

Prospects of Building Information Modeling (BIM) in Malaysian Construction Industry as Conflict Resolution Tool

Syed Shujaa Safdar Gardezi^{1*} Nasir Shafiq¹ M. Faris B. Khamidi¹

1. University Teknologi Petronas, Bander Seri Iskandar, 31750 Tronoh Perak, Malaysia;

*Email address of corresponding author: engineershujaa@gmail.com

Abstract

The construction industry of today's world is becoming more challenging and the projects, on the other hand, are becoming more complex than before. The projects in construction industry consume huge proportions of resources especially in-terms of financial resources. Malaysian construction industry is also no exception to this challenging environment. Different concepts and technology innovations have been developed to mitigate and rule out factors affecting the performance of the construction industry. Building Information Modeling is one of them (BIM). The BIM technology helps building in a virtual environment prior to physical construction. This objective of this study is to propose a model / frame work based on BIM technology which will allow reducing the potential adverse affects of delays, cost overrun, productivity, quality and other errors in the light of the available literature and past construction practices. The paper highlights the challenging issues like construction delays, claims, design changes, delayed approvals etc.

Keywords: Building Information Modelling (BIM), Construction Industry, Construction delays, Claims, Malaysian Construction Industry

1. Introduction

Construction is one of the major industry contributing significantly in the economy, in terms of GDP, for the most of the countries especially developing countries. Despite of the fact stated above, the construction industry is not performing to its fullest potential in almost all countries due to certain barriers caused due to its volatile nature. The nature of construction industry is such that there is an inherit conflicting issues between the major construction project stakeholders, participants, owners, design professionals, consultants, contractors. The history of such issues is well known to the players that have been in the industry for quite some time. The one important fact that remains to be accepted that the nature of human beings is such that it is not possible get entire satisfaction in any aspect of any works. Same is the case with the construction industry. No matter how advanced and sophisticated the technology becomes, the scheduling methods improve, manufacturing and computer modeling methods innovate and construction methods become hi-tech, the never ending war of interests between the major roles of a construction project are likely affect the potential performance of the industry forever. Given the inevitability of conflicting interests of human nature, one must be wondering whether there is a hope for the industry for reducing the severity and extent of such interests. But there is always room for improvement and fortunately, the affects of such conflicting interest can be minimized up-to a great extent by using proper knowledge, professional skills and technology advancements and innovations.

The Malaysian economy is a fast growing economy in South-East Asia (Sambasivan & Soon,2007). The Malaysian construction industry is one of the main pillars of the country's economy. In addition, it also provides a large no. of employment opportunities for the skilled, semi-skilled and unskilled labor force. However, the Malaysian construction is no exception to conflicting issues and the projects in Malaysia also continue to suffer from such environment. The issues like construction claims, design errors, poorly defined scope of work, poor communications, unrealistic expectations, project delivery methods, sustainability issue, ineffective and inefficient methods and practices, difficulty in securing timely and adequate financing at various stages of construction and difficulty in repatriating profits / dividends, inability to provide total integrated solutions in foreign projects and inadequately trained workforce also impairs the industry's ability to adopt new technologies and to cope with new challenges.

The construction industry of today is at the cross roads of change. Looking to the future is an important aspect in its improvement. Different advancement in technology and specific knowledge areas along with proper skills can help and lead to offset maximum effects of such confliction environment. Building Information Modeling (BIM) is one of such technology innovations. Building Information Modeling (BIM) represents the process of development and use of a computer generated model to simulate the planning, design, construction and operation of a facility in a virtual environment as shown in Figure 1.

