

## *Original Paper*

# The Exploration of the Application and Management of Project Cost in Smart Buildings Using BIM Technology

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Received: October 26, 2023    Accepted: December 05, 2023    Online Published: December 20, 2023

doi:10.22158/ibes.v6n1p35

URL: <http://dx.doi.org/10.22158/ibes.v6n1p35>

### **Abstract**

*In recent years, the slow development of engineering construction management in China has been attributed to outdated management models and low level of informatization. To address the deficiencies in project cost management, relevant departments have proposed the application of BIM technology. BIM technology encompasses a wide range of areas, including planning, construction processes, and cost management. It enables the simulation of these processes to create dynamic real-time building models. Additionally, BIM technology facilitates the rapid transmission of various information during the construction process, thereby improving the overall efficiency of the construction project. Information technology has become ubiquitous in people's daily lives, and this foundation has led to the emergence of smart buildings. The operation and development of smart building projects require effective project cost management. Accurate cost estimation can help construction enterprises effectively control project costs and increase economic benefits. However, many companies still rely on traditional methods such as manual measurement based on drawings, bill of quantities, or engineering rates, which often lead to calculation errors. The application of BIM technology in project cost management can help alleviate this problem.*

### **Keywords**

*RBIM technology, Intelligent building, Engineering cost, Manage*

### **1. Introduction**

Smart buildings have gradually emerged into the public's view. In simple terms, it means constructing a building platform and integrating systems, structures, and management functions within it to enable intelligent features such as memory and transmission. From a holistic perspective, this approach enhances the efficiency and safety of the building while aligning with green and sustainable principles.

With advancements in technology, BIM technology plays a crucial role in project cost management for such buildings. Compared to traditional methods, BIM technology enables faster analysis and processing of data, thereby improving the timeliness of issue detection. Based on these factors, this article focuses on exploring the application of BIM technology in project cost management for smart buildings.

## **2. The Impact of BIM Technology on the Cost of Smart Building Projects**

The application of BIM technology has changed the traditional working thinking of cost personnel and simplified the previous work flow. First of all, in the case of no BIM technology, the project cost mode is mainly to identify the drawing, calculate the quantity, calculate the casing item, adjust the material price, adjust the fee, and complete the cost. In this workflow, repeated operations are needed for many times, and the cost problems related to many links need to involve a large number of manual labor to solve, and the different costs generated need to be calculated in the feasibility study, design, bidding and construction stages. Therefore, these processes will also bring additional cost consumption, especially the change design link involved in the later stage. After each modification, the drawings need to be re-checked to determine the degree of change. If the traditional working mode of single machine and single profession is only used, the cost personnel cannot accurately recognize all the modification content when working, thus leading to a place being forgotten. Such a cost calculation will definitely have a lot of errors with the actual list. Based on the cost under BIM, the cost list of different stages can be calculated at different stages, and very accurate cost information can be obtained as long as the model is sufficiently detailed.

The work of engineering cost mainly involves three aspects, namely, the problem of calculation, the problem of price grouping and the problem of contract. At this stage, the impact of the popularization of BIM technology on the project cost is mainly limited to the problem of calculation. As an application software, BIM simplifies the calculation of engineering quantities, separates the cost teachers from the tedious work of calculating quantities, greatly reduces the calculation work, and puts more attention on the group price and contract issues.

In addition, BIM technology can realize seamless docking of relevant data at all stages, and realize reliable and accurate project cost management of the whole process and all elements. To a certain extent, this breaks the previous problem due to the discontinuity of data at various stages and the obstacles of collaborative sharing between various links, resulting in opaque engineering information and the "water depth" phenomenon of engineering projects. Finally, by building the BIM model, the components within it can be connected to all the lists and quotas of the project, and then the specific amount of the cost list can be obtained. If the model is modified, the cost will also be changed, and the working mode of real-time measurement can be modified to ensure the accuracy of the list. At the same time, the model also has the functions of batch modification, multi-project link and visual operation.

### **3. Application Basis of BIM Technology in Cost Management**

#### *3.1 Modeling Computation Platform*

BIM technology provides workers with the ability to build building models. Only by inputting relevant engineering parameters into the system, the corresponding virtual building model can be generated, and then the virtual model is used to calculate the observation amount and obtain the relevant data information. In addition, BIM technology has an intelligent system, which can improve the accuracy of data in terms of cost, thus improving the accuracy of cost. Through BIM technology, the staff can complete the building model construction work more efficiently and accurately.

#### *3.2 Cost Analysis Software*

Cost analysis software is a tool based on BIM technology. Its application can refine each construction link of the project, and carry out statistics and analysis of relevant data, so as to accurately calculate the specific cost of each link. BIM technology encompasses a variety of geometric models, enabling building models and integrating the entire cycle of data engineering in the models. In addition, the software also has a sharing function, so that staff can easily access the required information through the software. Therefore, the application of cost analysis software can significantly improve the efficiency of engineering cost.

