

BIM IN FRENCH SMES: FROM INNOVATION TO NECESSITY

ARTHUR TRANCHANT, DJAOUED BELADJINE & KARIM BEDDIAR
LINEACT Laboratory, Ecole d'Ingénieurs CESI, France

ABSTRACT

Building Information Modeling (BIM) arrives in great strength in France and in Europe. This process has been mainly recognized for its capacity to energize the building market by sustainable means and the digitization of the current work system. For the SMEs (a business needs to have fewer than 249 employees to be considered an SME), this vast development site proves to be a difficult shift to implement but one that is not to be missed in order to gain competitiveness and be able to compete with markets that remained until now undiscovered. Being able to keep updated on the BIM in the view to understand its strategic stakes and to track its development, expansion, and regulatory framework in France will enable you to decide more efficiently on the strategy of BIM you wish to implement in your business. By defining the current state of your business and by setting targets and timeframes, you undertake a management change. Employees and stakeholders are the key elements of success of the BIM implementation. In order to assess the progress of the BIM maturity in the SMEs, a survey has been given out to several French stakeholders thus allowing us to have a good general vision of the innovation in the SMEs. The results of the survey conducted as part of this article, highlights a real enthusiasm from the participants of this sector, but with some concern and questioning.

Keywords: as-built BIM (Building Information Modelling), existing buildings, facility management.

1 INTRODUCTION

The issues are becoming clearer and economic, social and environmental concerns are on the front line. Increasing disparities and the awareness of global warming are causing several countries to make climate commitments.

Some studies, such as that of ADEME (French government agency of energy), show the distribution of final energies by sector of activity. The “residential” and “tertiary” sectors account for almost half of the consumption, with 44% of the energy consumed. In construction, it is the building of buildings that preaches.

Driven by the will to fulfill their commitments, several states are moving towards innovation in the construction sector. The Building Information Modeling (BIM) process first appeared in the industrial sector in the 1980s. It is a digitization of traditional working methods (evolution of 2D plans towards a digital model supporting architectural data, Technical, environmental ...) which aims to reduce waste and optimize the profitability of projects. The BIM is therefore the solution capable of transforming and structuring the construction industry.

In Norway, a rehabilitation project covering 20,000 m² with a total budget of €900 million was launched in 2003. The digital mock-up, built entirely in integrated engineering (structure and electricity), enabled several simulations to be established, risks and optimizing delays, thanks in particular to 4D (integration of “time”).

In the US, the BIM has existed since 2003 through a national program that allows integrated work while promoting a low environmental impact. According to McGraw-Hill Construction, the spread of the BIM spread to 70% of the protagonists against 17% in 2007, which shows a strong growth of the process.

As early as 2007, a 30,000m² rehabilitation project was launched in London, UK. The design of the digital mock-up was carried out successively on different software, via BIM



exchanges. The project was awarded in 2007 for the design competition. After a strong popularization in 2010, and a BIM reform announcement in 2011, collaborative digital models are now mandatory in all UK public procurement markets since 2016 (BIM Level 2) [1], [2]. Thanks to the training, more and more professionals are passing the BIM Ready.

Thanks to the precursors, many countries around the world are turning to the digital transition of the construction sector via the BIM. France, Brazil, Singapore, South Korea or Canada are all competing countries to integrate a development policy in this direction. Conversely, China, the largest consumer of concrete in the world, is still far from an overall use.

Application of the process involves several steps, such as specific employee training, powerful IT facilities, adapted software, and multiple training to implement the BIM, sometimes synonymous with loss of turnover for skeptics. In 2015, feedback from 40 BIM projects highlighted two main observations. Collisions between objects are numerous and reflect a lack of collaboration on the part of the actors. Moreover, the lack of mastery of the tools sometimes favors the prolongation of the delays.

Although promising, the BIM requires a lot of work and financial investment, with no real certainty of development. Nevertheless, the companies quoted in A.Y. QIAN's Benefits and ROI of BIM for multi-disciplinary project management admit a reduction in costs, reduction of errors, waste and delivery times.

