



D O S S I E R



BIM, Boom, Baum

Building Information Modelling: renewing design processes

Carlo Bughi *

The coming of BIM (Building Information Modelling) was expected like a mystical event. It's since 1999 that BIM is discussed in the US. As revealed in a number of studies and research performed by many universities, even Italian ones, in Italy, as well as in Europe, designers, builders, manufacturers and customers are patiently waiting for this revolution to happen and to change their lives by finally introducing a multidisciplinary and integrated design approach as a shared practice.

BIM's history meets sustainability's [both in processes and in products] Boom. An approach that initially appeared vaguely eco-friendly and almost elitist, it has become a fundamental practice in the building industry as an answer to the growing interest in resources and energy preservation, and to a real economic need.

Together with building performances' requisites, also designers' need to handle complex processes and to gain new and specific skills has grown exponentially. These are not only cultural changes: practices need to take into consideration the stricter legal requirements regarding buildings' performances which have given designers more and new responsibility.

Baum means 'tree' in German, therefore it means wood and this word contains another word, 'bau', building. Wood constructions contain themselves the two main themes: BIM and sustainability. Designing a timber building requires the designer to approach the whole production line and the building processes and for these cases BIM it's not an option, but a real need.

In these pages: via Cenni's site in Milan. Pictures taken in november 2012.
Photo by Carlo Bughi
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View of the D tower in Via Cenni during the upper floors' completion phase. The structure is made by two 2-storey blocks delimiting a green court, and four 9-storey towers raising from the main buildings.
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It's no coincidence that we are recalling German words: it's in German speaking countries (Germany, Austria, Switzerland and the northern Italian regions, Alto Adige and Trentino) that the European timber constructions' tradition has evolved from a technological and applications point of view, in opposition to the American platform frame tradition. Today's wood building aporia, short production and distribution system versus forest management, can be solved with a balanced and considered sustainability approach, or such an approach can at least offer a set of credible development outlooks. Wood sustainable buildings' design using BIM adds a further character to the GreenBIM issue, as presented by few authors. This is the research goal of a course taking place within the Architecture Techniques Representation course 2 at the Department of Architecture at University of Ferrara: this experience capitalises on a more than ten years' old teaching practice where the late Gabriele Tonelli and Giuseppe Dosi led the way and introduced BIM system courses over ten years ago. Restricting a research domain and narrowing down the area of activity leads to a reduction of the variables to be considered, however, in this event, we'd like to think that the BIM's methodology related concepts have a wider value and that they can frame an application 'model' that can be transferred, as a method and a purpose, also to other fields.





We want to fill the void and create new ones at the same time: the aim is to discover new needs, to elicit new research questions, to encourage new applications by making it immediately clear that the target are designers: such a clarification is needed whereas much of the existing literature addresses builders and managers (just to remind how broad are BIM's implications in the building industry) . The architect should always act as a coordinator who manages all the specific skills and leads the whole design process.

The key question therefore is: what do the professionals working in the team need in order to be able to contribute to the workflow? What data and which kind of data, how much detail should be produced in course of construction? Which tests should be done? What processes should be considered?

It's not that BIM software are not popular, but hence- here comes the problem. Brad Hardin, among the others, provides a meaningful definition of BIM: "BIM is not just software. BIM is a process and software. Many believe that once they have purchased a license for a particular piece of BIM software, they can sit someone in front of the computer and they are now "doing BIM. What many don't realize, though, is that building information modeling means not only using three-dimensional

modeling software but also implementing a new way of thinking. It is in essence a new way of not doing the same old thing"

Comparing softwares it is easy, but changing processes it's much harder. As things stand now, we are not wrong if we say that practice is still stuck with BIM's first definition's misunderstanding, as stated in 1999 by Charles M. Eastman that wrote about " a digital representation of the building process" .

The process has gone lost along the way and that isolated building sounds much more like 'edifice': hence the reductive idea that BIM only means 'a digital representation of an edifice'.

It's no accident that whereas BIM softwares are thought at Universities, they are generally confined to the representation field and for the same reasons, professionals mortify expansive software's potentials reducing them to a mere project presentation tool. Elsewhere, BIM is faced as a method and an approach, however there is a lack of practical and operative indications that could help designers to overcome the pure system's speculations' cul-de-sac. The intersection between BIM and sustainability has been well tackled by Krygiel and Bradley, whose book has a significative title: "Green BIM: Successful Sustainable Design with Building Information Modeling" .

