

Influencing Factors of Lean Construction in Enterprises

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Abstract: With extensive growth of the construction industry, the market competition of construction enterprises have become more and more fierce, and many enterprises have introduced lean construction ideas into the construction process in order to enhance the core competitiveness of market. It not only allows construction enterprises to shorten the construction period, improve quality and ensure production safety, but also allows construction enterprises to obtain more benefits. Based on the above analysis, this paper expounds the literature review of lean construction in enterprises, then finds out the influencing factors affecting lean construction of construction enterprises, and finally puts forward reference suggestions for the implementation of lean construction capabilities from personnel factors, enterprise factors and social factors.

1. Introduction

In recent years, the construction industry, which has developed rapidly for more than a decade, has been affected by various complex factors such as anti-globalization, the new crown epidemic and trade wars, and the market environment of construction enterprises has become worse and worse, according to the statistics of the China Construction Association, the output value profit margin of the construction industry in 2021 is the lowest point in nearly a decade. Many construction enterprises have also closed down as a result, so construction enterprises want to continue to survive and develop, and enhance the core competitiveness of the market by building their own core competitiveness has to be put on the agenda.

Lean construction is the application of lean thinking in the production process of building products, and lean construction has important value for transforming the production mode and management concept of the construction industry. Compared with the traditional construction mode, lean construction has obvious advantages in reducing costs, improving quality, shortening construction period, and ensuring safe production. In the post-epidemic era, more and more construction enterprises have introduced lean construction principles and technical methods in the process of engineering project management after recognizing their own current situation, so as to build their own core competitiveness and achieve transformation and upgrading.

With the progress of the times, most domestic construction enterprises introduce lean ideas and theories in the construction management process, but due to the low degree of application of construction technology methods, the overall effect of domestic lean construction implementation is

not good. Based on this, this paper studies the influencing factors affecting lean construction of construction enterprises according to the literature review method, so as to provide reference value for construction enterprises to improve lean construction capabilities and maximize value.

2. Literature Review

After more than 20 years of development, lean construction theory has formed a relatively mature theoretical system. At present, some scholars have studied and analyzed the influencing factors of lean construction capability from different levels and different perspectives. Anumba and Baugh (2002) believe that the use of different management tools and lean construction technology tools is an important factor affecting the lean construction of enterprises, and only by choosing the appropriate lean construction technology and tools of the enterprise can we better improve the lean construction ability of the enterprise^[1]. Toni L. Doolen and Marla E (2003) believe that the lean capabilities of enterprises are more relevant to people, culture, and organizations^[2]. Abdulla Yaqoub Al Sayed and Dinesh Seth (2019) found that the development of policy and economic management can seriously affect the ability of lean construction by studying the important influencing factors of lean construction in the context of Qatar^[3]. David Carvajal-Arango et al. established the relationship and synergy between lean construction and sustainable construction concepts, and identified the positive impact of lean construction on the environment, economy and society during the construction phase of the project^[4]. Johansen E and Porter G (2004) put forward the view that the importance of lean culture in enterprises will affect the implementation effect of lean construction, and pointed out that the lack of lean culture is an inherent obstacle to lean construction^[5]. Kim D and Park H-S (2006) believe that the degree of support of middle and senior managers for the implementation of lean construction is an important factor affecting the lean construction ability of construction projects^[6].

Li Xiaokang et al. (2018) constructed a lean construction capability evaluation system for construction enterprises. The impact of lean quality management, lean cost management, lean construction period management, lean safety management, and lean organizational management on lean construction ability is summarized^[7]. Du Cunpo and She Jianjun (2017) proposed countermeasures for improving the lean construction management capability of construction enterprise projects from the factors of enterprise informatization level, business philosophy, procurement value chain, enterprise internal culture and other factors in view of many factors influencing the lean construction management capability of construction enterprise projects, through the study of structural equation model^[8]. Jing Shuwei (2018) pointed out in the research on the evaluation index of lean construction capacity of construction enterprises that the delivery ability of enterprises, procurement ability and construction ability of enterprises are important index components^[9]. Wang Changjiang(2012) summarized 16 factors affecting the implementation of lean construction through interviews with enterprise managers and literature analysis, and applied explanatory structural models (ISMs) to 16 influencing factors are stepped and hierarchical, and it is finally determined that employee execution is the direct cause affecting lean construction ability, and corporate culture, executive support, information sharing, corporate training, tool adoption and other factors are the basic factors affecting lean construction ability^[10].

In summary, it can be seen that the current influencing factors on lean construction capability are mainly concentrated at the individual level, the organizational level and the enterprise environment. The construction and cultivation of lean construction capabilities of enterprises is a systematic project, and the influencing factors of the same level or different levels are not independent of each other, but have certain correlations. Therefore, the factors influencing lean construction capability should be considered comprehensively, cross-level and systematically.

3. Influencing Factors of Lean Construction

Through various literature review and combined with lean construction theory, this paper finally discusses the influencing factors of enterprise lean construction from three aspects: personnel, enterprises and society.

