Building Information Modeling in Construction Sector

Sachin S Nalawade¹, Pravin J Gorde², Sneha Sawant³, Nilesh Patil⁴
¹Associate Professor in Civil Engineering Department
²³⁴Assistant Professor in Civil Engineering Department

Abstract: In the age of advancement Building Information Modeling is gaining popularity around the globe because of its potential. BIM is a very intricate tool in planning and execution stage. As BIM consist of all domain of construction it is equally important to understand its effect on cost of project. This paper presents key points of Building Information Modeling and its effect on cost saving of project, information related to same is collected through rigorous literature survey.

1. Introduction

Building Information Modeling is a graphical representation of physical and functional characteristics of a building. BIM are adopted early at the planning stage as such any project is bifurcated as BIM project or Non-BIM project. Decision of adopting BIM depends on the management bodies involved into a project. Its cost effectiveness is studied prior to its implementation. When construction companies expand into developing countries the list of potential issues may broaden to include things like socio economic stress, resource shortage, environmental concerns, globalization, construction industry development, and organization culture. The Indian construction industry has been one the fast growing industries in the region and accounts for most of the major investments in India. Based on Interiors (2015), the total construction industry value in India was $126 billion as of 2013 with a total construction spending of $427 billion, the third highest in Asia. The growth of the construction industry in India from 2000-2013 averaged 11 percent of Indian GDP. According to Laskar & Murty, (2004) the construction industry is the second largest industry of the country significantly supporting the overall economy while providing employment opportunities. The use of technology and the deployment of project management skills and techniques have resulted in the successful completion of mega scale projects in India.

As the growth is drastic in construction industry, it is important to note the cost components of a project. Basically three cost components are considered for any project viz. fixed cost, variable cost, miscellaneous cost. Every cost category has some characteristics with progress of time. Using BIM enables us to keep the track of project. Through level 3 BIM, cost estimating can be carried out through the 5D function, by linking the model to an estimating database. It is said that this can be done through sources such as Building Cost Information Service (BCIS), to provide high level cost information, which will be useful in the early project stages. Certain software providers are now publicizing that it is possible to develop detailed cost plans through linking a ‘5D Cost Library’ to BIM.

Process of BIM

Every construction project is unique in nature as such the procedure for construction project varies with circumstances. Generally, BIM adoption depends on quantum of work and complexity of project. Following steps stands guidelines for implementing BIM in a project.

Stage 1: Preparation and brief
This part of project consists of various appraisals relevant to project. It also Brief and information requirements and appointing contractors in a project

Stage 2: Concept design
In this stage performance targets are frozen and project plan which are made earlier those are revised and finalized in this stage.

Stage 3: Developed Design
This stage describes the main components of building and it also checks that how it will fit into it. It should provide sufficient information for applications for statutory approvals to begin.

Stage 4: technical design
Stage 4 involves design undertaken by specialist subcontractors it also provide design with sufficient details so that it could be used by different stakeholders in proper coordination

Stage 5: Construction
The construction stage (sometimes referred to as ‘build and commission’) may include both on-site construction and off-site manufacturing, along with activities necessary to prepare for occupation.
If the employer will be responsible for operating the development once completed, an in-house or outsourced team should be appointed to witness testing and commissioning, ready to take over the running of services once practical completion is certified. If they have not already done so, the employer may also wish to appoint site inspectors.

Stage 6: Handover and close out
This stage takes place after the construction has ended. The employer is able to occupy the development but the contractor remains responsible for rectifying defects during a period known as the 'defects liability period' (or 'rectification period') which typically lasts six to twelve months.

In some of the project the procedure adopted for implementing BIM is followed as, At the beginning, a 3D model of the construction object is developed using an adequate modeling application. After that, the 3D model is imported into suitable BIM construction management software. Thereupon, the project costs are estimated on the basis of quantities of required resources, consumptions, production rates and unit costs. The project activities are then defined and linked to the construction elements of the 3D model as well as updated with allocated resources and costs. The activities with established durations are mutually connected together into a project network plan by taking into account relevant precedence relationships. The project duration is automatically determined from the generated network plan. Finally, the BIM model of the construction object is completed by upgrading the 3D model with defined scheduling and cost data. An application example is presented in the paper to demonstrate the advantages of BIM implementation in architecture, engineering and construction industry.

Costing of bim to a project
There are two kinds of project in BIM. One is BIM implemented and Secondly Non-BIM. A case study was referred for analyzing the effect of BIM for cost output in a project. Empirical data on two public housing projects – one with BIM implemented and the other without – are used to calculate the costs/benefits of BIM implementation. It is found that, when compared with the non-BIM project, BIM implementation increased the effort input at the design stage by 45.93%, but at the building stage decreased the cost per square meter of GFA by 8.61%. Taking a holistic view of the AEC processes, BIM implementation contributed about a 6.92% cost saving to the sample BIM project. While these research findings can be used to justify the promotion of more widespread BIM adoption in the AEC industry, cost-benefit analysis (CBA) of BIM implementation remains hampered by a general lack of data. In this way, BIM costing is based on the quantum and nature of work. Its implementation costs bit higher in planning stage but considering overall cost and monitoring of project, this cost saving could be considerable in complex project. The above said case study is one of the examples of cost output relevant to BIM.

Tools of bim
At the beginning, the BIM was used to form virtual 3D building models that were able to visualize the construction objects and make their design more understandable. For this purpose, different modeling software, such as AllPlan, ArchiCAD, Bentley Architecture, Revit Architecture, Tekla etc., were put forward and successfully applied in. Over the years, the modeling software has been upgraded with different modules for handling structural design, analysis of reinforced concrete, mechanical design, energy and environmental issues, visualization, facility management, product and technical information for manufacturers and distributors, etc. Today, some of them use external applications in which the interoperability is often enabled by statical work with import and export of data. Synchronization of multiple data formats, for the purpose of executing the work between the modeling software and other applications in a dynamical manner, is still a great challenge of managing the construction projects using BIM. Scheduling plans for the construction object frequently represent an outcome of common work of different experts. They may incorporate into schedules various information about execution of project activities, application of materials, assignment of workers, employment of machinery, etc. Classically used software for project scheduling includes computer applications such as MicroPlanner, MS Project, Planisware, Primavera, SuperProject, Teamwork, X-Pert among others. On the other hand, the basic aim of the BIM is to combine 3D building models with scheduling data to produce 4D models in which the fourth dimension is time. The results may include an animation of the construction execution as well as the scheduling data connected to the 3D model. Nevertheless, accurate estimation and planning of actual project costs are also very important for success in construction business. Handling the project cost data by BIM approach give us an opportunity to manage the construction project costs more efficiently. As soon as the construction costs are identified and connected to the construction elements and scheduling data, the 5D building information model is created. Over the past few years, the BIM applications have been successfully combined with scheduling and other software. However, the combinations between different software were oftentimes unique and hardly generally applicable. It was also reported in
mentioned references that the converter must be applied for data synchronization between BIM and scheduling software.

**Conclusion**

The aim of this paper was to brief on BIM, Its introduction, work process, tools used and its effect on cost of project. In doing so, it has been observed that BIM is advantageous technology provided It should be practiced in developing countries like India. Till date it is not used because of it awareness and in depth knowledge of BIM. BIM model of the construction object can contain information about the type of building elements, the geometrical quantities, the number of items, the resources needed for implementation, the execution times of project activities. Also it is key worthy to note that all data of a project is stored at one place and the relevant data could be shared as per the needs. The sharing of data is in total control of owner as such any modification made in model could be identified.

**Acknowledgements**

This work was supported in part by co authors of this paper and my students

**References**


