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Research on the Current Situation and Countermeasure of Lean Construction in China

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Abstract. The lean thinking of manufacturing industry is successfully applied to the construction industry by lean construction, and it can help enterprises to improve the overall economic benefits. In the paper, the implementation subject and development status of lean construction in China are analyzed, and the lean construction mode of 3RD Construction CO.,LTD of China Construction 5TH Engineering Bureau is taken as an example to analyse the typical development mode of lean construction in China at present. Finally, the paper summarizes the development strategies of lean construction in China, with a view to providing reference for the development of lean construction in China.

1. Introduction

Lean Construction originated in the early 20th century, and experienced the development of Taylor System, Fordism, Toyota Production System, Lean Production, Lean Thinking and so on. At last, Lean Thought developed in the construction industry. Finally, the lean thinking is developed and applied in the construction industry, resulting in the concept of "lean construction"[1]. Lean construction is a kind of management mode, and a kind of embodiment of management idea and enterprise culture[2]. It has developed under the strong support of lean production theory, and based on the theory of transformation-flow-value (TFV), combined with the characteristics of one-time and complexity of construction projects, integrated into the key technologies of lean construction, such as the last planner system, 5S management, visualization management, standardization management, supplier management, team work method and interpolation construction, to continuous and dynamic improve and manage the construction projects to achieving the goal of eliminating waste, maximizing customer value, and helping enterprises to achieve overall economic benefits.

2. Subject of lean construction implementation in China

In China, lean construction is implemented through construction enterprises and real estate enterprises with the support of the government. Therefore, the implementation bodies of lean construction can be divided into four kinds: government, construction enterprises, real estate enterprises, strong and strong combination of construction enterprises and real estate enterprises.

2.1 Government-led

As a new management mode, the implementation of lean construction in construction enterprises and real estate enterprises cannot be separated from the government's leading guidance and support. In



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addition, in some government investment projects, the government will also require lean construction management. Therefore, the implementation method is to take the government as the core, and the Contractor as the lean construction collaboration partner.

2.2 Construction enterprises-led

When the construction enterprise has begun to implement lean construction, and the owner has no experience in lean construction, the construction enterprise will implement the lean construction mode of "construction enterprise leading" according to the management requirements of the company. This implementation method is based on the construction enterprise as the core, the owner and other units as collaborative partners. This approach can motivate owners to participate in lean construction model. For example, the companies of China Construction Systems have better lean construction methods in their enterprises. Even if the owners do not put forward the requirement of lean construction, they can also spread the lean construction mode to the owners through the management of the company, requiring the owners and other relevant units to cooperate in the whole process, and helping the owners form the awareness of lean construction.

2.3 Real estate enterprises-led

The lean construction mode implemented by the "real estate enterprise-led" is usually based on the management mode of lean construction of the real estate enterprise and when bidding for a project, the real estate enterprise requests the contractor to use the lean construction mode in the project management. The implementation method is based on real estate enterprises as the core, construction enterprises and other contractors as collaborative partners. By this way, the real estate enterprises drive the contractors to participate in lean construction and promote it to the construction enterprises. For example, the Jin Se Hai Rong project of Vanke and the Xi Xi Mountain villa II Project of Green City Real Estate require contractors to implement lean construction in project management, and especially Kunxing Construction, through its own website to promote the refined management of the company.

2.4 Construction Enterprises and Real Estate Enterprises joint-led

When construction enterprises undertake real estate enterprise projects, if both enterprises have their own lean construction mode, then the lean construction mode at this time is "construction enterprise and real estate enterprise joint-led". At this time, because both sides have the requirement and consciousness of lean construction, they can jointly promote the smooth implementation of lean construction. Take the Vanke's Yuncheng project in Shenzhen as an example, the contractor of this project is Three Bureau One Company of China Construction, they and the owner Vanke all have the requirement of lean construction, so in the project, the Three Bureau One Company of China Construction and Vanke Group jointly implement the lean construction.

3.Current situation of lean construction in China

3.1 The Development Course of Lean Construction in China

3.1.1 Standardization management stage. The State Council of China formally put forward the concept of "safety and quality standardization activities" in "Decision on Further Strengthening the Work Safety Management (Guofa [2004] 2)". The following year, the "Guiding Opinion on Standardization of Safety and Quality of Construction" was formally issued by the Ministry of Housing and Urban-Rural Construction. It clearly pointed out that the implementation of standardization should be included in the specific requirements of "safe and civilized construction"[3]. These two documents have put forward the concept of "standardization" successively in the construction industry, and they provided a basis for promoting the standardization management of construction enterprises. Since then, "standardized management" has gradually integrated into the

management activities of construction enterprises. Standardized management is the initial development stage of lean construction in China.

3.1.2 Lean management stage. Construction enterprises further put forward the concept of "lean (fine) management" to create "quality engineering" on the basis of standardized management. Although the concept they put forward is not the name of "lean construction", its goal and execution mode are essentially the content of lean construction. They are also based on standardization requirements and take customer needs as the ultimate goal. Through standardized management, the waste can be eliminated in the process and the value maximization can be achieved. Therefore, lean management is the second stage of lean construction development, and it laid the foundation for the development of lean construction.