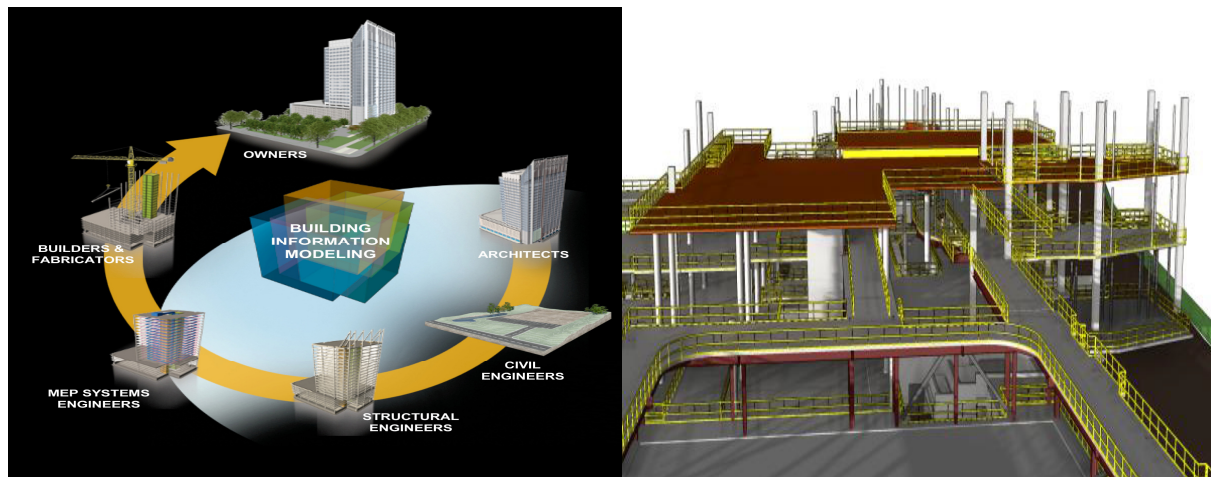


Figure 1: BIM Generated Model (Salman et al , 2012)

The resulting model, a Building Information Model, is a data-rich, object-oriented, intelligent and parametric digital representation of the facility, from which views and data appropriate to various users' needs can be extracted and analyzed to generate information that can be used to make decisions and to improve the process of delivering the facility (AGC, 2005).

This study is aimed to propose a model based on Building Information Modelling (BIM) technology innovations which will act as conflict resolution tool for major current issues which occur between the different stake holders of Malaysian Construction Industry.

2. Literature Review

The construction industry is subject to more risk and uncertainty than other industries. Construction projects involve complex and time-consuming design. The processes of construction are also characterized by unforeseen circumstances (Acharya et al ,2006). As a result, risk management has become a major problem that confronts the construction industry (Ogulana, Promkuntong & Kearkjirm).Mainly there are three main stake holders of a construction project i.e. the Client/Owner, Consultant and the Contractor. The conflicting issues in the construction industry are being categories according to these three (Sambasivan & Soon,2007):

Client/Owner Related Factors:

Proper arrangement of funds, timely payments, and owner's interference, slow process of decision making and approvals, unrealistic time durations, frequent design changes.

Consultant Related Factors:

Delay in approval of variation statements, discrepancies between contract documents, delayed preparation and approval of drawings, quality assurance and waiting time for approval of test and inspection.

Contractor Related Factors:

Poor site management, improper construction methods, improper planning, errors during construction, inadequate experience of the contractor, level of labour and staff hired, lack of procurement schedule, organizational structure.

Two major common issues of conflicts i.e. construction delays and claims are being focused in this study.

2.1 Construction Delays

The delays in the construction industry are a global phenomenon (Sambasivan & Soon,2007) and are considered as one of the most persistent problems throughout the world (Tumi SAH & Omran,2009). Delay may be defined as an event that causes prolongation or extension of time to complete all or part of a project (Sambasivan & Soon,2007). It may also be defined as the time overrun, either beyond the date for completion specified by the contract or beyond the extended contract period where an extension of time has been granted (Fugar & Agyak ,2010). The six most attributed affects of delays are: time overrun, cost overrun, dispute, arbitration, total abandonment and litigation (Aibinu & Jagboro ,2002).

The key controlling features of time, cost, quality and safety for a project are adversely affected by the impacts of such delays. The delays in construction industry have many after effects among which the main are time extension, cost overrun, disputes, arbitrations and litigations etc (Bryan, shapiro & Knutson ,2005).A project may be facing delays in all phases of project life cycle. However, the construction phase is the one with the occurrence of most delays (Acharya et al ,2006). Delays give rise to disruption of work and loss of productivity, late completion of project increased time related costs, and third party claims and abandonment or termination of contract (Tumi SAH & Omran,2009). The main causes of the delays in construction projects may be delayed payments, lack of instructions, delayed decisions, changes in the design etc. So it is essential to define the actual causes of delays in order to minimize and avoid them in any construction project.

