BIM Based Construction Project Budget Management

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Abstract. The use of computer construction engineering budget has great practical research value. Construction engineering projects, from investment to estimation, bidding to final cost settlement, are finally integrated into a comprehensive system to form an integrated system for construction project budget management become a very important direction for future development. In order to solve the shortcomings of the existing construction engineering budget research, this paper discusses the functional equation of construction engineering value inspection, the BIM budget management value and the characteristics of engineering budget data, aiming at the project of BIM based construction engineering budget management. The overview and project list are briefly introduced. And design and discuss the cost budget process of BIM based construction project budget management, and finally discuss the accuracy and manual calculation and manual calculation of the budget book for reinforced, concrete, decorative and metal structures in A construction project. The Excel method is used for comparative experimental tests. The experimental data show that the accuracy rate of budget book configuration in BIM based construction project budget is higher than that of manual calculation and Excel method. The accuracy rate of budget book configuration in steel, concrete, decorative and metal structures the middle BIM reached more than 96%, while the manual calculation and Excel were lower than 92%, thus verifying the superiority of the BIM based construction project budget management application.

Keywords: BIM Technology, Construction Engineering, Budget Management, Cost Budget

1   Introduction

With the continuous development of computer and information technology, the level of construction project budget management in my country is also constantly moving towards the field of modernization and intelligence. Therefore, higher requirements are put forward for the design and development of the construction project budget management model.

Nowadays, more and more scholars pay attention to the research of various technologies and platforms in the budget management of construction projects, and through

practical research, they have also achieved certain research results. Koseoglu O introduced a building information model (BIM) and energy simulation that is widely used to collect large amounts of documented data, due to the inability to meet the needs of energy retrofit cost and production assessment, building construction and budget analysis. Invalid budget information often leads to rework and budget deficits from substandard construction projects. The progressive BIM approach proposed by Koseoglu O addresses all aspects of budget management for construction projects. Experimental results show that this method can more accurately predict energy consumption in construction projects, reduce project investment costs, and prevent project construction budget delays [1]. Mahamadu A M proposed a cost analysis method based on economic indicators in construction engineering, which is used for cost forecasting in construction engineering. When forecasting the cost of construction projects, due to the error of future budget data, Mahamadu A adopts a forecasting method to reduce the error of cost forecast. Mahamadu A also proposed the BIM method to accurately estimate the cost of construction projects and analyze the construction and operating costs of construction projects [2]. Stegnar G believes that the (COET) method was originally developed for computational planning and engineering budget analysis of bill of quantities data. Stegnar G outlines a method for automatically configuring a decentralized building information model through the characteristics of the BIM model and the costing of construction works through COET software. Stegnar G outlines the configuration decentralization method of BIM models as one of the applicable methods for the cost of construction projects. The model defines the method of decomposition of the project through BIM model data and CONTEC software. To realize the automatic analysis of the configuration scattered data of the BIM model [3]. Although the existing research on construction project budget management is very rich, the research on construction project budget management based on BIM is still insufficient.

Therefore, in order to solve the problems existing in the existing research on construction project budget management, this paper firstly introduces the functional equation steps of construction project value inspection, the value of BIM budget management and the characteristics of project budget data, and then discusses the application of construction project budget management based on BIM The project overview and project list, and finally designed the cost budgeting system in the construction project budget management based on BIM, and through the application of the BIM based construction project budget management to carry out the experimental test, the final experiment shows that the BIM technology proposed in this paper can be used in construction Feasibility of project budget management.

2   BIM Based Construction Project Budget Management

2.1   BIM Project Budget Management

The application value of BIM in budget management mainly includes:

(1) Time-sensitive database

Time-sensitive database the most important technology of BIM is the database formed by its computer three-dimensional model data. The data information of this

database will be dynamically adjusted according to the actual situation during the whole project construction process [4]. The person in charge of the relevant project can adjust the information data of the component structure according to the actual situation of the project, and then all project participants can see the updated data [5].

(2) Resource planning function

Using the database information of the data model provided by BIM, the project leader can make reasonable capital and time schedule for planning deployment [6]. That is to say, the data model of BIM is stored in detail in the database. The time information of any model component can be calculated by the automatic calculation function to calculate the specific workload, and any sub-component can be subdivided according to the actual situation. workload, or subdivide the time period for any workload [7].

(3) Accumulation and sharing of budget data

BIM technology allows engineering data to easily form electronic data with BIM parameters, which is very convenient for storage, transfer, analysis, and reference [8].

(4) BIM simulation decision-making for construction projects

The data model established by BIM, in addition to the software functions such as simulation construction and visualization technology provided by BIM, can provide a solid foundation for the person in charge of the project to make correct and timely decisions [9].

