

## BIM MOCKUPS: OPEN AND RICH DATA THAT CAN PLAY A PART IN MEETING THE BUILDING INDUSTRY'S MAJOR CHALLENGES

EXPERT OPINION



By **Emmanuel Giorgi** | Director - Keyrus Management

This publication offers insights into the importance of building information management (BIM<sup>1</sup>), and notably digital mockups, in meeting a significant part of the challenges associated with the value production chain of the Building and Public Works Sector, facility management, and, in broader terms, smart cities.

**It underlines the strategic issues for the industry and highlights a few of the changes we can expect to see as the effective management of building information becomes more widespread.**

But what is BIM? Today, BIM covers all the data produced and managed by the building industry, trade by trade, and more besides. By way of illustration, BIM now tends to encompass:

- Data on the siting of buildings, data on highways, on geology, etc.
- Plans by architects, urban planners, etc.
- Data and calculations produced by engineers in the framework of structural studies and technical ones (air conditioning, electricity, etc.),
- Data concerning materials and modules installed in buildings (windows, technical cabinets, etc.),
- Assembly methods, illustrated (4D) or shown in video form to the parties in charge of the construction,
- Data on the management of construction projects,
- Data enabling buildings, be they industrial or tertiary, to be maintained, managed, and transformed (remodelings, facility management, maintenance in operational condition, etc.),
- Data to prepare for the arrival of virtual reality by simplifying, securing, and accelerating works to renovate sites and maintain them in optimal operating condition, guide visitors, and make technical, historical, and cultural etc. data available
- The reserve of data from "sensors" that can be integrated right from the digital mockup design

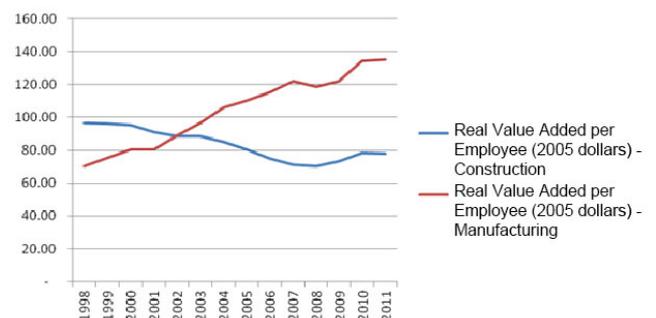
phase for improved management and above all improved anticipation through the implementation of predictive models (examples: smart meters, predictive maintenance of mechanical parts...).

All these data find themselves concentrated in digital mockups that are at the heart of industries, construction, and facility management.

These data feed what we call "Big Data".

### CONSTRUCTION, THE ONLY INDUSTRY WITH CONSTANTLY DECLINING PRODUCTIVITY

The building industry is the only industry with a declining per capita productivity rate. Due to the levels at which the building industry mobilizes cash, the value created by its players is already structurally low, and its level is tending to decrease. Institutional and political actors, who nevertheless wish to support the building industry in order to meet the challenge of the growth in cities, have gauged this trend.



Value added in 2005 per employee for the construction and manufacturing industries from 1998-2011.  
(Source: BEA Value Added and Employment data by Industry)

<sup>1</sup> BIM: Building Information Modeling

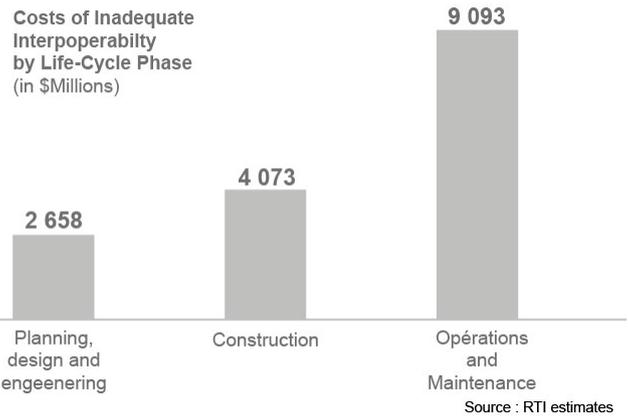
**The 7 fundamental causes of this situation are identified:**

- An industry characterized by a large number of small and very small firms each undertaking a small part of the construction,
- A single construction, built by multiple teams, often small in size, performing a multitude of trades, at sites and locations that vary greatly from one building site to another, making it more difficult to capitalize on methods and re-use them,
- An industry subjected to numerous elements of uncertainty that are difficult to predict, such as the weather, regulatory developments, etc.
- A procurement system based on competition between all players rather than collaboration, leading to a stacking of margins to cover against the risk,
- A (still) low level of use of digital data and a very high level of use of paper data,
- An economic environment characterized by a downward trend in labour costs that does not encourage a drive for increased productivity,
- The large size of the renovation market, in which, in contrast to the new-build market, its random nature and the lack of a structured approach to the work compromise profitability.

