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Analysis of the Application of Information Technology in Construction Project Economic Management

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Abstract: This article focuses on analyzing the application of information technology in construction economic management, aiming to enhance project efficiency. In the face of challenges such as cost control difficulties, project complexity, and poor information flow in the construction industry, the article presents the dilemmas of construction project economic management. It showcases the significant advantages of integrated applications of technologies like BIM, cloud computing, big data, and the Internet of Things through relevant case studies, while also exploring their potential application space in the future. Additionally, the article addresses implementation challenges and proposes corresponding countermeasures, emphasizing the critical role of information technology in the digital transformation and economic management optimization of the construction industry, guiding future research directions.

Keywords: Information Technology; Project Cost; Economic Management; Application Analysis

1. Introduction

With the advent of the information age, information technology has become an indispensable direction for the development of construction enterprises. The application of information technology not only effectively addresses challenges such as cost control difficulties, high project complexity, and poor information flow but also promotes innovation and upgrading of enterprise management systems. By optimizing cost expenditures, it aids construction enterprises in achieving sustained economic growth. Therefore, in-depth research on the application of information technology in construction economic management holds both theoretical significance and practical implications, providing scientific decision support and operational guidelines for enterprises, and contributing to the digital transformation and enhancement of economic benefits in the construction industry.

2. Analysis of Dilemmas in Construction Project Economic Management

Construction project economic management, as a core driving force for the successful implementation of construction projects, encompasses comprehensive considerations and effective management of project costs, time, resources, and quality. It is not merely an organization and coordination of a series of financial activities but a systematic strategy aimed at achieving economic goals and maximizing value through scientific methods and advanced technological means. However, construction project economic management faces numerous challenges and dilemmas in practice:

2.1 Difficulty in Cost Control

The challenges in cost management primarily arise from inherent complexities and uncertainties. Fluctuations in material prices, changes in labor costs, increased engineering difficulties, and unforeseen events collectively pose risks of cost overruns during project implementation, presenting significant challenges for budget and control [1-3]. Furthermore, construction projects involve numerous suppliers, contractors, and subcontractors, each with unique cost structures and pricing mechanisms. This requires managers to possess deep financial knowledge and a thorough understanding of the characteristics and operational processes of the construction industry, making the collection and integration of cost information a heavy and complex task. Additionally, in a rapidly changing market environment, the timeliness and accuracy of cost decision-making are critical, necessitating high standards of decision efficiency and insight.

2.2 Inaccurate Project Schedule Management

The inaccuracy of project schedule management is another dilemma in construction project economic management, primarily stemming from the complexity of projects, uncertainties in external environments, and internal management challenges. Specifically, construction projects involve extensive resource allocation, complex process flows, and multi-stage construction processes, where every step is crucial. Any delay in one step may lead to a postponement of the entire project timeline. Moreover, instability in material supply, weather constraints, unexpected technical difficulties, or improper human resource allocation can directly impact project schedules, rendering originally precise plans difficult to execute. Furthermore, a lack of effective communication mechanisms, inadequate data tracking, insufficient risk management, and a lack of flexible response strategies contribute to the inaccuracy of schedule management. Therefore, enhancing the precision of project schedule management remains a significant challenge for construction project economic management.

2.3 Poor Information Communication and Insufficient Risk Management

In construction project economic management, uncertainties in the natural environment, drastic market fluctuations, challenges posed by technological innovations, and legal compliance risks collectively constitute potential crises [4]. However, due to a lack of comprehensive risk identification, assessment, planning, and response mechanisms, many projects appear fragile when facing these risks, resulting in cost overruns, schedule delays, quality defects, or even project failures. This is primarily caused by a lack of risk awareness, inadequacies in risk management processes, a shortage of professional risk management talent, information asymmetry, and subjective judgments in the decision-making process. Therefore, enhancing risk management capabilities, establishing a comprehensive and systematic risk management system, raising risk awareness, adopting advanced risk management tools and technologies, and strengthening cross-departmental collaboration and information sharing are key to addressing this dilemma [5].

2.4 Insufficient Contract Management and Decision Support

Construction projects involve complex multi-party collaborations, requiring clear contractual stipulations at every stage to ensure a precise definition of rights and obligations. However, in practice, issues such as incomplete contract terms and inadequate execution supervision often arise, leading to frequent contract disputes that affect project schedules and cost control. Additionally, non-standardized contract change management can easily result in extra costs and disputes.

An effective decision support system can help management quickly obtain critical information and conduct data analysis, enabling more informed decision-making. However, due to difficulties in data integration, outdated analytical tools, and imprecise decision models, many decisions still rely on personal experience and intuition, lacking scientific basis, potentially leading to irrational resource allocation and ineffective cost control.