2.2 Claims

The construction claims are one of the most occurring events in the construction projects (Bryan, shapiro & Knutson ,2005). There may be two main types of such claims: time extension claims and financial claims. These claims probably cause more disputes than any other contractual or technical issue. The major causes of the claims may be delayed payments, delayed approval, disruption of works, cost overruns, change in scope of work, additional works etc (Sambasivan & Soon,2007). Almost 95% of all the claims arise out of the state of contractual relationship between the parties involved in the project (Bryan, shapiro & Knutson ,2005). Provided that principal stakeholders spare a little time and emphasis on this issue, most of such conflicts can be easily avoided or settled without any delay.

2.3 Building Information Modeling (BIM)

Building Information Modeling (BIM) is also known as n-D Modeling or Virtual Prototyping Technology. This revolutionary development in technology is quickly reshaping the Architecture-Engineering-Construction (AEC) industry (Salman & Tayyab ,2006). It is a technology as well as a process. The main edge of BIM is that it enables project stakeholders to visualize in a simulated environment what is actually going to be built and helps them to identify any potential conflicting issues pertinent to design phase, construction or operational phase (Salman et al, 2013).

The model characterizes the geometry, spatial relationships, geographic information, quantities and properties of building elements, cost estimates, material inventories, and project schedule (Salman et al, 2013). It can be used to display the entire life cycle of a building project.

2.4 Construction Industry of Malaysia

The Construction industry of Malaysia is making its vital contribution in the followings economic sectors: energy, water resources development, communication, building, architecture and planning, public health engineering, oil and gas, petrochemicals and industries etc. A revived construction industry striving for excellence shall lead Malaysia to world class country by improving its overall performance in terms of quality, efficiency, productivity, site safety, environmental sustainability and customer satisfaction.

3. Research Methodology

A comprehensive literature review has been carried out for the issues resulting into delays at the project site in Malaysian construction industry. Significant factors resulting in delays have been identified from these studies and are streamlined with the innovations provided in the BIM technology. Different features of BIM technology are being applied on these identified factors and a model has been proposed accordingly.

4. Proposed Conflict Resolution Model based on BIM

Considering the conflicting issue related to the three prime stakeholders (Client, Consultant and Contractor) for the most of the projects, a conflict resolution model is being proposed, in Figure 2, which is based on BIM innovations.

