

Collaborative Management Model of Construction Project based on BIM

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Abstract: In project construction, information coordination is an important aspect of collaborative management of construction project. The project information integration and sharing of project participants will be conducive to improve project management efficiency and project implementation result. At the same time, BIM can integrate related information of project, manually set model information parameters, and model information are automatically associated with each other, which greatly improves the efficiency of communication among project managers. Therefore, the introduction of BIM into information collaborative management of construction project will not only be conducive to improve the efficiency of collaborative project management, but also be conducive to promote the development of BIM in the field of construction management.

Keywords: Collaborative; Management Model; BIM

1. Introduction

The global construction industry has been criticized for its slow technological progress and low inefficiency. The main reason for this industry crisis was opposition and inconsistency among construction project participants. Collaborative management has become a key factor affecting the success of construction project and improving production efficiency. The construction industry is facing new opportunities for development. With the rapid development of the market economy and the continuous improvement of China's economic system, the construction industry is increasingly market-oriented. The cost of the construction industry, such as labor, construction materials and construction machinery, continues to rise, coupled with the increase of the regulation and control of the current real estate market, and the concept of green building is advocated throughout the country, which raises new requirements for construction project cost management. The Chinese construction industry is not highly integrated. The types of information generated by enterprises are complex, diverse and numerous. The degree of information integration and sharing is very low. All of these lead to poor communication of information during project implementation. The difficult integration of information resources greatly limit the efficiency of construction project management. How to improve work efficiency and improve cost management and information management are problems that need to be solved. BIM technology is considered as a revolutionary concept and landmark technology of the global construction industry and has become an important factor, means and method to improve the management and coordination ability of construction project. In view of the innovative nature of

BIM technology, how to improve the organizational relationship of construction project and establish a stable collaborative management mechanism for construction project has become a new topic that needs to be solved in the industry and academia.

2. Current Research Status of BIM

The construction project is an activity that integrates preliminary planning, program design, construction management and property management. Throughout the life cycle of a project construction, the number of project participants is large and the project information varies in content and quantity. In the management process, fuzzy project information data and serious information loss often appear. Therefore, project information cannot be effectively communicated and shared among all participants, which greatly reduces the management efficiency of the project and affects the normal operation of the project. At the same time, due to the increasing scale and complexity of modern engineering construction project, the degree of informatization at each stage of project construction has been unable to satisfy the development requirements. For example, if traditional information management is used again, computer aided drawing cannot satisfy the needs of complex structure design. The method of coordinating all the participants of the construction project will inevitably consume a lot of energy and time, leading to increased project construction costs, increased engineering changes, and extended schedules. Therefore, the use of advanced information management technology for the collaborative management of all participants in the construction project is an inevitable trend.

2.1. Research status of BIM in domestic

The concept of BIM first entered China in 2003. With the promotion of BIM in various countries and industries, BIM has been recognized in the construction industry. Among them, design and construction companies use BIM more commonly. At the same time, the national construction administrative department has also begun to formulate related BIM policies to guide the rapid application of it in the industry. For example, in 2012, the Ministry of Construction incorporated the “Uniform Standard for the Application of Construction Information Model” into the specification revision plan of project construction standard. At present, the progress of BIM application and promotion in the Chinese construction industry is slow. The BIM application survey reports issued by professional organizations such as the China Real Estate Association from 2010 to 2012 showed that the reasons of slow development of BIM in China are mainly reflected in three aspects. First, although most builders have accepted the concept that BIM can bring benefits, BIM applications are still inadequate during project implementation. Second, among the contractors, design companies and suppliers, the contractors’ BIM application frequency is the lowest; finally, BIM is used for collaborative management and information sharing in construction projects. There is a big problem.

With the vigorous promotion of the national policy and the continuous improvement of the information requirements for the construction industry, the related research and application of BIM is continuously developing. Currently, for example, in terms of data exchange formats of a program, Zhang Xiaofei and others explained that exchanging information between BIMs requires the implementation of different software through a unified IFC standard. In the aspect of BIM application extension, Feng Liang and others outlined the current status of the project information system, analyzed the existing problems, and established the framework of the BIM project information management system. Zhang Yong and others believed that the application of the BIM model should not be limited to the project design and construction phase, but can also be extended to the project operational phase, and discussed the solutions and management models. Chen Jianguo analyzed and summarized the application status and development trend, and analyzed the nD management in BIM, and discussed the specific implementation method of nD integration management. Zhang Jianping developed the GCPSU system based on the 4D concept and proposed a 4D model management system that integrates construction objects, on-site construction models, and project management systems.

2.2. Research status of BIM at abroad

The construction information model BIM originated in the United States. Charles Eastman first proposed the concept of construction information model in his book “Models of Construction Products”. Later, Eastman defined BIM in the BIM manual as: “BIM integrates construction component information into the building model through parametric modeling. During the entire life cycle of the project, project participants implement the transfer and exchange of project information through the model.”. After BIM was proposed, it was gradually adopted by designers, contractors and suppliers.

