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Present Situation and Challenge of BlM Development in Construction Cost Industry

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Abstract: This paper analyzes the construction cost situation, BIM technology development, cost measurement methods, cost pricing system, cost control practice and cost management experience of our country and the United Kingdom, the United States and Japan. Finally, the outlook for the future development of engineering cost industry in our country is concluded. and the relevant suggestion is given, which provides a useful reference for the development of engineering cost industry in our country.

Keywords: Engineering Cost Industry; Cost Measurement Method; Cost Pricing System; BIM Technology.

1. Introduction

1.1. Research Background and Significance

Among many elements in the construction industry, project cost occupies the core position, which plays an indispensable role in ensuring project quality, restricting cost and improving efficiency. The progress in the field of engineering cost has a direct determining effect on the overall competitive situation and long-term development ability of the construction industry.

With the development and globalization of China's economy, the practice of construction cost in China is increasingly influenced by international standards and overseas experience. Therefore, this paper aims to compare and analyze the similarities and differences between China's engineering cost industry and the engineering cost industry in Britain, the United States, Japan and other countries, explore its development status, characteristics and laws, provide certain reference and reference for the improvement and innovation of China's engineering cost industry, and guide the industry to move towards a more sound and international standards. And then enhance China's competitive advantage and influence in the field of global engineering cost.

1.2. Internal and External Research Status

The exploration of the domestic academic circles in the field of engineering cost mainly focuses on improving the cost management system, innovating the cost measurement means and deepening the practice of cost control. in the law, although has promulgated such as "Contract Law", "Construction Law" and "price law" and other laws and regulations, the project cost management provisions, but these legal provisions on the cost management content distribution is more scattered, it is difficult to form a complete and systematic guiding principles and norms. For the management system, China is relatively attached importance to the project cost management, so the government has set up different management agencies and departments to carry out the project cost management, but the functions of these management agencies and departments have been crossed, when some problems are prone to mutual prevarication and repeated management phenomenon[1].

The project cost research from the international perspective, with Britain, the United States, Japan and other developing countries as representatives, has shown rich results. The British research focuses on the standardization and professionalization of cost measurement methods; The American research focuses on the establishment of a sound construction cost system framework. While the Japanese engineering cost field emphasizes the integration of humanistic care and technological innovation in the cost management.

2. Overview of Engineering Cost Industry

2.1. General Situation of Construction Cost in China

In recent years, the development momentum of China's engineering cost field is rapid, the market demand for the service continues to grow, at the same time, engineering cost enterprises also reflect the trend of significant improvement. Figure 1 shows the number and growth rate of China's construction cost enterprises from 2010 to 2022.

The government's macro-control plays an increasing role in the management of project cost, and the management methods adapt to the transformation from planned economy to market economy, which makes the project cost become its own system to a certain extent and enhances the effect of cost control. At the same time, the implementation of the registered cost engineer system also makes the project cost management of our country more standardized and professional. However, under the further development and prosperity of the market economy, the existing project cost management system and model begin to expose more limitations, although the formulation of relevant system control. But the effect is still not good[2].

In China, the preparation and audit of construction project cost constitutes a comprehensive task, which permeates all the core links of construction projects, and emphasizes the importance of implementing cost consulting services in these stages. The construction cost industry plays an indispensable role in various links such as quotation formulation, contract conclusion, change control and project completion settlement. The engineering cost industry also constantly introduces new technologies, such as the application of BlM technology in engineering cost, which provides strong support for

improving work efficiency and quality.

