Construction Site Communication Study Using the RAM Management System for BIM Adaptation

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ABSTRACT

The UK’s construction industry is witnessing an annual increase in costs due to a lack of communication between the different organizational operators on the construction site that often leads to construction defects. Meanwhile, a cost-reduction strategy plan using BIM has become a fundamental requirement for the government, aiming to keep costs under control. To facilitate BIM adoption in the industry, the BIM strategy was introduced in four phases, with each stage entailing a number of criteria. The industry has seen a global reaction to the Level 2 BIM program and a significant cost saving of 840M in 2013/14 in Europe. However, the industry is unable to match the level 3 BIM, where a collaborative model file server is required as a common sharable platform to achieve efficient communication. This study contributes toward formulating a communication framework in the UK industry to understand communication issues and manage defects. A survey was targeted at construction industry practitioners and academics, with a total number of 328 participants.

KEYWORDS

Building Information Modelling, Communication Tool, Communication Tool Assignment Matrix, Organization Breakdown Structure, Responsibility Assignment Matrix, Work Breakdown Structure

INTRODUCTION

The construction industry is considered to be a key sector of the UK economy. 57% of construction budgets is wasted or becomes non-added value, as estimated by the Construction Institution (McNell, 2008). Over 20 billion per year in the UK is wasted on construction defects, much of which is caused by communication failure between the organizations operating on the construction site (Ernest, 2004). The government started a BIM implementation strategy that consists of 4 levels. In 2016, level 2 BIM compliance became compulsory in the public sector. This step has led to strong collaboration between the government and the industry to reduce costs further. BIM implementation has shown that an additional global 804M was achieved in 2013/14 in France (compulsory in 2017), Germany (compulsory in 2020) and other EU nations, as recorded by the Cabinet Office (Modelling & Plan, 2015).

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The majority of communication tools used on-site display building information as 2D drawings, (e.g. plans, sections, site plans) which unfortunately often proves to be ineffective and can lead to construction errors, as only experienced and well-trained organizational personnel are able to use them to communicate effectively on construction sites (Wang, 2006). However, the upcoming BIM level 3 raises the complexity level, requiring the integration of a multidisciplinary model using a web based environment in a centralized server instead of local servers. However, a similar system of a web based environment BIM server model has not been proposed until now (Gu & London, 2010).

Building construction is a complex set of tasks that involves a number of different parties and many activities that need to be organized to perform together at the same time. Regardless of the project size, construction companies find it beyond their capabilities to perform all construction activities without interacting with a number of organizations, including architects, engineers, consultants, contractors, clients, etc. In addition, a wide range of data needs to be dealt with, ranging from architectural data, structure systems, mechanical services and other factors, that increases the complexity even further (Steel et al., 2009).

Typically, 2D drawings and other types of documents are the most commonly used medium for communicating and sharing information on construction sites. Because of construction’s need for frequent information updates, companies try to find a solution to improving communications with other departments, such as using software tools to define the design model details. Although software tools do help companies to organize and manage complex data, designs are still frequently rendered as 2D drawings when they need to be communicated to other collaborators on-site (Howard & Penttilä, 2006).

2D drawings are essential for any project to succeed as a communication tool. Their importance is not only in helping to describe the design project, but they can also serve as information records to identify miscommunications easily in the case of a design issue or construction defect occurring on-site. 3D models are often used to provide additional information compared to the 2D versions. In the case of architecture and design practices, 3D models tend to be used to share knowledge, such as about the building materials employed on the building façade, to create a virtual affect and so convince the clients about the design. In contrast, these types of materials were intentionally selected for presentation purposes only and were not meant for construction site use (Steel et al., 2009).

Communicating information in this complex environment, such as architectural materials, can easily lead to miscommunication if this information is used on-site. The only solution is to perform multiple data inspections to ensure that the right information has been delivered to the correct place (Steel et al., 2009).

**Building Information Modelling Current Status**

The UK construction industry is facing an overlapping issue, characterized by the project specifications, project nature, project life duration and unavailability of standardization in the product process. All of these challenges have made the industry more competitive than ever before, as well as lowering the profits to a minimum and raising costs (Charalambous et al., 2013). To adapt to all of these challenges, a BIM implementation model has been developed by the UK Department of Business Innovations and Skills (BIS), defined in four different levels, starting from level 0 up to level 3, to facilitate BIM adaptation in the construction sector. Building information modeling is a methodology for interdependent networks to manage the essential building data in a digital format throughout the project lifecycle (Howard & Penttilä, 2006). As an emerging management tool, it is considered to be useful for increasing efficiency, as lower costs improve collaboration in the design and process (CITB 2014). However, based on recent studies (People et al., 2012), it has been found that 64% of construction companies are still at level 1 of BIM implementation, with the exception of a few companies such as Arup that are experiencing the advantages of level 2 (Figure 1).

The introduction of BIM level 2 in 2016 addresses the above issues. A significant realization of BIM’s value has started to emerge and a BIM framework adaptation has become a necessity for
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