

Research on digital-based engineering project management system

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Abstract

With the rapid development of engineering construction in my country, the scale of engineering, technical content and digital demand are constantly improving. The disadvantages of the traditional management model have been digitized, and a new solution has been proposed. With the rapid development of digital-related technologies, large-scale project management has proposed more. However, the traditional model has been unable to solve its needs reasonably and compliantly, and the research of engineering project management system based on digitalization can effectively solve such problems.

Keywords

Digitization; Engineering Management; Projects.

1. Introduction

In recent years, as the concept of "digital city system" has been optimized, digital technology has gradually penetrated into all sectors of social development, greatly affecting and changing people's production and lifestyle. Digitization and wisdom are often proposed at the same time in urban construction, but they are not exactly the same. Digitization is the conversion of a variety of complex and variable information into measurable numbers and data, and then the establishment of an appropriate digital model, which is used to express the characteristics and essence of affairs more directly and accurately^[1].

In the field of engineering project construction, the scale of engineering construction is expanding with the changing needs of society. The integration and internationalization of project management are increasingly in demand, and the importance of digital management is becoming more and more prominent. The traditional management mode can no longer meet the growing digital demand. The establishment of digital project management system will accurately and effectively distinguish engineering characteristics. It optimizes the collaborative management between different division units, and strengthen information sharing. It also facilitates the supervision and controls the whole process, all-round and all-elements of engineering projects which strongly promotes the development of project management to depth and breadth.

Starting from the goals and demands of the digital engineering management system, this paper studies the drawbacks of the traditional management model, builds a management implementation platform based on digitalization, organically integrates engineering project data management, and starts from the impact of digital development on construction projects. Visualization, intelligent, virtual reality and other digital intelligent technologies are applied to the construction project management, and the integrated management of all-round, all-element, and full-life cycle of the project is integrated, and the methods and measures of the project management under the guarantee digital system are discussed.

2. Disadvantages of traditional management mode

The construction of the project is inseparable from the cooperation of many parties. According to the traditional engineering mode of operation is easy to produce poor information. The construction departments of all parties are prone to disputes over different work, and conflicts between them can easily hinder the smooth implementation of the project.

2.1. Serious lack of professionalism

The main operation projects are also landmark projects of local governments, and they are also extremely important projects concerning the people's livelihood. No matter the scale or the cost are high standard and strict requirements, especially the key issues such as construction period and quality and safety. However, the level of some construction personnel varies, and the managers cannot collect timely and uniform Project management information and node material in the construction process, resulting in the loss of important construction node material material, which cannot play a key role in the later stage after the completion of the project construction.

2.2. High communication cost

Traditional engineering construction planning and design program decision-making usually requires the government, enterprises and design parties to communicate. A single specific detail needs to consume a great deal of time and energy costs, which is a very high consumption for the construction of engineering projects^[2]. Especially for time-critical and task-heavy projects, large projects have many stakeholders, and rely on traditional communication and coordination methods. It is easy to produce huge consumption costs for data and information management and take up a lot of resources.

2.3. Existence of information barriers

In the process of engineering construction, paper documents are inevitably needed as support, such as change visas, legal contracts, financial purchase orders, engineering files and other related documents and information^[3], but each information is independent of each other and is not associated with each other. So that when the project is in urgent need of decision making, it is impossible to obtain effective information quickly and efficiently. Forming an "information island" cannot be effectively connected "The completely different kinds of information seriously affect the communication efficiency and process of the project.

3. Construction engineering digital management system

At present, the main direction of the development of engineering projects are new urbanization construction comprehensive development, etc. The main demand for business of project management and emergency command system business volume increases brought about by the increase in the amount of decision-making. Whether listening to the cooperation unit report or report to the government decision-making level, the traditional reporting method which is not intuitive, time-consuming and laborious have been difficult to meet the real needs.

At the same time, engineering projects often require comprehensive information perception, management and supervision of key nodes or important matters. The development of company scale is generally accompanied by the increase in the number and difficulty of projects, and management also needs to keep pace with the development of the times. Efficient digital management and supervision mechanism can effectively improve the project construction effect.

3.1. Engineering digital management content

There are five main aspects of engineering digital management: project integration management, project scope management, project content management, project process management and project file management^[4].

