Discussion on the Characteristics of Construction Technology Management in Building Engineering and the Application of Information Technology

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Abstract: Technology management in building engineering construction is a crucial link to ensure project quality, construction safety, and progress efficiency, exhibiting distinct characteristics of dynamism, complexity, and collaboration. It is necessary to address real-time challenges such as frequent changes in working conditions and concurrent construction by multiple trades, coordinate the cooperation requirements of different participants including planning, construction, and supervision, and respond to the combined impacts of multiple factors such as manpower, materials, and machinery. To overcome the shortcomings of traditional management methods, the integrated application of information technology has become an important breakthrough. By leveraging technologies such as big data and intelligence for information processing, transparent management throughout the entire construction cycle, early identification of hidden dangers, and rational allocation of production factors can be achieved, significantly enhancing the accuracy and timeliness of technical supervision and promoting the development of the construction industry towards intelligence and informatization.

1. Introduction

Against the backdrop of the continuous deepening of urbanization in China and the ongoing upgrading of the construction industry, modern building engineering projects are characterized by larger scales, more complex structures, and increased technological intelligence. Traditional construction management methods, which mainly rely on manual operations and empirical judgment, have shown obvious limitations when facing construction sites with multi-trade collaborative operations, closely coordinated work procedures, and intertwined risk factors. There is an urgent need for technological innovation to break through management dilemmas. As a key control factor throughout the entire life cycle of a building project, the level of construction technology management directly affects the achievement of core indicators such as project quality compliance, schedule control, and work safety. Accurately grasping the characteristics of construction technology management is a fundamental prerequisite for improving management methods, while the rapidly evolving information technology provides important technical means for solving various management challenges during the construction process. This study aims to comprehensively analyze the inherent characteristics of building construction technology management and, in combination with the latest developments in information technology, deeply explore the organic integration of the two. This not only helps to improve the theoretical framework of building construction management but also provides practical technical implementation plans for actual engineering projects, promoting the sustainable development goals of energy conservation, environmental protection, quality improvement, and efficiency enhancement in the construction industry.

2. Characteristics of Building Construction Technology Management

2.1 Dynamism

Construction technology management needs to adapt to both internal and external variables. During project advancement, technical management must maintain a high degree of flexibility and

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cannot adopt a fixed operational mode [1]. On the one hand, there are significant differences in technical requirements at different construction stages. During the foundation construction period, the focus should be on controlling the standard operations of earthwork and support systems; during the main structure construction period, precise control of the process standards for concrete pouring and steel bar placement is required; during the later decoration stage, it is essential to coordinate the technical connections between electromechanical pipelines and decorative surface layers, and the management focus needs to shift dynamically according to the project progress [2]. On the other hand, construction technology management needs to respond to multiple external interference factors: rainy weather requires modifications to concrete curing measures; hot climates necessitate re-planning of work schedules and material storage methods; when encountering sudden geological conditions, such as the displacement of underground pipelines, technical adjustment plans must be quickly formulated to ensure construction quality while maintaining project continuity [3].

2.2 Complexity

Building construction technology management involves multi-dimensional and cross-domain collaborative management. Engineering project management faces the need for three-dimensional control over personnel, machinery, materials, and methods, significantly increasing the difficulty of coordination [4]. During the management process, it is necessary to comprehensively manage various technical indicators, including the professional qualifications of construction personnel, such as special trade operation certificates, material performance parameters, such as concrete grades and steel tensile strength, and machinery operating conditions, such as the positioning accuracy of cranes and the working stability of mixing equipment. Any technical defects in any link may have a cascading effect [5]. Moreover, contemporary building engineering projects generally exhibit the characteristic of multi-system integration, involving different fields such as the main structure, equipment installation, air conditioning and ventilation, and automation control. There are interface overlaps in the construction processes of various specialties, and it is necessary to eliminate isolated operations through technical connections to ensure close professional cooperation and scientific spatial planning, preventing repeated construction [6].