3.1. Human Factors

3.1.1. Leadership Support

Enterprise leaders are the core and soul of enterprises, and the implementation of a new project can only provide sufficient resources and support for new projects with the support of enterprise leaders. In addition to integrating lean thinking into the daily management of enterprises and projects, the lean construction management model also includes the implementation of a series of lean construction auxiliary technologies. Lean construction auxiliary technology is the core of lean construction management model, and it is also an important support for the realization of lean construction management model. Therefore, the level of support of business leaders plays an important role in building lean construction capabilities.

3.1.2. Staff Quality

The quality of enterprise employees is a key factor in the development of enterprises, an enterprise in the construction process to train employees and instill lean construction ideas, so that the enterprise employees construction of lean construction technology operation ability enhanced, so that can not only improve the comprehensive quality of employees and the mastery of lean manufacturing related skills, but also promote the improvement and implementation of enterprise lean construction capabilities. Of course, the learning ability of employees is also very important, lean construction requires all members in the implementation of the project to participate in the project progress, quality, cost, safety, environmental protection and other project management process, higher staff learning ability can make lean construction faster and more accurate. It can be seen from the above that the quality of employees has a non-negligible impact on the implementation of lean construction.

3.2. Enterprise Factors

3.2.1. Lean Culture Construction

For an enterprise, corporate culture represents the face of an enterprise. Qi Ershi (2008) believes that lean production is not only a tool, a means, but also a management concept and management culture, so enterprises should pay more attention to the cultivation of lean culture when promoting lean concept during construction^[11]. Lean culture has been developed for more than 20 years, but in the process of promoting lean construction in China, more attention is paid to the application of lean construction technology and ignoring the construction of lean culture, resulting in the effect of domestic lean construction has not been very good, which can also be seen that the impact of lean culture construction on enterprise lean construction is not small.

3.2.2. Project Implementation Management

Enterprise construction process, construction site and logistics management are all processes that cannot be ignored by an enterprise. The flow of production factors such as manpower, materials,

equipment, information, capital and technology in the construction process of enterprises affects whether the enterprise can operate efficiently, and lean process management can reduce production waste and improve construction efficiency. Construction site is the most important and most difficult to manage a place of construction production, traditional construction site, often construction site management and construction organization design is unreasonable, and site lean management can make the construction site neat and orderly, things stacked reasonably, so as to improve the efficiency of municipal construction, reduce the occurrence of safety accidents and waste of materials. According to studies in recent years, the cost of materials accounts for nearly seventy percent of the construction cost. Lean logistics can realize on-time procurement of materials and on-demand supply, avoiding material accumulation caused by untimely supply or early supply. Sadly, it can be seen that the project implementation process is also one of the main factors affecting lean construction capabilities.

3.2.3. Organizational Structure Form

The organizational structure form is a division of labor and cooperation relationship formulated by an organization to achieve certain goals, which reflects the dynamic structural relationship of the organization in the three aspects of duties, responsibilities and rights. Kim D and Park H-S (2006) proposed that the rationality of organizational structure form and the harmony between organizational structure form and lean construction are an important factor affecting lean construction ability, and through interviews with experts, It was also found that the organizational structure of the project is an important factor affecting lean construction capability^[6]. As a major strategic goal of construction enterprises, lean construction must formulate a reasonable organizational structure to create conditions for the implementation of lean construction and improve the lean construction ability of enterprises.

3.3. Social Factors

3.3.1. Policy Support

According to literature studies, China's application of lean manufacturing in the construction industry is far lower than the application of lean production in manufacturing, which further shows that China's application and research in lean construction are not deep enough, but more importantly, for now, the Chinese government has not further promoted and given corresponding advantages to lean construction. Only when the government's support in the implementation of lean construction becomes higher, providing technical support and giving policy subsidies, China's lean construction can further develop rapidly.

3.3.2. Market Competition

The improvement of lean construction capability is a long-term process that requires a long-term investment of money and manpower. Fierce market competition makes enterprises only take into account short-term interests and ignore long-term interests, thus hindering the implementation of lean construction by construction enterprises. The peer demonstration effect refers to the number and effect of peers implementing lean construction in existing projects. The peer demonstration effect provides other enterprises with experience and lessons that can be used for reference, which can help other enterprises avoid detours and promote the improvement of lean construction capabilities.

4. Recommendations

4.1. Relevant Countermeasures Based on Human Factors

4.1.1. Formulate Lean Training Programs and Improve Training Mechanisms

If traditional construction enterprises want to carry out lean transformation and upgrading, the first task must be to formulate lean training programs and improve training mechanisms. Enterprises can carry out step-by-step classification and hierarchical lean training for employees at different levels at the same stage, formulate lean training programs, design lean series courses, covering universal training, professional training, benchmarking learning and enabling training, and at the same time carry out lean competitions, encourage employees to share practice, further improve various management work, make various management more standardized, perfect and efficient, achieve the purpose of reducing production costs and improving economic benefits, so as to achieve the improvement of the overall team.

