

Research on Information Integration of Construction Project Management Based on BIM

Xiong Gao¹, Yansheng Wu¹ and Yan Li²

¹Faculty of Environmental Engineering, Kunming Metallurgy College, Kunming, Yunnan, 650033, China,

²Faculty of Architectural Engineering, Kunming Metallurgy College, Kunming, Yunnan, 650033, China,

Abstract. The application of BIM play a crucial role to improve the current situation, and it has attracted increasingly attention from ACE (Architecture, Engineering, and Construction) industry participants, which improves the quality of project management and the ability of processing, integration and sharing information. The paper puts forward the framework of information integrated management mode based on BIM technology generally and based on the conceptual model of integrated information management system. The work still needed to complete is to develop BIM platform of integrated information management system based on Cloud technology and Internet of things at the later stage.

1. Introduction

The implementation of construction project management is a complex system composed jointly by the multiple units and a number of departments; all participants have to standardize the information process between them and organize the reasonable information flow to achieve communication at any time. Building Information Modeling (BIM) is the bridge between the organization and the information management system. The original construction industry has implemented a set of working process and management modes for many years, which cannot match the needs of the development of information technology in the construction industry. There is a big gap especially in the information integration management. Information integration of construction project management is to realize the sharing of data and information among the project participants between the life-cycle of the construction project. Information integration is not a simple way to achieve information sharing between various departments on technology, but from the perspective of system operation to ensure that each part of the system can send the right information to people who need the information at the right time, place and in the right way at each stage of the operation. The construction project information integration based on the management process needs to solve two problems: the integration of management work and organization and information system integration of management process. It is based on technology incorporating information in three dimensions (3D) and integrates the necessary information required by Architecture, Engineering, and Construction (ACE) industry. BIM is model information technology platform, which can be used for design, construction and maintenance management of construction project.

At present, BIM is a collaborative process in which all parties involved in the project exchange data and information. Through this process your project effectively stays on task and optimizes workflows to increase productivity and profitability. The integrated BIM information is a significant improvement



in all processes where project participants have to use and communicate complex, accurate and interrelated construction project information[1].

2. Building Information Modelling (BIM)

Building Information Modelling (BIM) is a collaborative process in which all participants involved in the project exchange data and information through the building life cycle[2]. BIM is described in many ways, but at heart it is a collaborative way of working, supported by software tools that make information about buildings available and analysable.

2.1. Definition of BIM

The concept of building information modelling (BIM) has many meanings, we may definition of BIM from Organizations.

Table 1. Definition of BIM from Organizations.

Organizations	Definition of (BIM)
The Associated General Contractors of America (AGC) (2005)[3]	The development and use of computer software model to simulate the construction and operation of a facility. Produced models are equipped with a variety of data, object-orientation, digital data representation of intelligent and parametric facilities, whose views and data needs of multiple users can be extracted and analysed to produce information that can be used to make decisions and improve process delivering building services.
China Construction Industry Standard(CCIS)(2007)[4]	Coordinated data of building information makes it easy for computer applications to access, modify or add. The information includes the physical and functional characteristics of building facilities expressed with open Industry Foundation Class (IFC) standard in the project life cycle.
American Institute of Architects(AIA) (2007)[5]	A project delivery approach that integrates people, systems, structures and practices in the process together and take advantage of the views of all stakeholders in order to optimize the production of projects, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication and construction.
National Building Information Modeling Standards (NBIMS) (2010)[6]	A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM process to support and reflect the roles of that stakeholder. The BIM is a shared digital representation founded on open standards for interoperability.
British Standards Institution (BSI)(2013)[7]	Process of designing, constructing or operating a building or infrastructure asset using electronic object-oriented information.

Based on the definitions mentioned in Table1, it can be concluded that BIM is not just a technology, but it also encompasses the process by using product of the right kind of software[8]. BIM application connects all parties such as architects, contractors, surveyors, designers and owners to work together on a common information system[9]. Thus, this allows all parties to share the information with each other and increasing the confidence and consistency among them.

2.2. Characteristics of BIM

2.2.1. Visualization Visualization is the most obvious characteristics of BIM. In the working environment of BIM, which includes a series of operations such as architectural design, collision detection, construction simulation and disaster avoidance route analysis can be done in the situation of visualization. The result is the actual formation of the building what see is what get[10].

2.2.2. Collaboration Collaboration work based on BIM is conducive to exchange of information and the consultation of different participants. It can also change the disorder in information exchange, and realize the centralized management and sharing of information exchange.