In terms of BIM application and expansion, the University of Salford, UK, integrated project cost information, progress information and construction performance analysis information. In the BIM model, the nD model was developed, and Hamid and others explored a new project information data collection method BIM based on the project information data, and studied how to use the collected project information to manage projects in real time.

3. The Collaborative Management Model of Construction Project based on BIM

3.1. The concept of TBIM

The Chinese translation of BIM is a construction information model that simulates the real state of a building through digital information. BIM is a product of the development of science and technology. In the process of the development of construction history, people have gone through two-dimensional construction drawings successively and they are not drawn onto the drawing board. The application process of AutoCAD not only eliminates tablet that the human beings have used for thousands of years, but also implements the 3D collaborative design and management tool of BIM as a tool to meet this need [1]. The “father of BIM” Charles Eastman described the contents of BIM as early as 1975 in a paper entitled “Architectural Description System” written by the AIA Journal. Jerry Laiserin detailed the importance of Build Information Modeling in the paper “Comparing Pommies and Naranjas”, and explained that this is a next-generation design software. Phil G. Bernstein proposed this concept and terminology to UIA in the latter half of 2002, which is the first public release of BIM [2]. The American AIA defines it as a digital model that combines the physical and functional characteristics of a construction project, and a reliable shared information resource that makes any decisions throughout the entire life cycle of the initial conceptual design of a construction project. The BIM model can integrate the project’s geographic location information, component engineering information, construction progress information and demonstrate the implementation process of the entire construction life

cycle. Information extraction of relevant parts of the construction system is very convenient, and participants can implement the same model [3-4]. Specifically, through BIM technology, all participants in the construction project's entire life cycle can obtain relevant information they need based on the BIM model, and update, insert, extract, and share project data through the BIM management platform.

3.2. Collaborative management of construction project

Cooperation refers to the process of achieving planning goal based on the coordination of multiple individuals and related resources on the basis of mutual dependence and resource sharing. In Igor's book "Corporate Strategy", he pointed out that cooperation is a cooperation between human beings in order to achieve common goals. Collaborative management refers to the effective completion of activities by organizing and coordinating heterogeneous resources. Heterogeneous resources refer to the complementarity between different individuals and different resources. In the collaborative management process, the concept of collaboration is needed to improve the coordination of different individuals and the integration of different resources so as to improve the coordination ability of the entire system. The specific collaboration methods include process coordination, function coordination, and information coordination. The collaborative management of construction project is a product of the demand and development of modern construction project. Because of the characteristics of strong liquidity, diverse types of resources, and complex organizational relationships, a construction project need to use collaborative management concepts to integrate project participants and project resources. In order to better complete the project goals, the project management theory and practice need to be upgraded to a new stage. The project collaborative management discussed in this paper is mainly for the cooperation of different participants in each phase of the project life cycle. Since the success of the international application of network technologies such as CPM and PERT in project schedule and control in the 1950s, project management has gradually become a global development and opening up. With the gradual improvement of project management concepts and methods, the project management model has gradually evolved into the following models.

The owner self-management model. That is to say, the owner raises funds by himself, signs the contract with the design and construction unit, and establishes the corresponding organization to realize the direct management to the project by the owner. Under this model, the owner plays the role of project sponsor,

designer, supervisor, and construction worker, which requires the owner to have high project management experience. With the complexity and long-term constraints of domestic and foreign engineering construction project, this self-management model has also been hit hard.

The model that the owner commissions the contractor to build (DBB). The DBB model is the oldest and most widely used project management model in the world. The owner of the model signs contracts with designer and contractor, respectively. The owner commissioned the designer to implement the project's pre-project design and project bidding. The design unit is usually responsible for coordinating and supervising the work. This model has a long construction cycle, complicated management coordination, and more design changes. Because it is widely used in international and based on the FIDIC contract, it is also adopted by most of China's projects.

The model that the owner hires a management contractor. With the development of global economic integration, the scale of construction is becoming bigger and bigger and the complexity of project is becoming higher and higher. In order to keep up with the development of the project, the project management model also shows a new look, such as the design and construction of general contracting model (DB), project management contracting model (PMC), CM model, and clear code model (EPC). These project management models reflect the owner's risk transfer, the increased total package risk, and the improved total package management capabilities. The model of cooperation between the owner and the contractor. With the development of information technology, in the project management process, the problems of participation of seeking self-interest, and inaccessibility of information have led to cost control and project management out of control. Project management is more in a collaborative direction, and Partnering model and Integrated Delivery (IPD) model has emerged. These models emphasize project management methods for project participation, information sharing, risk sharing, and collaborative management.

4. Conclusions

This paper describes the construction of the collaborative project management model based on BIM. Firstly, the construction idea and function of BIM information collaboration system are analyzed, and the design framework of BIM information collaboration system is proposed. Afterwards, the modules that make up the BIM information collaboration system are described in detail. Finally, starting from all stages of the construction project, the operation of BIM

information collaboration system was introduced in detail.

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