(5) Multi-calculation and comparison of different dimensions of BIM

Multi-calculation comparison often refers to analysis and comparison from the three dimensions of process, time and space. At the same time, BIM can uniformly code all components of the 3D model and paste time, process, space and other information, so that 4D and 5D situations can be quickly realized. Arbitrary analysis statistics under [10].

2.2   Construction Project Budget Data

The project budget data information has the following characteristics:

(1) There are many data types, including CAD drawing data, database table data, and other formats such as Excel spreadsheet data.

(2) The amount of budget data is large, including engineering quantity data, quota data, information price data of materials and machinery, and calculation intermediate data [11].

(3) The data calculation rules are complex, including engineering quantity calculation rules, quota conversion rules and so on. There are different calculation rules for the quantities of different divisions in construction projects, and the calculation rules for the quantities of the same division vary from place to place.

2.3   Value Inspection of Construction Projects

(1) GT calculation

$$GT = \frac{Y_{max} - x}{x - 1} \tag{1}$$

Among them, $\gamma_{\max}$ is the largest eigenvalue of the project, x is the project eigen-value of the project budget, and GT is less than 1, indicating that the accuracy of the budget statement is high.

    (2) UT calculation

$$UT = \frac{GT}{HT} \tag{2}$$

In the above formula. If A, the data in the budget book reaches the actual budget data; if B or a negative value, it needs to be recalculated.

    (3) Value Engineering

$$U = \frac{Y}{K} \tag{3}$$

In the above formula, U represents the value of the production and budget proposal of the construction project, Y represents the role of the production and budget pro-posal of the construction project, and K represents the role of the production and budget proposal of the construction project.

3 Investigation and Research on Construction Project Budget Management Based on BIM

3.1 Project Overview

In this paper, BIM is applied to budget management in construction projects for budget data analysis, and the actual project data is needed as a carrier for application experiments. Therefore, the data investigated in this paper is a comprehensive construction project developed by a real estate company in a certain city. This paper the research is mainly based on the B office building in the construction project. The specific construction project overview is as follows:

    (1) Ground floor area of office building: 206,502 square meters
    (2) Floor area of the office building: 86512.6 square meters
    (3) Total construction area: 293014.6 square meters
    (4) The building height is 98.55 meters
    (5) Absolute elevation: 1290m
    (6) The number of floors is 23 floors above ground and 2 floors underground
    (7) Structural design: shear wall structure
    (8) Service life: 50 years.

3.2 Project List

The application of BIM to the budget management of construction projects requires output through the bill of quantities report. When carrying out the calculation of the bill of quantities for construction projects, it is necessary to output a unified bill of quanti-

ties for bidding according to the specifications. The bill of quantities should be output as shown in Table 1:

Table 1. Project List [From GB50500-2013]

Item code	Project name	Unit of measurement	Number of projects
0105100010002	Precast concrete beams Beam Section: Rectangular Concrete strength: C45 Mortar strength: M5.0 Transportation distance: 2.0km single root volume<1.0 m^3	m^3	120.86

4   Application Research of Construction Project Budget Management Based on BIM

4.1   Cost Budget Process Design of Construction Project Budget Management Based on BIM

According to the structural characteristics of BIM and the projects in the construction project selected in this paper, the process structure of the budget analysis of the construction project budget based on the BIM model is designed. The calculation process is the actual project cost obtained by decomposing, calculating and summarizing the steel bar, concrete, decoration and metal structure engineering projects of the construction project. The specific process structure is shown in Figure 1.
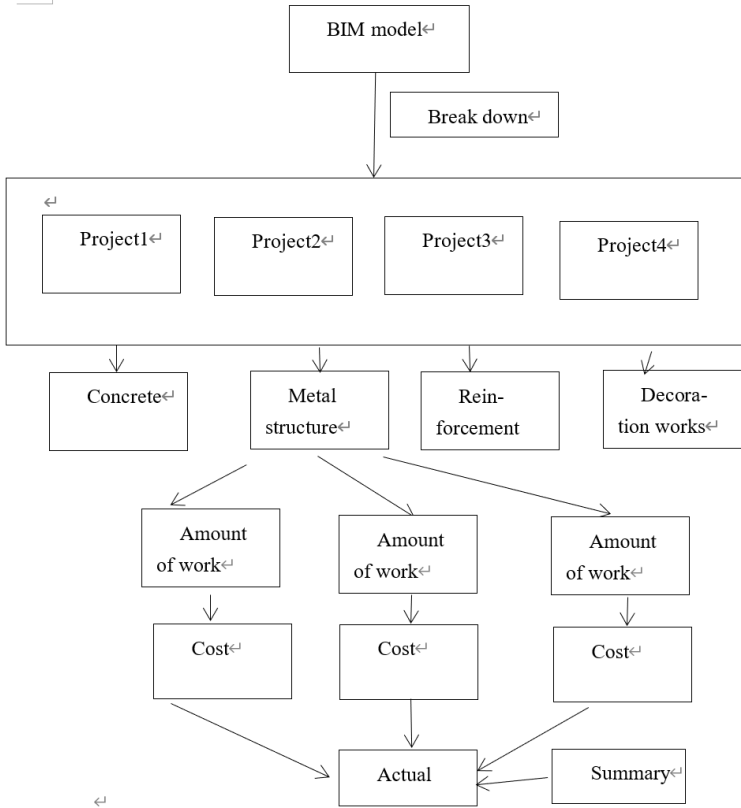
Fig. 1. BIM-based construction cost budgeting process [Owner-draw]