In France, the BIM develops timidly. Although major players such as VINCI, BOUYGUES and EIFFAGE are driving innovation, change is more complicated for Small and Medium Enterprises. Indeed, SMEs have less financial means to allocate to research and development and can't afford to record a temporary slowdown in their productivity. However, the first feedback is reassuring and the contracting authorities are increasingly asking for the BIM.

The British government is setting an example with an ambitious plan initiated as early as 2011 and reinforced by the Built Environment 2050 report, which resulted in the almost complete conversion of the construction sector to the use BIM in 5 years. France has sought to make up for this delay following the Delcambre report [3] and the implementation of the Digital Transition Plan for the building.

Through several working groups, France participates in the global development of the BIM. From the "PPBIM" standard for generic objects to the "BIM for all" to facilitate accessibility for each, these working groups reflect on the constraints in order to put in place tools, guides or notices and promote the development of the BIM.

Although supported by the government, French SMEs seem divided on the fact that the BIM must become mandatory. However, in the direction of energy and digital transition, measures should be taken quickly. Innovation becomes necessary, and SMEs have no choice but to jump into the digital revolution.

2 ADOPTION OF THE BIM IN NORTH AMERICA AND EUROPE

As of 2010, McGraw Hill Construction is interested in the positioning of the BIM [4] in Europe. The company compared the data of the 948 survey respondents, notably with respect to the adoption of BIM in North America and Europe (UK, France, and Germany). This reveals that in 2009 in North America, half of the companies moved to BIM, compared with 36% of European companies in 2010.

Looking at Fig. 1, it can be seen that the adoption of BIM by the European countries lags behind North America, which has grown strongly in just two years.



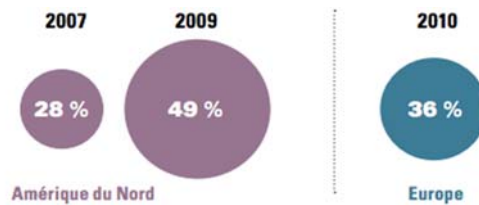


Figure 1: Adoption of the BIM, North America versus Europe.

Among the three nations in Europe, France with 38% adoption is the only country where it can be seen that the rate of adoption of engineers (44%) is slightly ahead of architects (40%). The UK is positioned just behind with a rate of 35%. The highest adoption rate is that of architects (60%), followed by engineers (39%) and entrepreneurs (23%).

Germany adopts the BIM at 36%. As in the United Kingdom, adoption is carried out first by architects and then by engineers.

These figures show that a first level is crossed in the race to BIM Ready. Soon, a majority of global construction players will speak the same language.

3 THE PTNB SURVEYS (DIGITAL TRANSITION PLAN IN THE BUILDING)

Since then, France has put a policy of development of the BIM on the way, but much later than their Anglo-Saxon neighbor. Following the implementation of the Digital Transition Plan in the Building, the French State interrogates users in order to situate the adoption trend of the BIM and under what conditions. A digital barometer was drawn up in April 2016 and reissued in March 2017. In addition to locating companies in innovation, these surveys enable them to observe the evolution between surveys.

The second report [5], based on the 1246 responses from the second survey, records 35% (+ 8%) of professionals as BIM users in their operations (Table 1).

PTNB found that 26% of construction owners are beginning to impose BIM on construction projects, although only 12% require digital model. However, the profile of respondents in the PTNB surveys refers to firms that are of different sizes. In France, 95% of construction companies have fewer than 10 employees. These surveys mainly reveal a disparity between the companies and their expectations (Table 2).

Table 1: The evolution of BIM adoption in France according to the PTNB surveys.

BIM adoption					
General contractor		Building company			
50%	+13%	20%	+4%	<50 employees: 10%	≥ 50 employees: 56%

Table 2: The disparities between the construction companies and their expectations.

Business expectations		
<10 employees	From 10 to 49 employees	>49 employees
Information on BIM opportunities, financial aid	Support for training, adoption of a common standard, financial assistance	Evolving regulations to encourage BIM use, adoption of a common standard, support for training

These different expectations show the different advances in the adoption of the BIM according to the size of the companies and highlight several questions: Is financial investment really possible for SMEs? Is it too risky for very small businesses (less than 10 people)?

