

Tadeusz Kościuszko University of Technology
Institute of Urban Design A-3

Title:

**The impact of the BIM methodology
on shaping architecture in an integrated design proces**

Author: **mgr inż. arch. Maciej Jamroży**

PhD Supervisor: **prof. dr hab. inż. arch. Magdalena Jagiełło-Kowalczyk**

ABSTRACT OF DOCTORAL DISSERTATION

This PhD dissertation analyses the effects of applying the BIM (Building Information Modelling) methodology – with regard to project development, organisation, and management – on architecture modelling within the Integrated Project Delivery framework. The research is aimed at the identification of relevant factors that affect architecture modelling and enhance its quality through the application of the BIM methodology.

The developing world requires performance. The contemporary planning and design companies work faster and more productively, creating ever larger, more complex, and more technologically advanced structures, at the same time maintaining significant precision and efficiency and documenting every detail with much greater accuracy than ever before. The traditional model of the functioning of architecture design industry, which has remained stable over the years, needs to be upgraded in this fast-changing world. Planning and design sector is going through a revolution that is significantly improving the effectiveness and quality of developed construction projects and altering the working model of planning and design companies. Consequently, there are tools being implemented to optimise the design and planning process and to manage the team and the documentation, and even the entire life cycle of a building, more productively.

Chapter 1 – *Introduction* – it introduces the research in general, discusses the research background and the rationale for undertaking the topic along with the justification for the

research conducted. The chapter outlines the subject of the dissertation, its aims and objectives, and the research methodology applied. The research conducted to date is described and source materials characterised. The chapter outlines the thesis, research area and structure of the dissertation.

Chapter 2 – *What is the BIM* – provides an overview of the literature on the general concepts, functions, and characteristics of the BIM methodology. The chapter describes the background to the methodological development, the divergent definitions, and aspects of the BIM application as well as the methodologies for their implementation in organisation, process, and design. The differences between conventional design approaches and the BIM methodology as well as the prospects for implementing and applying multidimensional models and interoperability in practice are presented here.

Chapter 3 – *The BIM in the Integrated Project Delivery* – explains what the Integrated Project Delivery is, defines the role of the BIM methodology in the planning, design, construction, and post-construction stages. The chapter analyses the potential and prospects that arise from the BIM methodology application in the construction industry. The chapter addresses the methods that translate into enhanced productivity in construction and guides the dissertation to analyse the current state of the BIM methodology adoption in the design and planning process.

Chapter 4 – *The BIM application in the Integrated Project Delivery* – provides an overview of the BIM implementation initiatives and accomplishments in developed countries that are leading in the BIM adoption. The BIM adoption in these countries appears to have been a business and political initiative, strongly supported by individual governments and professional institutions. This is followed by an update on the BIM adoption in Poland – an emerging market as regards the level of the BIM awareness and its application. The chapter additionally provides a description, results and analysis of the survey and interviews. The current situation in the industry, the problems and potential for the BIM implementation on the Polish market are determined based on own survey. The survey was conducted across organisations where the barriers and benefits arising from the adoption of the BIM methodology were analysed. The evaluation of these studies identified problems in the evolution of the conventional CAD technology and the shift in the design paradigm. The

specificity of the Polish market is defined, the benefits of the BIM methodology implementation are demonstrated, legal and organisational barriers limiting its application in design are identified as well as the challenges associated with adapting new tools and technologies to local standards are indicated.

Chapter 5 – *The BIM and architecture development* – presents a case study analysis. The chapter details the research methodology, including the philosophy behind it, its approach and the research methodology adopted. It explains what method and how the data collection is used. The data acquired represents grounds for the evolution of conventional design creation processes and faster adoption of the BIM methodology by promoting knowledge of its potential, which will facilitate its larger-scale implementation in the country. The benefits of the BIM adoption and the barriers associated with its acceptance were also discussed. The chapter describes a comprehensive data analysis and research results on the analysis of factors that improve the quality of developed architecture by applying the BIM methodology. The chapter concludes with a discussion on the research findings.

Chapter 6 – *Conclusion* – evaluates and summarises the research. It reflects on the objective and implementation of the research tasks, as well as the conclusions supporting the thesis adopted therein. It outlines the original contribution of this dissertation to science and research. Based on the obtained research results and the analyses, specific factors are identified which, when applying the BIM methodology in the Integrated Project Delivery – by considering the current formal and legal requirements as well as the needs of the investment process participants – contribute to an effective improvement in the quality of the developed architecture. The conclusion outlines the results of the author's research work and identifies the prospects and challenges of the BIM implementation.

The findings of the research conducted can be applied to create a common development strategy. The dissertation can also serve as an introduction guide, a map of objectives and benefits and a knowledge resource, thus improving the BIM adoption in an investment process in Poland.

References, list of graphs, tables and figures and abstracts in Polish and English are provided in the final part of the dissertation.