2.3 Collaboration

Technology management is not an independent responsibility of a single department but a comprehensive work system that requires multi-party collaboration and cooperation. Construction enterprises must promote close cooperation among departments such as technology, construction, quality inspection, and procurement [7]. The construction plans formulated by the technology department need to be technically explained and implemented by the construction team, the quality inspection department is responsible for the technical acceptance process, and the procurement department must ensure that material supplies comply with technical specifications, thereby ensuring that technical standards are implemented throughout the entire project process [8]. Externally, it is necessary to coordinate the resources of design institutes, supervision agencies, owners, and government regulatory departments. The design institute should provide detailed technical drawing instructions, the supervision agency should supervise the implementation process of the technical plan, the owner should review the feasibility of technical changes, and the regulatory department should check whether various technical parameters meet the standards. Only by forming a technical consensus among all participating parties can the project be carried out legally and compliantly [9].

3. Application of Information Technology in Building Construction Technology Management

3.1 Improving Informatization Construction

In the process of promoting the application of informatization, construction enterprises should focus on strengthening the construction of information systems, strictly comply with current regulations and industry norms, and effectively implement various control measures to fully unleash

the potential value of information technology in digital transformation and ultimately significantly improve the level of engineering construction management. The key lies in the fact that promoting information system construction can not only optimize the timeliness and classification accuracy of project data processing but also enhance the application efficiency of data resources. Relying on modern network technology, the management team can achieve multi-objective parallel query functions. It can be seen that the introduction of Internet technology in the implementation of control can not only significantly improve the efficiency of construction process management but also ensure the instant availability of project data. To ensure the standardized operation of construction process management work, during the process of technological innovation, construction enterprises must deepen the application of information technology and implement various control measures effectively.

Construction enterprises should also fully integrate informatization means with construction technology management processes, implement whole-process dynamic management, and maintain real-time updates of archive information to ensure the orderly progress of the project. When formulating management norms, it is necessary to scientifically utilize database resources to systematically review the technical documents submitted by construction units. At the same time, it is essential to clearly define job responsibilities and implement a responsibility-to-person management mechanism. For example, with the help of informatization means, enterprises can monitor the implementation of drawings by construction units in real-time and evaluate the matching degree between the construction period and the overall plan. Through information technology platforms, progress control plans and contingency plans for unexpected situations can be formulated to ensure that project quality meets the standards. The application of BIM technology can achieve three-dimensional simulation of construction progress. In actual operations, by comparing the simulated data, it provides managers with a basis for quality inspection and evaluation of the effectiveness of technology application, thereby improving construction organization design and continuously enhancing project management efficiency.

3.2 Optimizing Manual Management

The informatization system for building construction technology management opens up innovative paths and solutions for managers. Therefore, when using digital tools, managers must emphasize transformation, effectively integrate technology with traditional management models, and achieve quality and efficiency improvements in construction technology management. In terms of regulatory system innovation, the introduction of informatization management platforms has catalyzed changes in building technology control models, which requires timely adjustment of existing rules and regulations to ensure their coordination with the new management model.

In terms of assessment, with the help of an informatization management system, the personnel performance evaluation system can be reconstructed. For example, by setting key parameters such as online learning duration indicators, task delay ratios, and project delivery deadlines, the system can automatically track and comprehensively analyze core dimensions such as employees' professional ability growth trajectories, differences between task planning and actual execution, and project progress efficiency. It can real-time collect and present important data indicators such as employees' skill development curves, the matching degree between plans and results, and project execution timeliness in multiple dimensions.

In terms of assessment, using modern information technology means, the personnel assessment model can be reshaped. The platform continuously records and three-dimensionally displays key performance elements such as employees' professional quality improvement paths, comparative analysis of work plans and actual outputs, and work timeliness performance through preset quantitative standards such as training duration requirements, work overdue ratios, and task deadlines.

In terms of job optimization, the application of informatization technology will inevitably lead to adjustments in organizational structures, prompting employees to adapt to new engineering management models. Specifically, the electronic integration of construction technical data achieved

through building information management systems can effectively replace traditional manual processing, verification, and archiving workflows, thereby reasonably streamlining the staffing of document management positions. In addition, based on the informatization management platform, the mechanical work burden of employees can be significantly reduced, the number of redundant operational positions can be cut, and the configuration ratio of front-line construction supervision positions can be correspondingly expanded to improve work efficiency.