4 WORKING IN A BIM FRAMEWORK:

ADVANTAGES AND CHALLENGES FOR DIFFERENT COMPANIES

The R&D investment of large enterprises is incomparable to that of SMEs. However, some aspects of BIM and its implementation seems to benefit SMEs.

First, the deployment of BIM in the company. It is easier to adapt the procedures and the working method when the employees are not numerous, which promotes good organization in the companies. The major groups are committed to copying a model of work on international standards, more complex to set up. Then, the BIM software once dominated, competing with the big companies, as much on technical projects as on major projects.

The overall vision provided by the software reduces labor and increases productivity. It will become as easy, no matter the size of the structure, to respond on time to projects that hitherto favored larger firms because of their need for resources for studies (time to quantitatively long and complex, good definition of the techniques envisaged ...). Finally, large companies will be faced with a major search for qualified BIM staff, which is sometimes difficult to find. The staff must be productive immediately and play on the immediate profitability of the company (hires linked to a new market, specific demand, etc.).

In the case of SMEs, it is true that the staff must adapt to the company, but it can also change the procedures, which allows a good integration in the working methods. As a result of these shortcomings for large companies, they will certainly have to turn to subcontracting, be it with respect to data entry, analysis or processing (management of the Plans ...). We can see that the complexity of large projects favors the use of BIM because of the centralization of data. If economies are good for motorway or railway companies, they are even more important on small projects. The supervision of the works thanks to the digital model allows a total control of the project and it is thus not uncommon, for example, to see offices of study using the BIM for individual houses. As far as the customer is concerned, it should be borne in mind that the additional cost of studies in BIM will ultimately lead to profitability related to home automation, building automation and smart grids

As far as SMEs are concerned, it is easier to increase their number of business studies and thus increase their productivity. The high overhead costs of large companies do not allow them to take on business below a certain price of work; it becomes more accessible to small businesses to compete with the averages, and averages to compete with the larger ones.

These benefits encourage SMEs to look to BIM, but to what extent? How do SMEs position themselves in the adoption of the BIM?

5 A SURVEY ON THE FEELINGS OF SMES IN FRANCE

5.1 Objective

Thanks to the movement pioneering of UK enterprises, it is now possible to obtain feedback to understand the various reasons why small firms have not moved to the BIM [6], [7]. First, there are those who claim that the BIM claim is non-existent. This can be understood. Today in France, many medium-sized companies are “frustrated” at being stopped at BIM Ready. Small businesses believe that the BIM is only applicable to large-scale projects. This is false and the use BIM for small structures (example: realization of the individual houses respecting the new thermal regulations and technological advances) becomes indispensable in project



management. Many of these small businesses survive in spite of the conjuncture that is not at the heart of the priorities. The financial disadvantages of the introduction of innovation considerably hamper firms, which seems legitimate. However, the first feedback from England is satisfactory for most of the precursors. In Britain, BIM Ready companies already have an advantage over others. Finally, some small firms have noticed the lack of specialized labor in the BIM. An inconsistent argument since everyone knows that the BIM is new. The training awarded to the employees trains the specialists of tomorrow.

Thanks to a strategy of involvement and its positioning, France sees opportunities for development and growth. In order to be able to establish a general feeling of the actors having passed to the BIM and their antagonists, I chose to draw up a survey in the framework of a professional thesis, considering the direct contact with the public concerned to be coherent.

The primary objective of the survey was to be able to establish feelings. The second is to make the survey attractive in order to capture the audience. The survey consists of a double path, allowing revealing significant figures on the two types of protagonists: adventurers and apriorists.

In order to disseminate this survey, professional social networks have been used with specialist groups mainly composed of French construction actors. The National Order of Architects and the CINOV Federation participated extensively in the distribution of the survey via their newsletters, allowing them to touch architects, design offices and construction companies. No fewer than two hundred French players responded between April and June 2016.

5.2 The survey composition

The survey is divided into 6 parts:

- Distribution of the hearing.
- Use.
- Feeling of users BIM.
- Feeling of those who do not use BIM.
- Use perspective.
- Use tendency.

