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Implementation of Bim Tools in Construction Project– A Review

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Abstract: **Building Information Modeling (BIM) is a software technology used to efficiently plan, design, construct and manage buildings and infrastructure for Architecture, Engineering and Construction (AEC) professionals. The object oriented parametric models in BIM represent the objects by both physical and functional parameters. Diverse BIM tools such as Autodesk Revit Architecture, ArchiCAD, Bentley Architecture, *etc.* have been widely adopted within AEC industry in design/modeling, construction energy analysis and clash detection, construction scheduling and cost estimating. In this project, diverse BIM tools and applications have been introduced with an emphasis on construction scheduling and cost estimating. Two approaches for 4D scheduling in BIM have been presented: i) BIM tools with 4D capacity, and ii) use of 4D BIM tool to link the 3D BIM model with the project schedule. For the cost estimating capability, three types of available methods have been discussed: i) export the Quantity Take off (QTO) list from the BIM tool to the estimating software such as MS Excel, ii) link BIM components to estimating software and iii) use QTO tool to extract the QTO list from the model.**

Key words: BIM, 3D Model, Project Scheduling, Cost Estimation.

I. INTRODUCTION

The development of software can simultaneously manage building, scheduling and cost data as well as to be suitably applied in Architecture, Engineering and Construction (AEC) industry, emerged in the year 2004 with the introduction of BIM (Building Information Modeling). At the initial stage, the BIM was used to form virtual 3 Dimensional building models that were able to visualize the construction objects and make their design more understandable. For this need, different modeling software, such as ArchiCAD, Bentley Architecture, Revit Architecture, Tekla etc., were put forward and successfully applied in practice.

Over the years, the modeling software has been exalted with different modules for handling analysis of reinforced concrete, structural design, 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 ordinary 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 Micro Planner, MS Project, Planisware, Primavera and Super Project. 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, exact 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.

A step forward to enable the combinations between BIM applications, scheduling tools and cost estimation programs more employable for wider use was recently done within the ProjectWise Navigation software. The purpose of this paper is to give an insight into the construction project time and cost planning process using the BIM approach. The contribution presents a step by step implementation of BIM on an actual construction project using the ProjectWise Navigator software application as an interface for project time and cost planning.

II. LITERATURE REVIEW

Amol A. Metkari and Dr. A. C. Attar (2013) conducted an application of Building Information Modeling Tool for building project. Building Information Modeling (BIM) is a smart technological tool that allows a project to be built virtually before being built physically. It develops and uses coordinated, computable and consistent information about a building project. This dependable digital information about a building can be used for production of high-quality construction documents, design decision-making, cost-estimating, performance predictions, construction planning and eventually for managing and operating the facility. The purpose of this paper was to see the impact of BIM

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implementation on the traditional conventional building design methods. BIM extends its procedure into width, height and depth as third dimension (3D) with the time as the fourth dimension (4D) and cost as the fifth (5D). 4D model based scheduling simulation can be used to monitor the progress at site without being actually present there. It can also help in monitoring delays in relation to a planned schedule. 5D model based estimating produces accurate quantities for the efficient estimation of architectural, structural and services components. These quantities can be extracted at various stages: at concepts stage for generating budgets, at the end of design development stage for floating tenders, at GFC stage for verifying contractor bills. The BIM tools is to be helps for design, defining the building form and spaces, visualisation to analysing costs, time and energy performance. BIM is a construction management (CM) tool useful for an original simulation process of the existing building project. In the undertaken case study, BIM is useful for increasing total project quality, providing accurate quantity take-offs, improving scheduling timetables, consequently diminishing total project contingencies and costs. The case study presented in this paper suggested contractual arrangement for the building project resulted in improved productivity, better coordination, reduced error and rework of construction.

Ibrahim Motawa and Kate Carter (2013) identified sustainable BIM based evolution of building. Building Information Modelling (BIM) plays a vital role in supplement to its capability to make more homogenisation of the construction supply-chain. The designers usually calculate the amount energy used by the building and anticipated CO_2 emission for analysing the energy packages. With the application of BIM, energy analysis has been initiated to upgrade this process but mostly at the design stage. However, after the construction stage, there is a need for a proper and organised methodology to monitor the behaviour of buildings and to make critical decisions to ensure that the energy basis of the design is really met. This paper establishes a visionary BIM-based model that can improve evaluation process for constructed building and meet the industry requirements for sustainable buildings. They identified key operational, carbon performance variables and information across operation stage to support energy management activities.