3.1.3 Lean construction stage. After standardization management and lean management stages, construction enterprises have clearly begun to use the concept of "lean construction" to change the management model of the company. For example, the company of China Construction Systems has explicitly put forward the concept of "lean construction" and applied its ideas to practical projects. Their lean construction model is based on the TFM theory of western countries and carries out in-depth theoretical research. And they introduce various lean construction key technologies for project management, such as interpolation construction, 5S management, supply chain management and so on.

3.2 Types of Lean Construction in China

At present, the types of lean construction in China mainly include "lean construction", "Japanese management" and "standardized management". "Lean Construction" and "Japanese Management" are two branches of Toyota's production mode originated in Japan, and "Standardization Management" is based on standardization, which is also a major feature of Toyota's production mode. It can be seen that these three types of lean construction have the same root, the research objectives and methods are consistent, they are different stages of development and different forms of implementation of lean construction, so they are collectively referred to as "lean construction".

3.3 Development Model of Lean Construction in China

The lean construction implemented by China Construction Systems Corporation is a typical model of lean construction in China at present. The paper takes the 3RD Construction CO.,LTD of China Construction 5TH Engineering Bureau as an example to introduce the lean construction mode of the company in detail. According to the "Guiding Opinions on Standardization of Construction Safety and Quality" issued by the Ministry of Housing and Construction in 2005, the 3RD Construction CO.,LTD of China Construction 5TH Engineering Bureau began to formulate the standardization management plan of the company in 2005, and integrated the lean idea into the standardization management to build a lean construction management model based on standardization. The company's theoretical achievement of "Lean Management Based on Standardization in Construction Enterprises" won the first prize of "National Enterprise Management Modernization Innovation Achievement"[4]. So far, the lean construction model has brought comprehensive benefits to the company. Its lean construction framework is shown in Figure 1.

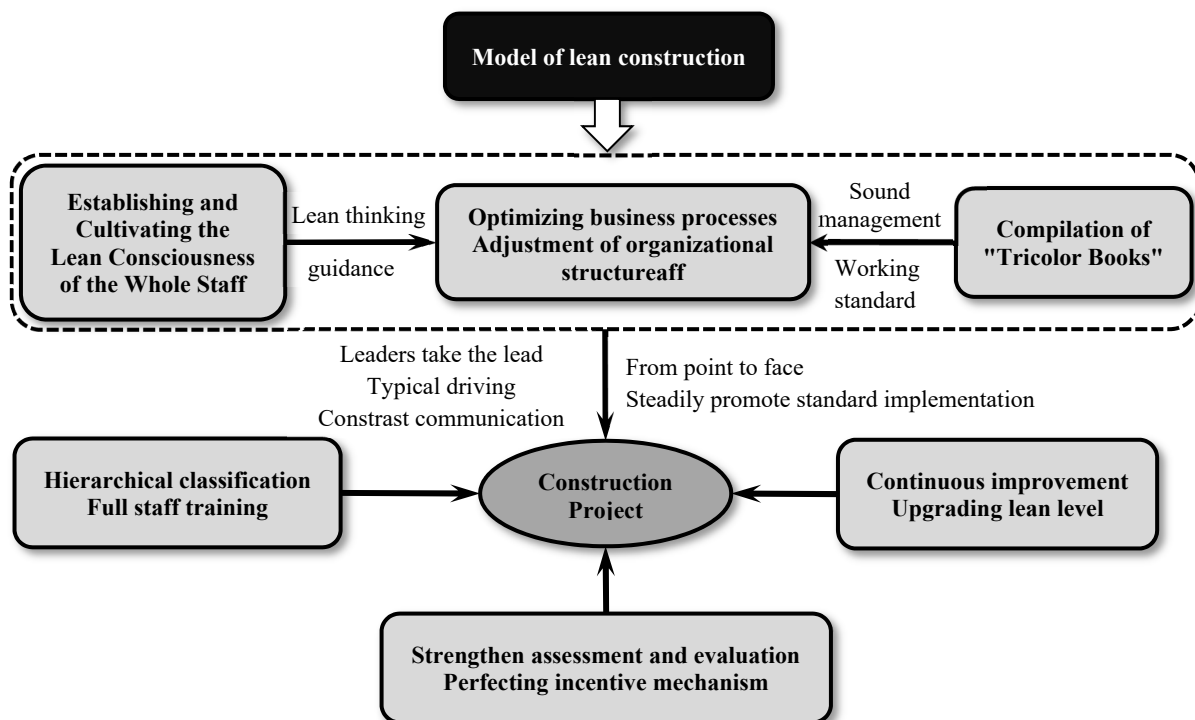


Fig.1. Lean construction diagram of 3RD Construction CO.,LTD of China Construction 5TH Engineering Bureau

