When BIM becomes a LEAN-tool: approach for BIM in process-management

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Technology Transfer: Implementation of LEAN planning and LEAN building in the building industry, enhanced by BIM

Failure costs in the building industry - estimated between 8 and 13% - are often still treated wrongly as inevitable or uncontrollable losses. Multiple economic crises in recent years and the pressure on the industries margins render this approach obsolete.

This research project is aimed at developing methods for reducing failure costs in the building process by introducing known LEAN techniques, enhanced by BIM, with a positive impact on profit margins.

Neighbouring countries, such as the Netherlands, have been using LEAN techniques in the building industries for some years now. Belgium however needs to step up, and that is exactly what this research project is meant for…

We will focus on 3 user groups within the target audience of SME's:

- Execution: general contractors, technical installations, …
- Design firms and Execution monitoring: architects, engineers, …
- Support: software and application integrators

The final research report will combine and transfer LEAN and BIM knowledge. Raising awareness and spreading knowledge about LEAN & BIM implementation are incorporated in the research process.

Building information Management

Commonly, BIM is used as an acronym for either Building Information *Modelling* (the 'act' of creating a virtual building), Building Information *Model* (the modelled 'design' as an interactive database) and/or Building Information *Management* (managing the information in/of a building). This research project (TETRA – Technology TRAnsfer) will obviously be focusing on the last concept.

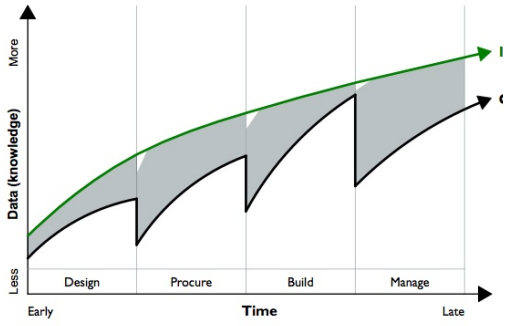

Figure 1 The upper curve suggests that the BIM-approach guarantees less or no loss of data (when adequate interoperability is present)

Management is generally defined as "*the control and making of decisions in a business or similar organization*" and "*the process of dealing with or controlling people or things*"[1] and this definition is easily transferred in a BIM-context as "managing the BIM-data" or "controlling the model". This often implies avoiding the loss of BIM-data, the well-known 'data-drops' during a building process, typically depicted as shown in *Figure 1*[2].

Strangely enough, this diagram suggests that a) data continues to 'grow' over time during a building process, following a root function curve (so there is no real limit to the amount of data when a process keeps going on) and b) data loss (the size of the 'drop') increases in each phase, so the expected 'gain' from using BIM is bigger in the later part of a typical building process.

This analysis raises 2 questions:

1. Does using BIM guarantee less data-loss in a building process? Or, in other words: does BIM has the intrinsic quality of eliminating data-drops, when used with adequate interoperability?
2. Does building data grow (infinitely) over time in any typical building process and is the amount of "knowledge" (data) bigger in later phases than in early ones?

Although the TETRA-research project is not focused on answering these two questions, they are very important when the ambition is to use BIM as a (LEAN) management tool.

Managing BIM-data

Compared to classic 2D CAD-driven processes, BIM has one big disadvantage: the lack of real interoperability (in native formats) between the different software solutions – fortunately, this has started to 'shift' recently [3]. Even though there is a wide-spread use of formats such as IFC and BCF, these solutions are dissatisfying for many BIM-users because of their allegedly inevitable loss of data[4] [5]. But this is not the only problem when studying BIM-data being transferred from one 'user' to another. Even within a closed BIM-environment, where all users are using the same software and interoperability shouldn't be that big an issue, data is still "lost" in the process. Unfortunately and more importantly, users often export or share data within their model, without even realizing that it was there in the first place…

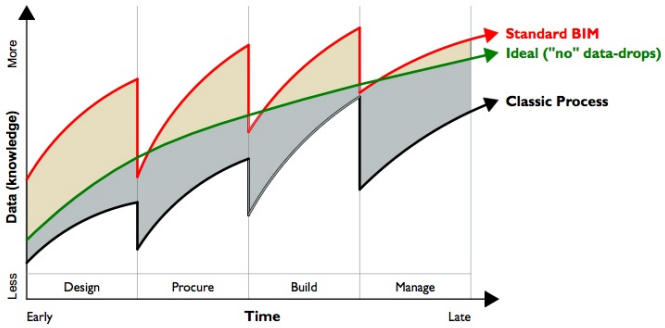

Figure 2– The available amount of data in BIM is much bigger than mostly thought or known by its users

Typically software vendors and developers will pack their applications with extensive data-rich libraries. The objects and elements containing this data are used in projects where possibly some data isn't relevant (yet) or isn't accurate in the project's circumstances (e.g. because of the 3D-texture linked to it, a designer could be using a very well defined virtual building material, containing data such as 'thermal conductivity' or 'density', without paying attention to this piece of information but nevertheless sharing this data with his energy advisor through the use of BIM).

