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BUILDING INFORMATION MODELLING: A FASTTRACK APPROACH OF CONSTRUCTION MANAGEMENT

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Abstract*: *The Building Information Model is primarily a three dimensional digital representation of a building and its characteristics. It is made of intelligent building components which includes data attributes and parametric rules for each object. Furthermore, BIM provides consistent and coordinated views and representations of the digital model including reliable data for each view. This saves a lot of designer's time since each view is coordinated through the built-in intelligence of the model. Building Information Modeling "BIM" is becoming a better known established collaboration process in the construction industry. Owners are increasingly requiring BIM services from construction managers, architects and engineering firms. Many construction firms are now investing in "BIM" technologies during bidding, preconstruction, construction and post construction. The goal of this paper is to understand the uses and benefits of BIM for construction Management.

Keywords: **Building Information Modelling; Construction Management; Collaboration Process; Digital Presentation.**

I. INTRODUCTION

Construction management involves the optimum use of available funds, the control of the scope of the work, effective project scheduling, the avoidance of delays, changes and disputes, enhancing project design and construction quality and optimum flexibility in contracting and procurement. Information is of great value for the construction manager. Traditionally, CMs access the necessary information via periodic meetings, blueprints, reports, and work schedules; they coordinate the construction processes with this information. However, preparing and presenting the information is time consuming and includes human factors. It can be stated that traditional methods fall short in monitoring complex construction projects. On the other hand, developments in IT allow the CM to access more accurate and current as well as visual information, which in turn allows the CM to monitor construction processes more effectively. Developments in IT have affected the CM's duties and responsibilities and therefore, are expected to change the practice of construction management too.

IT systems used today in construction encompass all disciplines and are used to describe and document the contributions of each member of a project team. The most current IT product is Building Information Modeling (BIM) which is a process by

which a digital representation of the physical and functional characteristics of a facility are built, analyzed, documented, and assessed virtually, then revised iteratively until the optimal model is documented.

BIM is not only a 3D virtual representation of building, but also a giant database which includes significant information packages for the basic construction management practices such as estimating, scheduling, change orders, etc. So, the designer can use BIM as a real simulation of the actual project before real construction starts. Web-based systems have improved access to information, communication between parties and overall efficiency. The basic practices of construction management involve the use of sophisticated computer tools. Budget, schedule, risks, constructability, etc. are modeled and analyzed before the execution of the actual project and tracked during the construction process on the computer screen. These computer tools allow CMs to perform their duties with great speed and accuracy.

II. CONSTRUCTION MANAGEMENT AND BIM

A. Budget Management

Budget management encompasses all project-related cost aspects of CM practice. The CM has the responsibility to confirm, generate, track, report, and substantiate all budgeted costs from the first estimate to the final accounting. The conceptual budget for the project, prepared by the CM before design begins, becomes the team's line-item financial guide as the design process moves toward the bidding phase. After bids are received, the amounts of accepted contractor proposals replace estimated line-item amounts and become the construction phase budget. As construction proceeds, payments to contractors, contract changes, and budgeted expenses are accounted for in detail. Every aspect of project cost is estimated as early as possible and substantiated as it occurs.

B. Contract Management

According to Haltenhoff, contract management encompasses the involvement of the CM in the operational and administrative provisions of the contracts used in the project. Construction management expertise includes the recommendation of standard contract forms and the performance responsibilities to be included in contracts, but does not extend to the writing of contracts or in any way infringe upon the legal profession. This area is important because the construction management system is a unique contracting system, the success of which depends on a workable alignment of traditional contracting roles and participant responsibilities. It is the CM's responsibility to establish a contracting format for the project and see that each contractor's operational and administrative requirements are included.

C. Decision Management

Decision management encompasses the development and handling of the interrelationships between the project and the construction team, and the relationship between the members of the construction team. It is the CM's responsibility to consistently extract decisions from the team without alienating any team members in the process. Team members must make decisions cooperatively, respecting each other's project function, expertise, and operational capacities. Decisions that become contentious must have a prescribed path for resolution.

D. Information Management

Information management encompasses the collection, documentation, dissemination, safe keeping, and disposal of verbal and graphic project-related information. The team structure and the use of multiple contracts significantly increase the information available to the owner. The volume of information generated for project accountability purposes requires a multilevel, need-to-know reporting structure and an efficient information storage and retrieval system. Information management can be established by setting up a communication platform such as BIM. Since BIM is a database of information, the CM can reach the digitized documents whenever needed and set up a computer-based communication system.

E. Material and Equipment Management

Material/equipment management encompasses all activities relating to the acquisition of materials and equipment from specification to installation and warranty. Material handling includes procurement, inventory, shop fabrication, and field servicing. The construction management delivery system facilitates direct owner purchase of materials for the project. The planning, specifying, bidding, acquisition, expediting, receiving, handling and storing of direct purchases must accurately reflect the requirements of the project schedule. Proper control and management of materials can increase productivity significantly. 4D and 5D BIM models can be used to analyze the time and cost impacts of the selected materials. Also, Mahalingam et al. state that construction planners can use 4D simulations to select the appropriate construction equipment for the project and to check the safety conditions for the movements of equipment. Currently, 4D BIM models are used to optimize site layouts, and improve site logistics and space work execution.

F. Project Management

There is a growing use of BIM models to minimize the potential for design and construction errors, to identify critical space and time during construction, to determine the most suitable construction methods and sequence, and to monitor construction progress.

G. Resource Management

BIM technology is used for visualization purposes by most construction professionals. But this technology has moved far beyond its original visualization stage. Some researchers have investigated the integration of construction resource management to BIM.

H. Schedule Management

4D models integrate 3D geometry with time as the fourth dimension. Any building component in a 4D model contains geometric attributes that describe its 3D shape, as well as a time attribute that indicates the start and finish times of the construction of this element. A 4D model of a structure can therefore be used to graphically simulate the sequence of construction operations, thereby providing the operator with a virtual, visual understanding of the construction process. 4D visualizations can be used by a wider variety of project participants at varying levels of skills and experience

III. CONCLUSION

- The future of the design and construction industry lies in the use of technology; and BIM is expected to shape this future effectively.
- The introduction to BIM into design and construction practice has brought along new duties and responsibilities for the CM.
- However, the existing CM body of knowledge is based on traditional methods despite the fact that BIM is becoming more popular.

- BIM is effective in every phase of a project's lifecycle as it covers several CM functions in the most critical phases. Hence, traditional CM duties and responsibilities are inadequate in handling the CM related functions of BIM-based projects.
- Not taking advantage of the benefits provided by 4D and 5D BIM models reduces management efficiency and is detrimental to the overall performance of the project. Therefore, CMs' duties and responsibilities must be updated to take full advantage of BIM models.

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