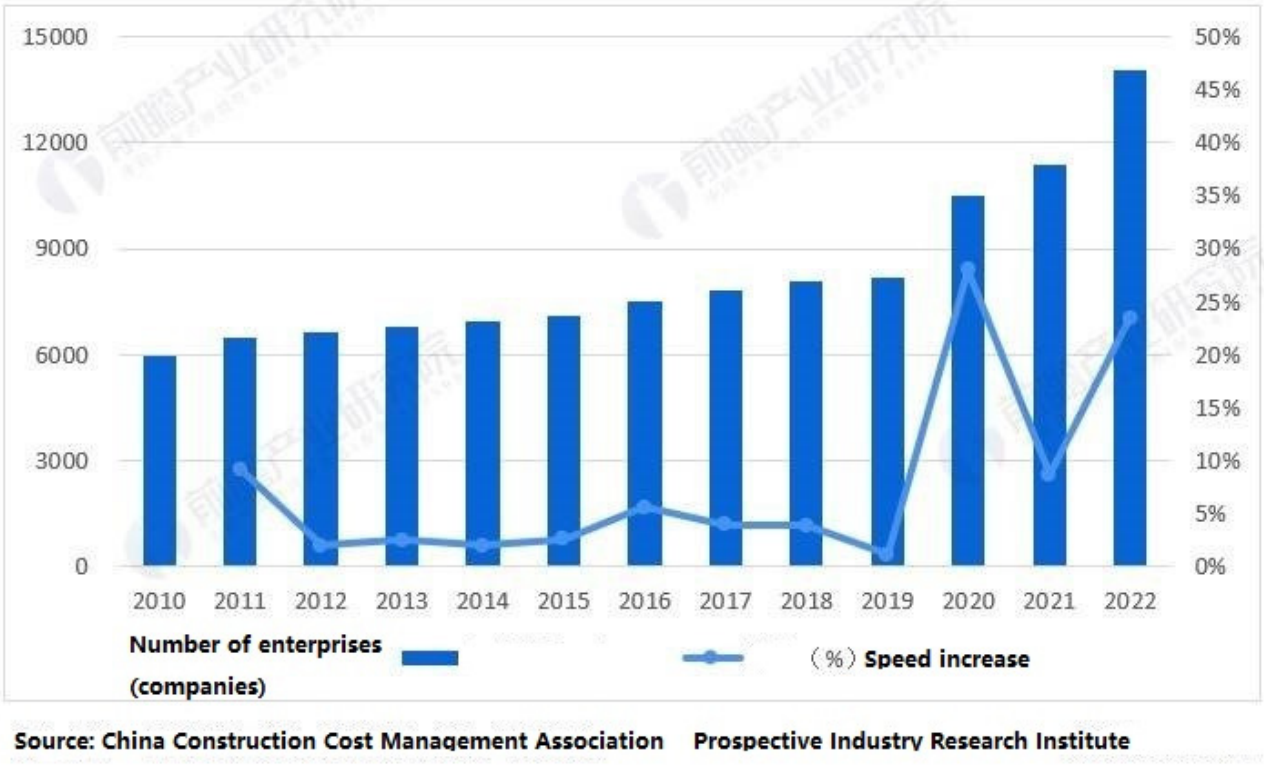

Figure 1. Number and growth rate of China's construction cost enterprises from 2010 to 2022

2.2. Overview of National Engineering Cost in Britain, America and Japan

The British engineering cost industry not only has a long history and rich experience accumulation, but also has a group of professional and technical personnel and expert team, which can provide professional and comprehensive cost services for construction projects. The British project cost management is to determine the project cost through project approval, design (including preliminary design and technical design), bidding and signing, project construction, settlement and other stages of work, which is characterized by the full participation of quantity surveyors in each stage, to the project stage approved or approved investment as the limit, in the design stage, bidding and signing stage, construction stage for gradual control. Finally determine the total settlement of the project completion[3]. In this industry, many professional organizations and associations actively update and issue relevant standard guidance documents, not only unify the industry operation process, but also promote the improvement of service quality. It is worth noting that the Royal Institution of Chartered Surveyors (RlCS), as an authoritative organization in the industry, undertakes the important task of certification and supervision of professional surveying teachers. The professional qualification certificate issued by RICS is widely respected and enjoys a high reputation in the engineering cost industry.

The engineering cost industry in the United States is an important part of the world engineering construction field, and it is in a relatively mature and standardized stage. In general, In the United States, the federal government has no government department in charge of the construction industry, so there is no government department in charge of the engineering cost consulting industry. The engineering cost consulting industry is completely managed by the industry association and conducts business guidance[4]. However, the United States has a sound project cost management system and standardized laws and regulations. It is cost industry pays attention to technological innovation and information application, and widely uses advanced construction technology and software tools, which improves the efficiency and accuracy of project cost assessment. The engineering cost industry in the United States has a huge and professional talent team, and the professional quality and skill level of the engineering cost division are generally high, which can meet the needs of different types of engineering projects.

