

Influencing Factors of Coupling Coordination of Enterprise Lean Construction Capability and Economic Benefits

Xiaoshuo Shen, Qiang Liu, Bing Li*, Ming Liu

School of Economics and Management, Liaoning University of Technology, Jinzhou, Liaoning, 121001, China

**Corresponding author*

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Abstract: With the progress of The Times, owners require construction enterprises to lower prices, higher quality, shorter construction period, construction enterprises into the era of micro-profit competition. Construction enterprises to satisfy the market environment of more graduates and fewer graduates, in order to survive enterprises began to improve the construction capacity and economic benefits. Based on the above situation, this paper first analyzes the coupling mechanism of lean economic benefit and construction capability of enterprises. Then, through a comprehensive analysis of relevant literature, the coupling mechanism is analyzed from two aspects of lean construction ability and economic benefit, and then the main influencing factors of the coupling coordination between lean construction ability and economic benefit are found out. The conclusion provides a reference for realizing the coupling analysis of lean construction ability and economic benefit.

1. Introduction

With the continuous decline of China's birth rate, green environmental awareness and lean construction and other technologies temporarily fully popularized, China's construction industry now has problems such as labor shortage, rising labor costs, and continuous reduction of output value profit margin. As China's economic support industry, the construction industry cannot always affect the development of China's economy because of traditional construction problems. In order to solve traditional problems, lean construction helps traditional enterprises to transform, comprehensively improve the production and management level of the construction industry, and change the extensive management, serious waste and long construction period of traditional construction.

Lean construction is a scientific management idea, which is the specific application and practice of lean production concept in the construction industry. The application of lean manufacturing management mode in project management can reduce project costs, shorten construction period, improve the quality of building products and increase the efficiency of enterprises, so as to achieve

the goals of energy saving, emission reduction and environmental protection^[1]. This management model not only meets the requirements of sustainable development of the construction industry, but also the model that China's economy should vigorously promote in the post-epidemic era and enter the new normal development.

Economic benefits have always been the focus of debate and attention in the construction industry, and with the proposal of lean concepts, the structure of the construction industry has changed, and the output value of the construction industry has also changed. Through the lean concept, the maximum use of building materials and manpower, avoiding any waste and valueless activities, construction personnel fine operation, excellence, and finally fast, high-quality, less input to complete the construction task, but this also puts forward higher requirements for the ability of construction personnel. Therefore, it is important to evaluate and coordinate the coupling relationship between lean construction capabilities and benefits. Although the existing research has made important explorations in the relationship between lean construction capability and efficiency, mainly focusing on the one-way impact of ability on efficiency, the coupling relationship between the two is rarely analyzed. Based on this, this paper finds out the influencing factors affecting the lean construction ability and efficiency of construction enterprises through the literature method from the perspective of coupling.

2. Analysis of Coupling Mechanism

The relationship between economic benefits and construction capacity is mainly manifested in: (1) economic benefits are the product of construction capacity to a certain level, and economic benefits will become the fundamental driving force of construction capacity.(2) Economic benefits and construction capacity are each other's cause and effect, in a certain sense, the essence of construction capacity is economic benefit, and the result of economic benefit is construction capacity.(3) Economic benefits help to improve the quality of regional construction capacity, and the level of construction capacity will also promote or restrict economic benefits. There is a direct or indirect coupling channel between the two. It is through these coupling channels that the coupling effect of economic benefits and construction capacity is generated to promote the construction capacity and the construction capacity to drive the economic benefit.

Among them, the main role channels between economic benefits and construction capacity are manifested in:

(1) The coupling channel between construction capacity and economic benefit input. The improvement of construction capacity can simultaneously increase economic benefit income, creating greater possibilities for economic benefit income; the increase of economic benefit input will also promote the construction capacity of enterprises to a certain extent, improve the added value of resources and economic output efficiency.

(2) Coupling channel from construction capacity to economic benefit environment. The level of construction ability of civilization and progress can provide a good economic benefit environment for economic benefits; the continuous optimization of the economic efficiency environment will also contribute to social progress.

