Client and User Involvement Through BIM-Related Technologies

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ABSTRACT

Building Information Modelling (BIM) is part of a wider digital innovation that has arrived as an epocahal transition in the Architecture, Engineering and Construction (AEC) Industry. Although the benefits of BIM within the supply-side of the industry have been widely explored, its impact on the value for clients and end-users has been researched in a limited manner so far. The paper reviews some of the BIM-related technologies which could effectively support client and end-user involvement in the briefing process. Four main types of information technologies are considered and grouped as (1) rule-based validation tools (i.e. briefing software; rule-based model checking) and (2) simulation-based validation tools (i.e. gamification, immersive virtual environments). Those technologies are analysed and compared in order to identify what has already been done, possible future trends, evaluate their integration in the briefing process and, finally, take into account both their advantages and disadvantages in supporting the effective involvement of the demand-side of construction in digitally-enabled processes.

KEYWORDS

BIM, Briefing, Briefing Software, Gamification, Immersive Virtual Environments, Model Checking, User Involvement

INTRODUCTION

Building Information Modelling (BIM) is a set of management processes and information technologies which enable multiple stakeholders to collaboratively design, construct and operate a facility (Succar, 2009). The effective implementation of BIM methods and tools, indeed, is a function of the collaboration level implemented within the project team and it is also affected by the timing from when digital practises and BIM processes are managed (Eastman et al., 2011). A digitally-enabled collaborative process that starts from early design phases, in fact, could have a greater impact on innovation and design quality (Leon et al., 2014). Moreover, the implementation of information technologies and virtual environments in design processes could effectively enable the engagement of the demand-side of construction (e.g. clients and end-users), reducing communication gaps and providing the client with coherent and updated information at each stage of the decision-making process, from requirements setting to building use (Ashworth et al., 2016). Clients and end-users, in fact, are the actual key beneficiaries of BIM (Eastman et al., 2011). As stated in Gurevich et al. (2017), clients have a decisive role in the process of adopting BIM because “they manage the entire process and they are able to influence all of the other parties”, effectively playing as game changers.

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Moreover, the so-called active BIM clients are the ones who are able to clearly articulate what they need to know from the Building Information Model (BIModel) (BIM Dictionary, 2016) at each stage of the decision-making process; they invest in educating their teams to effectively use data coming from BIModels (Saxon, 2016), realising significant benefits over the operational phase and with a positive impact in terms of costs, sustainability and usability of a facility (Ashworth et al., 2016). On the other hand, end-users are the ultimate beneficiaries of the services provided by the building once it is in use (BS 8536-1:2015). They will occupy the building, living and working within it, and it is therefore necessary to consider and manage their requirements and needs promoting their involvement since early design stages (Wang, 2014). To this end, clients should promote a process of stakeholder engagement for representing the needs of end-users (BS 8536-1:2015). The result would be a reduction in the gap between requirements of clients, expectations of end-users and final design solutions, one of the major problems in traditional processes (Kiviniemi, 2005).

Within this framework, the scope of the paper is to review some of the BIM-related technologies used to involve clients and end-users in the digitally-enabled briefing process. The first section describes the research approach, the motivation behind this paper and the methodology applied for reviewing literature. A second section introduces the briefing process and the role of clients and end-users in managing design requirements. The third section investigates BIM-related technologies for briefing and user involvement, describing rule-based (e.g. briefing software, rule-based model checking) and simulation-based tools (e.g. gamification, immersive virtual environments). Finally, the conclusion compares them according to their advantages and disadvantages in supporting the involvement of clients and end-users in the decision-making process and suggests possible further developments.

**RESEARCH APPROACH**

**Motivation and Aim**

This review paper is part of an ongoing doctoral research project aiming at the digitisation of the briefing process, with a focus on operational requirements and social outcomes. Some of the Information technologies (IT) that could be implemented in order to involve clients and end-users in a BIM-based design process are described. BIM protocols and processes are not within the scope of this paper because the structured integration between them, information technologies, soft landings strategies and the briefing process in each project stage is planned as a next step of the research. The motivation behind the proposed research project deals with the need to consider BIM methods and tools as an effective support to the decision-making process; the focus is on early design phases and the involvement of the demand-side of construction in order to improve building use and benefit operations (Haugbølle & Boyd, 2016; Ashworth et al., 2016). To this end, the main actors taken into account in the paper are clients and end-users. Briefing is meant as the process to manage the dialogue between them and the design team that has to answer to their requirements and needs.

**Methodology**

The process of literature review about BIM-related technologies within the scope of this paper has been conducted based on subsequent steps of keywords selection in order to identify, among the journal papers and conference proceedings dealing with BIM tools, the ones focusing on client and end-user involvement in digitally-enabled briefing and design processes. The literature review is based on publications available in online research databases, such as Web of Science, Scopus, Science Direct and Iconda CIB Library. Other than journal articles and papers from conference proceedings, the scope of the literature review includes books (e.g. Blyth & Worthington, 2010; Saxon, 2016), standards (e.g. BS 8536-1:2015) and normative texts (e.g. ISO 9699:1994; UNI 10722-2:2007). The selection has been further narrowed highlighting some of the main representative concepts within
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