

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

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Abstract: The management of technology in building engineering construction, as the key link and main means to ensure quality of construction, safety in construction and efficiency of progress, has significant attributes such as dynamism, complexity and collaboration. Solve the real-time challenge of constant change in working conditions, concurrent operations by different trades and coordination between participants (planning, construction and supervision) through the intrinsic requirements of these tasks while capturing the joint impact of resources such as manpower, material and machinery. The integrated application of information technology has become an important breakthrough to overcome the deficiencies of traditional management methods. It can make full use of big data and intelligence technology in construction project management, realize real-time transparent management throughout the whole cycle of construction projects, timely find safety hazards, rational allocation of production factors, greatly improve the accuracy and timeliness of technical supervision, help the intelligent development of construction industry informatization.

1. Introduction

With the background of continuous deepening of urbanization in China and significant upgrading of construction industry, modern building engineering projects have larger scale, more complex structure, and increasingly intelligent technology. 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. This innovation can be either for a urgent need the break free from management dilemmas in technology. The construction technology management is a key control factor in the whole life cycle of building project, which can directly affect the completion of core indicators such as project quality compliance rate, schedule control level and work safety. Understand the nature of construction technology management well, which is a basic starting point to improve management methods, and the fact that information technology itself continues to evolve rapidly all provide important technical means for solving various problems in construction project organization management. This study is an overall analysis of the inherent characteristics of building construction technology management and, based on this, a comprehensive exploration with the newest development in information technology focusing on deeply fusing both technologies together. It not only focuses on enhancing the basic theoretical framework of building construction management, but also based on the practical technical implementation plans of real Engineering projects (such as energy-saving economy promotion and environmental protection promotion), promoting the goal of sustainable development for Building Construction Management Course.

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 cannot adopt a fixed operational mode ^[1]. On the one hand, there are significant differences in

technical requirements at different construction stages. Post-Foundation construction period, prevention should focus on standard operations of earthwork and support systems; phase for main structure construction finishing, standards for process control such as concrete pouring and steel bar placement must be strict; post-decoration stage coordination between the technical connections of electromechanical pipelines and decorative surface layers is essential wherein dynamic management focus according to project progress ^[2]. However, construction technology management must cope with multiple external interference factors: rain will modify concrete curing measures; hot weather will need to re-plan the work schedule and store materials; sudden geological conditions encountered, such as underground pipelines displaced by engineers, a technical adjustment plan must be quickly formulated to achieve construction quality under the premise of continuous project implementation ^[3].

2.2 Complexity

It is generally multi-dimensional and cross-domain collaborative management in building construction technology. Due to the use of three dimension space in engineering project management, coordination and control increases significantly in complexity as it is now necessary to have proper definition and adaption of personnel, mechanization, materials and methods ^[4]. Throughout the management period, we must conduct comprehensive management of professional technical indicators such as special trade operation certificates for construction personnel, material performance parameters (e.g. concrete grades and tensile strength of steel), machinery operating conditions (e.g. positioning accuracy of cranes and working stability of mixing equipment). And this may trigger a chain reaction for the defect in any link ^[5]. In addition, most of the current building engineering projects are also characterized by multi-system integration, including various disciplines such as the main structure, equipment installation, air conditioning and ventilation face system automation control. The construction process of various specialty have the overlap of work interface, so it is necessary to establish technical connections and eliminate isolated operations to achieve close professional cooperation and scientific spatial planning, avoid 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

When promoting informatization, construction enterprises should pay attention to the promotion of information system construction work. They should not only strictly implement relevant regulations and industry norms at present but also effectively apply various control measures so that

the potential value of informatization can be fully brought into play in digital transformation and management of engineering construction can achieve significant improvement as well. The crux is that carrying out information system construction can not only improve the timeliness and classification accuracy of project data processing, but also increase the application effectiveness of data resources. Based on the combination of modern network technology, multi-objective parallel query functions can be achieved by the management team. Internet technology being applied to control implementation can not only greatly improve the efficiency of construction process management but also strive for real-time availability of project data. In order to realize the standardization and standardization of construction process management work in the direction of technological innovation, construction enterprises must deepen the application of information technology for effective control.

Construction enterprises should also make full use of informatization means and carry out more effective construction technology management processes, realize whole-process dynamic management, keep the archive information updated in real time, ensure the orderly progress of the project. In formulating management standards, the database resources should be scientifically utilized to carry out systematic review of technical files submitted by construction units. Meanwhile, set job responsibilities clearly and adopt a responsibility-to-person management method. Take the means of informatization for example, one can monitor real-time implementation status of drawings by construction units and match the construction period against the whole plan. The development of progress control plans, as well as contingency plans in the event that an unexpected situation arises (through information technology platforms) can be made to ensure acceptability of project quality standards. Fusion of BIM Technology with application can fulfill three-dimensional simulation construction progress. In practice operation, it not only compares simulated data, but also gives managers a reference for quality inspection and evaluates the effect of technology application which can help them to perfect the design of construction organization and constantly improve the efficiency of project management.