In addition, "construction capacity→ economic input → economic benefit output" is not only a combination of direct and indirect coupling channels, but also a correlation between economic benefits and internal components of construction capacity. Specific manifestations of the causal cycle:

(1) The improvement of the level of construction capacity can improve the quality and quantity of economic input, and at the same time, the new demand caused by construction capacity will stimulate economic input.(2) The improvement of the quantity and quality of economic input

directly leads to the increase in construction capacity output.(3) The output of economic benefits will be counterproductive to economic construction capacity, and new technologies directly improve the level of economic construction capacity, guide and create new consumer demand, thereby affecting economic construction capacity.

3. Influencing Factors of Coupling Coordination

3.1. Factors Influencing Construction Capacity

T.M.Viana and P.V. Salles (2017) believe that implementing lean construction techniques in construction projects can reduce waste generation and improve the efficiency of the construction process. They analyze the benefits of applying lean construction concepts in civil construction projects. Lean construction implementation has led to a significant reduction in waste generation^[2]. Adnan Enshassi and Nour Saleh (2019) believe that lean construction techniques can reduce accidents during construction and improve project safety^[3]. Jing Shuwei (2018) pointed out in the research on lean construction ability evaluation indicators of construction enterprises that construction technology, construction quality, cost saving and safe and civilized construction are its important index components^[4]. Du Cunpo and She Jianjun (2017) believe that standardized construction level, safety management level, cost control level, quality control level and construction period management level are important factors affecting the lean construction ability of enterprises. Through the research of constructing the structural equation model, the countermeasures for improving the lean construction management ability of construction enterprise projects are proposed from the factors of enterprise informatization level, business philosophy, procurement value chain, and internal culture of the enterprise^[5]. Fu Tao (2019) established a lean construction capability evaluation system for construction enterprises, which includes lean culture construction ability, lean tool use ability, lean procurement ability, lean construction ability, and lean delivery ability. Finally, FCEM is used to comprehensively evaluate the lean construction capability of construction enterprises^[6]. According to the analysis of existing literature, this paper finally identifies five factors affecting lean construction, namely safe construction ability, construction period assurance ability, standardized construction ability, continuous improvement ability and waste identification ability.

3.1.1. Safe Construction Capability

Through the survey, it is found that the safe construction ability of enterprises is one of the important factors affecting the lean construction ability of enterprises. Due to the low quality of many construction personnel, lack of basic safety common sense and poor safety awareness, resulting in casualties; Coupled with poor construction environment and poor coordination of construction safety management, safety accidents are caused. Therefore, the effective formulation of safety standards, technical specifications, environmental specifications and operation specifications can ensure the safe construction of enterprises, so as to improve the safe construction capabilities and benefits of enterprises.

3.1.2. Construction Period Guarantee Ability

Construction period guarantee is also an important content in construction management, lean construction project duration guarantee is the whole process from the project design stage to the project completion acceptance stage, the entire construction cycle situation of time control management, in order to achieve the contract in the construction period target to achieve the maximization of project value and profit. The project duration assurance ability is affected by

management, organization, material schedule, construction, etc. An enterprise can only be scientifically organized to strengthen the connection of processes; Implement information management, scientific scheduling, and balanced construction; Strengthen quality, safety and environmental controls; Equipment, materials, funds are in place in time, and technical equipment casualties are updated in time to meet the construction requirements, in order to ensure the construction period, so as to achieve the purpose of lean transformation of enterprises.

3.1.3. Standardized Construction Capabilities

Standardized construction refers to the successful practice and experience of project management through management replication in the same or similar management modules, so that project management can be transformed from extensive to institutionalized, standardized and standardized. The implementation of standardized construction in the lean construction process can largely solve the extensive management, shortage of management talents, quality problems and safety dead ends in traditional construction, and can also improve the overall scientific management level and efficiency of the enterprise, thereby improving the construction capacity, economic and social benefits of the enterprise.