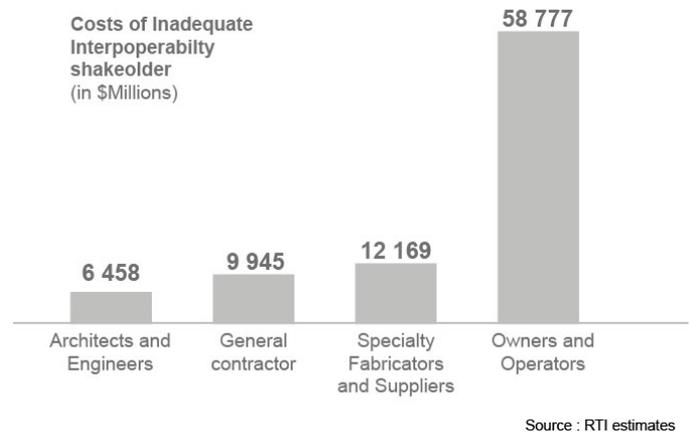
The factors that are intrinsic (i.e. aside from market impact and manual labour costs) to the industry can be boiled down to a single issue: interoperability, in other words, the ability of the various trades to act together. To illustrate this in almost caricatural terms: it is about making sure that the electrician or the plumber do not come out to work on the construction site until the work to be done by the mason has been carried out. It is also about avoiding ordering materials that will end up not being installed, or special machines that serve no purpose, etc.

Despite the fact that the American market is relatively productive given its qualitative characteristics (with renovations accounting for a relatively small part of the market), economic studies carried out there revealed additional costs in the order of USD 60 billion in 2005<sup>3</sup> due to the lack of interoperability.

These additional costs are spread out unevenly throughout a building's life cycle; they are concentrated at the end of the construction cycle.



All these additional costs are borne by the end users of the constructions and take the form of delays in completion and invoices that exceed – sometimes by a considerable amount – the initial quotes.



The beneficiaries of the constructions and the facility managers bear two thirds of all additional costs.

**THE SOURCES FOR IMPROVING THE PRODUCTIVITY OF THE BUILDING INDUSTRY ARE IDENTIFIED**

Whilst the industry's players do not today expect its low and decreasing productivity to change radically as a result of solutions that, although they may be possible, nevertheless require a transformation in working methods and a broad dissemination of new technologies for processing information, there is, however, consensus on what these sources of progress are.

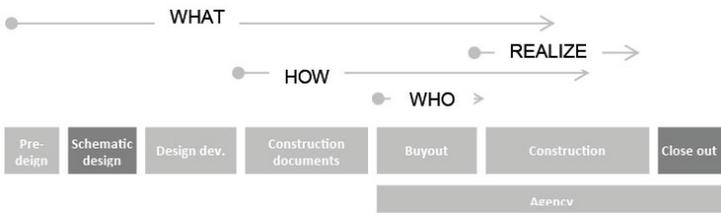
**• A better and wider use of BIM data**

Making more widespread use of BIM throughout the value chain, from the sketches done by the architects, through the design and then construction phases, to the maintenance of the site later on, could be a way of improving the completeness and effective transmission of information throughout the cycle.