Robert Eadie et.al (2013) analysed BIM implementation throughout the UK construction project lifecycle. Substantial impacts through BIM implementation may be achieved throughout all stages of the construction process. BIM benefits for the entire project lifecycle was identified in this paper and it is most often used in the preceding stages with progressively less use in the latter stages. This research is mainly based on the demonstration of 92 responses from a sample of BIM users that coordinative aspects produce the highest positive impression and the process aspects are more important than the software technology. BIM needs contribution in software and training however, smaller practices can manage it. Stakeholder financial benefits are ranked concluding that clients benefit most financially from BIM followed by Facilities Managers. Despite this, over 70% do not provide a 3D model and Cobie dataset at the conclusion of a project. Currently, Determination of Key Performance Indicators findings indicate a limitation of industry expertise and training providing an opportunity for education providers.

Mr. Satish A. Pitake and Prof. Dhananjay S. Patil (2013) analysed visualization of construction progress by 4D modeling application. Tremendous development in construction industry created large extent of work in infrastructure, residential and commercial field and with the growing complexity of construction projects and the shortage of resources there is a need for more sophisticated tools for construction planning and management. This paper proposes a visual method of scheduling with application of 4D model for better co-ordination and communication among project team. They developed 4D model with the help of software's such as Naviswork Manage, Google sketch-up and MS office project. The construction progress information is gained from 4D tools in the form of project viewing, review and simulation. As per case study 4D Model is useful in the graphical presentation and communication of the construction schedule. It helped in time saving, effective visualization of the construction process and ultimately cost of construction by reducing the delay. 4D models help to improve construction plans as compared to traditional planning tools.

Abdulsame Fazli et.al (2014) analysed the appraising effectiveness of Building Information Management (BIM) in project management. The Iranian construction industry has long been criticized for being inefficient. It has been declared that 80 % of all content within the construction process is the same for all construction projects and there are huge opportunities for enhancement. The project manager is necessary for the successful distribution of construction projects. The purpose of this paper is to avoid dispensable works, to analyse how BIM (Building Information Modelling) can be used by project managers as a good tool to simulate project condition, to avoid dispensable works and waste of time and cost. As a result, the understanding of BIM applications is difficult for the project managers because they have little knowledge about BIM. This study concluded that Building Information Modeling can help project managers in the task of distributing successful projects. BIM a better basis for providing decisions when compared with traditional projects.

Ales Tomek and Petr Matejka (2014) conducted a study on the impact of BIM on risk management as an argument for its implementation in a construction industry. They have investigated the importance of risk management and BIM relation for implementing BIM in a construction industry. Literature reviews and surveys were analysed which leads to identification of key risk and BIM related issue. The identification of these correlations is not only used to bring effective BIM implementation process but also to understand BIM threats and opportunities during both implementation and post-implementation process.

Ireneusz Czmoch and Adam Pekala (2014) compared a Traditional design and BIM based design. This paper shortly

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presents the history and development of the traditional design in civil engineering. Additionally, the idea of Building Information Modelling (BIM) and its practical benefits are described. Main aim of the paper is to discuss about the kind of difficulties we may encounter during the implementation of the BIM technology and how they are related to the potential benefits. Case study presents the existing design prepared in BIM technology.

Kuo-Feng Chien et.al (2014) made an empirical study to identify and assess critical risk factors for BIM projects. They were found out 13 risk factors related to the technical, management, personnel, financial, and legal aspects of BIM adoption. A questionnaire survey was constructed and circulated to architects, engineering consultants, academics, and construction companies in the architecture, engineering and construction industry in Taiwan; as a result the relationships between risk factors were found out using the decision-making trial and evaluation laboratory method. Based on the test result, the major two risk factors such as inadequate project experience and lack of skilled persons were identified which affects other factors.

Dr. Peter Smith (2014) analysed BIM & the 5D Project Cost Manager. This paper examines the global issues related to the role of project cost management professionals in the implementation and evolution of Building Information Modeling (BIM) in the construction industry, auditing of existing industrial practises issued by using BIM technology and detailed interviews with quantity surveying firms in Australia. BIM involves more than just 3D modelling and is also commonly defined in further dimensions such as 4D (time), 5D (cost) and even 6D (as-built operation). The 3D model is linked with information and data using 4D for project programming and scheduling data and facilitates the simulation analysis of construction activities. 5D integrates all of this information with cost data such as quantities, schedules and prices. 6D represents the built up model that can be used during the operational stages of the facility. This paper explores the necessity of project cost management professionals to be integrally involved across all project phases and to embrace the 5D to become key players in the BIM environment – the '5D Project Cost Manager'. The issues associated with BIM and identifying leading edge best practices in the field by professional project cost management firms was examined based on literature review and industry interviews. The paper concludes with the findings that the greatest value with the modern day project cost manager lies in their ability to be 5D literate and able to utilise software models to provide detailed 5D estimates and living cost plans in real time.

