



JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Review Paper on Construction Quality, Cost and Material Management Using BIM

Miss Pranshu S Saksule¹, Asst. Prof. Ashish Ugale²

^{*1}Miss Pranshu S Saksule (P.G Student, Construction Engineering & Management, Department of Civil Engineering, PRMCEAM, Badnera)

²Asst.Prof. Ashish Ugale (Assistant Professor of Construction Engineering & Management, Department of Civil Engineering, PRMCEAM Badnera)

Abstract: Main essence of the success of a construction project is information. The degree of accuracy and detailing provided at each and every stage of a construction project is very important. To achieve this, till today many information techniques are used by construction companies. Integrated project approach helps to improve bonding between different parties involved in a project and Visualization design approach improves project understanding and helps for clash detection at early stage of a project. The common issues faced by construction industry are time delays & cost overruns. This problem mainly because of incorrect and insufficient inputs and lack of information sharing. BIM will definitely help to overcome these conditions in construction industry. This paper is going to concentrate on the application of 5D BIM for cost control of a project. This tool facilitate with different cost related activities such as scheduling & monitoring of cost of a project.

IndexTerms: Building information modeling(BIM), CAD, AEC, Cost control, 3D

I. INTRODUCTION

This study focuses on the application of BIM on quality, cost and material management. Achkar (2016) mentioned that the core concepts of management include quality control, quality assurance and communication protocol. The communication protocols encompass a) Organizational structure and responsibilities of project stakeholders; b) Communication channels; c) Frequency of information exchange. Lee et al. (2014) indicates that the Quality Assurance (QA) and Quality Control (QC) tasks to be conducted onsite include the review, testing, inspection, quality control documentation and record keeping in the file management system. It is evident that construction companies need to deal with the onsite tasks involving certain degree of complexity in order to reach higher quality. Hence, project efficiency can be enhanced on site with sufficient tools and support. Therefore, it is crucial to promote the utilization of BIM in the construction stage, combine it with quality, cost and material management to develop innovative approaches and improve performance efficiency of the management system.

Proper cost control is also a vital ingredient for a successful project. The first step of cost control is to identify the factors that affect project costs. The existing factors can be divided into two major categories: quantitative factors and qualitative factors. Currently, the AEC industry researchers have given many efforts to develop techniques that only consider quantitative factors and ignore qualitative factors such as “client priority on construction time, contractor’s planning capability, procurement methods and market conditions including level of construction activity”. It is true that the AEC industry has moved to the CAD stage. With this advanced technology, the AEC industry is brought to a higher level: the design process is simplified data can be conveniently stored and shared; the quality of drawings is improved etc.

A case study approach was adopted to explain the site material supply model that was developed from a comprehensive review of the literature. In the case study, the design and construction data were acquired from the project general contractor and CAD drawings and the construction schedule were obtained from the project owner and from contractors.

Construction projects generate a large amount of complex information which is generally stored in document formats during its lifecycle. This information provides important potential for further application. The reuse of this knowledge and experience contained in information during the construction process is becoming more and more important in construction management. The Building Information Modeling (BIM) concept originated in the 1970s. It is a set of interacting policies, processes and technologies generating a “methodology to manage the essential building design and project data in digital format throughout the building’s lifecycle.” In recent years, BIM has been put forward as an information integration platform to facilitate construction project management. Therefore, BIM data sharing and exchange among different software should have a standard.

1.1 Need to study

The purpose of project quality, cost and material management is to inform and direct project participants about specific quality practices. Information resources include sequence of activities, controls, and checks that have to be implemented during construction. Prior to the commencement of construction work, general contractors are required to prepare a specific project management plan, detailing the control procedures that are required to demonstrate its ability to consistently provide products and services that satisfy requirement needs of the customer as well as applicable quality and cost standard requirements.

1.2 Objectives

The purpose of this study is to develop and apply quality cost and material control requirements for improving the design based on BIM. This research aims to introduce a model that integrates quantity estimation & cost of each element of building with the advances in data visualization to provide decision makers with a tool for better monitoring and control of their construction projects. To compare the actual cost variance with BIM based cost and cost of project with traditional method. To create a simulated view of cost control to enhance decision making over cost variances.

2. LITERATURE REVIEW

Amol Metkari & Dr. Attar studied on the application of the BIM in the process of project management & how it helps in time and cost saving of project. A study of different cost control techniques is done by Arthi & ShashiKumar, & they reached a conclusion that Earned Value technique is the powerful cost control technique. Ye Wen researched on cost control of construction project based on the theory of lean construction & BIM. He says that integrating lean construction technology & BIM can give better cost control in construction. Zhao & Wang gave a comparison study of using traditional cost estimating software & BIM for construction cost control. Result from their study says, that BIM has some limitations to full atomization for cost control purpose, still they do not neglect the importance of BIM in whole. One more research helped me in my work & ie. done by Emad Elbeltagi, Ossama Hosny, Mahmoud Dawood, & Ahmed Elhakeem. It is about BIM based cost estimation & monitoring for building construction. They feel that BIM visualization is a powerful tool which enables effective cost control.