3.1.4. Ability to Continuously Improve

The continuous discovery of management elements, management activities and management personnel to solve problems and improve problems is continuous improvement^[7]. Continuous improvement is mainly divided into two aspects: first, the second-level organization improves management, and timely rectifies the problems found in the work process; the second is the effectiveness and enforceability of the management system at any time, make up for the blank points in management as soon as possible, and correct and improve the deviations in management in time. The continuous improvement of enterprises can improve management and construction efficiency, enhance market competitiveness, improve product or service quality faster, eliminate obstacles in construction, reduce costs and reduce quality loss. Continuous improvement requires the participation of all employees, and improving the ability of continuous improvement means improving the construction or management ability of all employees.

3.1.5. Waste Identification Capabilities

The main purpose of lean construction is to reduce costs and maximize the benefits of the enterprise, and the elimination of waste is an indispensable core of this process. Lean production divides the waste of enterprises into two types: (1) the operation content that does not create value in production, but must be available and operated under existing technology and production conditions, such as necessary online inspection, material transportation, etc. (2) Work content that does not create value and can be removed immediately, such as unnecessary waiting, unnecessary actions, unnecessary approvals, etc.^[8]. In the process of lean construction, whether there is lack of materials or waiting materials, whether mechanical equipment fails, whether materials are abnormal, whether standard construction is carried out orderly, and whether the proportion of unqualified products is too high will increase the construction cost of enterprises. Therefore, if construction enterprises want to improve construction capacity and maximize benefits, they need to participate in garbage identification.

3.2. Factors Influencing Economic Benefits

Bajjou M S et al. (2017) argue that lean management methods such as last-minute planning

system (LPS), value flow mapping (VSM), and just-in-time system can achieve creative improvements to traditional cost management by reducing waste and encouraging personnel participation^[9]. Sun Renjin et al. (2011) established an economic benefit evaluation index system, including net fixed assets, unit full cost, profit and tax, industrial added value, etc., based on the relevant data of each enterprise in a certain year, and applied the model for economic benefit evaluation^[10]. Chen Ningang (2010) improved building standards, improved building functions, strengthened the management and supervision of building quality, and optimized building energy efficiency, discussed how to improve the economic benefits of current construction projects, and put forward several effective measures^[11]. Yang Fei (2016) comprehensively analyzes economic benefits from indirect economic benefits, environmental economic benefits, quality economic benefits and socio-economic benefits, so that buildings can better serve people's lives^[12]. According to the comprehensive literature analysis, this paper finally identifies four factors affecting economic benefits, namely lean design cost, lean procurement cost, lean production cost and lean service cost.

3.2.1. Lean Design Costs

Lean design is the process of realizing the unity of economy, technology and management, good lean design can maximize customer value, enterprise benefits are also maximized. According to relevant data, the impact of the design stage on the construction cost of the enterprise reaches about seventy percent, so it is necessary to focus on the design stage of lean benefit management, and take cost optimization measures in the design stage to improve the economic benefits of the entire enterprise. In the process of lean design cost management, we should properly emphasize limit design, strengthen the awareness of standard design, and combine technology and economy, so as to maximize the economic benefits of enterprises.

3.2.2. Lean Procurement Costs

Procurement cost refers to the expenses related to the purchase of raw materials, usually including raw material costs, procurement process costs and procurement management costs. In the lean management of modern enterprises, the procurement cost of enterprises has always been one of the important factors affecting the economic benefits of enterprises. For many enterprises, procurement costs account for more than sixty percent of the total cost of production and operation, and there are many links that need to be controlled, so the requirements for procurement constitution, financial management mode, internal inventory grasp and the ability and quality of procurement personnel are relatively high. An experiment shows that for every one percent reduction in procurement costs, the economic benefits of enterprises will increase by five to ten percent. In terms of technology to meet the material needs of enterprises, reduce material prices as much as possible, purchase on demand, purchase on time and improve the ability of procurement personnel, etc., by reducing the waste of the procurement process, the realization of the ultimate laying a solid foundation for maximizing the economic benefits of the enterprise.

