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A Chinese Construction Engineering-Based Study Involving the Integration of Quality Control, Lean Structures, and Building Data Modelling

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Abstract

As a result of the "because of the country's poor standards for construction, China's construction industry has suffered significantly (which refers to existing defects, not deliver value to the customer and not meet the expectations of the customer). Increasing the quality of Chinese construction is hindered by the question of how to do it. Research has revealed that both BIM and lean construction have the potential to improve building quality (Misfeld and Bonke., 2014; Marosszeky et al., 2002; Kim et al., 2015; Park et al., 2013; Wang et al.,2015). On the other hand, Lean and BIM aren't panaceas for all construction defects. Utilizing lean construction and building information modelling together is more effective than using each method separately. There is a paucity of quality-based links between lean construction and building information modelling (BIM) during the construction phase. The design management, integrated framework, and visual management of BIM and lean construction are currently the subject of academic inquiry. Nonetheless, it's certain that quality is ignored, especially in the "development. It's difficult to find much research on this topic. The combination of lean building methods with building information modelling (BIM) has been proven in certain research to improve building quality "quality (Liu and Shi, 2017; Laine, Alhava and Kiviniemi, 2014). Especially in the context of China's current construction boom, studies on how lean construction and BIM might improve construction quality are still missing. If we can improve our understanding of quality-based interactions, lean construction and BIM might be used to raise the bar in Chinese building. Therefore, further research must be done to fill up the gaps in our understanding. These considerations drive the need for studies of the synergistic effects of lean construction and building information modelling on project quality. Before now, interactions during the construction phase "been identified as the focus of this investigation, and the study will stop here.

Keyword: Design Management, Lean Construction

INTRODUCTION

Construction in "China, a key component of China's economy, has grown at an unprecedented pace with the fast growth of the country's economy (Wei and Lin, 2004). With a GDP of 6.66 percent of the country's GDP in 2016, China's construction industry had a GDP of $19.35 trillion (Sinchew, 2017). In 2017, China's construction sector employed a total of 61,576,100 people (CEIC, 2018). However, despite the fact that China's building sector is massive, it lacks in quality (Liu, 2016). Every country tends to struggle with building quality (Guan and Li, 2011), but China's issues are particularly grave (Wang, 2013). Many people have died and a considerable deal of property has been destroyed as a result of quality-related mishaps occurring so often in China. Quality defects are reported by 46 percent of clients, according to a survey (Xinhua, 2013). The Chinese government shifted the construction quality management mode from inspection quality management to statistical quality management and subsequently to overall quality management in order to address the quality issues (Zhang, 2008; Zhang, 1999; Zeng et al., 2003; Shen and Chen, 2015). There is still some way to go before the quality of construction is acceptable (Ou, 2012). BIM and lean construction have also been introduced by the Chinese government to enhance construction quality in recent years. In China, the use of BIM's clash detection feature has been widely used to improve building quality (Liu, 2016). For the past several years, some of the lean construction principles have been used in China to address quality issues (Wen, 2000). Good quality building means" eliminating faults, delivering value, and meeting the customer's expectations. China's construction quality increase can be attributed to these factors.

LITERATURE REVIEW

In lean construction, "every customer's expectations are met or exceeded, waste is eliminated, and value is sought (Dickmann et al., 2004). With its roots in Toyota's production system TPS, lean construction has become a global phenomenon. When it comes to lean construction, China is only now getting on the bandwagon (Tan, Xia and Yang, 2014). However, the extent to which lean construction is used in China varies (Ou, 2012). There are some firms who have already implemented this approach successfully, while others are only beginning to do so (ibid.). In the last" several years, various lean techniques have been used in China to enhance building quality.

Using BIM, a "new construction method, architects and builders can design and build structures digitally. Sacks, Radosavljevic, and Barak (2010) describe BIM as a parametric objective modelling technique that can show construction information and perform simulations. Conveniently constructing what will be built on site in a virtual environment saves time and money (Azhar et al., 2008). Even though BIM has just recently arrived in China, there is little question that BIM has garnered a lot of attention there (Liu et al., 2017). According to a 2013 research, 55% of construction organisations had heard of BIM, however just 15% of construction companies utilised BIM in their projects (Chinese Construction Industry Association, 2013). BIM was only used on roughly 40% of Chinese construction projects in 2016. (Lu, 2018). According to the relevant papers from the People's Republic of China Ministry of Housing and Urban-Rural Development (2015), integrated BIM will be used in

90% of new projects by the" end of 2020. Currently, some of the BIM's features are being used to enhance the quality of construction.

