

Application Study of BIM Technology on Construction Engineering Cost Management

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Abstract: Construction project cost is part of the construction industry. Under the “new normal” of the construction industry, the development of project cost should also conform to the trend of the times. Construction projects have the characteristics of long cycle, many participants and large amount of information in the construction process. Although many professional cost software have been produced in recent years, they have got rid of the shackles of traditional hand-made prices, but they cannot be well integrated with engineering construction in information sharing and communication. Other processes are connected, and BIM (Building Information Modeling) technology can integrate engineering project related information into an information model, and promote information sharing and communication between project participants, thus saving project construction investment. Therefore, Using BIM technology to realize the project cost management of construction projects is a new trend in the development of modern construction industry.

1. Introduction

Faced with the “new normal” development trend of the construction industry, engineering cost as a branch of the construction industry is certainly not to be outdone. China's rapid development during the “Twelfth Five-Year Plan” period. Under the situation that the international environment is complicated and the development mission is so arduous, under the situation that the downward pressure on the economy continues to increase, the project investment and construction projects have developed rapidly, and the project cost industry has remained stable. Rapid growth, engineering pricing system, basis and material price information leading and constraining role, project cost management water steadily improved. At the end of the “Twelfth Five-Year Plan” period, China's social fixed assets investment exceeded 55 trillion yuan, and the construction industry's total output value exceeded 17 trillion yuan. The market scale has expanded year by year. The engineering cost consulting industry has a revenue of 110 billion yuan, an average annual increase of 14.4%. The number of related companies is as high as 7,000, of which the number of Grade A qualifications exceeds 2,800, and the number of employees is as high as 400,000. The transaction structure of the project cost industry has undergone significant changes, and the proportion of traditional project settlement and audit transactions has dropped by about 10%. The project cost consulting service rate has continued to rise, and the business layout has gradually moved toward the high-end industry driven by the continuous emergence of information technology. The pricing basis of the project construction project and the further improvement of the list pricing system; the revision of the Jian'an project and other professional engineering quotas is completed; the quotas of various industries and places are continuously updated; the information services such as construction material prices and labor unit prices of various provinces and cities nationwide are released on a monthly basis. And the basis of pricing is continuously supplemented; these measures have met the diversified needs of the engineering cost industry in terms of policies and supported the development of the engineering cost industry. Facing the complicated domestic and international situation and the downward pressure of continuous economic development, under the leadership of the people's governments at all levels, all regions have publicized and implemented the five development concepts of “innovation, coordination, green, openness, and sharing”, and accelerate the promotion while expanding moderate aggregate demand. The structural reform of the side supply, vigorously promote the people's entrepreneurship, innovation, and the overall steady

development of the national economy.

2. Basic principles of BIM technology

BIM is an abbreviation of English terminology, namely “Building Information Modeling”, translated into Chinese as “Building Information Model”, which is a digital expression of the transformation of the physical and functional characteristics of a project. The building information model is a new tool for both building and engineering. It uses the input of construction project information to establish a conceptual model of virtual buildings. It has five characteristics: visualization, coordination, simulation, optimization and graphics. In the construction of BIM data storage information, it is mainly based on various digital technologies, and the digital information model is used as the basis for each project construction to carry out related work. BIM can achieve integrated information management throughout the life cycle of a construction project. The information model combines the corresponding construction project management behavior information. Therefore, in some cases, the building information model can simulate real building construction engineering analysis, such as building sunshine analysis, external maintenance structure thermal analysis. By adding the fourth dimension-time to the 3D model created by BIM technology application, a 4D model with visual simulation of the construction process function can be formed, which can be used to study the feasibility of construction tasks, arrange and optimize construction plans, etc., thereby reducing construction risks. BIM5D technology adds the cost dimension to the BIM4D model, which fundamentally breaks the traditional virtual display animation construction process and redefines the visual virtual construction function in BIM technology. This function realizes the project manager. Before the construction of the project, the construction organization plan, capital use plan, materials and labor demand plan of each key part of the project construction process are predicted, and problems are discovered beforehand and the problems that may be foreseen are solved in time. The BIM5D model is a collection of engineering quantity, engineering progress, and engineering cost data. It can not only realize the traditional quantity of engineering statistics, but also connect the 3D visual model of the component with the WBS work to realize the real-time monitoring of the progress and cost during the construction process.

BIM3D is the basic information model for construction project informationization and virtual construction technology. After adding the time and cost dimension, it is possible to establish a three-control two-pipe (progress, cost, quality, contract, resource) project target control system. All in all, the emergence of BIM5D technology provides a new development idea for solving the existing problems of China's engineering cost management system, and is of great significance to the development of information technology in the construction industry.

3. Problems in China's engineering cost management

Domestic engineering cost management is mainly based on the engineering quantity list. However, because China is still in the primary stage of socialist economy and has many areas at the same time, it has caused difficulties in regulation and management, difficulty in dynamic quota control, and low engineering cost accuracy. The project participants lack unified goals and effective communication in project cost management. The supervisory unit only controls the quality and progress in the construction process, neglecting the control of project cost, which leads to frequent cost management problems at this stage. Through the comparative analysis of the domestic and international engineering cost management mode and the status quo, it summarizes the following aspects of China's engineering cost management:

(1) Quota-based, weakening market competition. China is a socialist country, and the government has interfered too much in macroeconomic regulation and control, resulting in weakening of market regulation. The project cost is based on the quota of the provinces and cities in the country and is statically priced. This leads to frequent changes in the construction process of the project, affecting the economic and social benefits of the entire project.