S. M. Dodia1 and S. Hariharan (2015) conducted a case study for evaluating effectiveness of BIM application in Construction Projects. The purpose of this paper is to evaluate the effectiveness of Building Information Modeling (BIM) as method of quantity estimation versus conventional methods. A case study of a residential tower situated in Mumbai is taken into consideration for the comparative analysis. The methodology to be used consists of three stages; model creation, scheduling, and cost estimation with the help of BIM tool. The difference will be then compared between conventional method of estimation and BIM based one with regard to time, accuracy, ease in access and future scope. It is to be noted that BIM has gained popularity in recent times and is also mandated in international projects. The results of the analysis shall be useful in understanding the effectiveness of the tool and to explore innovative means of application of BIM in projects.

Hans-Joachim Bargstadt (2015) made an in depth study on challenges of BIM for construction site operations. Building Information Modeling is a competent tool for the design and for a consistent set of data in a virtual storage. For the application in the categories of realization and on site it needs further improvement. The paper describes main demand and features, which will help the development of software to better service the needs of construction site managers. Building Information Modeling yields high potential. Currently this is gaining momentum in the architect and engineering phases. However, for site operations, there are additional and specific demands. The paper shows the specific tasks, which can be supported by Building Information Modeling in the realization phase. Main features are collaborative detailing on a consistent data model, the flexibility for work planning, as-built documentation and powerful procedures to process changes. Nevertheless, the more Building Information Modeling automates support services the more the applied algorithms must be made transparent for the responsible site engineer.

J. J. McArthur (2015) analysed a building information management (BIM) framework and supporting case study for existing building operations, maintenance and sustainability. Building Information Management (BIM) models are transforming how buildings are designed, constructed, can facilitate multi-disciplinary coordination; integrate 3D design, analysis, cost estimating and construction scheduling. BIM models can be used to offer a consolidated interface for information regarding all aspects of building operational performance, support Facilities Management and Building Operations with the help of advancing the model into the post construction period. Four key challenges must overcome to develop BIM models suitable for Sustainable Operations management: (1) the management of information transfer between real-time operations and monitoring systems (2) identification of critical information required to inform Operational decisions, (3) the high level of attempt to create new or modify existing BIM models for the building, and the BIM model and (4) the handling of uncertainty based on incomplete building documentation. This paper describes the process used to addresses and overcome each of these challenges. The Building Information Modeling framework and its refinement are presented along with evaluative data from a case study where a model was developed using this framework for a complex university building. As a result, this study indicates how BIM models can be developed for the demanding prevailing building and effectively used to improve building management and performance.

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Sagar M Malsane and Amey Z Sheth (2015) simulated construction schedules using BIM 4D application to track progress. The architecture, engineering and construction (AEC) industry is shifting from 2D CAD drawings to more semantically rich building information models (BIM). The introduction of BIM concept highlights on adopting an approach of defining a building in a single building model with enough information to meet its various demands instead of defining it in separate document. Further BIM is a tool which not only stands as a 3D geometric modelling tool, but also supplies useful information, data about several aspects throughout the life-cycle of a project and also information required for facilities managers, stakeholders. A BIM based approach assists professionals during the conception and designing of building but the same approach can also help in monitoring construction execution and maintain a control over it. This research explains role of BIM methodology in the field monitoring of work progress and tracking schedules by developing a BIM for a residential building, linking it with project planning systems and tracking it's on site progress. This work is carried out using a simulation tool Navisworks Manage which helps reduce delays and sequencing problems and helps simulate construction schedules in 4D to visually communicate and analyse project activities.

Shashank.R.Chandak (2016) analysed a cost optimization of construction projects using Building Information Modelling. Building Information Modelling "BIM" is becoming a better known established collaboration process in the construction industry. Many Construction firms are now investing in "BIM" technologies during Bidding, Preconstruction, Construction and Post Construction. The goal of this research is to understand the benefit of Fifth Dimension (5D) BIM in lowering the costs of structure during preconstruction phase i.e. planning stage & while construction phase i.e. execution phase. A 3D Model of a Residential Project including Luxurious Apartment and High class Amenities is developed in 3D Modelling software i.e. Autodesk Revit Architecture 2015, Database of Cost estimates and Schedule are prepared in Microsoft Project Software available commercially by Microsoft and further linked to the 3D Model of the project using Autodesk Navisworks software, Clash detection between objects is an another part shown in Navisworks which omits the design errors in the 3D Model for better accuracy in the estimation. Thus any change in the Building design can ultimately be reflected in the overall budget of the project.

