

Analysis and Optimization Problem Analysis of Strategic Management of Small and Medium-Sized Construction Enterprises in the BIM Environment

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Abstract

At present, the application of BIM technology in China has gradually matured, but there are still large problems for small and medium-sized construction enterprises. In order to further analyze the management methods and optimization problems of small and medium-sized construction enterprises in the BIM environment, this paper proposes a strategic development and management model based on the problems and application risks of small and medium-sized construction enterprises in the BIM application at this stage, analyzes the overall management method from the perspective of transformation planning, education and training, on-site operation and maintenance, and further refines the problems of management efficiency, management foundation and management effect that need to be optimized in the application of BIM technology to actual projects. It provides a reference for BIM technology in the application of small and medium-sized construction enterprises.

Keywords

BIM; Small and Medium-Sized Construction Enterprises; Strategic Management; Optimize Problem Analysis.

1. Introduction

In recent years, the application of BIM Technology in the engineering field has become a key link to obtain the competitive advantage in the future market. The application of BIM Technology is widely used in projects with high complexity, but the application in small and medium-sized enterprises, which now account for more than 90% in China, needs to be promoted. The main reason is that small and medium-sized enterprises are in short supply of BIM technicians, small project scale, low customer demand and lack of awareness of BIM Technology. In the face of competition between enterprises and the balance of technological innovation, it is difficult to maintain a stable state and fall into trouble. Therefore, strengthening the promotion of innovation in the application of BIM Technology by small and medium-sized enterprises is still an important strategic goal of modern information development.

Domestic large enterprises have gradually matured their exploration of BIM Technology, but small and medium-sized enterprises have many problems after adopting the experience of large enterprises [1]. The main reason is that large enterprises have sufficient capital costs and the complex attribute needs of the project itself, which is quite different from the conditions of small and medium-sized enterprises, resulting in the obstruction of small and medium-sized enterprises in information construction [2]. Li Pengfei [3] put forward reasonable suggestions on the application of BIM Technology in small and medium-sized construction enterprises according to the three main lines of administrative departments, construction enterprises and

suppliers; Taking small and medium-sized enterprises as the object, Zhang Zhongsheng [4] proposed a BIM training system suitable for construction enterprises, design enterprises, owner enterprises and other different organizational structures; Ma Yu, Li, Kouch and others [5-9] analyzed the influencing factors, obstacle causes, management elements, implementation points, etc. of small and medium-sized enterprises on the application of BIM Technology from different angles.

To sum up, there are many difficulties in the application of BIM Technology in small and medium-sized enterprises. In today's situation, the correct guidance of BIM Technology for small and medium-sized enterprises is still very critical. Therefore, this paper analyzes BIM Technology from the four perspectives of transformation planning management, education and training management and field application management of small and medium-sized construction enterprises, and analyzes the optimization problems existing in the application of BIM Technology, so as to provide reference for engineering construction.

2. Root Cause Tracing and BIM Application Risk

2.1. Problems Existing in Small and Medium-Sized Construction Enterprises

With the construction of digital economy, the competition between the construction industry is more intense, and small and medium-sized construction enterprises are facing more severe tests. In view of the difficulties faced by small and medium-sized enterprises, this paper summarizes their main problems:

(1) Lack of talents and unclear responsibilities

Small and medium-sized construction enterprises are relatively short of professional and technical talents. Due to the continuous reform and transformation to adapt to the market, there is a strong instability, resulting in a serious brain drain. The company's existing professional and technical talents have uneven structure and imperfect human resources, which can not form a more systematic and comprehensive development system, but also affected by the lack of personnel in the construction of responsibility system, Specifically, the technical personnel are responsible for a number of different technologies, the technical force they master is scattered and decentralized, there is no unified standard for the provisions of responsibilities, and there is a high degree of uncertainty in technology and management ability.

(2) Insufficient ability and backward management

Compared with large-scale construction enterprises, the qualifications of small and medium-sized construction enterprises are obviously low, the restrictions on business expansion are large, and the technology of the professional technical team is immature, which leads to difficulties in adapting to the market competition environment and the inability to undertake complex and novel projects, resulting in the phenomenon of single business and narrow scope of small and medium-sized construction enterprises. In order to maintain the company's benefits, leaders often look at the benefits in the form of receiving orders, There is no long-term consideration for the survival and development of the company. The existing management ability is poor, the working attitude is not rigorous, the management responsibility is not clear, and it has not been improved. There is a large gap in skill improvement, and there are often problems of low efficiency and poor quality.

After years of development, China's construction projects have been gradually reduced, and it is very important to seize market resources. In the general environment, small and medium-sized construction enterprises are bound to improve the system, make breakthroughs and innovations, and seek development under the resource monopoly of large-scale construction enterprises.

