
Analysis on the Maturity of Prefabricated Building

Yuanyaun Duan ^a, Hongyong Liu ^b and Xiaohong Guo ^c

Southwest petroleum university, Chengdu 610500, China

^a1127900583@qq.com, ^b1174488742@qq.com, ^c1450179545@qq.com

Abstract

Prefabricated building has become the mainstream of the future construction industry, How to ensure that the smooth implementation in the transformation stage of the construction industry in China has attracted the attention of domestic and foreign experts and scholars. Firstly, this paper analyzes the present situation of the prefabricated building and the advantages of prefabricated building in our country. This paper expounds the mutual relations and functions of each participant in the prefabricated building system. And the idea of the maturity model is introduced. Based on the maturity model, this paper puts forward the idea of setting up a set of maturity model of building system in order to promote the development of prefabricated building.

Keywords

prefabricated building; related party analysis; maturity; evaluating indicator.

1. Introduction

In the 2016 government work report, special proposals were made to actively promote green building, to develop prefabricated buildings, and to improve the standards and quality of construction engineering[1].Following it, the government introduced a series of policies to encourage the development of prefabricated buildings, enough to see the government attach great importance to the construction of prefabricated buildings. At the same time, the experience of the United States and other developed countries in the construction of the prefabricated building also inspired us, the prefabricated building will become the mainstream of the construction industry. Because of the particularity of the prefabricated building, the management ability and management method of the related enterprise must be improved. The project management team must be very familiar with the design, construction and other aspects of work, in order to control the quality, schedule and cost accurately during the construction process of the prefabricated construction project, and to finally hand over the building that meets the market requirements. Developers need to understand the level of their own built project management, to find shortcomings of prefabricated construction project management, targeted on the prefabricated construction project management ability to enhance, to improve its competitive advantage in the industry, and to promote the development of prefabricated buildings.

2. Development Status of Prefabricated Building

With the disadvantages of the traditional construction methods becoming more and more prominent and the implementation of the National prefabricated building policy, many cities in China have responded to the call and actively promoted the prefabricated building. In some industrialized countries, prefabricated building occupies a higher proportion, so it has mature technical system, high standard parts and perfect industrial chain. Compared with these countries, our country's prefabricated building is faced with a single product form, a low level of mechanization and chemical industry. And there is no uniform quality standards and acceptance standards. There are strict requirements to control

the construction process and construction technology process, but so far in China both construction management and construction installation technology or detection methods are not up to the requirements, often made between parts transportation and construction site plan of this contradiction. Quality management and schedule management is difficult to control the prefabricated building in the project management. And my domestic industrialization is not high, so the one-time investment in the construction of prefabricated buildings is generally higher than the traditional cast-in-place building[2], which is not conducive to cost control in project management. In order to save resources, protect the environment, speed up the reform of the construction industry and raise the level of construction, the prefabricated building has become a way to reform the construction methods of our country.

3. Advantages of Prefabricated Building Development

3.1 Shorten Construction Period and Improve Production Efficiency

The parts of the prefabricated building are processed and manufactured by the factory, and each component's production mode is different from the field construction. The factory adopts centralized industrial production, that is, the parallel production mode. In the factory, the parallel production mode can combine many specialized techniques to produce the same component in batches, and it is convenient for the components with more complicated production forms. It is more convenient to control the quality of the components than the cast in place. The wet work of the prefabricated construction site is very little, and only a small number of professional technical personnel are required to lift and splice each component, thus reducing the corresponding construction process. This way reduces labor investment and labor intensity, but also greatly improves the utilization of time, more convenient and efficient.