STATEMENT OF THE PROBLEM

There is a lot of "attention on project management, cost, performance, implementation, design management and the customers in lean construction research at the moment (Alves and Tsao, 2007). While lean construction has garnered a lot of attention, quality has been overlooked in the studies. Lean construction and construction quality made up just 0.7 percent of the papers published between 2000 and 2006 on lean construction (ibid.). The studies that have looked at quality in lean construction aren't very in-depth, though. As evidenced by the current research (Misfeld and Bonke, 2004; Marosszeky et al., 2002; Liu and Shi, 2017), lean construction may increase the quality" of a project. There aren't enough studies looking at how things work together, especially during building.

Objective of the Study

- To "examine the quality-based lean construction methods and the quality-based" BIM methods.

Research Questions

- What is the "relation between lean construction and BIM approach"?

Research Methodology

A detailed study "of the quality-based interactions between lean construction and BIM is still lacking. As mentioned by Saunders et al. (2007), exploratory research may be used to discover new information. As a result, this study used exploratory research. In light of the literature review, further research is needed in this area. Qualitative research, according to Thomas (2003), is an effective method for investigating unfamiliar issues. Professionals' perspectives might be gleaned via case studies and questionnaires. With the use of these strategies, the researcher may accomplish their goal. Research methodology, procedures, and data collection strategies have been selected based on the findings of the literature evaluation, and the impacts are addressed further along with the" reasons for each research approach. Research approaches used in this study are summarised in Table 1.

Table 1: Summary of Research Methodology

Research methodology	Adopted in this research
Research philosophy	"Real is montology and interpretivism" epistemology
"Research approach"	"Qualitative research"
"Research design"	"Case study and survey"
"Data collection technique"	"Data collection techniques in case study" • "Documentation" • "Directly observation" • "Interview" "Data collection technique in survey" "Interview"

Research Design

In order "to gather data and make conclusions, the research design is utilised to find the best method of doing so (Fellows and Liu, 2008). Researchers utilise research design to decide not just how they will gather and analyse data, but also how they will conduct their research. There are a variety of ways to do research. Action research, ethnographic" research, experiments, case studies, and surveys are all typical research design types.

Data Analysis

The "Interview data from the case study will be evaluated thematically. This approach is simple enough that even inexperienced researchers won't be put off by the prospect of working with complex qualitative data. It's possible that a theme analysis framework may be utilised to give an in-depth and all-encompassing interpretation of the data. The procedures below will be implemented "in order to reach this objective.

Studying the data that has been gathered

Along these lines, "In order to answer these two questions, it is necessary to look at every piece of evidence to see if it supports the hypotheses. In the next part, we will discuss the interview data analysis concepts that will be applied to the interview transcripts. Some notes will be taken now to underline the most crucial "details.

The Creation of Primitive Codes

In theory, you could "Locate the codes using either a manual process or a piece of software like NVivo. In this investigation, we employed a manual method. Highlighters, pens, and Post-it Notes will be used to take notes. We'll be transcribing the recordings and encoding the key phrases. It was necessary to uncover as many potential codes as possible. All information that shared a certain code will be compiled "together.

Looking for a direction to take, it "We started categorising the many codes into doable groups at this point. A mind map was utilised to help them zero in on the key topics. Codes will be recorded there before being analysed and themes drawn out on A3 paper. Putting these papers up on the wall in a group helped us obtain a more holistic view of the situation "themes.

It's worth going through the main points again.

And it will "This may have been the time at which we first started categorising the various codes into potential themes. The key ideas were uncovered with the use of mind mapping. A3 paper will be used to record the codes, analyse them, and develop themes. Putting these sheets up on the wall helped everyone gain a better sense of the big picture "themes.

CONCLUSION

Here, "This paper describes the steps taken to create and verify the proposed quality-based lean and BIM interaction framework. Two-level interaction matrix listing 17 quality-based strategy interactions and 11 implementation interactions. The two-tiered frameworks are shown in Tables A and B. The reader's grasp of the interactions is facilitated by the concise and

straightforward exposition. An interaction framework is the focus of this investigation. The framework will be developed based on the results of surveys and case studies. This research explores the links between building information modelling (BIM) and lean construction (LC) from the perspective of improving project quality. Based on this paradigm, further research into raising the bar of Chinese construction quality should centre on lean construction and building information modelling. This model may be used to look at how lean building practises can "in building information modelling (BIM).

Limitations of the Study

When "discussing the amount of case studies required, time and resources will be taken into account. While in China, a researcher had the opportunity to interview construction workers and gather data from their perspective. As a Chinese national, access to case study material will be difficult to get since only a small number of contractors will be dealing with the difficulties outlined in this study. Additional case studies may have made this work more helpful, but given the paucity of awareness about lean construction inside Chinese contracting organisations, this would not have added much to the research. Even while the case studies cannot be considered as representative of the building sector in China, they do assist to show concerns that could not be discovered by other data gathering" methods, such as questionnaire surveys.

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