2.2. BIM Technology Application Risks

BIM Technology can establish an accurate numerical model, present the actual situation of the construction site in a visual state, control the information of the full year life cycle of the construction, and provide convenient management conditions for the progress, safety, cost and risk of the project. However, for small and medium-sized construction enterprises, the demand should match the actual situation, so the risk of applying BIM Technology is also raised, which can be roughly summarized as follows:

(1) Investment risk

The biggest impact of the application of BIM Technology lies in the investment risk. For small and medium-sized construction enterprises, it is very important whether the capital investment is proportional to the income and whether the capital loss tolerance of the enterprise is within the acceptable range. Whether the adoption of BIM Technology can achieve the expected results in management, staffing, technical training, equipment costs, putting into use and profitability, and whether it has a great impact on the company's capital flow is still the primary problem to be solved in the selection of small and medium-sized enterprises.

(2) Demand risk

The demand risk of BIM Technology is mainly manifested in whether the nature or scale of the project itself needs BIM Technology to implement. Due to the limitations of the business scope of small and medium-sized construction enterprises and the ability of the company, the difficulty level of the contracted construction project is general, and the role of BIM Technology in the project is very small, resulting in the unclear demand for BIM Technology.

(3) Technical risks

For small and medium-sized construction enterprises, the biggest technical risk of BIM lies in its unsound technical team, lack of experience in management and implementation, and insufficient BIM technical capacity of the enterprise. Moreover, BIM Technology is still in the development stage at this stage, and many functions still cannot be used in all fields of the entire construction industry.

(4) Environmental risks

The application environmental risk of BIM Technology in small and medium-sized construction enterprises is mainly attributed to the enterprise's own conditions and the industry standards related to BIM Technology. Most small and medium-sized construction enterprises cannot keep up with the application environment of BIM Technology in resource management. Although the relevant industry standards of existing BIM Technology and the development of BIM Technology continue to improve, for small and medium-sized construction enterprises, it is still a major problem that enterprises need to face that they cannot better match the application environment of BIM Technology.

(5) Organizational risk

The main embodiment of organizational risk is the risk caused by the inability to adapt to the original operation mode of the enterprise or the mismatch with technology when learning from the management, functions and modes of other enterprises. Due to the shortage of personnel and funds in small and medium-sized enterprises, this risk is easy to cause losses in small and medium-sized enterprises due to poor management and disturbed operation mode.

3. Analysis of Strategic Management

According to the above analysis results, small and medium-sized construction enterprises themselves have major problems, and the risk performance of small and medium-sized construction enterprises is relatively prominent in the application of BIM Technology.

Therefore, how to do a good job in the strategic management of small and medium-sized construction enterprises in the BIM environment is the focus of this section.

3.1. Transformation Planning Management

In order to guide small and medium-sized construction enterprises to establish correct development goals in the application of BIM Technology and have a correct understanding of BIM Technology, the four step strategy can be referred to in the enterprise transformation planning, as follows:

First of all, two-dimensional CAD model drawing instead of manual drawing has been popularized in current enterprises in China.

Secondly, based on BIM Technology, rivot software replaces the traditional two-dimensional CAD drawing model to guide the construction site, intuitively reflects the causes of on-site problems through three-dimensional graphics, improves the communication and coordination efficiency between departments, and is more concise and clear in guiding construction.

Thirdly, introduce other functions of BIM Technology, such as construction simulation and 3D visualization, combined with the network platform, further strengthen the operation and management ability and business execution ability, refine the division of responsibilities and management of each department, and improve the control ability of on-site construction progress and safety.

Finally, based on the previous BIM Technology construction, the information management platform is introduced into the construction to improve the decision-making ability and management ability of construction projects, realize the transformation of engineering construction from digitalization to intellectualization, closely follow the future development trend, and improve the survival ability of enterprises in the general environment.

3.2. Education and Training Management

After clarifying the development objectives of the enterprise, it is imperative to establish the training mode of BIM Technology and cultivate BIM technology professionals within the enterprise. The specific implementation is as follows:

(1) Targeted training and professional training

BIM Technology is widely used in construction engineering, such as architecture, structure, equipment, etc., and the division of majors is clear. Therefore, first of all, we should clarify the training objects of each major, test the results of BIM training with the CAD drawings of actual projects, and on this basis, establish a good relationship between teachers and students for targeted training. Under the same mode of teachers and students, it is more conducive to the development and learning of training.