3.2 Improve the Quality of the Project and Reduce the Hidden Danger of Safety

The assembly parts of the building are mainly manufactured in prefabricated units. In the process of production, the temperature, humidity, size and other parameters are strictly controlled. So the quality of components is more easily guaranteed. And in the traditional cast-in-place construction site, the quality of workers varies greatly. Human factors often lead to quality accidents, resulting in unnecessary casualties and cost losses. Most of the construction work in the traditional cast-in-place building is in open-air work, high altitude operation, which has a lot of unsafe factors. It is easy to cause safety accidents. The prefabricated building is to transport part of the components manufactured in the prefabricated plant to the construction site. It is hoisted and spliced by the professional technical installation team in strict accordance with the working procedures, which not only greatly improves the quality of the project, but also reduces the security risks[3].

3.3 Reduce Labor Costs and Improve Workers' Sense of Belonging

At this stage, China's construction industry is facing lack of technical personnel, the lack of labor force, the increasing age of the labor force year by year, that causes the traditional cast-in-place construction to face the big difficulty[4]. The part of the fabricated building is industrialized in the assembly line of the prefabricated plant, making the site wet work construction personnel to the factory centralized transformation. The worker only needs to master his own module technology and improve work efficiency. When the component is transported to the site, only professional technical personnel are required to carry out the lifting and splicing. Therefore, wet work is greatly reduced and considerable labor cost is saved[5]. The working environment is moved from the off-site to the interior, which greatly improves the working environment. Factory wages are paid on time, reducing the risk of defaulting on wages. The workers can go to work on time, greatly improving the workers' sense of belonging.

3.4 Energy Conservation, Environmental Protection, Pollution Reduction

All the components of the fabricated building are produced in the prefabricated plant. The form and scaffolding used can be recycled many times, thus saving a lot of wood. Field construction requires only professional technicians to assemble the components at the construction site, and only a small amount of wet work is done. It greatly reduces noise and smoke pollution at the construction site and reduces the surrounding environment.

4. Analysis of Related Parties in an Assembled Building System

Prefabricated building is defined. First the various parts of the whole building is split into parts; Then the parts are manufactured in the prefabricated factory and transported to the construction site; By means of mechanical lifting and certain means of connection, the scattered parts are connected together to form a whole building[6].The prefabricated construction reduces a lot of site wet work compared with the traditional cast-in-place building, which realizes the civilized green construction. But the participants are different from the traditional cast in place buildings. In contrast to traditional cast-in-place buildings, prefabricated units have been added to prefabricated buildings. In contrast to traditional cast-in-place buildings, prefabricated units have been added to prefabricated buildings. During the construction of an assembled building, construction units, design units, supervision units, components of prefabricated units, construction units from the task design to completion, which are necessary for all departments and units to cooperate with each other in the implementation of the whole project. During the whole construction process, the prefabricated building has dynamic relevance. Each participant is in a dynamic environment, so they need to share information and feedback in real time. That puts forward higher requirements for collaborative management among departments.

4.1 Government

In the development of prefabricated building, the government should play the role of guidance and encouragement. In the 2016 government work report, special efforts have been made to develop prefabricated buildings. The government needs to set up a relatively complete prefabricated construction laws and regulations, standard and standard system, to provide the legal guarantee for the development of the prefabricated building. The government should formulate guiding policies such as finance, credit, taxation, publicity and land, so as to guide the participating parties to actively invest in the construction of prefabricated buildings.

4.2 Developers

Developers act as the implementer and financiers of prefabricated building. Because the development cost of the prefabricated building is higher than that of the ordinary building, it is necessary for the society to undergo a process of cognition and acceptance of the prefabricated building. Therefore, developers for prefabricated building are also in a wait-and-see state. Developers should develop prefabricated construction projects. First of all, we should analyze the market situation according to the market research provided by the consulting service, and make decision analysis under the overall grasp of the market situation. Supported by preferential policies such as government credit, land and so on, the financing and land for the development of fabricated construction projects are obtained by adopting reasonable financing methods. The funds, land, design, management and other factors committed to the prefabricated building, forming prefabricated construction entity, and ultimately through marketing ability to realize its value.

