



# **BUILDING INFORMATION MODELING AND OPERATION**

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The research project "BIM-based operation" contributes standardization and uniform understanding of the BIM process and the resulting changes in the construction and real estate sectors. The project develops an ideal-type target process chain, based on an actual process analysis, for using the BIM method in real estate operations. A standardized life-cycle process is intent to show required information for operation actives in concrete terms. Based on this, information and communication interfaces can be identified to analyze changing performance requirements of the parties involved, and open questions such as legal issues can be further elaborated or dealt with. Based on literature research and numerous expert interviews, it analyzes and determines how individual process steps are carried out and which parties need to deliver what kind of information to which participant at what time, to fulfill build owners' requirements to a successfully constructed and managed building. The focus is thus on the exchange of information between those involved in the operation phase. Existing standards are consciously integrated into the development. Companies, institutions, and other stakeholders are thus given an overview of the situation in relation to the important exchange of information. In particular, the real estate operating phase is attributed to a high optimization potential through digitization.

*Keywords:* Process management, Digitalization real estate life-cycle, Information delivery, Process-orientated method, ISO 19650, Implementation guideline.

## **1 INTRODUCTION**

The digitization of the economy has been progressing steadily for several years, also in Germany. With regard to the building sector, the main focus is on the method of Building Information Modeling. Against the background of optimizing the effectiveness and efficiency and strengthening the competitiveness of the associated construction and real estate industry of Germany - even in international comparison - the implementation of the BIM method is also essential during the entire real estate life-cycle (Bauindustrieverband NRW e.V 2017). More and more information is being generated and stored digitally to improve the processes in the respective work steps. However, they are often not designed for further use in downstream phases. In practice, companies have to put the information into their systems and adapt it to their needs. The development of standards for the BIM-based processing of projects is necessary to ensure that the methodology can also be used across the board (ARGE BIM-Leitfaden 2013).

The research project "BIM and operation" is part of a longer-term overall concept to be set up. The aim is to promote the standardization efforts of building data models with regard to processes and the associated flow of information between the project participants in all lifecycle

phases with the focus on the processes of the operation lifecycle phase of a building. At the same time, this will help to create transparency with regard to the BIM method for those involved in construction and real estate management (ISO 29481 2016). To compile relevant information, the method of business process management is used. The Focus of the project is on the use of data during the lifecycle phase operation of a building. It covers a total duration of 24 months with a start in September 2017. This paper presents the BUW's process information management approach and the present status of the project BIM-bases operations.

## 2 METHOD

### 2.1 Scope and Process Model

According to the definition of the University of Wuppertal (BUW), the lifecycle of a real estate consists of five phases: development, design, realization, operation and demolition. Within these phases, new information are generated from various roles from various information sources.

The extensive consideration of all these phases is not feasible in a single research project. For this reason, the BUW has decided to subdivide the lifecycle of a real estate in a structured manner and to develop the respective sub-areas in independent research projects, which are always interlinked. Through the close networking, synergies can be used as best as possible and a broad knowledge foundation can be established. The use of business process modelling allows to interlink information in a holistic system. This enables the chair of Construction Management & Economics at the BUW to publish the gained findings in a targeted way in the general public, thereby continuing promoting the digitization of the real estate value chain.

In the following, the above-described linkage of the research projects is presented and explained for the currently running projects in each case. The division takes place on the one hand by separating the sequence of phases or activities (horizontal axis). On the other hand, by means of the classification of the detailing process levels - subdivision of a process in sub processes (vertical axis).

- BIM - Processes - Lifecycle covers the overlapping frame over all phases of the lifecycle. The processes are viewed in coarser detail levels primarily from the point of view of the overall role of the building owner / operator. (Status: completed)
- BIM - Processes - Realization considers the phase of the realization and the resulting requirements for the upstream and downstream phases of the real estate lifecycle. The processes are viewed in deeper detail from the perspective of the execution companies. (Status: completed)
- BIM - Processes - Work Planning considers the step of the work planning of small and medium-sized enterprises (SMEs) in the implementation phase. (Status: ongoing)
- BIM - Processes - Health and Safety considers the planning, realization and operation phases from the specific point of view of occupational health and safety. The processes are viewed over all process levels and integrated into the overall landscape. (Status: completed)
- BIM - based operation -considers the operation phases from the specific point of view of occupational parties. (Status: ongoing)
- BIM - Processes - Demolition considers the phase of demolition and the resulting requirements in terms of the material cycle. The processes are viewed in deeper detail from the point of view of the demolition and recycling companies. (Status: ongoing)

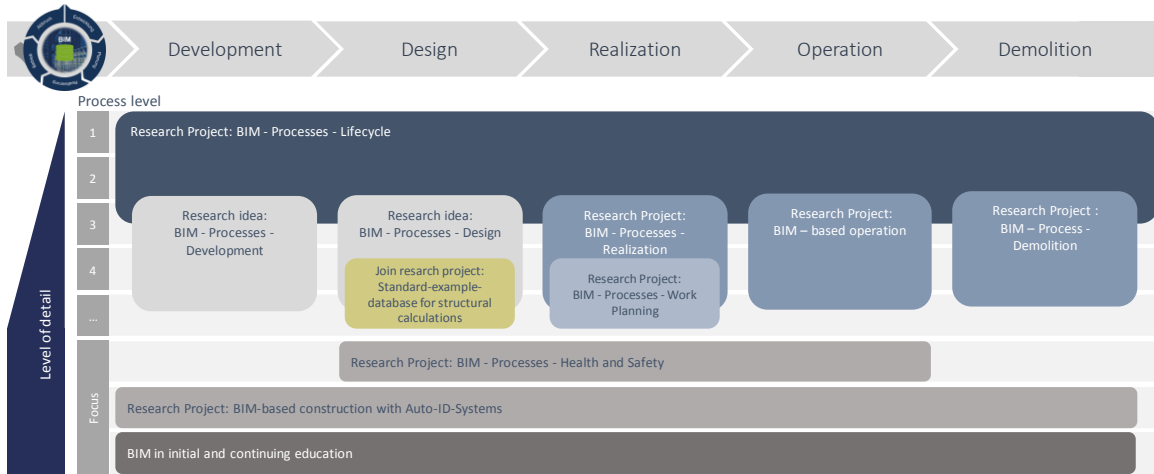


Figure 1. Integration of the BUW research projects in the real estate lifecycle.