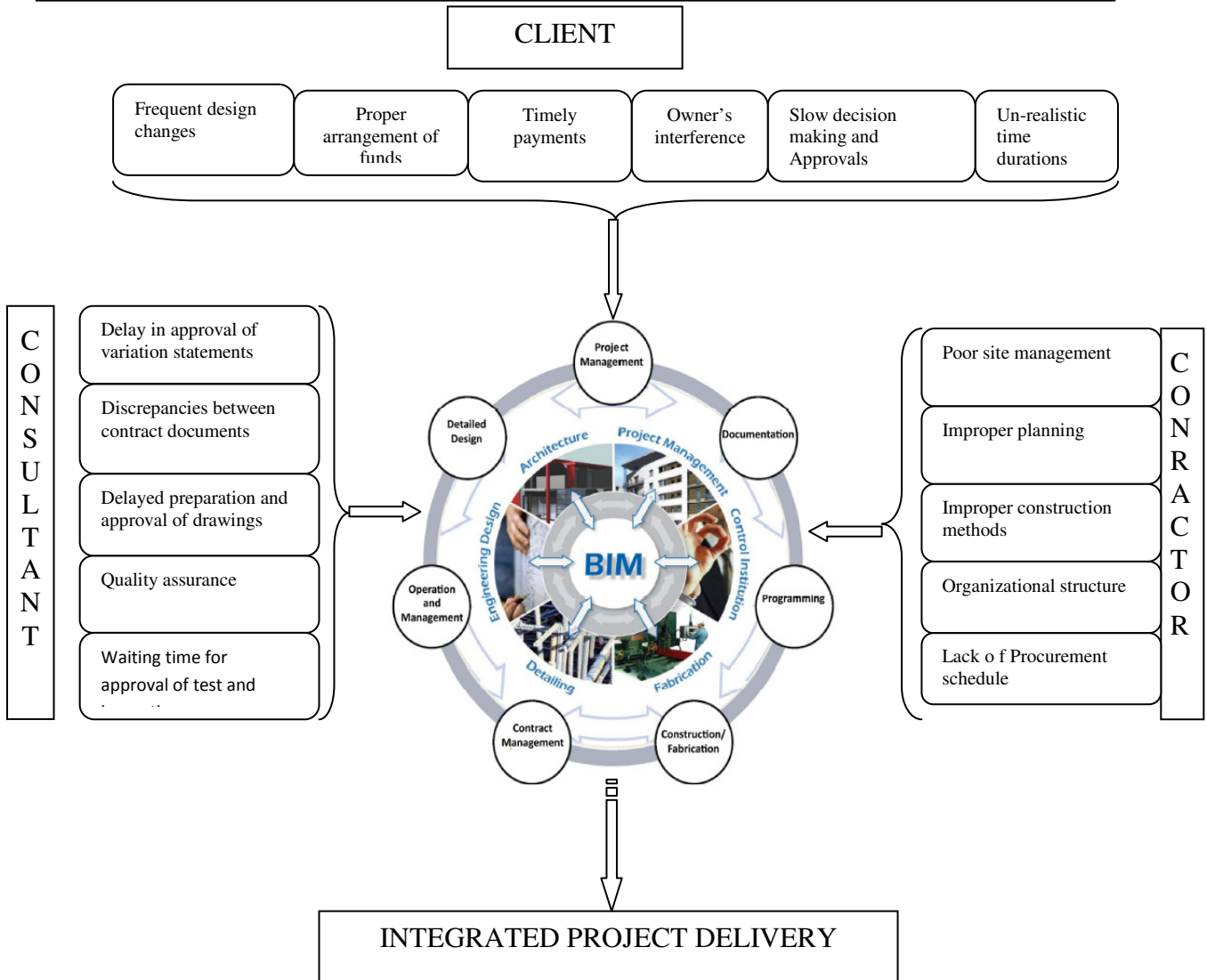


Figure 2: Proposed Model for Conflict Resolution through BIM

4.1 Client Related Factors

The conflicting issues pertinent to the clients are mostly related to financial management, timely decisions and realistic construction schedules. Clients can benefit significantly from BIM processes and tools to streamline the conflicting issues mentioned above. The ability of BIM to generate automatic quantity surveying from the project model under consideration shall help Clients to manage their financial arrangements at an early stage and effectively monitor the same when the actual execution takes place. A working environment between different stakeholders under BIM umbrella shall enable the Clients to reduce errors, avoid changes during execution and enable the clients to achieve a more efficient, well coordinated and reliable delivery process which ultimately shall result in reduction of project expenses and time.

4.2 Consultant Related Factors

The issues of conflicts pertinent to the consulting firms are mostly related to the documentations. The ability of BIM to provide for a proper documentation directory is key to resolution of these issues. The ability of BIM to generate conceptual design, integrated engineering services, construction level modelling and design-construction integration are key features that shall ensure the timely generation and approvals of VOs, integration between different project documents, prompt delivery of drawings, perform routine inspection and ensure quality assurance and quality control for the consulting organizations.

4.3 Contractor Related Factors

The conflicting issues of the Contractor firms are mostly related to construction and site management e.g. poor site management, improper planning, improper construction methods, lack of organizational structure and lack of procurement schedules. The conflicts arise when the contracting firms lose a lot of time and finances for their

improper management and they do not get compensated for that even if they are themselves on the fault. The BIM technology provides a very efficient solution for that also. The 3D attribute of BIM helps the Contractors to observe the construction of building in a virtual environment which helps them to improve their site management, construction methods and strengthen their organizational structure as per project requirement. The 4D (time) attribute shall enable the contractor to explore project phasing and construction sequencing of the activities and ensure proper utilization of time frame allotted for completion. The 5D (cost) innovation of BIM can generate automated quantity take-offs and cost estimates at the design stage. If the contractors properly implement this innovation of BIM, it shall enable them to achieve a very comprehensive procurement schedule for them. They will be able to plan their procurements according to the construction phase of the project well before when its actual stage of execution is reached.

Conclusions

An integrated construction industry capable of continuous improvement towards excellence in a market-driven environment is our vision. By implementation of BIM, all conflicts or clashes between building systems can be worked out prior to physical construction beginning. Some of the long terms gains expected in Malaysian construction industry, by implementation of proposed model based on BIM technology innovations, are

- Avoidance of Delays
- Integrated Building Structures
- Timely Completion
- Innovative Project Award And Delivery Mechanisms
- Procurement, Engineering And Construction Process
- Constructability Analysis
- Cost And Schedule Controls
- Dispute Resolution Provisions
- Research and development Opportunities

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