4.3 Design Unit

Design units and assembly technology research and development institutions play an important role in the development of modular architecture, in which the design of component splitting is the most important part of the prefabricated building. The design part of the prefabricated building includes the formulation of the design task book, the preliminary design, the deepening design and the component

split design. Among them, the design of the component is different from the cast-in-place building. Although component splitting design should be deepened after design, the building components should be considered in the whole process of production, transportation, installation, use and maintenance. Component splitting design needs to be considered comprehensively and requires great demand. Because the project has one time feature and the component also has one time characteristic, and it is a batch of industrial production. If it returns to the trade union, it will cause great waste of cost. Therefore, from the beginning of the task book design, we should consider “how to build the prefabricated building” and “the type of prefabricated building”. The requirement of the construction unit and the device state requirement of component production unit shall be mutually satisfied, to realize the design for the construction of the concept of service[7].

4.4 Component Production Unit

The component production unit is the producer of the prefabricated building component. The component production unit carries out the specialized pipeline production according to the parameters of each component in the design units' drawing. In the production process, professionals are required to strictly control the size, temperature, humidity and other conditions in strict accordance with the set parameters. The construction process, technical level, management ability and personnel quality of the production units determine the quantity and quality of the finished components. The project has one-off features and the components produced are disposable. If the production is not up to standard, it will cause heavy losses to the component production units. Therefore, the management difficulty of component production units has increased.

4.5 Construction Unit

The construction unit is the undertaker in the construction task of the prefabricated building. The work of the construction unit in the prefabricated construction project is quite different from that of the construction unit in the traditional cast-in-place building. The prefabricated construction needs only a few specialized technical personnel to install the components, and component connections require wet job operations. Component connections require wet job operations. However, the assembly technology requirements of the component in the construction site are relatively high, mainly due to the new installation technology and connection process. Site construction management personnel should have high management ability, and need to have a good understanding of assembly technology, with strong construction site layout, personnel deployment ability. Site construction management personnel should have high management ability, need to have a good understanding of assembly technology, with strong construction site layout, personnel deployment ability. The construction unit should participate in the project when the component is split, and it will complete the design of the component split according to its own construction experience and design units, which will provide a lot of convenience for the subsequent construction and reduce the risk of rework.

4.6 Supervision Unit

The supervision unit is the gatekeeper of the prefabricated building construction. The prefabricated building is different from the traditional cast-in-place building. The components of the prefabricated building have been fabricated in the prefabrication plant prior to site construction, so the supervision unit shall have been involved in the processing of the components in the prefabricated plant. Prefabricated building site lifting and splicing require new technology and new process. Supervision units should also keep pace with the times, to understand new technologies and new technologies and establish new testing techniques and supervise and manage them.

4.7 Consumer Market

The consumer is the main part of the consumer market, and also the ultimate user of the prefabricated building. Their income level, cognitive level, consumption structure and lifestyle determine the development of prefabricated buildings. When buying a house, consumers first consider the safety,

comfort and economy of the house. Under the condition of low cognitive level, consumers are more likely to prefer traditional, cast-in-place buildings with relatively good psychological quality and relatively inexpensive prices. Only people with higher income levels have a certain understanding of prefabricated buildings before they consider purchasing prefabricated buildings.

5. A Model of Maturity of Prefabricated Building

According to the unique features of the prefabricated building and the present situation of the prefabricated building construction in our country, and referring to the maturity model theory, the maturity model of the prefabricated building system which belongs to our country is established, as shown in figure 1.

