buildingSMART Germany

BIM Basics

PIM for BIM

Product and Building Information Management in the Digital Built Environment

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bSD Verlag

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About buildingSMART Germany

buildingSMART Germany is the competence network for the digital design, construction and operation of buildings. We are part of the international buildingSMART community and operate in an interdisciplinary, user- and practice-oriented manner. More than 640 companies, research institutes and universities, authorities and public bodies from all areas of the construction and real estate industry are members of buildingSMART Germany. They all are united to successfully shape digitalization. buildingSMART members cooperate on the development of open and non-proprietary standards for digital methods and solutions and advance this work to the global level via buildingSMART International. On a regional level, buildingSMART members are organized in regional groups and promote the exchange of knowledge and experience on a broad scale through local and regional networks. Thus, on a regional, national and global scale buildingSMART is active in developing reliable and user-friendly solutions and standards for the successful digitalization of the built asset industry in Germany.
www.buildingsmart.de

Foreword

The idea behind the book is simple: PIM and BIM are interconnected, and we felt that this relationship is not properly recognized in the industry – there is no M in AEC acronym. Manufacturers are important for BIM, architects, engineers and builders are important for PIM. There is no BIM without data coming from producers of building materials and no PIM without end-data consumers. We want to fill the gap, because innovation happens in-between the borders, in no-man's land and when all assumptions are pushed aside. Both PIM and BIM are part of bigger wave of the digital change shaking the ground of good old business. Such a huge twist in business mentality needs special attention – therefore we explain how organizational change can be managed.

As authors we come from different backgrounds. We all got used to working in frames and within boundaries. Sometimes it is hard to see a bigger picture, or a purpose in one's work. As experts, we often think we work in silos of expertise, limited by gained knowledge and experience: it is either PIM or BIM, black or white, mine or yours. But then, why not enable skills and widen horizons to start seeing PIM and BIM together?

Our understanding of common ground between PIM and BIM is multi-dimensional and more creative. We indeed got out of our expert zones, met in the no-man's land, and decided to claim it ours. We invite you to join us here, in the PIM for BIM.

Vienna, Prague, 1 September 2021

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The brevity of this book is intended.

Contents

Who this book is for

The PIM for BIM book is an introduction to an area in-between Product Information Management (PIM) and Building Information Modeling (BIM). Reliable product data is for BIM what construction material is for building a house.

This is the first book on the topic of product and building information management. As authors, we see that data providers are looking for vendor-independent reference material that will guide them through the topic of product information management of building materials in the construction industry.

This book is for:

1. Producers of building materials:
   - production engineers and product managers who are filling in the databases with product information
   - product data stewards that manually populate PIM systems.
2. Specifiers, project designers and construction engineers:
   - BIM practitioners who are modelling and using product data to create digital models.
3. Wholesalers and retailers:
   - wholesalers who are managing the product catalogues of hundreds of manufacturers and maintaining their own product databases.
4. Anyone who is interested.

This book was written with the intention to be easy to read and easy to use in daily operations. It is to be read and put into practice.

How this book is written

As this book is written for a diverse group of readers with different backgrounds, it is split into three levels of detail.

- LOD 100 describes the context of PIM and BIM in the digital built environment.
- LOD 200 introduces information management in general, Product Information Management (PIM) and Building Information Modeling (BIM).
- LOD 350 focuses in detail on the product data journey, PIM for BIM and on organizational change management.
- At the end of the book each of the three authors proposes a vision of the future with regard to PIM, BIM and its shared existence in the built environment.

In order to balance the team of authors with external expertise, guest articles are placed between LOD's. The first concerns a product placed in the center and the second the legal aspect of providing product information.

1 LOD 100 – The Context

This chapter gives a brief overview of digitalization in the construction industry and the digital built environment as a context in which PIM for BIM is embedded. It describes the past and present of digital collaboration in the built environment. At the end it lists promising technologies for the near future.

1.1 Digitalization in the building industry

The beginnings of BIM and its relationship to production date back to 1957, starting with the first computer-aided software for manufacturing. In the beginning, Computer-Aided Manufacturing (CAM) – and Computer Aided Design (CAD) – were developed independently. But already Patrick J. Hanratty, an early pioneer in the field of numerical control (NC) and CAD/CAM software, highlighted a central aspect of digitalization: that every software or digital technology should be able to communicate with other systems, even with its competitors.

A milestone for digital design was the first CAD program with graphical user interface in 1963. The concept of BIM began in the 1970s, firstly as a Building Description System (BDS) with parametric 3D design and an integrated database for visual and quantitative analysis. The term building model was used for the first time in 1985 by Robert Aish and building information model by G. A. Van Nederveen and F. Tolman in 1992. It took another ten years for Autodesk to publish a white paper on building information modeling as a strategy for the application of information technology to the building industry.

