OPTIMIZATION AND IMPLEMENTATION POSSIBILITIES OF BUILDING INFORMATION MODELING (BIM) IN HUNGARY

PhD Thesis Booklet

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1. INTRODUCTION

The definition of BIM (Building Information Modeling) – Charles M. Eastman, 1975.

[designing by] "... interactively defining elements ... deriv[ing] sections, plans, isometrics or perspectives from the same description of elements ... Any change of arrangement would have to be made only once for all future drawings to be updated. All drawings derived from the same arrangement of elements would automatically be consistent ... any type of quantitative analysis could be coupled directly to the description... cost estimating or material quantities could be easily generated ... providing a single integrated database for visual and quantitative analyses ... automated building code checking in city hall or the architect's office. Contractors of large projects may find this representation advantageous for scheduling and materials ordering."

The definition above describes a methodology which allows to integrate and speed up the designing processes by using a virtual 3D model.

2. THE SCOPE OF THE RESEARCH

In my dissertation I am dealing with possible Hungarian implementation processes of the Building Information Modeling and Management (BIM). I have started my research in 2010 with the intent to develop the necessary tools and methods which can be applied to help the integration of BIM into the Hungarian building and construction industry. By discovering the complexity of this objective, I have decided to focus on those practices which can make the benefits of the technology visible already in the early stages of utilization despite of the immense process of the full implementation.

Since the beginning of the research numerous software and hardware developments have been realized which have fundamentally changed the former methods and which could also provide brand new solutions for the utilization of BIM. Because of the previously mentioned reasons I was conducting my research in a continuously changing environment: BIM was employed earlier for *quality checking* and by now it has turned into the tool of *quality control*, giving more opportunities to enhance the productivity of the construction processes.

In my dissertation I am focusing on the following fields of the implementation:

- *BIM integration into the higher education – from plan processing to design*
- *Developing simple BIM methods to support partial construction processes*
- *BIM standardization in large construction company scale*
- *BIM standardization within governmental environment, requirements of the digital data exchange*

Thesis 1:

I have proved that substantial restructuring is required for the architectural and engineering training in the higher education in order to conduct a successful BIM implementation in Hungary.

1.1. I have concluded that the existing commercial BIM modeling techniques based on plan processing should be integrated into Hungarian architectural training programs, therefore I have introduced BIM foremost into the architectural academic curricula in Hungary, Pecs, University of Pecs.

1.2. I have concluded that in order to make the education of BIM modeling techniques based on plan processing effective, the development of a new curricula is required, therefore I have written the first Hungarian BIM coursebook.

1.3. I have concluded that besides the coaching of "classic BIM" modelling methodologies, special modeling techniques should be developed for the industry-specific engineers, therefore I have extended the training program.

Thesis 2:

I have concluded that the adoption of BIM processes should start with the support of particular construction objectives in order to conduct a successful BIM implementation in Hungary.

2.3. I have proved by modeling and quantitative experiments that the bill of quantities, which are adequate for cost and construction time estimation, can be derived from a low detailed BIM model if there is an appropriate norm catalog available.

2.4. I have concluded that construction norms can be revised by using high detail BIM models and that there is a calculation problem in a special type of norms, in which the surface area is used to deduce the quantity values of the perimetric elements of the same surface. Low detailed models can be used to handle this problem and to provide much more accurate values.

2.5. By measuring and comparing the modeling times I have proved that the necessary quantitative values for scheduling and pricing can be derived from low detailed models more efficiently, without giving up the accuracy of the high detailed models.

Thesis 3:

I have concluded that it is not enough to start using international standards in order to conduct a successful BIM implementation in Hungary, they have to be tailored to the domestic workflows and processes.

3.1. Based on the PAS 1192 standard I have written the first Hungarian corporate BIM regulation which defines the contractual documents and the processing methods of the BIM model, from the beginning of the planning phase till the construction preparation.

3.2. By examining the practical use of the above mentioned regulations during the design and construction phases of Telekom Headquarters, I have concluded that it is not enough to create the regulation just once, it should be supervised and kept updated according to the technological developments.

3.3. I have concluded that the »classic BIM« modeling methods, which are based on plan processing, give only limited support for domestic Design and Build workflows. For D&B projects »classic BIM« methods can be used only if the construction drawings are completed and BIM is used for quality checking.

3.4. I have concluded that in case of BIM-based design processes the model progression schedule and the drawing package delivery schedule should be restructured, the documentation process, including the annotations and labels, should start only after the coordinated model has been submitted and quality checked.

Thesis 4:

I have defined and elaborated the structure of the Lechner BIM directives (handbooks) which are supposed to be used as governmental regulations, in order to conduct a successful BIM implementation in Hungary.

4.1. I have written and published the first volume of the unified national BIM handbook in Hungarian language, which is harmonized with the 1567/2015. (IX.4.) Government Decision. The preparation of the further volumes are in progress, considering all the details of the international and the Hungarian standardization processes.

4.2. I have defined the long term data storage requirements of the BIM models. I have examined the IFC format and I concluded that it gives adequate support for the long term data storage and for the integrated governmental building data environment.