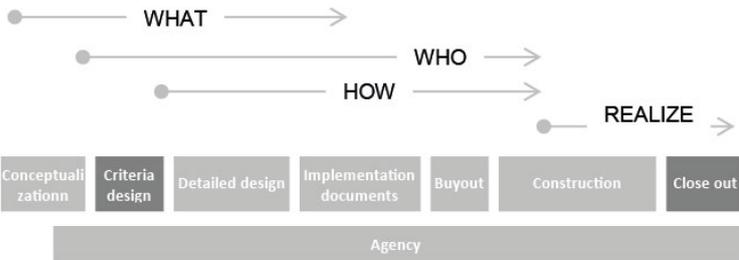
<sup>3</sup> source: US Department of Commerce

**• Making Integrated Projects (IPD<sup>4</sup>) more widespread**

As a reminder, traditional projects have a strong tendency to lengthen construction times, with a corresponding cut in the industry's ROI. These projects can be simply presented as follows:



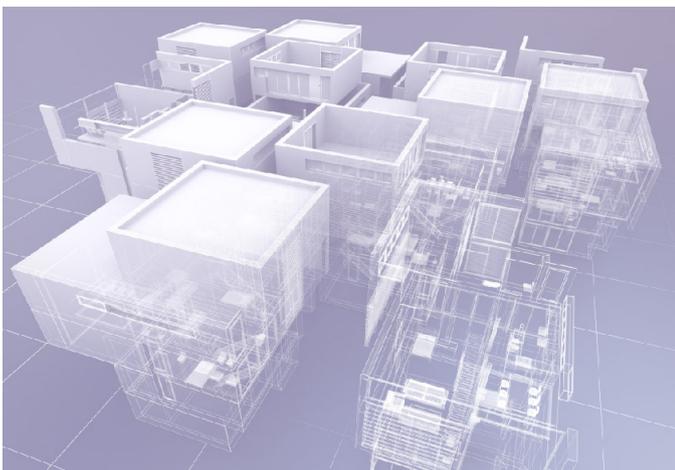
However, integrated projects, in which the parties who will carry out the work are selected right from the design phase and participate in the technical design, reduce the time periods for completing constructions.



**• Making BIM mockups more widespread and extending them...**

Naturally, **integrated projects** assume intense communication between all players right from the upstream phases of projects, which reinforces the need to master design and construction data (3D, 4D, 5D mockups, project management, management of technical data, etc.).

As a reminder, BIM makes it possible to manage and share the following types of data:



progression and sequencing of a construction phase,

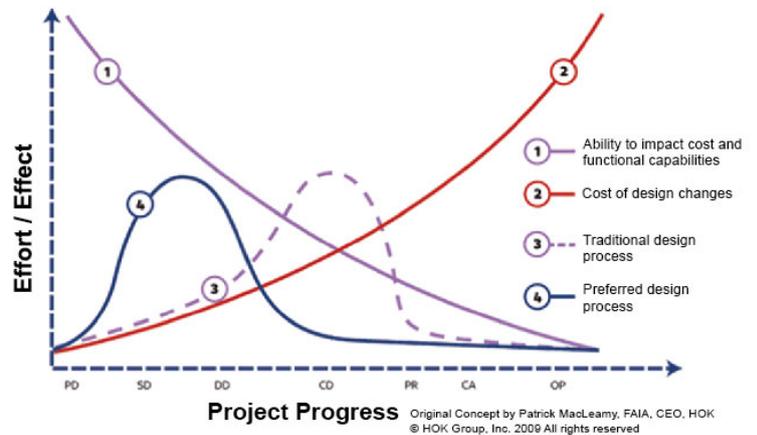
- **financial** (5D) to estimate, simulate, and steer construction costs in real time,
- those relating to the notion of **sustainable development** (6D),
- those associated with the life span and **use** of the building (7D), such as remodeling, site conversion, etc.

A BIM digital mockup is therefore created from at least hundreds of objects (running into tens of thousands for complex and highly technical programs such as a hospital) containing information on these different aspects. This information can range from the composition of the concrete for a structural component, to the exact reference of a door handle or a light switch, an assembly sequence, the thermal characteristics of a window... It naturally concerns players in the Building and Public Works sector but also property management firms, planners, maintenance activity players, and security forces.

**• ... to maximize the impact/result ratio**

The above diagram, which is well known to IT experts, shows how important it is to discover defects as far upstream in the cycle as possible.

**PROJECT EFFORT AND IMPACT**



There are numerous examples, from the discovery that more than 5,000 technical cabinets were missing from a famous Chinese tower, to the unauthorized gas piping in the rooms of patients at a famous Paris hospital...

A significant part of the additional costs created by these late discoveries could have been avoided through the upstream use of a BIM mockup shared by all the players in the construction.