(2) Market prices change frequently, and dynamic information updates are not timely. As a product, the engineering construction project is made of building materials, and the cost of building materials accounts for a large proportion. The constant change in the price of construction materials has made it one of the more difficult factors to control in project cost management. Although the price fluctuations of building materials occur, the relevant state departments will introduce a number of macro-control policies to control the stable building materials market. However, the macro-control of various building materials is very singular, and it is difficult to apply to large-scale regulation, so it still cannot be solved. The contradiction between the changes in the market economy and the cost; and the general period of construction projects is relatively long, the initial bid price is often not the final settlement price, and the rate of change in material prices increases during the construction project cycle. The combination of the above factors has caused the budget price of building materials to be unable to match the market price, and the gap is getting bigger and bigger.

(3) The company lacks a scientific system. Many enterprises in China lack a scientific management system for project cost management, and the degree of attention is far from enough, which makes it impossible to consider the problem from the overall project. In the actual construction, the phenomenon that exceeds the project budget frequently occurs, affecting the construction progress of the project, and the cost engineering staff will do a lot of settlement work during the completion period. In the final analysis, the company lacks a scientific engineering cost management system.

(4) The project participants lack communication. The lack of communication among the project participants makes the information difficult to share. For example, the design unit only participates in the design related work of the project, and will not be exposed to the preliminary analysis work; the supervision unit is only responsible for the quality and progress management of the construction phase. This will lead us to lack of active control of the project beforehand, and always have problems before we can solve the problem, and there is no prevention. The US research shows that it is difficult to share the cost of the project because the cost information is difficult to share.

4. Based on the application of BIM life cycle engineering cost management

In the early stage of the project, the decision-making stage is mainly to prepare the project construction proposal and feasibility study report through the comparison and selection of the project, so as to select the best investment plan and strive for the owner to achieve the maximum value of the project with the least investment. The decision-making stage occupies an extremely important position throughout the life cycle. According to relevant research, the decision-making stage affects the project cost (70%). It can be seen that the decision-making stage plays a decisive role in achieving project value requirements. The main application of BIM technology in the decision-making stage is to assist the owner's comparison plan, make investment estimates for the proposed project, and actively control the early stage of the proposed project.

Comparison of schemes: There will be multiple alternative investment schemes in the initial stage of the project. After comparing the cost of multiple schemes with BIM technology, the schemes with better economics will be selected, which will be more rapid and accurate, and the investment estimates will be biased. The probability is greatly reduced; Investment estimation: BIM has a strong database function. The data model of the built project can be permanently stored in the BIM model. The existing data in the BIM model can be used to complete the investment estimate for the proposed project. Estimated accuracy of the proposed project; Active control in the early stage of the project: The owner can observe the 3D building entity conceptual model of the design plan through the visual characteristics of the BIM technology, and observe the architectural sunshine analysis and lighting analysis. The impact of the surrounding environment on the project. On the partial issues of the project, it is also possible to perform a collision check on the conceptual model.

The construction phase is the process of transforming the engineering construction project from theory to physical object. During the construction phase, the important implementation phase of the

whole project life cycle, due to the long construction period, the engineering changes and payment of progress payments at this stage There are also more. The implementation of BIM5D technology solves these problems. Improve engineering change cost control ability: The use of dynamic cost BIM5D model does not need to be modified according to the traditional manual calculation of engineering quantity changes. It only needs to input variables in the information model of related projects when engineering changes occur. The quantity change will be reflected accordingly. According to the change of the engineering quantity, the changed components are found in the model, and the price of change is determined]. If there are multiple scenarios to meet the functional usage requirements, the 5DBIM model can compare and analyze the cost of these solutions, and then choose a reasonable and economical solution according to the results generated by the analysis report. The application of BIM technology increases the cost control capability of engineering changes. Enhance the ability to pay for progress: BIM technology can be used to divide the milestone phase of the project construction period, and then pay the project payment according to the milestone phase. In the BIM technology cost model, it is convenient for the construction party and the owner to compare the engineering quantities. It speeded up the speed of project participants in accounting projects and enhanced the ability to pay for progress payments. Multi-calculation comparison of different dimensions is realized: each component has its own data information in the BIM5D cost model, and the combined information and split information of each component can be queried in BIM anytime and anywhere, so BIM5D can realize the actual stages at different stages. The comparative analysis of cost and budget cost, plan cost and contract price enables multiple calculations of different dimensions to effectively manage the project cost within each stage.

5. Conclusion

This thesis has reached the above conclusions through the research on the literature and the application of BIM technology. However, due to the limited experience of the authors, there are still some shortcomings. For example, the research of BIM technology in the later stage of the whole life cycle of engineering cost is not very deep. It needs to be further strengthened. BIM technology is a product of the information age and will bring a new revolution to the construction industry. However, from the basic national conditions of China's primary stage of socialism, it takes a long time for BIM technology to play a leading role in the construction industry. For a while. With the development of economic globalization, the informationization of the construction industry is an inevitable trend, and the application of BIM technology will bring the field of engineering cost into the track of informationization. Applying BIM technology to the management of the whole life cycle of engineering cost will also promote the construction industry. The development of information technology.

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