The Japanese government plays a core role in the management of government-invested engineering projects, emphasizing that the government leads and collaborates with social groups to carry out joint governance. This management model reflects the dominant position of the government, but also attracts the participation of social forces to ensure the efficient operation of the project and transparent supervision. The Ministry of Land, Infrastructure and Transport, the national construction authority, is responsible for the management of the country's construction, land, roads and maritime affairs[5]. The characteristic of engineering cost in Japan is that it covers the entire cost of a construction project, including all the costs of the process from design, procurement, construction, installation to commissioning. In addition, the Japanese project cost also includes the cost of the quality guarantee period and maintenance period, as well as some additional service costs. Due to the fierce competition in the Japanese construction industry, the transparency and fairness of the project cost have been widely recognized.

3. The Application of BlM Technology in Various Countries

3.1. The Role of BlM Technology in Cost Preparation

BlM technology plays an irreplaceable role in the cost preparation. With the continuous development and popularization of BlM technology, its application prospect in the cost preparation will be broader.

3.1.1. Improve the Accuracy and Efficiency of Engineering Quantity Calculation

With the help of BlM technology, engineering projects can achieve accurate measurement of engineering quantities through 3D visualization and integrated database system, effectively avoiding the common shortcomings of reading errors and inaccurate estimation under the traditional two-dimensional drawing method. The BlM platform integrates various information such as the physical characteristics of the building, the building plan and the financial budget. BlM technology has revolutionized the process of calculating technical quantities, greatly speeding up calculations through automated processing and significantly improving operational efficiency. Moreover, BlM models have powerful data retrieval and editing functions to simplify data management and update processes and optimize resource allocation throughout the project cycle.

3.1.2. Support the Whole Process of Cost Management

In the decision-making stage, BlM visualization and modeling function presents a clear decision-making system for users. The 3D model allows the owner to further explore the decision-making process of the project, evaluate the feasibility of the project and the return on investment. This technology cannot only ensure the accuracy of cost forecasts but also help owners make more prudent judgments when making investment choices.

In the design process of the project, BlM technology speeds up the design process. It enables developers to quickly obtain detailed project information and then perform in-depth data quantification analysis of materials and various parts. This ensures that our proposed solution is technically feasible to facilitate consistency between design and budget.

The BlM model extracts quantitative data at the tender and tender stages to create a comprehensive bill of quantities. Firstly, it ensures the integrity and unity of bidding documents, secondly, it avoids legal contradictions caused by the uncertainty of the scope of work. and guarantees the barrier-free conduct of bidding.

In the construction process, BlM technology provides a strong support for the construction site. BlM technology allows the construction unit to monitor the cost of the project in real time, and regularly compare the actual cost with the budget target. Then the risk of exceeding the budget can be found and corrected in time. Through the analysis and processing of engineering information data and site management information, the project cost is forecasted and controlled.

In the process of completion acceptance and settlement of the project, the application of BlM technology improves the execution efficiency and accuracy of the project settlement. Using the engineering data in the model can quickly and accurately estimate the final cost, reduce the uncertainty of settlement and speed up the cash flow.

3.1.3. Facilitate Data Accumulation and Sharing

The application of BlM technology in the field of engineering cost has enriched the database. The database is built on the base of detailed data after each project is completed, covering everything from material selection and cost analysis to supply chain management. With the accumulation of project experience, the historical data has become a valuable resource for spending trend analysis and spending forecast, laying the foundation for future spending management of similar projects.

The introduction of BlM model has eliminated the barriers of information isolation in traditional project management and achieved a stable integration between design, construction and cost management. As a major data exchange platform, it provides all participants in a project with up-to-date and accurate information and avoids errors caused by delayed or inconsistent information. The multidisciplinary collaborative environment supported by BlM technology enables architects, engineers, contractors and cost planners to interact in the same virtual space, preventing communication problems in traditional workflows.

3.1.4. Optimizing Management Processes

The introduction of BIM technology builds an integrated collaboration platform for project participants. BIM technology facilitates interaction and coordination among designers, architects and cost managers. Through the same complex digital model, all parties can achieve barrier-free communication and reduce the delay and distortion of information transmission, reduce the coordination cost and avoid the deviation in the implementation process. The application of BIM technology optimizes the process of cost management. From the initial analysis of project decision making to the final settlement, BIM runs through the whole process and provides system solutions.

3.2. The Application of BlM Technology in the Cost Industry in Various Countries

The application of BIM technology in the cost industry in various countries has made remarkable progress in recent years, but the specific data comparison may vary by time, region and industry.

3.2.1. The Republic of China

China has seen significant growth in the adoption of BlM technology in recent years, widely covering the full life cycle of projects, especially in large-scale projects and key projects, to drive digital transformation. The government actively encourages the application of BlM technology and has introduced a series of policy measures to support its development.