3.3 Strengthening Software Development and Promotion

To effectively promote the informatization process of building engineering management, construction enterprises should adopt a dual-pronged approach, both strengthening the application of information technology and focusing on the research and development of professional construction technology management software systems. The specific implementation paths include: first, conducting in-depth research on engineering practice needs during the software development stage to ensure that software functions match construction technology management norms; second, continuously optimizing software operation efficiency, with a focus on improving intelligent information processing capabilities; third, establishing a special research and development fund guarantee mechanism to provide continuous and stable resource support for software development, thereby promoting the comprehensive informatization transformation of enterprise management.

During the operation of construction enterprises, the deep integration of digital technology can significantly improve cross-departmental collaboration mechanisms. With the help of modern network technology, various application terminals can not only complete remote control tasks but also achieve real-time exchange and synchronous update of data resources on a unified platform, thereby ensuring the timeliness of management information. When processing massive amounts of data in the field of building engineering, it is necessary to comprehensively utilize computer software and hardware systems, which can significantly improve the reliability of the final analysis results. Currently, traditional computing devices have shown obvious limitations in performance, and both software functions and hardware configurations are difficult to meet actual needs. To improve data processing efficiency, a distributed cloud computing architecture can be considered to alleviate local computing pressure. This technical solution can not only ensure computing efficiency but also maintain the accuracy of data output.

3.4 Building an Intelligent Management System

To ensure the efficient operation of the informatization management mechanism, it is necessary to build a supporting framework around three dimensions: technology matching, team quality, and institutional constraints to prevent the phenomenon of idle construction. First, construction enterprises need to clearly define the core correlations among different engineering projects, deeply integrate management processes with on-site operations and information technology, and promote the improvement and upgrading of the informatization management system. By deepening the application practice of big data and related technologies, a new information management architecture can be built to form a digital and intelligent management model, implementing all-weather dynamic supervision of construction sites and significantly reducing construction safety hazards. The combination of the Internet of Things and big data analysis can achieve full-cycle real-time monitoring of project quality. For example, relying on the Internet of Things and big data technology, full-cycle dynamic monitoring of construction quality can be carried out. Taking concrete pouring as an example, by installing temperature sensing devices inside the structure, continuous acquisition of curing temperature data can be achieved. Combined with big data platform analysis of the concrete strength growth trend, it can intelligently determine whether the curing effect is qualified. Once abnormal temperature fluctuations occur, the system will immediately send warning information to technicians, effectively preventing strength defects caused by improper curing.

Secondly, in terms of informatization talent cultivation, enterprises can adopt a school-enterprise collaborative education model and establish in-depth cooperative relationships with relevant higher education institutions to build practical teaching platforms for students, focusing on cultivating

applied talents with informatization professional skills. At the same time, for newly recruited employees, systematic pre-job informatization special training needs to be carried out, which can not only promote the effective circulation of internal knowledge resources within the enterprise but also significantly improve overall work efficiency.

Finally, it is necessary to focus on improving the operation and maintenance system of the established information systems, build an intelligent management collaboration mechanism, and compile supporting management regulation documents, such as the "Construction Data Collection Standards," to ensure that all operating links of the intelligent system have a basis through institutional norms and guarantee its continuous and stable operation, providing solid support for technology management.

4. Conclusion

In summary, under the current new development situation of the construction industry, the industry environment presents unprecedented complexity, setting higher standards for construction technology and management levels. During the specific project implementation process, it is necessary to accurately grasp the particularity of building engineering projects, deeply analyze the defects and shortcomings of existing construction technology management, and fully utilize modern information technology means to optimize and upgrade traditional construction methods and achieve technological innovation, ensuring the standardized and scientific advancement of project construction. In addition, it is necessary to formulate systematic implementation plans from the perspective of the overall project quality objectives, deeply integrate informatization technology into engineering construction, and gradually achieve technological breakthroughs and innovations through continuous practice and experience summarization, promoting China's construction industry to move steadily towards a more standardized and sustainable direction.

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