- **Promoting off-site manufacturing and construction by modules, to provide value and limit the risks traditionally associated with construction:**

<sup>4</sup> IPD: Integrated Project Development

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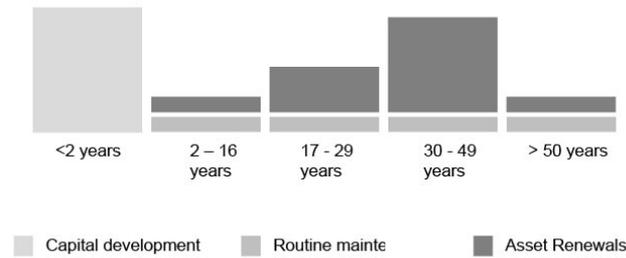
By using advanced tools that are not subjected to the vagaries of the weather, the construction of modules in the factory simplifies the work to be performed on site and reduces the need for manual labour where it is least profitable, namely on the construction site, thereby optimizing the use of the mobilized cash.

Comparative measurements of these two construction techniques show a time saving that can range from 30 to 50%.

Beyond the financial aspect, these techniques allow the construction to be greener, through better control over the energy footprint of the modules, safer for the workers, and more compliant with norms, and to consume less material.

**• A business model that integrates building facility management upstream**

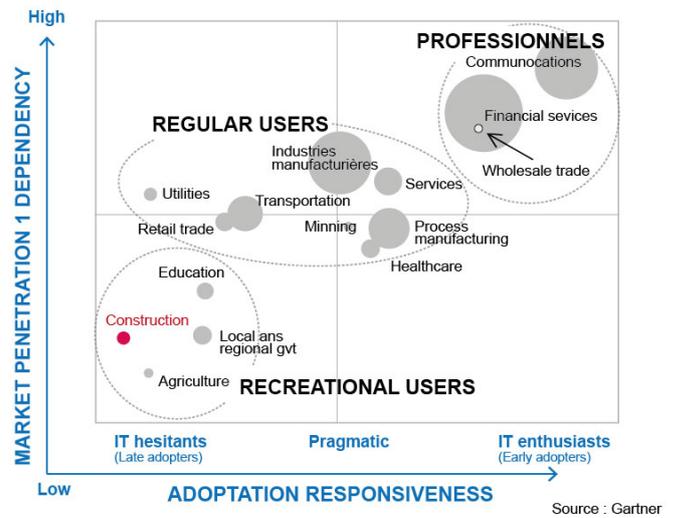
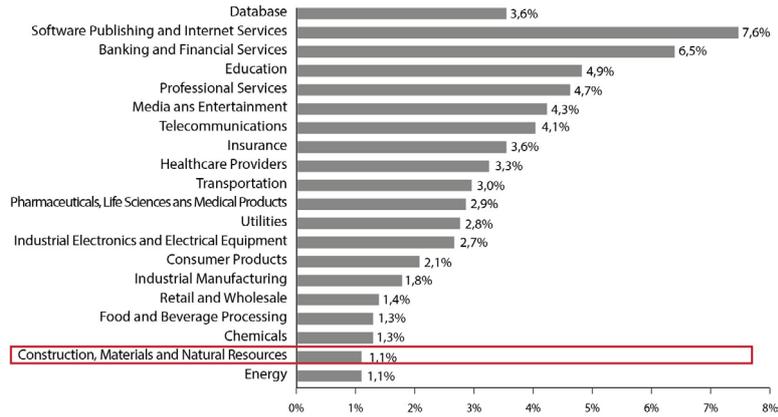
It is tempting to forget that the life span of a building is long and that the costs of maintaining and redesigning buildings are high when the construction information and data are scattered, managed in paper form, and, most of the time, hardly representative of the building "as it is".



**Faced with these findings, it is apparent that the creation of a digital ecosystem, sharing data between all parties involved in the value chain, is one of the keys to generating value and productivity for the whole industry. BIM meets this challenge through digital mockups.**

**The building industry has for a long time under-invested in its IT tools.**

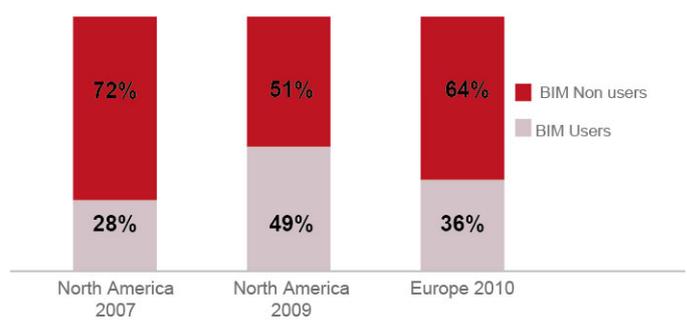
The average amount of the investment in IT tools is 1.1% of revenue, which places the Building and Public Works industry in 19th position out of 20! Surprisingly, the sector's major companies are those that invest the least as a proportion of revenue, whilst the small firms invest around 1.6% of their revenue in IT tools.