Each element of the survey allows to construct an analysis. All these analyze will give a global feeling of the construction actors. In order to make the survey clear and accurate, 50% of the questions are said to be “closed” (yes or no answer) and 50% of the questions are “open” (multiple choice question).

In order to know the rate of adoption of the BIM by French SMEs, it was wise to associate the tool (the digital mock-up) with the practice of the process. By surveying the panel on these tool use habits, 3D model or digital model, it becomes possible to identify the method, traditional or BIM and to deduce the adoption rate of the tool.

In the rest of the survey, the feeling of the actors is translated from the answer to two questions. Is the BIM complicated? and is the BIM costly? These two questions, addressed to the users of the digital model as well as users of the 3D model, make it possible to see the apriorists of people who have not crossed the cape of BIM and feedback from the people applying the process. Finally, some questions about the prospects of BIM for some, the age of the BIM experience for others, allow to frame the survey by observing the dynamism of the panel around the BIM (young users, experienced...). In addition, questions about the habits of the panel, such as the software used or the feeling of improvement expected by the BIM, make it possible to understand the context and the expectations of the users.



6 THE PANEL OF CONSTRUCTION COMPANIES

This survey gathers the answers of 205 actors, 96% of the panel consists of SMEs, which makes the survey rather targeted. In France, according to statistics [8] of the INSEE (National Institute of Statistics and Economic Studies) and the Ministry of the Economy, SMEs, all sectors combined, represent 98.8% of companies. The panel affected by this survey therefore more reasonably represents the French SMEs, contrary to the survey of the PTNB quoted above. Nearly 80% of the agencies surveyed report using the 3D model on a daily basis to design their projects. An important number that transcribes a craze for precision design and concrete visualization of project design. However, only 48% of agencies using 3D models enrich their models with interoperable data. This figure is still far too low, which seems incompatible with making BIM compulsory in public procurement at the moment.

As a reminder, SMEs contribute 58% of the shares of public procurement in 2013, according to figures from the Ministry of Economy, Industry and Digital. Currently, the observation tends to say that French SMEs are not ready to apply the BIM process legally. However, it is important to take into account the medium-term dynamics of medium-sized SMEs around the development of the BIM in order to understand the expectations and the apriorists of these.

7 FINDINGS

The dynamics of switching to BIM are strong. Some 35% of the agencies say they are in the process of launching and 15% use it for only one year. For 60% of agencies that use BIM, switching from 2D/3D to BIM is not perceived as “complicated”. The brake is rather financial with 60% of respondents considering the “onerous” implementation of the BIM. It can be seen that agencies that do not yet use the digital model perceive “complicated” the transition (55%) from 2D/3D to BIM. An interesting observation that proves that the perception of complexity of BIM decreases according to its use.

8 PROSPECTS AND TRENDS IN USE

Even more significant, 53% of respondents who do not yet use the digital mock-up report that they plan to move to the BIM over the next twelve months (survey: April–June 2016). The motivation arguments are various: 20% of the agencies say they hope that the BIM will facilitate the design, 23% of the agencies think that it will facilitate the exchanges and 20%

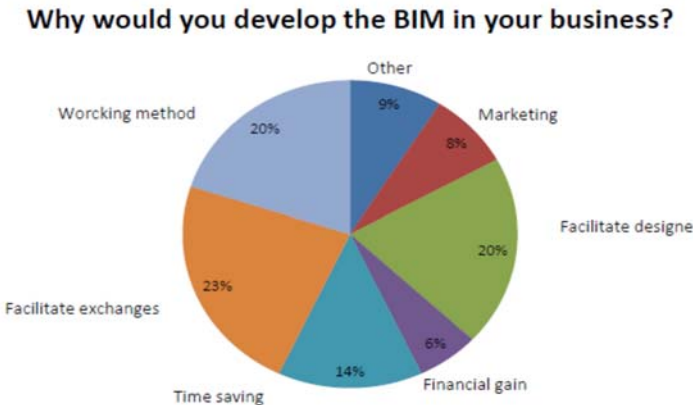


Figure 2: Diagram of BIM user response.

improve the methods of work. Only 14% of agencies expect a saving of time and 6% a financial gain. With regard to the CAD / CAD software used, the market is dominated by nearly 70% by the two digital giants: Autodesk and Trimble. Four types of software are used:

- AutoCAD, DAO, by Autodesk.
- ArchiCAD, by Nemetschek.
- Revit, by Autodesk.
- Tekla, by Trimble.