The lean construction mode of 3RD Construction CO.,LTD of China Construction 5TH Engineering Bureau is based on the standardization of lean construction theory, starting from the implementation of lean thinking and the cultivation of lean consciousness of employees. By identifying and eliminating waste in business processes, the organizational structure is flattened, and the implementation of standards is steadily promoted from point to area in combination with the "three-color book" compiled by the company[5]. At the same time, the middle-level cadres, ordinary employees, project managers and migrant workers are pre-job trained in different levels and classifications, and in combination with the assessment and incentive mechanism, the staff will have the consciousness of consciously implementing the standards. Finally, through the regular inspection of the workflow of the secondary organizations, problems are found and rectified in time, and at the same time, the headquarters immediately tracks the effectiveness of the "three-color book" to make up for the deviation, and takes the information technology as the technical support, finally realizes the continuous improvement of lean construction management. The company's lean construction model is worth learning and learning from other enterprises.

4. Analysis of development countermeasure of lean construction in China

Based on the analysis of the main bodies and development status of lean construction in China, it is concluded that lean construction in China should be implemented in the following aspects.

4.1 Focus on owner's needs and standardized production management

In lean construction projects, more attention should be paid to value management to meet the needs of owners as the ultimate goal, and standardized production methods should be used to ensure the implementation of lean construction, the owners' needs should be used to pull up the whole production and produce products that owners are satisfied with. At the same time, lean construction should be based on standardized management. Enterprises should step by step implement standardized management in response to the government's call, and formulate standardized system and measures mainly for construction site management, construction process and quality, safety and health. Through

standardized management, it can standardize the operation process, reduce the cost of work and improve the quality of work.

4.2 *Guaranteed by team cooperation*

In the lean construction production process, the owner, design unit, procurement unit and other participants should be built into a supply chain of product construction with the construction enterprise as the core. In order to achieve the goal of information sharing, win-win of all parties' interests and improve the overall work efficiency, enterprises in this supply chain should establish long-term cooperative relationship, and all relevant personnel of all parties should participate in, cooperate with each other and clarify their respective responsibilities. This core partnership cannot be achieved overnight, and cannot be terminated in order to pursue cheaper prices with excellent partners. It requires construction enterprises to sacrifice short-term opportunities to reduce costs, to seek long-term stable core partners compatible with lean construction management concepts, so as to ensure the stability of enterprise production process.

4.3 *Supported by lean construction key technologies and technological technologies*

In the implementation of lean construction, we should actively use the key technologies of lean construction and information technology. Standardization, 5S management, Kanban management, interpolation construction, teamwork, and value management are the most widely used key lean construction technologies by major enterprises. At the same time, major enterprises are also competing to introduce advanced technology to support the implementation of lean construction. For example, BIM technology has the highest utilization rate. BIM technology has been used in the project by China Construction Systems Corporation, Beijing Residence Group, Vanke Group and Green City real estate to help realize construction site simulation, quality control, safety precaution, multi-terminal team cooperation and other work contents.

4.4 *Lean construction culture integration and staff training*

World lean master Jeffrey Lake once said: "the focus of implementing lean production is on learning lean tools, it can achieve results in a short time, but it is difficult to sustain for a long time. In order to ensure the successful application of lean production mode, it is necessary to change enterprise culture at the same time in the process of implementing lean production mode"[6]. The introduction of lean construction in China is not the introduction of technology from developed countries and buy their equipment. These are the tip of the iceberg (as shown in figure 2). What is rooted in the characterization is the input of lean construction culture.



Fig.2 Iceberg model of lean construction

When implementing lean construction, we should incorporate lean construction culture into enterprises, and tell employees that lean construction is the most effective way to "recognize, think and solve" problems. Employees should consciously implement lean technology in daily life without supervision, and commit themselves to continuous improvement and eliminate waste by lean construction. At the same time, it is necessary to train employees with lean construction, to adjust their actions voluntarily and consciously, to clarify their responsibilities, and to strictly control the details of each operation, so as to meet the requirements of lean construction. Only when employees have the subjective initiative consciousness of lean construction, active cooperation and strict self-restraint, can they achieve the goal of lean construction.

5. Conclusion

The paper analyses the implementation subjects of lean construction in China, including the government, construction enterprises and real estate enterprises. It is analyzed the development of lean construction in China has gone through three stages: standardization stage, lean management stage and lean construction stage and it summaries the types of implementation of lean construction in China. Then it took the lean construction model of 3RD Construction CO.,LTD of China Construction 5TH Engineering Bureau as an example, and it studied the typical lean construction model and its characteristics in detail. Finally, in view of the current situation of lean construction in China, it put forward some countermeasures and suggestions for the development of lean construction, including four aspects: paying attention to owner's needs and standardized management, guaranteeing team cooperation, supporting lean construction key technologies and technological technologies, integrating lean construction culture and staff training. It is hoped that this research can provide reference for the development and improvement of lean construction in China.

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