### **4. Application Analysis of BIM Technology in Cost Management of Intelligent Building Project**

#### *4.1 Investment Decision Process*

In order to ensure the smooth development of smart building projects, investment decisions need to be taken seriously, and this link will directly affect the overall benefits of the project. It is very important to collect accurate engineering information in time for the quality of engineering cost in the process of investment decision. Through the effective application of BIM technology, it can accelerate the speed of cost personnel to determine the cost index, and then efficiently develop the estimate report to obtain the accurate investment budget. In addition, after building a virtual model through BIM technology, relevant information can be extracted to evaluate the feasibility of project investment. By integrating the project cost and financial parameters in the system, we can evaluate the benefits of each investment program, so that the construction project is more economical, reduce the difficulty of decision-making, and improve the effectiveness of management.

#### *4.2 Scheme Design Process*

BIM technology plays an important role in the engineering design process, especially in the design of smart buildings. Project cost is one of the key factors that must be considered. When applying BIM technology, designers need to set specific data limits and adjust the design according to the indicators to ensure that the project meets the principles of economy and feasibility.

BIM technology involves a large amount of model data, which designers can use for reference to standardize the design process and avoid the occurrence of later rework problems, thus greatly reducing the cost consumption of engineering projects. Through the use of BIM technology, the design drawings

can form a visual expression, so that the engineering cost personnel can calculate the overall engineering quantity and required materials and other indicators according to the drawings. If the design changes, the cost personnel only need to enter the corresponding data in the system, can quickly and accurately reflect the change of the design content, and timely adjust the cost data. Cost personnel use BIM technology to estimate budget on the basis of budget construction drawings, which can simulate the cost of different stages of construction projects. In addition, the detection function of BIM can reduce the occurrence of design contradictions, discover and correct design problems in time, improve the efficiency of cost management, and control the cost range reasonably.

#### *4.3 Bidding Process*

In the bidding process of smart building projects, BIM technology plays an extremely important role. If the two sides use the traditional method to calculate the projects involved one by one, it will inevitably consume a lot of time and energy, and often the settlement results of the two sides are inconsistent. However, modeling with BIM can effectively calculate quantities and unify calculation standards, thus obtaining more accurate information about quantities. This not only saves time and effort, but also ensures the consistency of the calculation results.

#### *4.4 Construction phase*

In the construction stage, the focus of the project cost is to effectively control the construction cost. The main task of the cost personnel is to settle the amount of the project, and determine the amount of the specific project by using a unified settlement method according to the contract agreement. This process involves architectural drawings, budgets, progress reports, and more. However, in the specific work, there are often many unexpected events, which will affect the project cost and lead to a large amount of cost loss, such as rework caused by substandard construction quality, large differences between the construction plan and the actual progress, and the construction is not completed on time. In order to effectively control costs, engineering managers need to take measures to avoid the above problems. In addition, some projects of intelligent buildings need to be constructed outdoors, in the face of changeable weather conditions, such as strong winds and heavy rain, the construction progress may be delayed, increasing the construction period. Through the application of BIM technology, relevant engineering data can be monitored in real time to reduce the impact of emergencies on construction, so as to ensure that the construction is completed on time.

#### *4.5 Completion Settlement Process*

In the process of construction, it is very important to control the project cost. In order to effectively control the construction cost, the main task of the cost personnel is to settle the project amount and determine the specific amount using a unified settlement method according to the contract agreement. This involves architectural drawings, budgets, progress reports, etc. However, in the concrete operation, there are often some accidents, which cause a lot of losses to the project cost. For example, the construction quality is not up to standard and rework is needed, and there is a big difference between the construction plan and the actual progress. In the completion stage of the project, it is necessary to

settle the cost of the whole project, which is a key link. The traditional engineering acceptance mainly relies on the repeated calculation of the engineering quantity in the drawing. This process is very complicated, and the calculation amount is huge, and the use of traditional calculation methods is prone to error.

However, the application of BIM technology can improve the work efficiency of the acceptance process, effectively prevent construction problems in the later stage of the project and formulate corresponding solutions. The 5D model created by BIM technology adds two dimensions of cost and construction schedule on the basis of 3D model. Staff can look at the model to understand the cost and progress of the project at different construction time points. In this way, the cost personnel can more easily check the settlement of funds, so that the cost control work is more smooth. In addition, based on the cost loss caused by engineering changes, BIM technology can automatically calculate the cost of increased engineering quantities. With the input of correct parameters, it can synchronize the project progress and design changes in real time, and calculate the cost data in time. This not only reduces the pressure of the staff, improves the work efficiency, but also can analyze and calculate the relevant data of the later project more efficiently, and ensure the accuracy of the completion cost settlement.

## 5. Conclusion

For cost engineers, the application of BIM technology can not only simplify the cost work process, but also guide them to find the right direction. Although calculators are only responsible for the specific work content, their goal is to effectively control the cost of the project. BIM technology cannot be considered a solution on its own, nor can it function on its own. However, by making full use of BIM technology, the scheme can be better improved and the cost efficiency of the project can be improved. The building structure of smart buildings is very complex, and traditional cost methods are difficult to ensure accuracy and comprehensiveness. Integrating BIM technology into the construction project can optimize the solution to this problem and improve the cost efficiency.

## Acknowledgements

Thanks for the support of foundation projects of Study on the Cost-Effectiveness of the Whole Life Cycle of Smart Buildings Based on BIM Technology (Project No. WLYB202331).

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