Based on initial literature research and subsequent expert interviews, the respective research projects have brought together information from which basic principles have been developed. Based on this, the project teams use the information in a database-based BPM software. It enables a central collection of the entire knowledge and thus ensures that the described overall concept can be implemented. Finally, the gained and implemented findings are verified by the practice partners.

## 2.2 Ideal-Type BIM Process with the Focus on the Operation Phase

On the basis of the defined real estate lifecycle phases, processes from specific points of view were standardized and displayed in the common process model. This was used to investigate the extent to which the processes change by implementing the BIM method. Even with the actual processes, a consistent, continuous flow of information can be generated. This allows the required information to be linked to an associated process as input and the condition that each process produces exactly one output. The processes represent a human process flow (independent of auxiliaries), which will not be changed in principle for the introduction of BIM. Through the digitization, only parts of it are supported or carried out by help of the IT, thus supplemented by a technical process and requirements. The IT-supported or semi-automated handling of processes requires more stringent regulations on storing information etc. This is because the automatism is based on pre-programmed queries, which can in principle only cope with the situations that were taken into account during programming. So, the focus is thus on the exchange of information between those involved in the life cycle to answer the question “who needs which information from whom when and for whom”, the so called information process.

Based on this the answer to the question for the ideal-type BIM (reference-) process sequence was created. In terms of construction, this is described by the so-called information management process. It describes "who has to do something that information can be generated and made loss-free available". This development is carried out by analysis of BIM guides, guidelines, standards, participation in various committees, the accompaniment of practical projects and support for the implementation of BIM projects of specialized companies. Subsequently, the information management process is assigned to the information process. The combination of both processes results in the specialized process flow of the ideal-type BIM target process chain.

The BUW BIM information management process is validity gained by different workshops with various national parties of the real estate lifecycle. The frame of the BUW information management process is also in accordance with the still not published international BIM information management process ISO 19650 to support existing standardization and regulation.

Especially for the operating phase of the life cycle process it is very interesting to define the relevant information for the processes of technical and infrastructural building management and to consider the interface of commercial building management aspects.

### **3 RESULTS**

The development of an ideal typical target process chain for the application of the method BIM investigates the business process along the building lifecycle and environment of information management and production to achieve beneficial business outcomes to asset owners, operators and the project management. The range of business outcomes reach from e.g. better cost management or clearly defined responsibilities to improve the project management to visualizations and 3-D models for better public relations work. To clarify the questions in the information management process, the project participants must initially set up their requirements for both the information as well as the information management process. The collaborative process landscape of the BUW considers this with BIM targets, BIM uses and BIM requirements, which together result in the so-called BIM application container. The information to be entered there from the relevant viewpoints is used for the corresponding research projects. Based on this, lists can be derived as a basis for the establishment of the information management process and various other information for the most diverse tasks.

At present, the BUW process model contains information focusing on technical and infrastructural building management. For further classification, the operating phase comprises the areas allocation of operation, preparation for commissioning, commissioning, ongoing operation and change of operator/owner. Within these areas are business processes for carrying out functional technical- and infrastructural building management processes. In case of technical building management, it consists e.g. Maintenance services, inspections for special services, warranties, expert inspections, statutory inspections, invoicing and payment and warranty processes for all shown areas. Supplementary processes are further updated and validated in the exchange of technical experts. The process record is scheduled to be completed at the end of 2018.

As a result of the BUW Process map, decision points required information can be easier generated by interfaces through other lifecycle parties, e.g., planning and construction companies. Individually required information can be defined and imported into the process model as well. Within finishing the research of information requirements, exemplary business outcomes will be assigned into the categories of BIM targets, BIM uses and BIM requirements, the so-called BIM application container. The defined application containers, within in their information requirements, will be part of the tender documents, that the information can be most efficiently produced down supply chains. The guideline for action contains a step by step descriptions to give building owners, operators and project managers an understanding of the practical implementation and potential business outcomes.

### **4 DISCUSSION**

The application of reference processes is discussed in many ways, especially in the context of individual construction projects. Against this background, it becomes even more evident how necessary the implementation and application of processes and consistent process models in the

real estate life cycle are, to obtain a large number of example processes to develop further reference processes.

## 5 CONCLUSIONS

Over the next few years BIM will appear to be well established. In doing so, the processes as a basis for the planning of digitally supported or fully automated processes will inevitably gain in importance. To this end, standardized process models, such as the process landscape developed by the BUW, will serve as a basis for the specific situations in companies and projects to be displayed more quickly. The process landscape of the BUW is suited for this task. In addition, due to the structured structure, you can flexibly adapt and expand.

The essential basis for the implementation of BIM is to implement the process landscape as well as the will of the industry and the acceptance of the employees. An additional essential factor for a comprehensive use of the method BIM depends on the collective action of the lifecycle parties and the interests of the building owners, operators and project managers. The guideline for actions will be a part to bring the method BIM more into the focus of this important group.

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