BIM based Design Management of a Building Project Collaboratively Designed with a Foreign Design Firm in China: A Case Study

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ABSTRACT

In parallel with China’s growing construction market, there has been an influx of foreign architectural and engineering design firms into the Chinese construction market. Those firms generally form partnerships with local Chinese firms or institutions to overcome various complications in the country. Adding to the complexity, relatively recent technologies such as Building Information Modelling (BIM) also started to play a role in those collaborative project design management efforts in China. This paper presents an in-depth case study of a complex building design project collaboratively executed using BIM by a foreign design firm from the USA and local Chinese firm in China. The project was analysed from different design management and stakeholder perspectives. Some of the findings confirm the previous accounts from the literature. New insights and the key lessons learned for BIM based design management in this context are also presented.

KEYWORDS
Building Information Modelling (BIM), China, Foreign Design Firms, Partnership, Project Design Management

INTRODUCTION

China has experienced a rapid economic growth since the early 1980s, averaging an annual economic growth of over 9% in Gross Domestic Product (GDP) since 1978 (NBSPRC, 2015). The construction industry is playing a leading role in this rapid economic growth. The average annual growth rate of the Chinese construction industry is 10.4%, which is higher than that of its GDP, and the industry is presently one of the world’s largest with a total output of 17.67 trillion Yuan (RMB) (2.88 trillion US$) in 2014 (NBSPRC, 2015). In line with this growth, there has also been a rapid influx of the number of Foreign Architectural & Engineering Design Firms (FDFs) penetrating in the Chinese market in the past decade, especially after the country’s entry into World Trade Organization (WTO) in the late 2001. Due to the current complexities of the construction regulations and legal restrictions, many top FDFs entered the Chinese market by means of either project-based collaborations with domestic design institutes/firms or establishing liaison offices (Ling et al., 2005; Xu et al., 2005b; Ling & Low, 2007; Zhao et al., 2012).

In China, the design process is divided into the conceptual design, preliminary design and construction documents phases. On the other hand, in Western countries, the design process consists of three main phases: the schematic design phase, design development phase, and construction...
documents phase (Wang, 2000). In practice, schematic design corresponds to conceptual design and the design development phase is similar to the preliminary design phase in China. However, the contents of design documents in those phases are different, particularly in construction drawings. In China, construction drawings submitted by local design firms are so detailed that contractors can even use them directly for work without having to create their own shop drawings. If there are some drawings similar to the existing “shop drawings”, they are produced only to direct site workers and are not submitted to architects for approval. In contrast to the Chinese practice, construction drawings by foreign designers are often not that detailed and consequently, shop drawings by contractors must obtain architects’ approval. Due to the difference in understanding of the design process and design documentation, in a project that is cooperatively designed with FDFs in China, FDFs normally play a main role in the conceptual design phase or preliminary design phase; whereas the necessary construction documents are completed by local design firms (Xu et al., 2004). In the collaborative execution of projects’ design, if the communication between FDFs and local design firms is not complete and fluent, the inefficient cooperation could lead to negative effects on projects’ time, cost, and even quality targets (Pheng & Leong, 2000; Gale & Luo, 2004).

On a global scale, construction projects are becoming much more complex and difficult to manage with increasing reciprocal interdependencies between different stakeholders (Alshawi & Ingirige, 2003; Chan et al., 2004b; Clough et al., 2008). In the Chinese case specifically, the rapid growth within the industry and fast-paced design and development processes can also cause communication challenges in the design phase (Zou et al., 2007). For instance, in some projects, especially in large-scale and complex projects, fast-paced design processes often lead to an insufficient understanding of or consensus on the design requirements (Assaf & Al-Hejjji, 2006). Also, in general, the investment in construction design has been traditionally low, representing only a minor portion of the total project cost, despite the fact that the design phase has significant impacts on both the construction and maintenance phase. In the construction industry, a reasonable and high quality design can accelerate construction delivery and reduce construction costs; on the other hand, low quality design outcomes suffering from communication and coordination issues could extend the construction durations, increase total construction costs and generated construction wastes (Sambasivan & Soon, 2007; Sun & Meng, 2009; Lu & Yuan, 2010; Xie et al., 2010). Under the light of the current situation, where schedules are tight and many design changes are common, design management becomes even more important to ensure value creation through high quality and timely design solutions. With the increasing complexity and scale of projects, the traditional approach of using 2D Computer-Aided Design (CAD) technologies is constrained by its capabilities to effectively answer to those design management requirements. Frequent design changes and corresponding needs to update relevant plans, sections and elevations can quickly become unmanageable with the extensive coordination need among different design trades and stakeholders as project sizes grow. In order to solve such design update and coordination issues, to better cope with design management complexities and to improve the design quality, more and more researchers and design practitioners are discussing the use of Building Information Modelling (BIM) in an effective way (Azhar, 2011; Eastman et al., 2011; Bryde et al., 2013; Wong and Fan, 2013). Despite some clear developments in the past decade, the overall adoption rate of BIM in China still remain considerably lower than that of pioneering countries (Cao et al., 2015). To better understand the current situation in China, this paper presents a case study to illustrate the key challenges faced in the design management of a complex construction project cooperatively designed using BIM by a local Chinese firm and a FDF. Some of the communication and coordination challenges are analysed and the key lessons learned are documented, as it is argued that the BIM adoption condition in China can be better understood under the light of the country’s specific construction conditions, general design management practices and engagement modes with FDFs.
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