All emerging structures in via Cenni are made by CLT (Cross Laminated Timber) structural panels, including the staircases, which generally, for this kind of tall building, are made by reinforced concrete.
© MAK Building



The book's core topic is integrated design and the design team, which is meant as an extended one that includes designers, the owner, builders and the whole community.

CLT (Cross Laminated Timber or XLAM) houses' design it's a perfect example of sustainability and BIM processes. Interoperability, roles, functions and the process are revolutionised compared to the traditional building systems. It's like the XLAM design introduces a further step (building components' pre-fabrication) that requires, in terms of interoperability, CAD-CAM transfer to cut the components with the numeric control machines. Design and components' production optimisation are well known sustainability values, especially when it comes to material waste. Therefore, the process.

Joseph Kolb makes a significant comparison between a timber framed house building process and a traditional one. His outline, beyond comparing the 38 weeks required – from scratch to the end – for a wood construction with the 48 weeks required by traditional buildings (we consider this assessment extremely optimistic, our experience would suggest to double the time at least), there's another relevant fact. The assignment of builders in the traditional buildings processes is a single moment, while in timber construction it's a period, a span of time. The collaboration between the designers' team (traditionally meant as including the project architect, the structural engineer and other professionals) and the builder is expanded and dilated: more time is spent on the design (20

Scaffolds are not needed for CLT buildings. In this event, site management preferred that solution to improve building site's safety and to enhance the insulating coating works. To complete the load bearing structure in five months, building site's management and organisation are pivotal. In Cenni MAK Building GmbH, as a supplier of panels, also played a role in logistical coordination between Stora Enso and the construction company Service Wood, for the planning of cutting planes, delivery and installation.

weeks versus 18) and building site's phases are clearly marked (4+6+2), including the components' production's time.

In the case of timber houses designed using BIM, we think it's possible, desirable and perhaps due, to innovate design processes further.

The sequence:

Preliminary design > final design > working plan > achievement

should be overcome by an approach where the working plan starts together with the preliminary design, where interoperability can be managed not as a problem to be solved, but as an opportunity to be exploited to increase both building's and the whole process' performances, extending the collaboration between the team and the builder, preceding builder's choices and opening the designers' team to all those actors who generally are considered external to the conception.

Building sustainability also brings in the products' grey energy issue, that hidden energy used to produce materials and components.

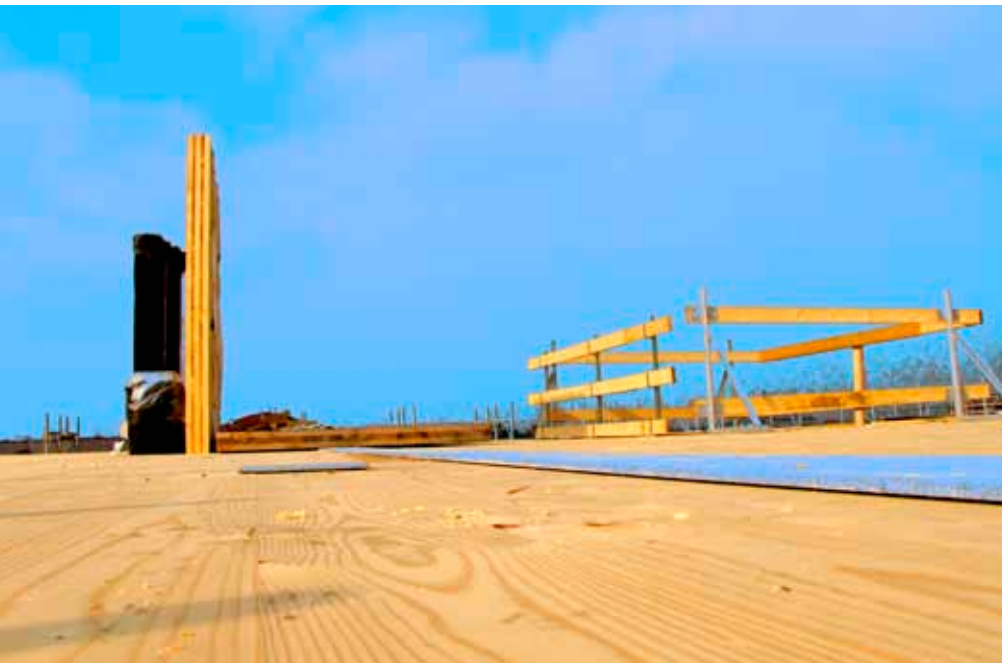
There's a grey energy even in the design process, which is that energy and that time spent to modify and to rethink, late trade-offs, which take time away from design's quality and that often waste initial important strategic choices (like the decision to build using wood) and diminish a sustainability-oriented design's potential.