(2) Instructional learning, practical testing

The so-called "teaching learning and practical testing" is a process of combining theoretical learning with practical testing results. In the systematic teaching of BIM Technology, it is mainly to systematically learn the basic concepts, basic principles, model establishment methods, engineering project model analysis methods, etc. of BIM Technology, which is the key to be mastered in the process of preliminary learning. On a certain basis, the learned knowledge should be effectively applied, which is inseparable from the importance of practical testing. This is the transformation of the process of theoretical learning and solving practical problems, At the initial stage of the training, the entity of the BIM three-dimensional model should be established by using the two-dimensional CAD drawings of the actual project. After the establishment is completed, the problems presented by the BIM three-dimensional model should be analyzed, and finally the relevant data should be found to verify whether there are such problems, put forward reasonable solutions, and further put forward the optimization effect, discuss between teachers and students and predecessors, and enhance the ability to

combine learning and practice, Finally, the purpose of guiding construction and saving cost is achieved.

3.3. Site Operation and Maintenance Management

The enterprise has its own BIM technical team. The most important step is to effectively manage and deploy the BIM technical team. From the perspective of small and medium-sized construction enterprises, the management problems that need to be solved mainly include coordination management, cost management, progress management, quality management and data management. Therefore, the management of each department needs to be equipped with corresponding BIM technicians to coordinate the completion of engineering tasks on site:

(1) Organization and coordination

The special feature of construction enterprises is that there are many participants in the construction process, and the interactive information in communication and communication is different, and their respective responsibilities are also different. Therefore, more efforts need to be made in the construction of organization and coordination. In the on-site construction environment, rework caused by delayed communication problems is common, causing greater trouble for the lack of funds for small and medium-sized enterprises. Therefore, it is necessary to give full play to the advantages of integrated management of BIM Technology, and gather all participants into the same model to coordinate and deal with relevant matters. In the process of management, it is conducive to improving the quality and efficiency of engineering construction.

(2) Cost control

Cost control is the most important link under the condition of ensuring quality and progress in the construction process. Enterprise development needs to be profitable, so it is also inseparable from cost control. Due to the large amount of work and the complex and diverse sub projects, such as the management of materials, equipment, budget, construction, etc., it is difficult to fully implement. The dynamic management system of BIM Technology can effectively solve this problem. BIM technicians should establish a model of construction simulation according to the actual engineering requirements, and control the construction progress and process pertinently, so as to find and solve the key to the increase of construction cost in time, To achieve the cost control of the whole construction process.

(3) Progress control

Progress management is mostly controlled according to the construction plan. During the construction process, due to the intersection of multiple operations or the impact of personnel mobilization, the construction progress will be hindered, whether large or small, and the readjustment of the construction plan will also have a great impact on the project progress. BIM technicians should adopt a dynamic way to manage the construction progress, control the construction progress layer by layer, optimize the construction progress in time, and ensure that the project is completed on time.

(4) Quality control

The quality control of the project is an important part of the final completion acceptance. In the construction process, it is easy to rework due to improper quality control. BIM technicians should follow up the construction site in real time according to the design drawings, check and feed back the corresponding quality problems in time. The project quality includes many aspects, such as personnel, machinery, materials, etc. in addition to information management, the most common collision problems in the design of pipelines also need to be checked and put forward modification suggestions, so as to effectively solve the unnecessary costs caused by cross problems.

(5) Data management

BIM Technology includes the construction preparation stage, project construction stage and project operation and maintenance stage. It plays a strong role in guiding and consulting data at any time in the whole life cycle. The later operation and maintenance of project construction also needs the digital support of BIM Technology Information Platform. BIM Technology is a data integration platform, and the corresponding BIM technicians should maintain the lack or imperfection of information in a timely manner, Avoid the loss of information.

4. Analysis of Management Optimization

There are still some potential problems in the application of Bim in small and medium-sized construction enterprises. How to treat the management optimization problem in small and medium-sized construction enterprises at this stage still needs to be taken seriously.

4.1. Management Efficiency Optimization

For small and medium-sized construction enterprises, the optimization of management efficiency should be solved from two aspects: waste of resources and low management efficiency. The specific problems are as follows:

(1) The management information chain is broken, and the collaboration subject is restricted greatly

The main reason for the rupture of the management information chain of small and medium-sized construction enterprises is that the management information chain is too long or the relationship between superiors and subordinates is complex, which affects the decision-making of the project in the process of information sharing and even leads to the increase of costs. On the other hand, compared with the construction unit, the main participants mainly include the owner unit, the supervision unit, the design unit and the construction unit, and some projects may also have the characteristics of subcontractors The division of responsibilities of each unit is different, the management area is wide, and the life cycle is long, which requires high efficiency of BIM Technology Management, which may lead to the phenomenon of delayed management efficiency.