The budget analysis of the construction project of the BIM model must be based on the standard list. In Figure 1, the cost of each project is connected with the project quantity of the sub-item in the list, so as to dismantle the steel structure, concrete, decoration and metal structure according to the above comprehensive dismantling. Steps to further understand the sub-projects after decomposing the list, and then you only need to return to their respective positions, and combine the sub-projects in the list with the sub-items in the model for comparative analysis, and then each basic component in the model can be combined respectively embedded in the branch. Therefore, the actual cost of the BIM model of the construction project can also be calculated by decomposing the summary process in the flow chart.

4.2   Application of BIM Based Construction Project Budget Management

At present, through the application of BIM technology in construction project budget management, the difficulty of project budget can be effectively reduced, especially in the aspects of rebar sample, heterosexual structure and decoration. Importing the cal-

culation BIM model on the basis of the design BIM can save 70%-80% of the energy on the basis of the original calculation workload. In order to verify the accuracy of the BIM model in the budget management of construction projects, this paper adopts the list quota in the BIM technology, and the specific experimental data comparison is shown in Figure 2. The accuracy of the budget book is compared with the budget book made by traditional artificial computers and Excel.
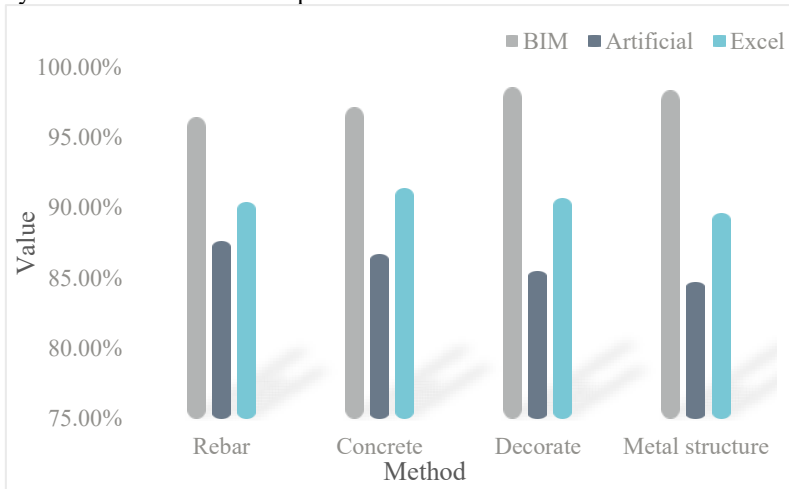

Fig. 2. Accuracy comparison of budget book configuration [Owner-draw]

From the experimental data in Figure 2, it can be seen that the accuracy rate of BIM technology in the configuration of the rebar, concrete, decoration and metal structure budget book of project A in construction projects is higher than that of manual calculation and Excel technology. In the budget book configuration, the accuracy rates of BIM technology are as high as 98.53% and 98.34%, which are higher than the manual and Excel accuracy rates of about 4% and 10%, respectively, and are comparable to the budget book configuration of the steel, concrete, decoration and metal structures of Project A. The accuracy rate of BIM technology in China is higher than that of manual Excel by 10% and 5% on average. Therefore, BIM technology has obvious advantages in budget management of construction projects compared with traditional manual calculation and Excel technology budget management.

5   Conclusion

This paper specifically introduces the technical basis for the realization of construction project budget management based on BIM, including the functional equation of construction project value inspection, the introduction of BIM budget management value and the characteristics of project budget data, and the project overview of BIM-based construction project budget management And the specific deployment process of the project list, and emphatically designed the architecture of the cost budget system in the BIM-based construction project budget management. By com-

paring the accuracy rate of budget book configuration in steel, concrete, decoration and metal structure with traditional manual computer and Excel budget book in A construction project, the feasibility of BIM-based construction project budget management application is verified. It can meet the actual application requirements of construction project budget management.

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