Although the overall penetration rate of BlM in China is relatively low, it has grown rapidly in recent years. According to some reports, the application of BlM technology in the construction cost industry in China is gradually expanding. The Chinese government has actively promoted the application and development of BlM technology in the cost industry by formulating policies standards and other measures.

3.2.2. Britain

The UK government actively promotes the application of BlM technology. Especially in public projects. Since 2016, the United Kingdom government has promoted the adoption of BlM technology by requiring all public projects to adopt the BlM Level 2 standard.

The UK government has mandated the use of BlM in high-

rise residential projects, which has had a direct impact on the construction industry. Due to the compulsory promotion of the government, the application level of BlM in the British construction industry has been significantly improved, and the application of BlM technology in the cost industry is also more extensive.

3.2.3. The United States

The United States is one of the pioneers of BlM technology, having begun the development and adoption of BlM in the construction industry as early as the 1970s. At present, BlM has been widely used in the construction industry in the United States, especially in large projects and complex engineering.

According to early data, the penetration rate of BlM in the United States has exceeded 70%, showing a high market acceptance. BlM is widely used in project estimation, cost control, material management and other aspects in the cost construction industry in the United States, which has significantly improved the economic benefits and management efficiency of the project.

3.2.4. Japan

Japan was one of the first countries in Asia to enter BlM practice, working on the development and improvement of BlM standards. BlM is also widely used in the construction industry in Japan, especially in large infrastructure projects.

4. Comparative Analysis

Britain has established a relatively perfect system in the aspect of project cost management. The UK has adopted the internationally recognized bill of Quantities standard to enhance the fairness and transparency of measurement. In terms of pricing mechanism, the UK implements the lump-sum contract or unit price contract model. And invite third-party agencies to check prices and consult services.

The engineering cost management system of the United States is also quite perfect, and its measurement technology combines the bill of quantities and detailed estimation table to achieve highly accurate measurement. In terms of pricing, the United States uses the unit price contract model, and uses professional service institutions to conduct price evaluation and consulting services to ensure the accuracy of cost estimation.

Table 1. Comparison of China's engineering cost system with that of Britain. America and Japan

	China	Britain, America, Japan
Cost measurement	Mainly according to the norm and list promulgated by the state, pay attention to the actual consumption of the project and the cost of labor, materials, machinery and so on	Pay attention to the market mechanism and the actual cost, usually based on market price information and the actual construction situation to determine
Pricing model	Usually adopt quota valuation and list valuation combined way	Using the market pricing model, the project cost is determined by the market supply and demand relationship, and the project cost is closer to the market reality
Cost control and management	There is a strict project cost management system, including budget, settlement, audit and other links to ensure the rationality and effectiveness of the project cost	Pay attention to the control and process management in the project start-up stage, through the fine project management and cost control, to achieve the dynamic management of the project cost

In terms of project cost management, Japan emphasizes the combination of list and estimate, and attaches importance to the preparation, update and maintenance of list. in terms of pricing, Japan uses fixed total price contracts and has professional institutions responsible for price review and consulting services. Japan strictly implements quality and safety management measures to ensure the accuracy of the cost.

China's engineering cost pricing industry system is undergoing market-oriented reform, multi-level management system, continuous improvement of institutional norms. and gradually from "quantity and price integration" to "quantity and price separation' change. At present, the industry is facing challenges such as fierce market competition, insufficient data accumulation and regulations to be improved.

5. China's Project Cost Advantages and Challenges Coexist

5.1. The Advantage of Engineering Cost in China

Under the background of the vigorous development of the construction industry, the importance of project cost management as the core link has become increasingly prominent. China's project cost management system has

unique advantages, laying a solid foundation for the steady development of the industry.

Digital intelligence drives profound changes in the engineering cost industry. and the integration of big data, cloud computing and Al technology improves the accuracy and speed of the cost. The wide application of BlM technology opens a new era of seamless integration of design and cost management. realizes information management, and optimizes cost control and efficiency

The concept of green building leads the new era of cost management, emphasizing both environmental protection and economic benefits. in the global environmental awareness, adhere to sustainable development into the whole cycle of the project. From material selection, design concept, construction to operation and maintenance, energy conservation, emission reduction and environmental protection are considered in every step, striving for a harmonious coexistence of economic and ecological advantages. The introduction of the green building certification system has set stricter criteria for cost assessment and stimulated the green transformation of engineering projects towards low carbon and environmental goals.

