Research on Intelligent Construction Intensive Management Based on Building Information Modeling Technology

Shuzhao Dong¹,*, Lin Wang¹, Wenjuan Huang¹

¹School of Civil Engineering and Architecture, Jiangsu University of Science and Technology, Zhenjiang, Jiangsu, 212003, China

*Corresponding author’s e-mail: 838102625@qq.com

Abstract. In the process of construction industry development, due to the slow development of information technology, low level of fine management, various working modes and other problems, it is difficult to form a benign closed loop among construction participants in the planning and decision-making stage, design stage, construction stage, production stage, operation and maintenance stage of the project. This paper proposes the concept of intensive management of intelligent construction based on BIM technology to realize the integrated development of the whole life cycle of buildings. Through studying the connotation, development status, research significance and function of intensive management of intelligent construction, the paper constructs an intensive management system of intelligent construction based on BIM technology, which realizes the independence and interoperability of each stage of the project, thus promoting the industrial upgrading and technology application of the construction industry and realizing sustainable development.

1. Introduction

The construction industry occupies a dominant position in China's national economy, but the growth of traditional construction is slower than that of other industries, with extensive production, lower labor efficiency, higher energy consumption, high pollution and other problems. Under the tide of informatization and industrialization, it is urgent to grasp the development trend of the industry and actively carry out transformation and upgrading.

In the traditional two-dimensional architectural design, the expression of architectural design results has inherent deficiencies in effect presentation and avoidance of design collision. Building Information Modeling (BIM) technology makes it possible for collaborative design and collaborative construction under intelligent construction, and improves the management quality and communication efficiency through intelligent management, so that the value and advantages of various resources can be maximized.

2. Connotation of intensive management of wisdom construction

As a new construction concept, smart construction is developed based on the concept of smart city and relying on BIM technology. It was first proposed by Dr. Yang Bao ming and has been applied in many projects, such as the National Speed Skating Stadium [1] and Beijing Daxing International Airport [2]. On the one hand, intelligent construction can promote the sustainable development of enterprises and industries; On the other hand, with the support of advanced digital nervous system information technology system, the enterprise's operating environment is fair and transparent, and the project management is efficient and refined.
Intensive management, in a word, is to "collect" resources, save "reduce" costs and improve efficiency, which is an inevitable measure to help enterprises finally realize scale economy [3]. At present, the competition in the construction industry is becoming more and more intense, and the intensive management of engineering projects has become the need for the development of the industry.

The wisdom of the project construction process intensification, will both organic fusion to form wisdom to build intensive management idea, to comprehensive utilization of digital information technology acquisition at various stages of information construction, to overcome the "information island" problem, all of the project implementation architecture information cooperated-building parties timely and efficiently in the circulation, Not only can effectively improve the management ability of construction enterprises, so as to effectively improve the management level of construction enterprises, ensure the smooth development of construction projects, but also can promote the sustainable development of enterprises.

3. Development status and research significance of intelligent construction intensive management

3.1. Development status of intelligent construction intensive management

With the continuous development of the construction industry in industrialization, information and internationalization, BIM, big data, mobile communication, cloud computing, Internet of Things, artificial intelligence and other emerging information technologies are constantly changing the management and production methods of enterprises and construction sites. Since 1996, CIFE Laboratory of Stanford University in the United States first proposed the concept of 4D model and CIFE 4D-CAD system [4], making 4D model technology gradually move towards construction and construction management. Subsequently, the United States, the United Kingdom, Singapore, Japan and other countries have also developed in intelligent construction.

In terms of the design research of intelligent construction, Forcael E, Nopes A et al.[5] found that primary health care centers in Chile have high social relevance and high energy consumption of operation, so it is necessary to use shared knowledge resources such as BIM to clarify the technology, form and construction strategy of each climate zone, so as to achieve efficiency and intelligence. In terms of innovation research of information management methods, Yu Z, Peng H et al.[6] proposed an innovative intelligent website management model based on BIM, which combined Internet, 3D scanning, digital building model, virtual reality and augmented reality technology. Can be used for intelligent human resource management, machinery and resource allocation, material supervision, site access, quality control, safety and other important information; In terms of intelligent construction application research, Zhu He, Zhang Jun et al. [7] sorted out and classified the smart construction site projects applied by the First Construction Co., Ltd of China Construction Eighth Engineering Bureau, systematically elaborated the typical application and innovative practice of smart construction site in the company's construction projects, as well as the problems encountered in the process and the solutions.

