

Theoretical Analysis of Quality Innovation in Prefabricated Building Construction Enterprises

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Abstract: As an important development direction of the construction industry in recent years, prefabricated construction provides an effective way to improve construction quality and labor productivity in terms of reducing on-site operations, reducing environmental pollution and saving energy consumption. With the development of economy and society, although the development of prefabricated buildings in China is rapid, the prefabricated buildings are still in the stage of exploration and development, and still need systematic theory and quality innovation to promote the prefabricated building construction enterprises to obtain a favorable market position and improve their competitive advantage, so as to achieve high-quality development. Therefore, based on the relevant research of domestic scholars, this paper theoretically analyzes all aspects of the quality innovation of prefabricated building construction enterprises, promotes the transformation of China's prefabricated building construction industry to the direction of high quality and sustainability, and contributes to the research on the related fields of quality innovation of prefabricated building construction enterprises.

Keywords: Prefabricated Buildings; Construction Enterprises; Quality Innovation; Theoretical Research

1. Introduction

The traditional construction industry has been faced with high carbon emissions and high energy consumption, the survey noted that the construction industry generates about 33% of the annual carbon emissions, accounting for about 40% of the global energy use. Under the background of China's new urbanization strategy and the implementation of energy

conservation and emission reduction policies, the traditional construction industry, which is dominated by labor-intensive and extensive construction methods, urgently needs to be transformed and upgraded. As a technology-intensive and environmentally sustainable construction method, prefabricated buildings and their construction have been strongly supported and promoted by the central and local governments at all levels [1]. The development of prefabricated construction industry in some developed countries started very early, and after decades or even hundreds of years, it has developed to a relatively mature and perfect stage. With the accelerated development trend of economic globalization, Chinese construction enterprises have gradually participated in the international competition, which makes the market competition in the construction industry become more intense [2]. China's economy has entered the transition period from high-speed development to high-quality development, and the new and old economic model has been transformed from the homogenized competition in "quantity" to the differentiated competition in "quality" [3]. For prefabricated construction enterprises, improving quality innovation is an important measure to promote the further development of the industry. Therefore, in order to promote the rapid development of prefabricated construction in China and improve the quality innovation of enterprises, this paper conducts a comprehensive theoretical analysis on the quality innovation of prefabricated construction enterprises according to the research of domestic and foreign scholars, which can provide reference for the theoretical development of the integration of quality and innovation, and help the high-quality development of the prefabricated construction industry, China's development transformation and upgrading, and achieve high-quality

economic development, quality innovation research is of great significance.

2. Theoretical Research on Quality Innovation

2.1 Theoretical Research on Quality

The development of quality management theory has a history of more than 100 years, and "quality" has experienced the predecessors' unremitting exploration, excavation and innovation, and its connotation has become quite rich. With the acceleration of the industrialization process and the rapid progress of society, as well as the continuous improvement of modern quality management theory in practice, the concept and definition of quality are constantly evolving and developing in the wave of great changes.

In the quality inspection stage from 1900 to 1930, quality was defined as: the degree of conformity with the technical standards of the product was used as the basis for measuring the quality of the product. From 1940 to 1960, Dr. Zhu LAN, a famous quality management expert in the United States, proposed that product quality is the applicability of products from the perspective of customers. That is, the degree to which the product successfully meets user needs. The basic requirement of the user for the product is applicability, which properly expresses the connotation of quality. From 1960 to the total Quality management stage, Feigenbaum defined quality in TQC as: "The quality of a product or service refers to the synthesis of various characteristics in marketing, design, manufacturing and maintenance. With this complex, products and services can meet customer usage expectations." Later, the International Organization for Standardization (ISO) defined quality in its ISO9000 "Fundamentals and Terminology of Quality Management Systems" as the degree to which a set of inherent characteristics meet requirements. Here, characteristics refer to the unique attributes of things, and the so-called inherent characteristics refer to the inherent attributes of things, which are formed through the design and development of products, processes or systems and the subsequent realization process.

The scope of quality has gradually evolved from the initial product or service quality to

process quality, and even to the quality management system of the entire organization. Now, the concept of "high quality" has extended to various fields of quality organization management [4].