3.2.3. Lean Production Costs

In the process of lean management of enterprises, the current cost management of production is mainly based on team economic accounting. In order to further improve the economic benefits of the enterprise, the enterprise can directly reflect the work results of the production according to the actual needs of the production site, and through recording and analyzing the results, propose technical measures for improvement that fit the enterprise itself, adopt the operation cost management method in line with the enterprise itself, etc. to control the lean production cost, and truly achieve the effect of energy saving, capital saving and efficiency, so as to maximize the

economic benefits of the enterprise.

3.2.4. Lean Service Costs

Lean service cost refers to the cost of meeting customer needs through service. Generally speaking, the higher the cost of services spent by enterprises, the more services they can provide to customers, and the more economic benefits customers can give. Of course, the monthly cost of lean service of enterprises is not as high as possible, because excessive lean service costs will bring economic burden to enterprises, so the service cost of an enterprise should be adjusted according to the output value of its own enterprise, so as not to violate the principle of cost-effectiveness, cause waste of resources, etc., and reduce the economic benefits of enterprises.

4. Conclusion

From the direct and indirect coupling channels of the main role channels of economic benefits and construction capacity and the internal components of economic benefits and construction capacity, this paper shows that the coupling effect of economic benefits promoting construction capacity and construction capacity pulling economic benefits is related and mutually reinforcing. According to the preparation, implementation and completion stages of lean construction, this paper summarizes the five factors that affect lean construction ability: safe construction ability, construction period assurance ability, standardized construction ability, continuous improvement ability, and waste identification ability. According to the principle of lean cost management of construction projects, combined with the economic benefit characteristics of economic construction, this paper summarizes the four factors affecting economic benefits of lean design cost, lean procurement cost, lean production cost and lean service cost in the pre-construction preparation stage, procurement stage and construction stage.

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References

- [1] Zhang Lianying, Li Yanwei, Chen Xi, Tang Ziwei, *Research on the application effect of lean tools in lean construction driven by knowledge management. Chinese Journal of Management.*2017, 14(10):1553-1560.
- [2] T.M. Viana, P. V. Salles, C. C. Carvalho, B. L. S. S. Teixeira, M. A. Moraes, W. J. Santos. *The Influence of Lean Construction on Reducing Construction Waste and Improving Construction Technology. Journal of Progress in Civil Engineering,* 2019, 1(11):7-13.
- [3] Adnan Enshassi, Nour Saleh, Sherif Mohamed. *Application level of lean construction techniques in reducing accidents in construction projects. Journal of Financial Management of Property and Construction,* 2019, 24(3):274-293.
- [4] Jing Shuwei, Feng Yunyi, Yan Junai, *Research on the evaluation of lean construction capability of construction enterprises based on ANP-SPA. Journal of Tianjin University (Social Science Edition),* 2018, 20(05):393-398.
- [5] Du Cunpo, She Jianjun, Zhang Chao, *Analysis of influencing factors of project lean management capability of construction enterprises based on SEM. Project Management Technology,* 2017, 15(06): 35-40.
- [6] Fu Tao. *Research on Lean Construction Ability evaluation of construction enterprises. Department of Management and Economics, Tianjin University,* 2019, 11:1-67.
- [7] Hou Jinyin. *Analysis on Influencing Factors and Countermeasures of Prefabricated construction Project Management. Green Environmental Protection Building Materials,* 2021(04):140-141.
- [8] Daniel Heigermoser, Borja Garcia de Soto, Ernest Leslie Sidney Abbott, David Kim Huat Chua. *BIM-based Last Planner System tool for improving construction project management. Automation in Construction,* 2019, 104: 246-254.
- [9] Bajjou M S, Chafi A, En-Nadi A.A *Comparative Study between Lean Construction and the Traditional Production.*

International Journal of Engineering Research in Africa, 2017, 29:118-132.

[10] Sun Renjin, Tian Li, Lv Jiatao, *Research on the economic Benefit Evaluation Method of Oil refining Enterprises based on data Envelopment analysis*.2011 (2): 81-85.

[11] Chen Ningang. *Strategy analysis of improving economic benefit of construction project*. *Contemporary Economy*. 2010 (22):74-75.

[12] Yang Fei. *Analysis on the Economic benefit Design of prefabricated concrete structures in housing construction*. *Architecture and Engineering*, 2016(03):47.