Parametric design was boosted by software development allowing for freeform, organically looking architecture that can be created by algorithms. This development has not only revolutionized architecture, but also the production of building elements. Fabricators started to feed geometric information directly into their production systems for building elements made of steel, timber, reinforced concrete or plastic. Scripting became the key for translating the geometry of highly individual elements into an efficient design, production and organization process.

In the early 2000s software programs like Revit, Navisworks and others made it possible to coordinate work in various authoring software, check potential clashes and provide other essential functions of digital teamwork. For the first time, it was possible that different parties in the planning process like architects, engineers or other specialist planners provided their contribution to one model that was built up jointly.

In the past decade, the horizon has widened: BIM is used not only for planning but also on construction sites and is seen as a means to digitalize facility management. Facility managers have early on understood the potential of a digital model for management and operation of the built object. Assets can be operated more efficiently, especially in connection with sensors transmitting information on the actual conditions in the building. Professional facility management and private house owners increasingly want to control their living environment with digital tools and make use of services building upon digital asset information.

BIM has become a synonym for digitalization of the whole asset life cycle. Developments vary strongly nation by nation, progress is uneven. But it is accelerating with an increasing number of building related enterprises being committed to work digitally. Particularly e-commerce and online procurement is advancing fast. The advantages of digitalization will materialize only if the whole digital supply chain adopts the technologies and use them to collaborate. Information available in digital form can then be shared and used repeatedly and the need to re-create information will diminish. Digital workflows connect contributors in the building process from offices to construction sites and operations. Having common data environment on a project enables reliable

information exchange and allows better coordination of the work force. Digital collaboration brings expertise to the construction site beyond the boundaries of a single business unit.

The same way as a physical building is the result of a common effort of specialists, the digital twin builds upon interdisciplinary teamwork and the cooperation of businesses. Collaboration has to be understood as the essential feature of the digitalized industry.

1.2 A project and a product

Products are the basis of any building project. The building materials determine the appearance of a building and contribute significantly to the aesthetics of what is built.

Production of building materials is mostly independent of the individual project. Only modular building or prefabrication require a preceding process of assembly to create specific elements for the individual project or particular construction type. To increase efficiency and reduce costs it is better to complete the building elements outside the construction site. Prefabrication and assembly in a factory allow independence from weather conditions. Better access to important installation steps improves quality. Valuable site storage is needed for shorter time frames and expensive on-site work can be reduced. Another promising technology that could bring more efficiency and possibilities is 3D printing.

Products are manufactured based on general market demand. The need for products starts with the decision to build. The construction project, starting with the first idea of the future owner or a property developer, is at the core of the building industry. In fact, the project with its extensive network of stakeholders can be considered as a customer for the manufacturing industry.

1.3 The project and asset lifecycle

The purpose of a construction project is to build an asset. The term refers to all building objects: houses, roads, railways, bridges, tunnels, pipelines, dams, docks, ports, airports and others.

In very general terms an asset goes through two major phases: the project and the operational phase.

The project consists of the following stages:

- project development;
- planning & design;
- procurement & production;
- construction;
- handover and commissioning.

The project starts with an idea and a concept for financing. Next, the design is developed, and required engineering aspects are defined. Then building elements are procured, manufactured and delivered to the site, assembled and installed or built on site.

Once the project is completed and the built asset is handed over to a client, it moves to an operational phase. Now the asset serves the function it has been designed for. Bigger or more complex assets will be managed and operated by facility and property managers. During the asset lifespan there could be smaller adjustments, extensive renovations or partial re-building. The life cycle of assets ends with demolition, reuse and recycling of building materials. Stages are as follows:

- facility management and operations;
- building adjustments and renovation;
- demolition and recycling of materials;
- end of the lifecycle.

1.4 Digitalization of manufacturing and construction

Manufacturing gained advantages digitalizing the whole production process. A large set of product-related data is generated, analyzed and

used in further processes. Product data is the basis for managing production and quality assurance, for controlling purposes and other internal processes. Part of that data is not relevant outside the organization, but a wide range of product information is valuable in the building process. And vice versa, information from projects can be used as feedback to production and can impact the manufacturing process and future product development.

The introduction of BIM process and digital collaboration tools have changed the need for product information in construction projects. Information on the products and their alternatives with equivalent performance can make design development in a BIM model easier. The project information model containing products with their properties can remain up-to-date with the desired level of information needed per project phase. Once the project is completed and as-built information is included in an asset information model, it is then available for owners and facility managers.

In the digital supply chain there is an interest in data on both sides. The requirement for product related information for the construction project is clear. But also, the manufacturing industry can benefit from project-related information. It is useful for a manufacturer to know which products will be used in near future, while the project is in the design phase. Major material decisions are made already in the initial design phase. As the design progresses, material quantities give indicators of future needs. This is not only valuable for the sales and marketing team of a manufacturer, but relevant for sizing and capacity planning of production as well.