Interoperability between software is due to two actions. The Universal format data (the IFC format has become the ISO 16739 standard for trade in the construction industry in 2013) and software capable of reading this universal data. Since IFC data transfer is much more complex than traditional data due to its structure, only some software leaders have developed towards this process.

This survey, which is much less important than the one carried out by the PTNB, nevertheless makes it possible to approach precisely the feelings of French SMEs on their adoption of the BIM. However, only the monitoring of users through surveys, the evolution of training requests, or the organization of competitions, makes it possible to be aware of the dynamics of development of the BIM. It is therefore important, as it is done for the PTNB, to survey the users continuously to see the evolution of their development. In the case of identification of deficiency, the working groups of the PTNB put in place tools for development assistance, such as the website of *batiment-numerique-outils-bim*, which allows to find the Informatique solutions according to the Needs of the company.

By comparing this survey with that of the PTNB (project owners, contractors, industrialists and companies), we can see in Table 3.

The stakes of the BIM seem to be faithfully transcribed in these results. When the two surveys are compiled, one figure emerges: about 30% are attributed to actors using the digital mock-up. A figure that is still too low to switch from BIM Ready to collaborative BIM. BIM adoption rates remain low, particularly compared to North America. The PTNB groups work on raising the awareness of the masters of works, companies, industrialists, building owners, etc., so that everyone becomes aware of the necessity of development towards the BIM. The rate of desire for training is rather satisfactory. This shows a certain enthusiasm on the part of the actors and a willingness to act in the BIM direction.

Although the price is quoted in the two polls as being prohibitive in the passage to the BIM, JM Rousseau, president of the BETOM group, announces that “the savings generated by the BIM model for a building are estimated at 20% for construction costs and 70% on maintenance and maintenance budgets”. This innovation is made possible only by decision-makers. One of the crucial points of BIM is therefore the involvement of governance and its will. It encourages the development of this innovation. It seems complicated for SMEs to be able to bear the investment represented by the transition to the BIM because it is not punctual but spread over time. In this case, it is recommended to carefully study the needs of the company, in order to minimize the investment while optimizing the training.

Table 3: Comparison of survey results (PTNB and SMEs).

	PTNB, 1st edition	PME
3D utilization	48%	80%
BIM adoption	28%	38%
Desire for training	45%	52%



9 CONCLUSION

The BIM seems to have existed for a long time but many countries are just beginning to consider its use in the construction industry. Driven by several economic and environmental factors, governments are implementing BIM deployment actions. Thanks to the synergy of the global associations dedicated to BIM, a unique process of conception takes shape, although unity is still utopian. In France, the shift in the evolution of the traditional system towards the digital world is an inescapable challenge for the objectives set for the survival of the planet. It therefore becomes necessary for all French companies to train before the BIM is imposed little by little by law. In the next few years, the BIM will gradually become compulsory in France, first in public procurement, followed by a general deployment. Who will be trained to implement this technology? Where and when will professional training be made available? Many large companies have already adopted BIM and are applying its processes. An immersive 3D projection was even carried out for the simulation of the Ajaccio hospital in France, which seems to have seduced clients and customers. But the heart of the economy of France is that of SMEs, which represents 96% of companies. As a result, the innovation of the BIM is becoming a necessity for SMEs, even if they do not practice public contract.

The state will not train the hundreds of thousands of construction companies as a whole, and it is important to take the lead on the use of BIM before being caught in the trap by innovation. However, the positive results achieved so far on BIM projects should promote the awareness and deployment of BIM to SMEs.

The BIM, far from being a fashion phenomenon, should impose itself in the construction sector. France, which favors preventive training, has not yet made the BIM process mandatory like the Anglo-Saxon neighbor. Innovation therefore becomes Necessity, and SMEs have no choice but to leap into the digital revolution.

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