Dariusz Walasek and Arkadiusz Barszcz (2017) analysed the adoption rate of Building Information Modeling [BIM] and it's Return on Investment [ROI]. In an effort to remedy the issue of stagnant labour productivity in the construction industry, Building Information Modeling was proposed in the late 80's as a new solution for modernising the design and delivery process of construction projects. BIM is a digital representation of a building meant to serve all project participants as a repository of all relevant data throughout the project's lifecycle. Administration of this data along with the collaborative nature of BIM has been shown to offer many potential benefits to those involved in the project. The adoption of BIM throughout the industry has been observed as slower than expected even though there is huge potential for increasing productivity as well as the overall efficiency of construction projects. This paper analyses and introduces the various hurdles obstructing the widespread adoption of BIM throughout the industry as well as recommends methods for addressing them. The author then answers the question of who should be responsible for driving the adoption of BIM and how to effectively do it. As a result, areas of further research and development which will assist in achieving a more widespread adoption of BIM throughout the industry.

III. CONCLUSION

BIM creates competency and also help users to get several benefits. It reflects the fact that users of all levels could see BIM as helping them work better, but cost savings are more likely to be realized by experienced users. The top-rated business benefits are: Visual Access to Building Information, Enables Easy Conflict Resolutions, Helps to Schedule the Construction Process, Supports Lean Construction, Helps to Manage the Involved Costs and Allows Improved Coordination and Better Management.

REFERENCES

[1] Ireneusz Czmoch and Adam Pekala, Traditional Design versus BIM Based, Procedia Engineering 91 (2014) 210 – 215.
[2] Ibrahim Motawa and Kate Carter, Sustainable BIM-based Evaluation of Buildings, Procedia - Social and Behavioral Sciences 74 (2013) 419 – 42.
[3] Kuo-Feng Chien, Zong-Han Wu and Shyh-Chang Huang, Identifying and critical risk factors for BIM projects: Empirical study, Automation in Construction 45 (2014) 1–15.
[4] Abdulsame Fazli et.al, Appraising effectiveness of Building Information Management (BIM) in project management, Procedia Technology 16 (2014) 1116 – 1125.
[5] Dariusz Walasek and Arkadiusz Barszcz, Analysis of adoption rate of Building Information Modeling (BIM) and its Return on Investment (ROI), Procedia Engineering 172 (2017) 1227 – 1234.
[6] Ales Tomek and Petr Matejka, The impact of BIM on risk management as an argument for its implementation in a construction company, Procedia Engineering 85 (2014) 501 – 509.
[7] J. J. McArthur, a building information management (BIM) framework and supporting case study for existing building operations, maintenance and sustainability, Procedia Engineering 118 (2015) 1104 – 1111.
[8] Robert Eadie et.al, BIM implementation throughout the UK construction project lifecycle: An analysis, Automation in Construction 36 (2013) 145–151.
[9] Hans-Joachim Bargstadt, Challenges of BIM for construction site operation, Procedia Engineering 117 (2015) 52 – 59.
[10] Dr. Peter Smith, BIM & the 5D Project Cost Manager, Procedia - Social and Behavioral Sciences 119 (2014) 475 – 484.
[11] Sagar M Malsane and Amey Z Sheth, Simulate construction schedules using BIM 4D application to track progress, International Journal of Mechanical and Production Engineering, ISSN: 2320-2092, Volume- 3, Issue-6, June-2015.
[12] Amol A. Metkari and Dr. A. C. Attar, Application of Building Information Modeling Tool for building project, International Journal of Science and Research (IJSR), Volume 4 Issue 5, May 2015.
[13] Shashank.R.Chandak, Cost optimization of construction projects using Building Information Modelling, International Journal for Scientific Research and Development (IJSRD), Vol.4, Issue 05, 2016.
[14] Mr. Satish A. Pitake and Prof. Dhananjay S. Patil, Visualization of construction progress by 4D modeling application, International Journal of Engineering Trends and Technology (IJETT) – Volume 4 Issue 7- July 2013.
[15] S. M. Dodia1 and S. Hariharan, Evaluating effectiveness of BIM application in Construction Projects, International Journal of Engineering and Computer Science, Volume 4, Issue 9, Sep 2015.