Integrated intelligent building and intensive theory research at home and abroad, mostly concentrated in the intelligent building, the development trend of relevant software development, design, research, technology innovation and practical application, and the comprehensive study of wisdom to build intensive construction management theory is still very rare, intensive theory is to build the theory of the continuation of wisdom, is to build wisdom construction management.

3.2. Research significance of intelligent construction intensive management

The concept of intensive management of intelligent construction aims to use information means to promote the refinement, low carbon and intelligence of the whole life cycle of the building, so as to promote the transformation of the construction process from the extensive industry with high consumption and low efficiency to the intensive type, and BIM technology is an effective way to realize the intensive management of intelligent construction.

This paper combines intelligent construction with intensive management, studies the framework of intelligent construction intensive management system, and uses BIM technology to realize the
visualization of management. It optimizes and resets from the aspects of progress, quality, cost, time limit and safety, and constructs a BIM technology-based intelligent construction intensive management system. It promotes the optimization and upgrading of construction technology and management mode in the domestic construction industry and has reference significance for the sustainable development of related construction enterprises.

4. The role of intelligent construction and intensive management

4.1. Comprehensive monitoring of the building
The content of the construction engineering project contains numerous, so the management is particularly important, and wisdom to build intensive management to the construction of intelligent can assign, for planning and decision-making, design, production, construction and operational process and construction of all parties and all elements, and based on the information technology to progress, quality, cost, time limit for a project to intensive management, security, and so on, taking into account all aspects of the whole construction project as a whole.

4.2. Overall improvement of efficiency
The ultimate goal of intensive management is to improve efficiency. In traditional engineering project, due to the rough management style, the production, the construction way backward, the waste of resources of the project is in critical condition, the parties can't efficient collaboration, wisdom to build intensive management according to these aspects, advancing with The Times, at the same time of improving the efficiency of benefit, put an end to "high cost and low efficiency" and "little, slow, poor, fee", to "low input, high output" and "more, faster, better, saving" business goal efforts.

4.3. Promote the coordination of various departments
The construction of a construction project requires a high degree of collaboration among all participants. Nowadays, in the face of the actual operation of all participants, the problem of difficult data exchange has gradually emerged. In project management, because of the complexity of the project and not standardized, management team members often orally or in writing, drawings describe the coordination communication, easy to cause low efficiency, loss of data, and the problem of data island, so need to build a wisdom to build intensive management platform for the project management, coordination of each member's work. Intelligent construction intensive management can give full play to the technical advantages of BIM technology as the core, promote the transformation of project construction and operation management, and promote the development of the construction industry towards the direction of information.

4.4. Promote sustainable industrial development
With the rapid penetration of scientific and technological innovation and the strong support of national policies, more and more real estate enterprises or construction enterprises make use of science and technology to enable construction production and realize the sustainable development of the industry. Wisdom to build intensive management can effectively reduce resource consumption and emissions, and the refinement to the engineering field bring savings, effective control of the construction waste of resources, reduce the rework caused by extensive management, schedule delays, etc., and in promoting the quality and to extend the project life cycle, on the basis of sharply reduce resource depletion and reduce carbon emissions. The intelligent construction intensive management concept will greatly improve the management level of large-scale construction enterprises, change the current situation of diseconomy of scale, promote the improvement of market concentration, realize intensive management, and quickly eliminate backward production capacity.
5. Intelligent construction of intensive management system based on BIM technology

5.1. The construction idea of the intelligent and intensive management system based on BIM technology

Intelligent building concept, as a kind of green, harmonious and sustainable development of a new mode of construction, in addition the concept of intensive management, greatly enhance the efficiency of the benefit of the parties, "low input, high output" and "more, faster, better," the business model got rapid development, however, different from traditional construction management model, wisdom was needed to build the realization of the intensive management to consider from the following several aspects: first, because of its higher informatization degree, advanced, high configuration of hardware and software resources should be updated in a timely manner, based on BIM technology as the core, the Internet of things, artificial intelligence, 3 d printing, virtual reality, big data and other technical wisdom to build new intensive management platform; Secondly, the intensive management of intelligent construction should be based on scientific and reasonable management system and management process, including the progress, quality, cost, construction period, safety and other processes of the whole life cycle, so as to improve the economic benefits while enhancing productivity, and improve the traditional production mode of construction industry which is inefficient and seriously wasting resources. Moreover, the intensive management of intelligent construction relies on advanced high-tech products, and the talent management should keep pace with The Times. Moreover, it is necessary to establish the employment mechanism of survival of the fittest while ensuring the advanced nature of personnel, and enable excellent talents to participate in the increasingly fierce market competition.

