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Circumventing obstacles in digital construction design - a workaround theory perspective

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Abstract

Building Information Modeling (BIM) has proven its value for design in the architecture, engineering, and construction industry. However, currently only a few leading firms succeed in reaping the full potential of BIM. Especially, specialist designers remain excluded from innovative practices. Reasons include the technical hurdles of BIM adoption and a misfit between human agency versus the affordances of BIM. Not all designers have the capabilities required to actively partake in BIM. Thus, BIM practice is often 'messy' and characterized by a large degree of unnecessary rework and workarounds. "How and why digital workarounds unfold in BIM design?" is at the core of the inquiry reported in this paper. Based on a 'fresh' theoretical approach entitled Theory of Workarounds, we explicate the nature of BIM related workarounds. The industrial setting involves an office refurbishment project in Oslo, Norway. Many specialist designers remained excluded from BIM in this project and a range of different workarounds have been conducted. We portray how and why digital workarounds happened. This provides valuable learning for researchers and practitioners interested in digital workarounds in construction. We contribute to better understanding of messy practices surrounding BIM and to drawing the attention of scholars to workarounds as an area in need of further research. Lastly, our work constitutes an early application of Alter's Theory of Workarounds in the setting of a construction project.

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1. Introduction

Completing today's large and complex construction projects at the necessary speed could not be done without advanced Information Technology. Especially, Building Information Modeling (BIM) systems have proven their value

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for construction design (McGraw-Hill, 2012). However, research to date has documented how many project teams struggle with how to work based on this new technology (Merschbrock, 2012; Merschbrock & Munkvold, 2012). Statistics show that all construction information needs to be re-created and/or reentered four to eight times throughout the life cycle of a project (Davis, 2007). Using BIM for integration and collaborative design remains challenging (Dossick and Neff, 2013). So far, only few, highly IT literate, and leading construction corporations enjoy the benefits of BIM technology, whereas those working in the periphery of the digital innovation networks (e.g. geo-technical, fire-protection, acoustics engineers, contractors, suppliers) are frequently excluded from the innovative practices (Leeuwis et al., 2013; Yoo, 2010). Features of the architecture, engineering, and construction (AEC) industry negatively influencing BIM deployment include its fragmented nature, the slow development of common data-exchange practices, and the lack of knowledge about the possibilities of information and communication technology (Dubois & Gadde, 2002; Howard & Björk, 2008; Linderoth et al., 2011). Thus, the current BIM design practice is 'messy' and characterized by redundant and unnecessary rework and workarounds (Dossick & Neff, 2011).

Workarounds can be defined as steps taken by practitioners faced with inadequate resources (Dalton, 2013). Researchers studying the enactment of integrated information technology (e.g. enterprise resource planning ERP) report that users respond in with inertia and reinvention in situations where technology is perceived as constraining. Users avoided system use as much as possible (inertia) or they worked around the systems constraints in unintended ways (reinvention). Reinventions are "unintended uses of technology where users compensate for their limited knowledge of the system and perceived technology deficiencies by developing tweaks and workarounds" (Boudreau & Robey, 2005 p.9). Using integrated technology requires a high degree of coordination especially when users are interdependent in their work tasks (Alter, 2014; Merschbrock & Wahid, 2013). Overcoming obstacles emerging in technology and task coordination requires users to resort to workarounds (Merschbrock & Wahid, 2013). Another source for workarounds are so-called technology misfits, situations where the new technology simply does not fit the realities of day-to-day work (ibid.).

BIM systems are intended to serve as a design space where multiple actors engage in collaborative design work. Thus, BIM systems fall within the category of integrated systems as they are designed for facilitating business transactions across organizations. Consequently BIM users are confronted with some of the same challenges users of other integrated technologies experience. For instance, many institutionalized ways of working in the construction industry need to be disrupted for making BIM work, hinting a technology misfit between BIM and established day-to-day work (Dossick & Neff, 2013). Thus, it is not surprising that researchers find BIM work to be characterized by poor communication and workarounds (Love & Li, 2000).

A review of workaround literature suggests that workarounds in organizations are both understudied and conceptualized (Alter, 2014). The author addressed this shortage by suggesting a theoretical framework called "theory of workarounds" derived from extant literature. Theory of workarounds draws from loose coupling theory in that it conceptualized workarounds along five voices (Orton & Weick, 1990). Moreover, the theory is a process theory useful for "classifying workarounds, analysing how they occur, for understanding compliance and noncompliance to methods and management mandates, for incorporating consideration of possible workarounds" (Alter, 2014 p.1041). In this paper, we put this 'fresh' theory to an initial test by exploring how well it serves for explaining workarounds happening in digital construction design based on BIM. The intention of applying workaround theory to the context of construction design is to add to the understanding of why many project teams struggle when working based on BIM. Thus, we ask the following research question:

How can workarounds happening in digital construction design based on BIM be explained?

In order to address the research question, we conducted a case study of digital construction design in an office refurbishment project in Oslo, Norway. We focused on the digital design work and present examples of workarounds conducted to circumvent challenges related to BIM. The case project is Norway's first 'green' refurbishment project to be awarded a 'BREEAM-NOR©' Outstanding score, making it a national role model for successful sustainable design. This complex project where BIM had been prioritized in design was considered a good fit for our study. Studying workarounds in the context of digital design is important for pinpointing what triggers workarounds.