In his books' preface, Hardin writes that: "BIM is an evolution, not a revolution".

History has taught us that revolutions happen in a limited time, thanks to a closed group of people. Evolution unravels through a much longer path, it involves everyone and it becomes clear by observing most groups and their dynamics and not focusing on single individuals.

Therefore, to become a cultural phenomenon and yield its benefits, the designing process' evolution requires patience, the admission and recognition of all mistakes, within the number of attempts and proposals, warding off the risk that technology is the wild weapon of a threatening IT dictatorship. If we don't control such an evolution, we would risk to distort design's essence.





Designing with a BIM approach implies a holistic view if the whole building process, including production standards and, in the case of timber structures, all the phases preceding the industrial transformation. This is the reason why this dossier presents articles dealing with forest management and the production system.

The experience of Via Cenni, described by Fabrizio Rossi Prodi in an article published in this extra edition, closes this dossier with a contribution by

A BIM process should involve all operators, from producers to designers, in every single phase, from planning to building site's management. Complex structure design using CLT technology specifically requires such an approach to enhance industrial components' production and improve a quick installation phase. MAK building's role within via Cenni building site has been pivotal for the supply.

Andrea Bernasconi, the structural engineer working on Via Cenni's project, who during the writing of this Dossier was defining the four 9-storey towers' working plans. Marco Medici and Pietro Massai describe in their articles the Austrian forests and Stora Enso's production sites: CLT (Cross Laminated Timber), or XLAM (as Mr Bernasconi likes to call them) panels used in Via Cenni are produced by Stora Enso and distributed by MAK building. Everything comes full circle.



Pictures presented in these pages were taken on the building site in mid-November, exactly four months after the first panel's placement. Barring accidents, the load bearing structure will be completed in December. The Empire State building was built in 21 months. The five months required for the load bearing structure and the fourteen months needed to complete the buildings in Via Cenni, might turn pale in a historic perspective. However, it's the historical perspective that inspires us further. The book edited by Carol Willis (Building the Empire State, edited by Carol Willis, The Skyscraper Museum, 1998) identifies two factors which enhanced the building plan's execution: "a team-design approach that involved the collaboration of the architects, owners, builders, and engineers in planning and problem solving; and the organizational genius of the general contractors". This was New York in 1930. Eighty years after, it is to be hoped that the designing and execution approaches gets renewed everywhere in Europe.

We have technologies.
Let's add the processes.

Carlo Bughi

DIAPReM Centre, Department of Architecture
Ferrara University
carlo.bughi@unife.it



* Translation from the Italian by Patrizia Bertini

Notes

- 1_ C. EASTMAN, P. TEICHOLZ, R. SACKS, K. LISTON, *BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors*, John Wiley & Sons Inc., 2008;
- D. K. SMITH, M. TARDIF, *Building Information Modeling. A strategic Implementation Guide for architects, Engineers, Constructors, and Real Estate Asset Managers*, John Wiley & Sons, 2009; S. M. LEVY, *Project management in construction*, 2011;
- G. SALAZAR, *Building Information Model: Fundamental Concepts and Strategies for successful Implementation*, John Wiley & Sons, 2011.
- 2_ B. HARDIN, *BIM and Construction Management*, Wiley Publishing Inc, 2009
- 3_ C. M. EASTMAN, *Building product models: computer environments supporting design and construction*, CRC Press LLC, 1999
- 4_ E. KRYGIEL, N. BRADLEY, *Green BIM: Successful Sustainable Design with Building Information Modeling*, Wiley Publishing Inc, 2008. See also Hardin (cit.): in his chapter "BIM and Sustainability", he links BIM and USGBC and LEED criteria, Green BIM and prefabrication, recovery and recycling of materials.
- 5_ J. KOLB, *System in Timber Construction*, DGfH - German Society of Wood Research and Lignum Holzwirtschaft Schweiz, 2008