5.2. Build an intensive management system of intelligent construction based on BIM technology

The construction of intelligent construction intensive management system has set up a basic process for the application of BIM as the core of intelligent construction technology. This paper analyzes the connotation of intelligent construction intensive management, introduces its typical characteristics and functions, and makes clear the necessity of intelligent construction intensive management. Therefore, based on the requirements for intensive management of intelligent construction of building projects, an intensive management system of intelligent construction with BIM technology as the core is constructed, as shown in Figure 1. This system includes five stages: planning decision-making stage, design stage, production stage, construction stage and operation and maintenance stage.

![Figure 1. Intelligent construction of intensive management system based on BIM technology](image-url)
Planning and decision-making stage
The new technology with BIM technology as the core provides a more open way of thinking for the planning decision-making stage, and the thinking of decision-making is upgraded from "experience decision" to "data decision". A large number of data generated in the construction process of engineering projects, through intensive data analysis can be obtained its hidden rules, which can be used to assist the planning decision, data model analysis, simulation, so as to optimize the decision.

Design stage
The development of BIM technology has had a significant impact on the progress of design tools in the construction industry. From two-dimensional design tool CAD to three-dimensional modeling software Revit, the leap of model-aided design makes possible the collaborative design of architecture, structure, water and electricity, etc., making the design process more intelligent, structural analysis more accurate, and management more convenient.

Production stage
Building production includes multiple steps. Driving production according to customer needs is an important concept of smart construction. The transformation of factory production mode to intelligent and automatic has become an important part of the sustainable development of the construction industry.

Construction phase
The application of intelligent construction technology in the construction stage is mainly focused on advanced construction concepts, as well as the intensive management based on BIM technology for people, materials, machinery and intelligent sites. The advanced construction concepts include the application of intelligent equipment and the upgrading of advanced construction methods such as assembly.

Operation and maintenance stage
In the operation and maintenance stage, an intensive management platform is built based on the core wisdom of BIM technology. The operation and maintenance information of the building, such as space, facilities, concealed works, energy conservation and emission reduction, etc. are presented in the form of data on its operation and maintenance integrated platform, so that the operation and maintenance personnel can quickly and accurately obtain the information and data of the building, and carry out intensive management on this basis.

6. Conclusion
On the basis of the theory of intelligent construction, this paper optimizes its management with the theory of intensive construction, and constructs an intensive management system of intelligent construction based on BIM technology, which is helpful to solve the problems of low information level, low level of fine management, diverse working modes and so on in engineering projects. While improving efficiency, promote construction enterprises to "low investment, high output" and "more, faster, better, and provincial" business goals. The system forms a benign closed loop among the participants and the project in the planning and decision-making stage, design stage, construction stage, production stage, operation and maintenance stage, etc. At the same time, the independence and interoperability of each stage of the project has been realized, and the industrial upgrading and technology application of the construction industry have been promoted to achieve sustainable development.

References
[1] Zhang Y, Su L Y, Shi Z Q, et al. BIM based intelligent construction practice of National Speed Skating Stadium project [J]. Urban Housing, 2019, 026(007):12-16.
[2] Lan W C, Wang Z Y, Zhang Z W, et al. "Intelligent Construction Site" Helping the Construction of Beijing Daxing International Airport [J]. Engineering Quality, 2020, v.38:No.354(01):29-33.
[3] Liu D J. Problems and countermeasures of project intensive management in construction enterprises [J]. Enterprise Reform and Management,2018(11):38+41.
[4] Collier E, Fischer M. Visual-Based Scheduling: 4D Modeling on the San Mateo County Health Center[C]//Proceedings of the Third Congress held in conjunction with A/E/C Systems. California, USA, 1996:800-805.

[5] Forcael E, Nope A, Garcia-Alvarado, Rodrigo, et al. Architectural and Management Strategies for the Design, Construction and Operation of Energy Efficient and Intelligent Primary Care Centers in Chile[J]. Sustainability, 2019, Volume 11(2).

[6] Yu Z, Peng H, Zeng X, et al. Smarter construction site management using the latest information technology[J]. Proceedings of the Institution of Civil Engineers, 2019, 172(CE2):89-95.

[7] Zhu H, Zhang J, Ning W Z, Wei S C, Du D F. Exploration on application of intelligent construction site—intelligent construction and intelligent management [J]. China Construction Informatization, 2017(09):76-78.