3.2 Optimizing Manual Management

Innovative paths and solutions for managers through the informatization system of building construction technology management. This can provide the basis for when using digital tools, managers should emphasize transformation, integrate technology into traditional management models in an effective and correct manner to achieve quality and efficiency improvements in construction technology management. As for innovation in the regulatory system, informatization management platform is an important factor promoting the changes of building technology control model, thus leading to timely adjustment on existing rules and regulations so as to make them synchronized with 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. Multi-dimensional, real-time collection and presentation of key data indicators: the skill development curve of employees, the matching degree between plans and results, project execution timeliness.

On the assessment side, means of modern information technology, that personnel evaluation models can be reconstructed. With the platform, key performance characteristics are continuously fed and displayed in 3D, including the improvement paths of employees' professional quality; compared work plans and actual outputs; coverage of preset numerical specifications (such as requirements for training duration, overdue ratio at work times, completion deadlines).

On the one hand, informatization technology can be applied to job optimization, which will inevitably lead to changes in organizational structures and enterprises forcing employees out of their comfort zone and adapt to new engineering management models. In particular, the electronic

integration of construction technical data made possible through building information management systems can largely displace the traditional processing, verification and archiving workflows that involved significant manual labor to carry out potential staff redundancies in document management positions. Moreover, with the informatization management platform as the carrier, it can greatly reduce the mechanized work burden of employees and also cut down redundant operational positions while properly increasing the configuration ratio of front-line construction supervision posts to further enhance working efficiency.

3.3 Strengthening Software Development and Promotion

In order to promote the informatization process of building engineering management, construction enterprises should not only strengthen information technology application but also in the research and development of professional construction technology management software systems vigorously. Concrete implementation paths include: first, to conduct in-depth study on the needs of engineering practice during software development so that functions can match with construction technology management norms; Second, continuously optimize software operating efficiency, especially enhance intelligent information processing ability; Third, special research and development fund guarantee mechanism should be established to provide continuous and stable resource support for software development so as to promote the comprehensive informatization transformation of enterprise management.

The profound fusion of digitization technology can effectively enhance the cross-departmental collaborative mechanism in the operation of construction enterprises. Thanks to the advanced network technology and various application terminals, we can not only complete remote control tasks but also realize real-time exchange of data resources on a unified platform and synchronous update of management information that must be timely. The processing of large-scale data in building engineering requires the integrated use of both computer software and hardware systems, which can greatly enhance the reliability of final analysis. At present, traditional computing devices have obviously limited performance, and neither software functions nor hardware configurations can meet the actual needs. A distributed cloud computing architecture (to reduce pressure on local computing) is an option to improve data processing efficiency. The implementation of this technical solution is able not only to ensure the efficiency of computing but also maintain high accuracy data output.

3.4 Building an Intelligent Management System

The informatization management mechanism is operated in functionality, should Establish core correlations between different engineering projects Construction enterprises need to define the core correlations of relevant data between a variety of engineering projects and deeply integrate management processes with on-site operations and information technology by vigorously promoting the improvement and upgrading of informatization management system. Through the deep application practice of big data and related technologies, it can build a new information management architecture, establish a digital intelligent management model, implement all-weather dynamic supervision in construction sites, keep relaxing construction safety hazards. Based on the Internet of Things and big data analysis, full cycle real-time monitoring of project quality can be achieved. 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 also necessary to strengthen the operation and maintenance system of the established information systems, build an intelligent management collaboration mechanism, compile relevant supporting management regulation documents such as "Construction Data Collection Standards", establish a basis for all operating links of the intelligent system through institutional norms and guarantee its continuous and stable operation to achieve technology management strong support.

4. Conclusion

In summary, when new construction industry development situation struggles to meet the requirements of the continuous growth of science and technology, environmental pollution, and tight capital supply chains. In the project implementation process, it is essential to understand its specialized characteristics of construction engineering projects accurately, to analyze deeply and refine existing construction technology management defects and deficiencies, as well as fully utilize modern information technology means to optimize and upgrade traditional construction methods for technological innovation; in order to promote effective institutionalization and scientific nature of project construction. Moreover, systematic implementation plans from the perspective of overall project quality objectives need to be developed, informatization technology needs to be deeply integrated with engineering construction, and technological breakthroughs and innovations should be achieved step by step from practice and experience summary in order to continuously promote China's construction industry moving into a more standardized way towards sustainable development.

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