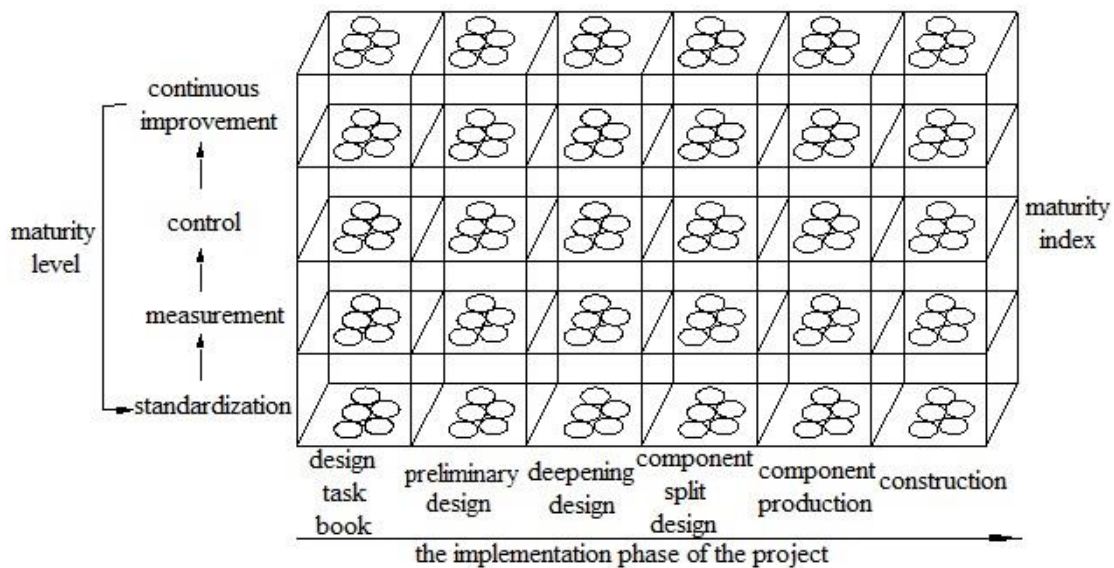


Figure 1. Prefabricated building system maturity model

The model is divided into three dimensions. The first dimension represents the maturity level of the modular building system, followed by standardization, measurement, control, and continuous improvement. The second dimensions represent the implementation phase of the project. They are the following six stages: design task book, preliminary design, deepening design, component split design, the component production, the construction. The third dimensions represent the maturity index domain of the assembled building system.

Index are selected on the basis of scientific and reasonable principle, based on preliminary reading a lot of literature, combined with the analysis of the model and the relevant parties involved in the foregoing chapters, various types of primary methods to establish preliminary evaluation index system from the angle of related parties involved. After the initial establishment of the index, a large amount of follow-up work should be adjusted, because the initial maturity evaluation index of the assembled building system contains a larger subjective component. In order to ensure the accuracy and validity of the evaluation, it is necessary to investigate and screen the indexes so as to enhance the rationality of the evaluation results.

6. Conclusion

In view of the present situation on prefabricated building development in our country, this paper analyzes the present situation and advantages of prefabricated building, and the maturity model of the prefabricated building system is constructed and to establish the preliminary maturity model of the prefabricated building system, in order to reflect the maturity of the prefabricated building in China and to find the constraints of the prefabricated building development, and thus to promote the development of the prefabricated building. The model is only preliminary, and a lot of work needs to be done to

adjust the final model. At the same time, more experts are needed to make further proof and feedback, and then through a specific case analysis to further demonstrate the rationality of the model.

References

- [1] 2016 government work report
- [2] Zhang Shen. Zhang Huifeng. Li Jiayue. Summary on the development of prefabricated assembly structures at home and abroad. [J]. mainland bridge view,.2016
- [3] Zhao Kai. Analysis on the advantages, technical difficulties and supervision of prefabricated building. [J]. China's real estate industry.2016
- [4] Li Chengyu. Research on engineering construction project management based on assembly technology [D]. Tianjin University,.2015
- [5] Cui Lu. Economic study of prefabricated steel structures [D]. Shandong building University,.2015
- [6] Yu Longfei. Zhang Longfei, research on the development of prefabricated construction [J]..2015:40-42 low temperature construction technology
- [7] Li Kebai, Qi, Baoku, etc.. Analysis of constraints on prefabricated building development based on DEMATEL[J]. theory of Urban Construction Research (Electronic Edition).2013