1.5 Digitalization of the eco-system – the wider picture

Construction industry and manufacturers of building materials exist in the wider context of the Digital Built Environment (DBE). It is an integrated environment where the digital and physical reality interact. DBE consists of the people and their organizations, processes of information exchange, the digital devices and their connections. Information technology (IT) helps to operate websites, offer indexing and search services,

8 The future – three visions

As authors, we know the future-oriented part of this book will age the fastest. Therefore, we are offering three glimpses into the future. One per author. To maintain relevance, we are looking as far into the future as possible.

8.1 Josef's view

1. Free standards. Standards and technical norms will be available for free and their distribution won't be prosecuted. It will be possible to share standards on intranets and as pdfs on open access websites. Is it ethical to ask 140 EUR for 31 pages of a document that reads like a law and has the same legal consequences?
2. One classification system (most likely ETIM version 10.0) that will contain classes for all possible products, and for each product class a set of pre-agreed mandatory properties. An ETIM classification system will make the concept of product data templates possible without creating another classification system or standard.
3. Every property will be identified by a GUID. There will be a central data dictionary that will contain all definitions of all product properties and PIM systems will store the GUIDs next to the other property attributes: the name, the unit of measurement, the value, the determination method and the linked standards. Properties will belong to property sets. Organizers of public tenders will define property sets per tender phase.

4. The communication between a manufacturer and the project designer will happen through standardized interfaces to CAD tools. Manufacturers will feed data directly to CAD tools of designers as they design. The just-in-time delivery of data will further increase the possible liability of the data providers for the reliability of their data.
5. The role of intermediaries in the information exchange will continue to decline. Producers will want to own the communication between them and their customers. The intermediaries are too risky. The reliability of the product information stays with the manufacturer, so the product data must go directly from one system to another without anyone in the middle.
6. The more digital we work, the less we remain bounded by historical determination of the design; which will bring more focus on prefabricated solutions that are 1-2-1 production (e.g. custom-made facing bricks for a given project, the option of 3D printing of items on site that are hard to transport, single-use custom development.)
7. The sustainable future of construction will lie in six-story apartment buildings, where the savings are both in construction and in operations and the need for building plots is lower than for lower-density family houses.
8. BIM won't replace the creative process. We will still draw by hand whenever we want to talk and draw at the same time. The link between head and hand will remain.

8.2 Karina's view

Information relating to the product will increasingly be seen as an integral part of a product. Product information will be introduced at various touchpoints and channeled through the whole building process. Block chain technology will help to deal with liability issues.

BIM will increasingly stand for building up the digital twin of the built asset. A fully functional digital twin will be an essential result of the building process – appreciated by asset management and increasing the value of a property. It will be the basis for use cases along the building value chain and the whole asset life cycle. Fully integrated apps on our mobile devices will connect to the digital twin of the building we are living or working in or just visiting as part of our daily routine.

Big data analysis building upon digital asset models will help to optimize sustainable management of cities. Effective data and digital information management will be the real driver of digitalization of the building industry. Connected databases will be at the core of the digital building process. Lean data management beyond the boundaries of project phases and enterprises will bring the desired increase of efficiency.

Integration will be the topic of the future. There is the technological side of integration connecting information and technologies within the building process, the asset lifecycle and management of cities. Virtual reality will be more and more interwoven with the built reality. But integration is also the key aspect of digital collaboration between human beings. Different fields of expertise, disciplines and businesses enrich each other. It is about integrating of people – combining know-how, approach and creativity, mixing gender, age and personality.

A quantum leap is only possible if elements previously thought to be separate are combined. This was the case in terms of IT and building expertise having made BIM possible. This can be the case in terms of PIM and BIM. Seeing PIM and BIM as an integral part of the building process and asset lifecycle will open up new perspectives.

Annex

Authors

Karina Breitwieser

graduated as a civil engineer at the Technical University in Vienna and achieved a master's degree at the Imperial College in London. She has thirty years of experience in managing projects and organizations in the building industry, being part of the top management team of an international construction company for nearly two decades. With her expertise in process management she drove digital solutions for the design and building process of high-tech facades from the onset. Currently she is at the TU Vienna for research cooperation on digitalization with Wienerberger, and works as a consultant for digitalization and collaboration in the construction industry.

Malwina Nawrocka, PMP®

graduated in Slavic studies from Adam Mickiewicz University in Poznań, Poland and in Advanced Project Management in non-degree postgraduate studies from the University of Economics in Wrocław, Poland. She worked as a System Integration Consultant. In her role, she supported Cemex in concrete order-to-delivery tool implementations in EMEA region. Currently she works at Wienerberger AG as a Project Manager for PIM and BIM, focusing mainly on transformational projects for Pipelife.

Josef Platil

studied Informatics at the University of Life Sciences and Information Management at the University of Economics in Prague. He started his professional life at Deutsche Post DHL, working as an application support, solution consultant and a project manager. He later moved to Deutsche Börse managing a project to build a single source of truth for investment funds. In his current role of a Product Owner for PIM and BIM at Wienerberger AG, he is responsible for its product information. He believes that standards should be publicly accessible just as laws are.