Hyunjoo Kim & Francois Grobler done the cash flow analysis using BIM, & they want to put forward with a International Journal of Engineering Research and Technology. ISSN 0974-3154 Volume 10, Number 1 (2017) © International Research Publication House <http://www.irphouse.com> 324 good thought of BIM coordination ie. contractors should be provided with BIM Model at the time of tendering only. So, they can also prepare their cash flow and can decide whether to accept the project or not, which can be a difficult process using traditional 2D drawing.

Lee et al. (2014) claimed the collaboration, coordination and communication in horizontal construction projects may benefit from the application of model driven approaches to QA/QC. Quantity evaluation is the subject of multiple studies, including Cheng, 2013; Monteiro and Martin, 2013; Wei et al., 2017. Wang et al. (2014) developed a systematic approach to conduct fitness review for BIM model using predefined standards, and built a system prototype to demonstrate the functions of flight path control. Chen and Luo (2014) established a product, organization and process (POP) data definition structure to explore the advantages of using 4D BIM on quality applications in accordance with construction codes. Lin et al. (2016) provided a BIM-based Defect Management (BIMDM) system by onsite quality managers during the construction phase.

3. THEROTICAL ASPECT

This paper discusses the concept of Building Information Modeling and its functions and role are introduced. Current BIM software is also discussed mainly focusing on the project-management needs.

3.1 Challenges in BIM



Figure 1 - Challenges in BIM

One of the most rigorous discussions in implementing the BIM comes from personal beliefs toward this concept. In a recent survey, Lahdou and Zetterman (2011) show that if the project team members do not really believe in the importance of BIM and its advantages on a construction project, the outcome will not be satisfactory. In another survey, Qian (2012) shows that top rated areas of BIM for investment includes software and hardware, developing internal collaborative BIM workflow and procedures, and BIM education. Brewer et. al. (2012) state that the challenges for using BIM on construction projects

3.2 LIMITATIONS

This project focuses on proposing a research agenda “Utilizing BIM for Quality, cost and material Management in Infrastructure Construction Projects” to the domain of Construction Engineering and Management. We believe that this paper put a stepping stone to this area of research. Based on the results of this study, great potential for BIM use for quality, cost and material management in infrastructure projects has been identified. Therefore, it is suggested to conduct case studies of BIM utilization in horizontal construction projects, through industry-academia collaborations, to promote BIM adoption in the infrastructure domain. In addition, applied research on BIM utilization for quality, cost and material management will be needed.

4. METHODOLOGY

Preparation of 3-D model using software for given building plan with details. Quantity Estimation and cost for different items from 3D model using software. Put these details in a Microsoft Excel sheet for further use. Feed the Actual data of construction site using Microsoft Excel sheet. Collecting the details of quantities and cost items with traditional method from office to verify the difference with respect to BIM. Calculate the difference of traditional method over BIM model.

Then compare the estimate

- a) from site (Manually)
- b) by the software

First, manual estimate conducted mainly considering the approaches of project quality, cost and material control, and CAD applications. Basic concepts and current methods of project control were reviewed and presented. Existing problems that cause cost overruns in the AEC industry were described.

Secondly, Then architect and construction management was consulted to work together with a real project BIM model. The process and model were analyzed. Data analysis based on the 3D models was conducted to illustrate a project quality and cost control. Major challenges for the BIM process were stated.

Preparation of 3-D BIM model using Autodesk's Revit Architecture software for given building plan with details. Quantity Estimation and cost for different items from 3D model using Autodesk's Revit Architecture software. Put these details in a Microsoft Excel sheet for further use.

- Cost 1 structural architectural actual cost 2d cad drawings from site compare

- Cost 2 quantity estimation BIM model.

