement with the ones found in the literature, which means that even though the company studied is a small one in a developing country, the process for BIM implantation is similar. Finally, the paper recommends that more research in small and medium companies be done, so that the results found can be confirmed and an action plan with measures to help them implement BIM can be proposed.

authors



Soraya Mattos Pretti is an architect graduated from Federal University of Espirito Santo (UFES), Brazil, where she also received her master degree in civil engineering, with a research focused in project management and concurrent engineering (CE). She has professional experience as a design process coordinator and is currently working as an architect at Vitória's City Hall. She is also a member of the Concurrent Engineering and Building Information Modeling Laboratory (LABESBIM) of Technologic Center, UFES.

Darli Rodrigues Vieira, Ph.D., is a professor in Project Management at the University of Quebec in Trois-Rivières (UQTR). Holds the research chair in Management of Aeronautical Projects. His current research focuses on project management, product development, logistics chain management, strategy and management of operations, and management of MRO (Maintenance, Repair & Overhaul).

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