2.2.3. Simulation Simulation is the visualization to analyzed results. BIM can design something need simulation to simulate experiment, such as: energy saving, emergency evacuation simulation, simulated sunlight and heat conduction simulation, etc.

2.2.4. Optimization Optimization and BIM have not necessary association, but better optimization can be done on the basis of BIM[11]. Using BIM model, the unreasonable place changes ahead of time, to the place where the collision implementation of collision avoidance in advance of the difficult sub divisional work adjustment in advance, reasonable arrangement of construction plan, in order to shorten the construction period and reduce the engineering cost.

2.2.5. Completeness The completeness of information is also reflected in the process of the creating process of building model. In this process, the information generated in the pre-planning, design, construction, operation and maintenance stages of facilities is stored in the model, which comes from a single engineering data source for updating and sharing.

3. Information integration

3.1. Information value

The term “value” is multifaceted, providing different meanings to different stakeholders. Simply it is the “cost” over “benefits”, which represent the ultimate worth of the considered matter[12]. The costs and benefits can be communicated in different ways. Repo (1986) explained a dual approach as “exchange value” and “value in use”. Exchange value refers to the market value of information when it is regarded as a product or service. On the other hand, value-in-use refers to the benefits of information to its users which include both subjective and objective perspectives.

The paper mainly focuses on the Architecture, Construction, and Engineering (AEC) context, it is necessary to consider the features related to information to define the value of information beyond project success.

3.2. Exchanging information

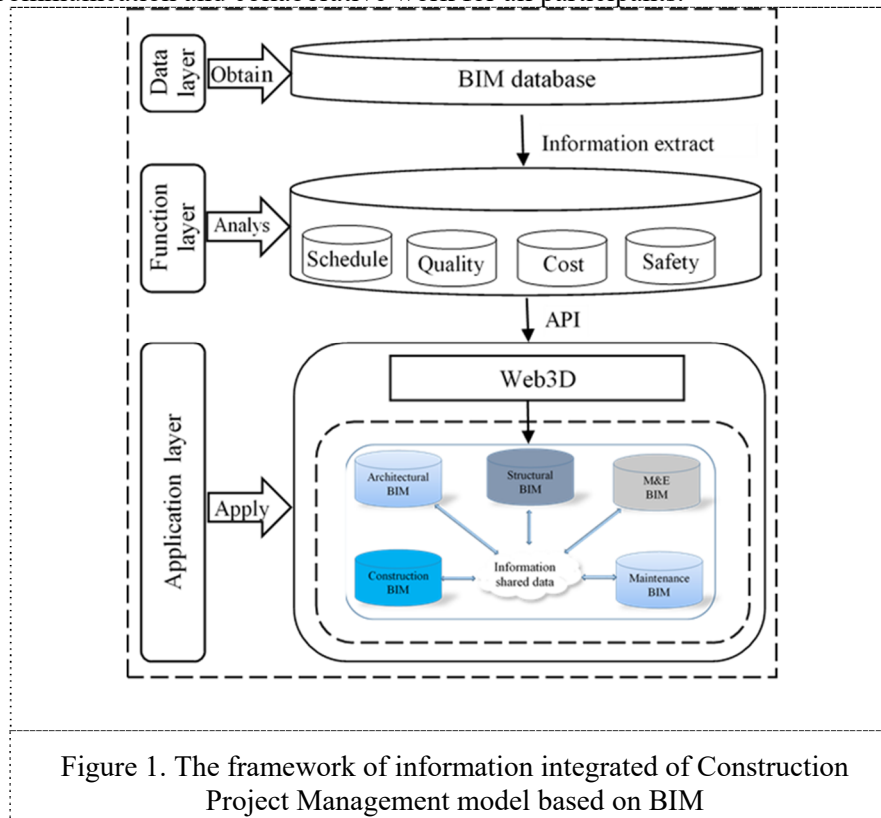
Construction project management process gives direct access to all relevant information which is needed by all stakeholders. The communication within the model takes place by means of files that need to be exchanged between the different stakeholders.

3.3. Information integration on BIM

Considering of the advantage of parameterization and integration of BIM, BIM models are combined with project management data in the various stages of the project. Information integrated management based on BIM is a web-based information integrated management system is developed to solve the consistency information shared problems between heterogeneous distributed engineering data. The system meets the different levels and requirements of information need between the different participants and departments. You can share information, which lets you maintain the information in multiple data stores and applications[13].

4. Build the system platform of information integration management based on BIM

This paper proposes to use the combination of database, BIM and network to share the virtual model and project information data in the cloud, and build a BIM-based project information integration management platform to realize the integration, management, analysis and sharing of massive information at all stages of the project is show in Figure 1, so as to provide an efficient platform for information communication and collaborative work for all participants.