Therefore, strengthening contract management processes, optimizing decision support systems, and enhancing data analysis capabilities are crucial for improving construction project economic management.

2.5 Insufficient Consideration of Sustainable Development

As global attention on environmental protection, resource efficiency, and social responsibility continues to grow, the construction industry faces immense pressure to balance economic interests with environmental protection, resource conservation, and social welfare. However, in reality, many engineering projects tend to focus on short-term economic gains during planning, design, and implementation phases, neglecting long-term environmental impacts and resource consumption, leading to energy waste, ecological damage, and pollution emissions. To address this dilemma, the construction industry needs to shift its traditional mindset, making sustainability a core objective and pursuing harmony between economic benefits, social welfare, and environmental protection for long-term stable development.

2.6 Relatively Lagging Technology and Information Application

With the rapid advancement of technology,

cutting-edge tools such as BIM (Building Information Modeling), big data, and cloud computing have gradually become essential for enhancing project efficiency, optimizing cost control, and strengthening decision support. However, many traditional construction projects have not fully leveraged these advanced technologies in practice, resulting in information silos, low data processing efficiency, and insufficient decision-making foundations [6].

3. Role and Case Study Effects of Information Technology in Construction Project Economic Management

3.1 Role of Information Technology in Construction Project Economic Management

The application of information technology in the field of construction project economic management acts as a catalyst for the construction industry, significantly enhancing management efficiency and quality. By integrating cutting-edge technologies like BIM, cloud computing, big data, and the Internet of Things, the construction industry can achieve comprehensive optimization across project planning, cost control, schedule supervision, resource allocation, and risk management. The introduction of BIM technology not only enhances collaboration during the design phase but also allows for simulation and optimization, substantially reducing design costs and construction risks [7-8]. BIM's three-dimensional visualization capabilities enable the simulation of various scenarios before construction, utilizing virtual reality (VR) and augmented reality (AR) technologies to immerse participants in the future building's layout and functions, identifying and resolving potential issues and conflicts during the design phase. This effectively predicts and avoids potential risks, reducing costs. The powerful computational capacity and resource-sharing platform provided by cloud computing facilitate massive data storage and processing for project management, allowing project teams to access project information in real-time, promoting efficient collaboration across departments and regions, and accelerating decision-making. Big data analysis offers precise foundations for cost forecasting and resource optimization, assisting managers in making more forward-looking decisions. The introduction of IoT technology transforms construction sites into "smart" environments, enabling real-time monitoring of equipment status, environmental parameters, etc., enhancing safety and ensuring resource sustainability. In summary, the application of information technology not only brings unprecedented convenience and efficiency to construction project economic management but also provides possibilities for achieving green and sustainable construction project management.

3.2 Typical Case Study Effects

Shanghai ** Skyscraper, a multi-functional skyscraper comprising offices, hotels, observation decks, and conference spaces, reaches a height of 632 meters. The project's immense scale involves numerous complex economic management facets. It employs BIM technology to create a three-dimensional building information model that includes all components, construction details, progress, and cost information. Through BIM technology, project managers can view and analyze project costs, progress, and quality in real-time, effectively enhancing the transparency and efficiency of economic management. This precision in cost control and orderly schedule management minimizes decision-making errors caused by information asymmetry, reduces project risks, and ultimately allows the project to be completed on time and within budget.

Beijing ** International Airport, the largest single-terminal airport in the world, involved substantial building materials and labor costs. During the project, big data analysis tools were introduced to collect and analyze historical project data, market data, weather data, etc., to forecast material price trends, labor cost fluctuations, and potential construction delay risks, effectively controlling project costs. Consequently, the application of big data analysis technology led to more accurate cost forecasting, more rational resource allocation, and effective cost control, enhancing overall project economic benefits.

Guangzhou ** Smart City Project is a comprehensive development project integrating office, residential, and commercial spaces, requiring efficient allocation of significant human and material

resources. The project adopted cloud computing technology to establish a cloud-based resource management system. This system facilitated online resource allocation, real-time monitoring, and dynamic adjustments, significantly improving resource utilization. Thus, the application of cloud computing technology enabled more flexible resource scheduling, reducing resource idleness and waste, while enhancing overall operational efficiency and economic benefits of the project. It also improved project management transparency and response speed, strengthening team collaboration capabilities.

These three cases demonstrate the effects of information technology (including BIM, big data analysis, cloud computing, etc.) in construction project economic management [9-11]. The introduction and application of these technologies not only improve management efficiency, reduce costs, and optimize resources but also support better decision-making and planning, ultimately driving the sustainable development of the construction industry.