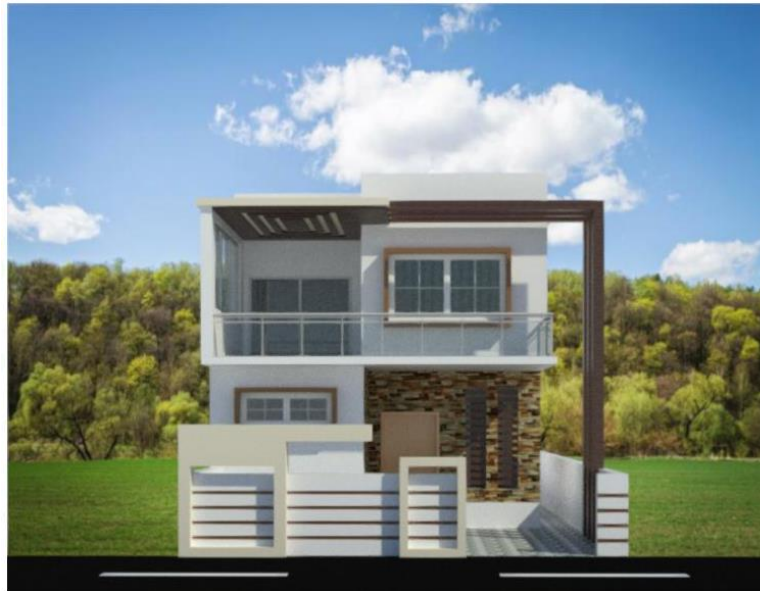


Figure 2 - BIM 3D Modeling

5. CONCLUSION

The whole process of management in construction of BIM based management mode, to optimize and improve the current management mode, help to improve the efficiency of management in each stage, the dynamic relation between various stages of management, improve the overall level of quality, cost and material control. It can effectively control the total quality, cost and material of construction projects, reduce the waste of energy resources, and make the construction management control more standardized and rational. The study includes utilization of BIM for visualization, 3D co-ordinates quality, cost and material.

6. REFERENCES

1. Achkar, E., 2016. A BIM-integrated approach to Construction Quality Management. Thesis, Construction Management & Engineering, Eindhoven University of Technology, Netherlands.
2. Afsari, K., Eastman C. M., Shelden, D. R., 2016. Cloudbased BIM Data Transmission: Current Status and Challenges. 33rd International Symposium on Automation and Robotics in Construction (ISARC), Auburn, Alabama, USA.
3. Chen, L., Luo, H., 2014. A BIM-based construction quality management model and its applications. Automation in Construction, Vol.46, pp.64-73.
4. Cheng, Y.M., 2013. Application of BIM on Quantity Estimate for Reinforced Concrete. 3rd Int. Conf. on Civil Engineering, Architecture and Building Materials, Jinan, China.
5. Cheng, Y.M., 2017. Application of BIM on Documenting Construction Defects. International Journal of Engineering and Technology, Vol. 9, No. 5, pp.393- 397.
6. Harmel, G., Bonjour, E., & Dulmet, M. (2006). "Product, process, and organization architectures modeling: from strategic expectations to strategic competencies." The 12th IFAC Symposium on Information Control Problems in Manufacturing, INCOM'06, Saint-Etienne, France.
7. Lee, N., Dossick, C. S., & Foley, S. P. (2013) "A Guideline for Building Information Modeling in construction engineering and management education." Journal of Professional Issues in Engineering Education and Practice, 139(4), 266– 274
8. McGraw Hill Construction (2012). "The business value of BIM for infrastructure: addressing America's infrastructure challenge with collaboration and technology," McGraw-Hill Construction SmartMarket Report, New York.
9. Penttilä, H. (2006). "Describing the changes in architectural information technology to understand design complexity and free-form architectural expression." ITcon. 11, 395–408.
10. Rowlinson, S. M. & Walker, A. (1995). The Construction Industry in Hong Kong.
11. Hong Kong: Longman. Shewhart, W. A. (1931). Economic control of quality of manufactured product. New York: Van Nostrand.
12. Smith, Deke (2007). "An introduction to Building Information Modeling (BIM)". Journal of Building Information Modeling, Fall 2007, 12–14.
13. Achkar, E., 2016. A BIM-integrated approach to Construction Quality Management. Thesis, Construction Management & Engineering, Eindhoven University of Technology, Netherlands.

12. Afsari, K., Eastman C. M., Shelden, D. R., 2016. Cloudbased BIM Data Transmission: Current Status and Challenges. 33rd International Symposium on Automation and Robotics in Construction (ISARC), Auburn, Alabama, USA.
13. Chen, L., Luo, H., 2014. A BIM-based construction quality management model and its applications. *Automation in Construction*, Vol.46, pp.64-73.
14. Cheng, Y.M., 2013. Application of BIM on Quantity Estimate for Reinforced Concrete. 3rd Int. Conf. on Civil Engineering, Architecture and Building Materials, Jinan, China.
15. Cheng, Y.M., 2017. Application of BIM on Documenting Construction Defects. *International Journal of Engineering and Technology*, Vol. 9, No. 5, pp.393- 397.
16. Ding, L., Xu, X., 2014. Application of Cloud Storage on BIM Life-cycle Management. *International Journal of Advanced Robotic Systems*, 11:129, pp.1-10.
17. Hansen, G.W., 1992. *Database Management and Design*, Prentice Hall.
18. Jiao, Y., Zhang, S., Li, Y., Wang, Y., Yang, B.M., 2013. Towards cloud Augmented Reality for construction application by BIM and SNS integration. *Automation in Construction*, Vol.33, pp.37–47.
19. Juan, D., Zheng, Q., 2014. Cloud and Open BIM-Based Building Information Interoperability Research. *Journal of Service Science and Management*, Vol. 7, pp.47-56