Among them, according to the analysis of the company's development needs, the system function design is mainly based on project management platform, economic operation analysis platform, emergency command system platform and integrated information management platform, which mainly contains system management, system configuration, basic project information, annual/monthly investment management, monthly project supervision, project major matters management and project economic operation analysis, and also contains the project's emergency command system requirements of the video platform and conference system.

3.2. Engineering digital management structure

3.2.1 Functional requirements of engineering digital management

According to the actual business needs of the company's development, digital monitoring, analysis and management of information of engineering project construction are carried out by means of digitization and intelligent perception. It establishes a unified project management platform, realizes information interaction of the project in various forms such as data visualization, video visualization of fixed-point deployment monitoring, analyzes and monitors the investment, progress, construction situation and major matters of the project, and improves the efficiency of project control. The specific requirements of the project are as follows.

Establish a unified project management platform, using digitalization, visualization and other means to achieve intelligent monitoring. Controlling of the project forms a sustainable management system. Establish a centralized management mechanism for project information, present trends, discover hidden risks and provide data reference for the management process by acquiring, processing and analyzing project progress, investment and other information. Establish a data management center for unified management of project data. It can continuously monitor data dynamics and provide support for data changes; establish an information reporting and exchange system to realize on-demand reporting and exchange of data and dynamically perceive regulatory information, as shown in Figure 1.

3.2.2 Content of engineering digital management

Engineering digital management system is mainly oriented to the company's demand, supported by advanced digital technology^[5] and multiparty cooperation to realize a visualization platform for the whole life cycle and integrated management of all elements of construction projects, which can not only assist in dynamic control of all aspects of engineering construction, but also realize functions such as decision support, on-site command and control, and engineering process storage.

(1) Planning and decision-making stage management content: the planning and decision-making of the project is crucial as the pre-project. The fundamental issues such as the choice of project construction, the determination of project location and the selection of investment plan can directly determine the success or failure of the project. First of all, through the conceptualization process of project planning, combined with the specific construction conditions and socio-economic development environment, the construction scale and construction level of the project is positioned to determine its feasibility, the system composition of the project, the composition of the individual projects within the project system, as well as other important planning links are an extremely important part of the project planning.

(2) Construction implementation stage management content: the project construction implementation stage is the most involved parties in the whole life cycle of the project construction, so the digital management of the project under the close cooperation and synergy of the parties involved in the project is more important. The main costs in the project construction implementation stage are duration cost, quality cost and safety and environmental protection cost. How to control the construction cost more reasonably and efficiently, reduce the cost loss, ensure the quality cost, effectively accumulate the bulk engineering data in the construction process and transfer them all to the operation stage to ensure the information sharing in the whole life cycle of the project, as shown in Figure 2.

(3) Operation and maintenance stage management content: The normal operation of a project in the operation and maintenance stage, maintenance work during the warranty period and maintenance and facility renewal outside the warranty period are the main tasks. As the post-evaluation of the project is a long-term continuous work. Throughout the whole project cycle, the evaluation results not only have an important guiding role for the operation and maintenance of the project itself, but also have a very important reference significance for other project construction and operation. The data collection of the post-project evaluation is mainly based on the maintenance data during the maintenance period, the renewal and maintenance data of the facilities, the post-project evaluation data and the dismantling management data of the project, as shown in Figure 3.



Figure 1 Project digital management platform



Figure 2 Project implementation stage management



Figure 3 Project full cycle management

3.2.3 The Structure of Engineering Digital Management

Analysis of the core requirements of the system: 1) The built platform serves as an integrated master control program for digital intelligent management of projects, not only as an application platform for project management and emergency command system, but also as an integrated entry for other applications such as 3D planning software and model making software. 2) The completed platform should be able to carry out investment control and progress control. It should reduce the cost required for project construction, and make the construction process more transparent. The construction process is more refined. Reduce project risks, so project to have better management and control, and achieve investment goals. control. 3) The built platform focuses on realizing the functions of project economic operation measurement and data statistical analysis, providing scientific decision-making and effective support for project pre-planning and project process control, improving overall project management capabilities, and accumulating historical data to provide valuable for new projects. implementation experience.