Paradoxically, this situation of chronic under-investment creates a significant opportunity for all digital tools, whether they be associated with purchases, diagnoses, or more generally with "as a service" tools accessible via the Cloud.

**In this environment, BIM stands out as the standard...**

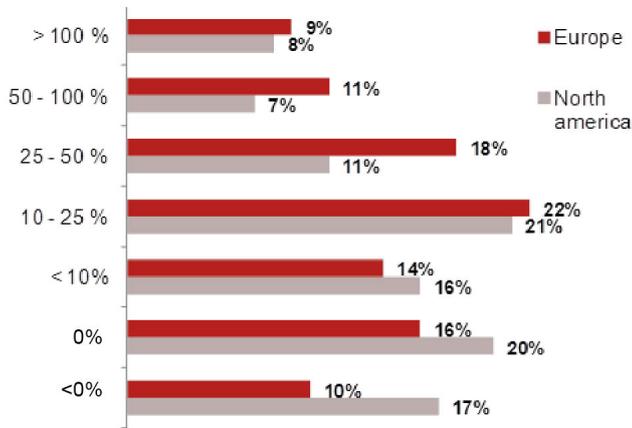
Although BIM has been around since the 70s, the tools and possibilities it offers are today enjoying a boom. The level of adoption of BIM varies depending on the continent, with a slight lead for America where the use of mockups in 3D, 4D, and 5D is widespread for all significant constructions.



Source : RTI estimates

**... and shows a positive and quick return on investment.**

- Three quarters (74%) of the Western European players using BIM report a positive perception of their investment, and this ratio is significantly above that for American companies (63%).
- On the two markets, the players who actually – in other words quantitatively – measure these gains perceive them to be greater than those players who go solely by their perception and qualitative aspects.
- In Europe, more than half of users actually measure the gains from BIM and their financial benefits. In the US less than a third do so.



**The major ordering parties are imposing BIM through open tendering procedures.**

Now systematic in the countries of Northern Europe, the BIM norm is tending to assert itself in most advanced countries. Aside from enabling more effective management of those buildings constructed using it, it serves to arm the local building industries and provide them with significant competitive advantages in the global competition for substantial construction contracts.

**BIM, A DECISIVE STEP TOWARDS SMART CITIES**

Beyond the benefits it brings in terms of construction techniques and relations between the various players in the value chain, BIM is in synergy with the fundamental upheavals associated with constructions and with the City and its relations with inhabitants. In this way, and without claiming this list to be exhaustive, its impact in the following areas should be underlined:

- Organizational changes in industrial companies (creation of departments dedicated to managing BIM objects, etc.),
- Skills and knowledge to be acquired and kept up to date by all players in construction,
- Extension of the value chain by the addition of new services (management of green spaces, etc.),

- Taking into account of the environmental quality of buildings and neighbourhoods (ecological and energy footprint, smart cities, resilient cities, etc.) right from the design phases,

- Attractiveness of territories and cities for inhabitants and tourists.

All these tendencies depend on the BIM mockups' data being of good quality and "fertilized" by data from their environment and the players involved throughout the value chain.

E.G.

## ABOUT THE AUTHOR

**Emmanuel Giorgi** is a Director at **Keyrus Management**. Benefiting from dual academic training both as an engineer (ENSEA) and in commerce (ESSEC), he has worked for more than 20 years in the areas of strategic studies and marketing, notably around the launching of innovative products and concepts, and he leads assignments involving the transformation of enterprises (management of complex projects).

Emmanuel has managed assignments for the strategic positioning and launching of new services in a variety of sectors and contexts (energy, telecommunications, business services). For a few years now he has regularly been involved with problem issues related to strategic marketing (portfolio segmentation, customer data) and distribution (sales).

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