4. Application Strategies of Information Technology in Construction Project Economic Management

The application strategies of information technology in construction project economic management should focus on four core areas: enhancing efficiency, optimizing processes, strengthening decision support, and promoting sustainable development. Below are some specific strategies:

4.1 Strengthening the Integration of Information Systems

To further strengthen this aspect, emphasis should be placed on data integration and sharing, building a unified data platform to achieve centralized management of project data and cross-departmental collaboration, improving data flow efficiency, and enhancing the accuracy of decision-making. Choosing stable and reliable technical architectures and tools is also a key factor in system integration, along with considering the openness and compatibility of the system for future expansion and integration with other related systems. Additionally, establishing employee training and support systems is essential to ensure all team members can proficiently operate and fully utilize the system's functions. Finally, a continuous improvement mechanism should be established, optimizing system performance through user feedback and data analysis to meet the ever-changing management needs and effectively implement intelligent decision support through information technology in construction project economic management.

4.2 Further Optimization of Resource Allocation

Optimizing resource allocation is key to improving overall efficiency and economic benefits. By implementing comprehensive resource management systems, ERP (Enterprise Resource Planning) systems can be used to integrate and optimize human resources, material resources, financial resources, and information resources, thereby avoiding resource waste and redundancy. Cloud computing and big data technologies can be used to deeply analyze historical data, predict resource demand trends, and make early preparations for resource reserves and allocation. Additionally, an intelligent procurement platform can be used to achieve transparency and openness in material procurement, reducing costs and improving procurement efficiency. Finally, a performance assessment system can be used to motivate employees to work efficiently, optimize team structure, and strengthen human resource management. Implementing these strategies can significantly enhance the effectiveness of resource allocation in construction project economic management and create greater value for enterprises.

4.3 Further Strengthening of Risk Management

By building a comprehensive risk management system and utilizing technologies such as big data analysis, artificial intelligence, and cloud computing, it is possible to monitor and warn of project risks in real-time. Establishing a risk database and monitoring system allows the collection and organization of various risk information and regular analysis of relevant indicators, improving the accuracy and timeliness of risk identification. Additionally, a collaborative platform with partners can be used to share risk information and achieve risk-

sharing and transfer. Ensuring data security and transparency is also a critical aspect of risk management. Finally, an emergency response mechanism should be established to swiftly initiate contingency plans in case of risk events, minimizing losses. These measures will strengthen risk management and provide a solid guarantee for the successful implementation of projects.

4.4 Promoting Sustainable Development

In construction project economic management, application strategies for information technology should also focus on promoting sustainable development, which is not only a responsibility toward environmental protection but also a strategic measure to enhance enterprise competitiveness. By introducing green building evaluation systems and using BIM (Building Information Modeling) technology to optimize building design and construction processes, resource consumption and waste generation can be reduced, and energy efficiency can be improved. IoT technology can be used to monitor building operations, achieving intelligent energy management and extending the life of buildings. Additionally, promoting the digital transformation of supply chain management, prioritizing the use of environmentally friendly materials and green suppliers, and reducing carbon emissions during transportation are essential steps. Lastly, establishing a sustainable development indicator system to regularly evaluate and report the company's environmental impact and social responsibility will enhance brand image and attract more partners and consumers who focus on sustainability.

4.5 Continuous Optimization of Personnel Training

By integrating online learning platforms with in-person training courses, a multi-level, multi-dimensional training system should be built to ensure employees keep up with technological advancements and master the latest management tools and technologies. Key training content includes the efficient use of project management software, data analysis and decision support, risk management strategies, green building, and sustainable development practices to improve the overall business and innovation capabilities of the team. Additionally, a long-term learning and development plan should be established to ensure employees' professional skills and knowledge are constantly updated to adapt to the ever-changing market and technological environment. This will promote the long-term stable development and competitiveness of the organization.

By implementing these strategies, the potential of information technology in construction project economic management can be fully realized, improving management standards and service quality across the construction industry, leading to both economic and social benefits.

5. Conclusion

In this article, the application of information technology in construction project economic management in-depth. Through the analysis of its advantages, challenges, and practical cases, several key conclusions were drawn. First, information technology greatly enhances the efficiency of economic management in construction projects by optimizing cost control, increasing transparency in decision-making, strengthening risk management, and improving resource allocation. Second, while there are challenges in practice, such as technological integration, data security, and the demand for specialized talent, these issues can be effectively resolved through continuous technological innovation, talent cultivation, and policy support. Finally, the application of information technology not only drives the modernization of the construction industry but also promotes sustainable development, helping to balance economic benefits, social value, and environmental responsibility.

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