4.1.2. Strengthen Organizational Leadership

To strengthen organizational leadership, we must first implement leadership responsibility. In the process of implementing lean construction, the role of leaders is more important, leaders should play an exemplary role, take the initiative to learn lean-related theoretical knowledge, and fully drive combat effectiveness and execution. Leaders lead employees to learn and apply lean-related knowledge together, give full play to the role of guiding direction and cohesion, and provide strength for the successful transformation of enterprises into lean construction enterprises.

4.1.3. Employees Actively Cooperate

In the end, the implementation of lean construction is carried out by grassroots employees, so the execution of employees is related to the implementation of lean transformation. Whether employees are willing to cooperate with the enterprise's measures also affects the quality of execution. It all depends on whether they have a real willingness to implement lean. Employee execution and employee quality, that is, employees' concepts, attitudes, knowledge levels, skill levels, learning ability, innovation ability, etc., employees, especially the final planner for lean construction theoretical knowledge level, operational skills and experience, recognition attitude will affect the implementation of lean construction.

4.2. Relevant Countermeasures Based on Corporate Factors

4.2.1. Establish Lean Corporate Culture and Cultivate Lean Awareness

According to the search, many enterprises fail to transform because of cultural conflicts and lack of lean culture. Integrate the culture of lean enterprise into the lean training program, and enter the lean construction culture, so that every employee can deeply identify with lean. Corporate culture affects the common values and behavioral norms of all employees, and the implementation of lean construction activities must be carried out by employees in the final analysis, and the execution directly determines the effect of implementing lean construction. In the case of combining national conditions and enterprise conditions, drawing on lean concepts, through continuous practice and strengthening, all employees can accept lean corporate culture tangibly and intangibly, gradually form behavioral habits, establish this unique culture, enhance employees recognition attitude to the implementation of lean construction, and improve employee execution.

4.2.2. Improve the Lean Performance Appraisal System

The employee's operation must be value-added, otherwise it is considered invalid labor. The constraints on employees mainly rely on the mechanism to force the problem to be exposed, and through Kanban management, visual management, fixed management and other transparent and standardized information to transmit, so that it is in full view and prompts employees to consciously solve it. The performance system can urge employees to grow, reflect and make corrections. Formulate a performance system that tends to implement lean construction, adjust the organizational structure, and create a working atmosphere for employees to learn, improve and improve. Employees are encouraged to implement lean construction at the beginning of the implementation stage, and failure is tolerated without penalty. The implementation of the performance system can directly reduce the cost of engineering and provide employees with operational efficiency.

4.2.3. Assemble a Lean Team

The basic unit of the implementation of lean production is the team, and various management groups are established within the team to solve problems in daily production. Under lean production, employees are required to have team spirit, team members must make decisions together, share or take turns to take responsibility for team leadership, and when problems involve a wide range, the team establishes temporary groups, such as product design team, comprehensive quality control team, etc. The purpose of this is to encourage participation, let them communicate more, constantly inspire each other, be responsible for the entire work process, eliminate waste in redundant management links, and gradually achieve hierarchical optimization and organizational structure optimization.

4.3. Measures Based on Social Factors

4.3.1. Improve Policy Support and Incentives

Local governments help local governments to continuously improve their operational capabilities by implementing lean management, strengthening on-site management, optimizing supply chain management, improving marketing management and user service systems. Call on government departments to issue corresponding promotion policies, such as:(1) use the implementation of lean construction effects as the basis for government evaluation of enterprise loans, tax exemptions, financial subsidies, etc.:(2) The government provides free training on theoretical knowledge related to lean construction;(3) The government has written to require enterprises to implement lean construction;(4) Government public works projects give priority to enterprises that have implemented or are about to implement lean construction.

4.3.2. Increase the Publicity and Promotion of Lean Construction Achievements

Give full play to the promotion role of the Innovation Alliance and increase the promotion rate of technological innovation achievements; we must strive for excellence and continuous improvement. It is necessary to quickly promote lean management, continue to promote on-site improvement work, adhere to small reforms, vigorously publicize it throughout the group, and encourage all employees to participate; Trade unions should focus on enterprises, serve the overall situation, and put themselves in the shoes of employees. Through project observations, on-site presentations, summit forums and other means, the industry can show construction enterprises the changes brought about by lean transformation, thereby improving social recognition.

5. Conclusion

In summary, the application of lean construction concepts in the construction of construction projects is of great value. The implementation of lean construction can effectively improve the construction quality of construction enterprises, realize the efficient use of construction materials and equipment, and at the same time, lean construction also improves the construction skills and construction behavior of construction personnel, maximizes the economic and social benefits of construction enterprises, and promotes the long-term development of construction engineering enterprises. And from the three aspects of employees, enterprises and society to improve, China's lean manufacturing technology rapid development is just around the corner.

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