What happens is depicted in Figure 2: there is actually more information present in our BIM-models than the ideal 'curve' of Figure 1 suggested, but a lot of it is unused or gets lost because the 'next in line' has no use for it. Managing a building process with BIM means that we truly need to take control over our BIM-data and provide all parties with accurate information, tailor-made for *their* purpose…

LEAN use of BIM-data

LEAN is a management philosophy, striving for self-directing organizations aimed at realizing products with maximum value for the client, whilst producing as little waste as possible. Its principles are derived from the Japanese (automotive) manufacturing industry, with Toyota as most well-known early example (the Toyota Production System was described as "Lean" for the first time in late 1980's[6]). Transferring this 'technology' from the automotive to the building industry, has potential in multiple ways:

- Shortening the lead time of the entire building process and thus increasing operational and financial strength (e.g. by executing tasks simultaneously instead of a sequenced execution)
- Avoiding failure costs thus creating bigger margins (e.g. by avoiding repairs/corrections during execution phase by detecting possible problems earlier on in the process)
- Optimizing building processes and thereby adding to the margins, creating room for further professionalizing the organization (e.g. optimizing material use (=reducing overproduction and unnecessary waste) by studying placement tolerances and modularity)

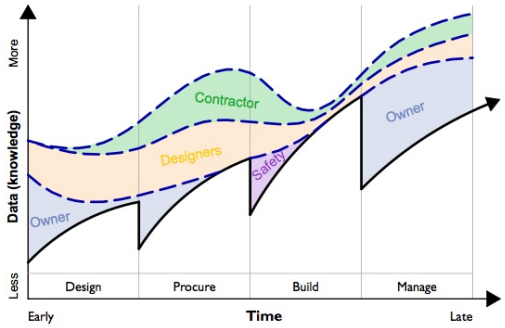

Figure 3 The need for information, or available knowledge depends on the phase in the building process and the party wanting or providing the data

Not all of the known LEAN-techniques will be meaningful in the building industry and the ones that are will not all be enhanced by using BIM. That BIM has a potential in supporting some of these principles is nevertheless quite obvious: creating 4D-models is a known technique for visualizing and enhancing a process-planning; most Building Information Models can give us faster access to (more accurate) quantity data; intelligent parametric BIM-object, linked to manufacturer's databases can help to avoid failure costs during execution and to shorten the decision-making process when implementing (last-minute) design changes. This is all only possible though, when we no longer look at BIM as a 'central' database, being filled up with (all possible) information during the process, but adapt a more 'LEAN' data-model of BIM, providing the right person with the required data at the right moment. Taking into account the remarks on interoperability, we can only wonder if this data *has* to be present *within* the actual model…

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[1] Hornby, A.S. , Crowther, J., et al (1995). *Oxford Advanced Learner's Dictionary of Current English* (5th edition). Oxford University Press.
[2] Source: Bernstein, P. G. , Autodesk AEC Solutions
[3] Grabowski, R., Teigha BIM. (September 12, 2016). *Exclusive! Open Design Alliance opens up the Revit file format. WorldCAD Access*. Consulted on February 27, 2017 at http://www.worldcadaccess.com/blog/2016/09/open-design-alliance-opens-up-the-revit-file-format.html
[4] de Riet, M. (November 20, 2013), *Myth Buster: Revit & IFC, Part 3. AUGI – Autodesk User Group International.* Consulted on February 24, 2017 at https://www.augi.com/articles/detail/myth-buster-revit-ifc-part-3
[5] McPhee, A. (June 29, 2013). *IFC, What is it good for?. Practical BIM blogspot.* Consulted on February 24, 2017 at http://practicalbim.blogspot.be/2013/06/ifc-what-is-it-good-for.html
[6] Krafcik, John F. (1988). *Triumph of the lean production system. Sloan Management Review, 30* (1), pp. 41-52