The integration and innovation of the industrial chain will become a key force driving the modernization and transformation of the engineering cost industry. Under the trend of the comprehensive modernization of the construction industry, the project cost must strengthen the close cooperation with the upstream and downstream industries, strengthen the multiple connection of design, construction, operation and maintenance, and achieve the optimal allocation of resources and fine cost control.

The continuous advancement of the "Belt and Road" initiative has opened a broad space for the international cooperation of the construction cost industry. The cooperation between China and countries along the Belt and Road in infrastructure construction has been deepening, but at the same time.it also faces many challenges such as legal systems, technical standards and cultural differences. Therefore, cost experts need to maintain an international perspective, have a deep understanding of the political environment, technical norms and market requirements of different countries, and improve cross-cultural communication skills to meet the complex and ever-changing needs of the international market.

5.2. Facing Challenges and Coping Strategies

However, opportunities and challenges coexist, the construction cost management in our country faces multiple tests.

The lack of supervision of project cost management, the lack of supervision measures in the construction process of construction cost management, the supervision work is not comprehensive, leading to the waste of cost resources. the lack of cost monitoring mechanism, it is difficult to find cost overruns or waste of resources in a timely manner, leading to the discovery of cost control problems in the later period, and ultimately increasing the cost of adjustment and improvement[6].

In the highly competitive market environment, engineering cost enterprises need to strengthen brand building, optimize service quality, and stand out with differentiation strategy. Attaching importance to the cultivation of talents and building a professional team is the cornerstone of the sustainable development of enterprises.

The evolution of policies and regulations urges enterprises to build a flexible response mechanism, keep up with the policies, timely optimize the management policy, and ensure the compliance of the project operation. At the same time, communication with government departments and actively seeking policy guidance and support are the key strategies for enterprises to obtain competitive advantages.

In the market environment full of variables, the construction cost industry needs to strengthen the construction of risk management system, introduce advanced intelligent early warning system, and improve the ability to respond to emergencies. Through cross-field cooperation, build a joint platform for risk prevention and control, collectively deal with market uncertainties, and ensure the steady progress of engineering projects.

6. Development Trends and Prospects

China's construction cost industry has experienced the transition process from planned economy to market economy. With the acceleration of economic globalization and the development of information technology, China's engineering cost industry will pay more attention to international standards, introduce more advanced technology and concept; With the transformation and upgrading of the construction industry and the development of green buildings, China's engineering cost industry will pay more attention to environmental protection and sustainable development; With the application of artificial intelligence and big data and other technologies, China's engineering cost industry will pay more attention to the development of intelligence and digitalization.

Engineering cost and national rejuvenation are mutually promoting. On the road of national rejuvenation, the rise of each landmark construction project reflects the role of engineering cost.

Looking forward to the future, China's construction cost industry will move toward commercialization, specialization and internationalization. Through exchanges and cooperation with global counterparts, China's engineering cost field will continue to progress.

7. Conclusion

To sum up, there are differences between China and Britain, the United States, Japan and other countries in cost measurement, pricing model, cost control and management, which is not only determined by the historical and realistic background of the development of China's engineering cost industry, but also the result of deepening exchanges and cooperation between China and the international community in the field of engineering cost. In the face of the future, we should actively learn from international advanced experience, constantly innovate project cost management mode and methods, strengthen industry supervision, improve the quality of employees, introduce advanced technology and concept and other measures to promote China's project cost industry to achieve a higher level of development.

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References

[1] Lei Yang. Analysis of current situation and development direction of construction cost management in China [J]. Ju She, 2020 (25):153-154.

[2] Huang Dengfeng. Current situation and Countermeasures of construction cost management in China [j]. Value Engineering, 2019, 38 (04):35-37.

[3] Nie Zhenlong. A comparative study on construction cost management between China and Britain [j]. Construction Economics, 2019, 41(10):20-23.

[4] Yang Hongyan. Reference Significance of Foreign Advanced Construction Cost Consulting Management [j]. Shanxi Architecture, 2009,35(11):208-209.

[5] Hu Xiaoli, Zhao Bin. Discussion on Construction Cost Management in Japan[J]. Construction Cost Management,2016 (05): 86-88.

[6] Li Ning. Research on the problems and Strategies in the whole Process Control of construction cost [j]. Home Industry,2024 (06): 160-162.