(2) Low input-output ratio and high proportion of energy consumption

According to the previous analysis, due to the low efficiency of BIM management application, the cost is further increased, resulting in more investment and less income. The serious energy loss in the process of BIM management is a manifestation of increased cost and reduced profit to some extent.

In order to solve this series of problems and improve the management efficiency of BIM, enterprises should establish and improve the management mechanism, simplify the management information chain of collaboration subjects, clarify the relationship between collaboration subjects, and solve the problems of collaboration subjects one by one in the way of itemized management, so as to promote the orderly progress of the project.

4.2. Optimization of Management Foundation

The basic problem of management mainly solves four problems, including concept transformation, consolidating the foundation, effective coordination and improving standards. The details are as follows:

(1) Conceptual transformation

Compared with the traditional management concept, the application of BIM Technology management needs to introduce a new management concept system. First of all, we should start with the talent team of BIM management system, improve the basic literacy and management level of BM management talents, promote new management concepts suitable for project engineering, and promote industrial development.

(2) Tamp the foundation

Compared with the traditional two-dimensional CAD construction drawing technology, BIM Technology adopts three-dimensional visualization technology for management, which requires technicians to have a higher technical level. The data information base of BIM Technology is the core point of the project. Therefore, we should establish and improve the information level of simulation technology and realize an information system integrating openness, sharing and communication.

(3) Effective collaboration

In order to ensure the project quality and personnel safety, a cooperative mechanism system should be equipped in advance to solve the problems of imperfect management mechanism, multiple types of project division of labor and diversified cooperation departments in the current construction industry, effectively solve the data exchange between departments and systems and the database management of the whole life cycle of project construction, solve many unreasonable problems in the project and ensure the orderly progress of the project.

(4) Perfect standards

The industry standards of BIM management are different for the efficiency of each enterprise. Different participants and different stakeholders need to effectively control the extraction, interpretation, change and revision of BIM management information. In order to ensure the smooth implementation of BIM management, it is necessary to standardize the functional scope of each participant according to local guidance and ensure the effective promotion of BIM management.

4.3. Optimization of Management Effect

BIM management effect refers to the embodiment of the effectiveness, accuracy, scientificity and rationality of data throughout the whole life cycle of the project in the application of BIM Technology. Therefore, the following points should be achieved:

(1) Database Collection

The database managed by BIM is a huge project, and the comparative analysis in the database is an important content. Therefore, in order to ensure the authenticity and effectiveness of the data, the corresponding special talents, special equipment and the provisions of the database collection rules should be specially set up for the management of relevant personnel.

(2) Database improvement

In addition to the database collection work managed by BIM, the process of database improvement and operation and maintenance is indispensable to ensure the integrity of data, avoid loss, or serve as a guarantee for future information maintenance. In particular, if the project changes for some reason, the previous data needs to be extracted and modified, and the interest relationship of data changes needs to be analyzed. All these require the maintenance of database integrity.

(3) Clarify the relationship between responsibility, power and interests

The database managed by BIM is as shown above. The collaboration subjects work closely together. Under the collaboration of the database platform, it is very important to distinguish the relationship between responsibility, right and interest. The information chain relationship existing in the database is easy to produce a certain benefit relationship due to the change of personnel or the weakening of intelligence. If the relationship between responsibility, right and interest is not clear, it will be easy to produce a conflict of interest, Thus, it will affect the application of BIM management system, and may even lead to the imbalance of BIM management system and affect the promotion of BIM management system.

5. Conclusion

BIM management has been gradually popularized in various industries in the construction field, but there are still many challenges for small and medium-sized construction enterprises. Aiming at the crisis of small and medium-sized construction enterprises in the BIM environment, this paper analyzes the BIM strategic management and further analyzes the optimization problems, and draws the following conclusions:

- (1) Small and medium-sized construction enterprises are facing more severe tests. Lack of talents, unclear responsibilities, insufficient capacity and backward management are the problems of most small and medium-sized construction enterprises. The application of BIM Technology still has risks of investment, demand, technology, environment and organization.
- (2) In order to keep up with the development of the digital economy, small and medium-sized construction enterprises should make fundamental changes, do a good job in the transformation planning management, education and training management and on-site operation and maintenance management to adapt to the BIM environment, plan the practical application of the BIM Technology Management Platform, develop their own potential and adapt to the trend of the times.
- (3) Small and medium-sized construction enterprises should also face up to their own difficulties, optimize management efficiency, management foundation and management effect, comprehensively solve the current problems, improve the management system under the BIM environment, establish and improve the management mechanism, distinguish the responsible subjects, seek benefits for their own development, and improve the quality of construction management.

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