

Chapter 1

Modelling Concepts for BIM

Sander van Nederveen

Delft University of Technology, The Netherlands

Reza Beheshti

Delft University of Technology, The Netherlands

Wim Gielingh

Delft University of Technology, The Netherlands

ABSTRACT

Building Information Modelling (BIM) is potentially a great technology for the expression of knowledge, supporting interoperability and communication throughout the life-cycle of a building. In fact, Building Information Modelling is not a simple technology. It requires a sound understanding of a number of abstract modelling concepts. Next to being a technology, BIM can also be regarded as a method for making a low or non-redundant (i.e. with every fact represented only once) model of an artefact that is sufficient to realize it as well as simulating it before it actually becomes physical reality. This chapter discusses the modelling concepts of BIM: what is Building Information Modelling, what is a Building Information Model and what are its rationale and objectives? A clear distinction will be made between (a) that what is being modelled, such as requirements, function, boundary conditions, building configuration, connectivity, shape, processes lifecycle aspects and discipline views, and (b) how it can be modelled, such as through parametric models, part libraries, nD models, various representations and presentations, including visualizations. Finally, there is a brief discussion of relevant methods and languages for information modelling, such as ISO 10303 (STEP, EXPRESS), BuildingSMART (IFC, IFD and IDM), process modelling and recent ontology-based approaches.

1 INTRODUCTION

Building Information Modelling (BIM) has become a major understanding in building research and innovation of recent years. It used to be a specialist

area within a group of experts working on research issues. But over the past few years, many software vendors as well as design and construction companies have been investing in the development and use of the technology. Although investments are relatively low and usage is mostly restricted to 3D

DOI: 10.4018/978-1-60566-928-1.ch001

design tools, this is expected to change once the industry sees the potential benefits.

Introduction of BIM is often accompanied by a lot of confusion. This is for a considerable part due to the fact that BIM requires abstract and conceptual thinking as well as the knowledge of a number of abstract modelling concepts that are commonly used in BIM.

This chapter discusses the most common modelling concepts of BIM. First, a few fundamental principles of BIM are explained: *What is Building Information Modelling?*, *What is a Building Information Model?* and *What are the rationale and objectives of BIM?* Next, a number of concepts are discussed that are commonly used in building information models, such as composition, configuration, connectivity, parametric modelling and part libraries, functional requirements, discipline view models, modelling of building spaces, modelling of shape, and modelling of life-cycle views. Finally, there is a brief discussion of relevant methods and languages for building information modelling, such as ISO 10303 (STEP, EXPRESS), BuildingSMART (IFC, IFD and IDM), process modelling and recent ontology-based approaches.

This chapter does *not* discuss implementation issues or experiences. The chapter is of conceptual nature, for discussion of implementation issues, industrial experiences, best practices, etc. please refer to other chapters in this book.

2 BIM PRINCIPLES

2.1 What is BIM?

There is no general consensus about what the term “Building Information Model” means. For the purpose of this book we define it as

“a model of information about a building (or building project) that comprises complete and sufficient information to support all lifecycle pro-

cesses, and which can be interpreted directly by computer applications. It comprises information about the building itself as well as its components, and comprises information about properties such as function, shape, material and processes for the building life cycle”.

The key difference with older technologies is that the building information will be stored explicitly in a formal, computer-interpretable way. Drawings, for example, are primarily intended for human interpretation. Information contained in drawings can be ambiguous because they contain redundant information: every fact may be expressed more than once. This causes the danger that information may be or become inconsistent, especially during change processes. Drawings do not contain sufficient information either, for instance process information or the rationale behind design decisions is not captured. In contrast, an ‘ideal’ BIM has every fact expressed only once (i.e. it is non-redundant) and acts as a master model for possibly derived models that do contain redundant information. This is because redundancy in practice can never be fully avoided, and is often required for different application or discipline views.

Although the term ‘Building Information Modelling’ and the abbreviation BIM are only common since about 2002 - after publications by (Laiserin, 2002) - the concepts and ideas are much older. In the eighties and nineties more commonly used terms¹ for the technology that we presently call BIM were ‘building product modelling’ or ‘product modelling of buildings’ (Eastman, 1999; Proceedings CIB W78).

These terms also show the relationship with a more generic technology: product modelling. A product model can be described as ‘a digital model of a product comprising all relevant information of a product ...’, etcetera, similar to the definition given above for building information model. Product modelling is applied in many industry sectors, such as mechanical engineering, aerospace,

16 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/modelling-concepts-bim/39465

Related Content

Effective Decision-Making in Project Based Environments: A Reflection of Best Practices

Brian J. Galli (2018). *International Journal of Applied Industrial Engineering* (pp. 50-62).

www.irma-international.org/article/effective-decision-making-in-project-based-environments/202420

Logistics 4.0 Energy Modelling

Megashnee Munsamy, Arnesh Telukdarieand Pavitra Dhamija (2021). *Research Anthology on Cross-Industry Challenges of Industry 4.0* (pp. 436-460).

www.irma-international.org/chapter/logistics-40-energy-modelling/276831

Continuous Review Inventory Model with Fuzzy Stochastic Demand and Variable Lead Time

Nita H. Shahand Hardik N. Soni (2012). *International Journal of Applied Industrial Engineering* (pp. 7-24).

www.irma-international.org/article/continuous-review-inventory-model-with-fuzzy-stochastic-demand-and-variable-lead-time/93012

Impact of Industry 4.0 in Architecture and Cultural Heritage: Artificial Intelligence and Semantic Web Technologies to Empower Interoperability and Data Usage

Claudio Mirarchi, Alberto Pavan, Beniamino Di Martinoand Antonio Esposito (2021). *Research Anthology on Cross-Industry Challenges of Industry 4.0* (pp. 1397-1421).

www.irma-international.org/chapter/impact-of-industry-40-in-architecture-and-cultural-heritage/276881

Rescheduling Activities in Face of Disruption in House Hold Goods Manufacturing Supply Chain

K. V.N.V.N. Raoand G. Ranga Janardhana (2016). *International Journal of Applied Industrial Engineering* (pp. 47-65).

www.irma-international.org/article/rescheduling-activities-in-face-of-disruption-in-house-hold-goods-manufacturing-supply-chain/168606