4.1. Data layer

BIM model itself is a BIM database, which contains all the information of a project. In the process of engineering project information management, the corresponding information is captured from the model database, and the output of the final result is achieved through the application program operation. Because the database involves all participants, theoretically allows each participant to extract and use the data, but in practice, it may be part of the kernel and data grab and modify the need for a certain management authority. The application layer is built on the basis of BIM database, the model data is the source of information, and the goal of total factor management based on BIM technology information management model is realized. The BIM database on IFC standard is used in building services and operation, in a centralized platform for display and management, to provide a visual information integrity data in construction project life cycle process.

4.2. Function layer

BIM function module layer can provide many functions such as the function module of schedule, quality, budgetary estimates, Construction site management, safety and facilities management etc.

4.3. Application layer

The application layer is built on the basis of BIM database, the model data is the source of information, and the goal of total factor management based on BIM technology information management model is realized.

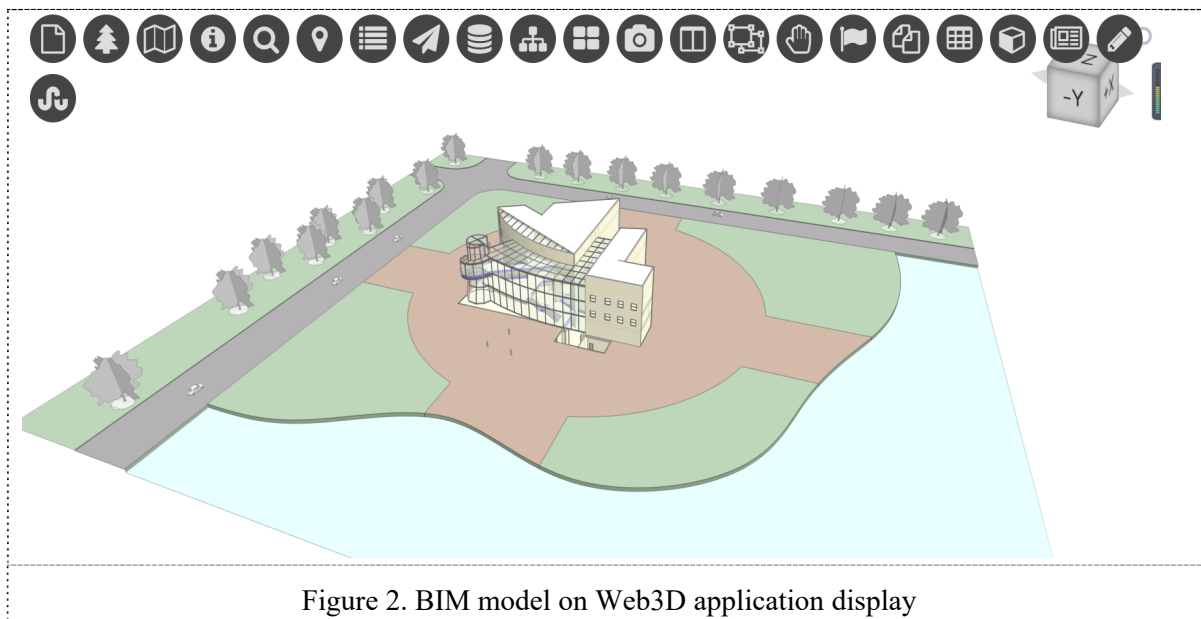


Figure 2. BIM model on Web3D application display

This layer is providing services for information integrated of Construction Project Management, It is to better generate, manipulate and visualize the flow of information along different processes and mechanisms (stakeholders). Besides offering an efficient streamline of information, it also helps establish the responsibilities and data requirements among the various stakeholders of the project. This layer provides a API (Application programming Interface) to meet individual needs and allows users to access all facility operation and maintenance data from the Web3D viewer embedded in the information portal, in the BIM Web3D viewer, users can access and create maintenance information such as contracts, documents, drawings through a menu is show in Figure 2.

5. Conclusion

Although the paper puts forward the framework of integrated management mode based on BIM technology generally and designs the functional platform of integrated information management system based on the conceptual model of integrated information management system, it takes time to realize the whole life-cycle integrated management of all parties and targets in construction project based on BIM platform by the lack of payment standard and application standard of BIM model, poor compatibility in the software system platform interfaces, backward project management methods and ideas due to the limited time and level. The work still needed to complete is to improve the contract system and the organization structure based on the national payment standard and application standard of BIM model and to develop BIM platform of integrated information management system based on Cloud technology and Internet of things at the later stage.

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