Analysis of system user types: After careful analysis of system requirements, the project management platform mainly has the following four types of users, mainly the company's decision-making level, business participation and management personnel, general data entry users, and normal system operation and maintenance personnel.

Analysis of system data types and collection methods: According to the analysis of system functional requirements, the data types and collection methods of projects are mainly reported by different data types. Through intelligent hardware such as cameras, the data of each project is manually entered or uploaded by video to the system. The analysis platform is analyzed and utilized by the analysis platform, and finally forms relevant display data on the computer terminal.

System logical structure analysis: The project is divided into five subsystems, including video surveillance system, video conference system, economic operation analysis system, background project management reporting system, and large-screen display from the logical structure, and includes corresponding hardware equipment, system integration and software platform.

4. Implementation platform for the construction of digital management system

4.1. Establish a complete information resource network

To build the implementation platform of the digital management system, first of all, the corresponding information resource chain should be established, the business process should be clarified, the information relationship between various business departments should be clarified, and the information model system of the management platform should be established. Then measure the data information in the existing database according to the established information model, integrate the parts that are consistent with the usage and the parts that are not consistent with the reform, and carry out reasonable and effective optimization and adjustment based on the specific implementation situation to ensure that the project Construction information is comprehensive, timely and accurate to be preserved and applied.

4.2. Clarify the functions of each module of the platform

The platform software for the construction of the digital management system should mainly include the work of the following four modules: building an investment management model; economic analysis module, video conference module, and monitoring module. The functional requirements of the main modules are as follows: it is used to realize the function of estimating expected return of investment in engineering management projects, and has the function of adjusting preset parameters; realizes the aggregation function of progress and investment information through data visualization; has the ability to automatically classify and summarize after data input, supports The ability to record major events; the ability to display the full picture of data through data visualization methods that are not limited to line charts, bar charts, and pie charts; the display interface has strong editability, and sub-items can be adjusted by themselves; Mobile cameras, aerial photography of drones, etc. realize long-distance monitoring and real-time backhaul, and support remote control of drones; have real-time calls and video intercom functions with the scene.

4.3. Build the external environment for platform operation and maintenance

In the early stage of the construction of the digital management system, the market environment, prerequisites, participants and other multiparty systems are not mature, and it is difficult for one party to unilaterally promote it. Therefore, it is necessary to build a suitable external environment in time to actively promote the construction of digital management systems for projects. It is mainly necessary to start from the construction of network infrastructure, the

construction of fixed-point demonstration projects, the talent reserve plan, and the formulation of incentive and incentive measures and policies, etc., to vigorously build an excellent external environment for platform operation and maintenance, and to formulate a recyclable and benign operation management mechanism.

5. Conclusion

The digital management system of construction projects can effectively promote the project development process, form a "three-dimensional" organizational structure, dilute the boundaries of organizational management, effectively reduce operating costs, and form a project culture of mutual trust. However, at present, the implementation management of engineering projects is still immature, and there are still many problems. Therefore, it is necessary to continuously adjust in the process of building a digital management system, communicate with projects in a timely manner, and form a set of effective and easy-to-use engineering project management mechanisms and platforms, vigorously promote the process of digitalization of engineering projects.

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References

- [1] Chen Si. Research on the digital management platform of construction projects[D]. Beijing Jiaotong University, 2009.
- [2] Gao Penglong, Zhao Xue. Analysis of digital management system in construction projects[J]. Electronic Technology, 2021, 50(5): 170-171.
- [3] Wang Xiaolong, Hou Hanpo. Design of digital management system for construction projects[J]. China Soft Science, 2010, 4(7): 64-70.
- [4] Jiang Shuai, Liu Yisheng. Research on Digital Management System of Construction Engineering[A]. James Madison University, Wuhan University High-Tech Research and Development Center, American Scientific Research Press. Proceedings of International Conference on Engineering and Business Management (EBM2011)[C]. James Madison University, Wuhan University High-Tech Research and Development Center, American Scientific Research Press: American Scientific Research Press, 2011: 5.
- [5] Wang Xiaolong. Research on digital management system of construction projects[D]. Beijing Jiaotong University, 2010.