2.2 Theoretical Research on Innovation

Joseph Schumpeter, the famous founder of innovation Theory, mentioned innovation for the first time in his book Theory of Economic Development, and made a specific concept definition and explanation of innovation. Professor Schumpeter believes that innovation refers to the process of recombining various resource elements and production conditions within an organization on the basis of breaking the original production function. On the basis of Professor Schumpeter's research, subsequent scholars have made a new interpretation of innovation from different angles. For example, innovation is to generate new ideas and realize the landing from the idea to the product; Innovation is the creative reuse of old resources or knowledge; Innovation is the whole process of creating new solutions to existing dilemmas and constantly improving them. Innovation process management serves the enterprise innovation strategy and innovation output target [5].

With the countercurrent of economic globalization, the market environment faced by Chinese enterprises is becoming more and more severe. As an important driving force for enterprise development, the importance of innovation has been paid more and more attention by people, and because China has gradually entered the stage of high-quality development, people's focus on innovation has also begun to change from quantity to quality.

2.3 Theoretical Research on Quality Innovation

The complex and changeable quality environment, the globalization of quality competition and the diversification of consumers' quality demands have challenged the theories, methods and means of quality management. Academia and industry have noticed that enterprises must quickly adapt to the changeable quality environment and respond quickly to consumers' quality demands. The focus of obtaining quality competitive advantage is not quality management, but quality innovation. British

scholar Swann is the first to study quality innovation, Swann [6] believes that quality innovation is a special form of innovation, which has three characteristics. It is the introduction of a new version (usually improved) of an existing product, rather than a brand new product; Quality innovation can be analyzed within the existing quality or feature space; New dimensions for new products.

Quality innovation in our country can be divided into two stages. The first stage is mainly exploratory qualitative analysis. Lou et al. [7] believe that the connotation of enterprise quality is constantly changing with the needs of market environment, and under the role of market, quality is constantly undergoing gradual evolution and breakthrough evolution. Xu et al. [8-9] put forward the theory of Total Innovation Management (TIM), arguing that enterprises should change their traditional emphasis on efficiency and quality to focus on creativity and flexibility in management. Wang et al. [10] expanded the dimension of quality management and proposed three models of quality innovation. At this stage, scholars at the forefront of quality management theory research in China mainly discussed the reform and innovation of quality management theory from different perspectives and entry points, integrated innovative elements into the existing quantity management, and formed theoretical achievements such as TIM.

The second stage focuses on the divergence of quality innovation, and begins to focus on quality innovation itself, which greatly develops the theory of quality innovation and quality management practice. Yang [11] believes that quality innovation is a part of innovation quality and a special expression of innovation. Sun [12] believes that innovation quality is a series of continuous and unobstructed innovation quality characteristics that can meet specific needs. After systematically studying relevant theories of quality innovation, Cheng [13] defined quality innovation, believing that quality innovation refers to "continuous improvement and improvement of inherent characteristics of products through technological upgrading, production innovation and other means, so as to better meet consumer demand".

With the progress of science and technology and the change of market environment, the

traditional theory and method of quality management can no longer meet the current social needs. The innovation of technological elements such as R&D and technological transformation and the innovation of non-technological elements such as organizational concept, strategy and culture have an increasing impact on the quality of enterprises. In the increasingly competitive global market, the rapidly changing business environment requires creative quality change and innovation strategies. Enterprises should integrate quality and innovation, strengthen quality innovation in every link of research and development, design, production and service, and constantly create high-quality products and services for the society to promote the development of enterprises.

3. Research on Quality Innovation of Prefabricated Building Construction Enterprises

In the construction of prefabricated buildings, the construction quality has always been the focus of foreign scholars. In the 1970s, foreign scholars began to conduct a series of researches on construction quality management. In recent years, domestic and foreign scholars have carried out the following studies on quality management: Wallbuaum et al. [14] extracted the sustainable development evaluation index of prefabricated buildings from 75 construction technical indicators from the perspective of construction technology, and summarized the key contents to be paid attention to in the quality improvement of industrial building development. Chang [15] adopted the fuzzy multi-objective decision evaluation method to analyze engineering quality management from three aspects: quality planning, assurance and control. The results showed that quality planning had an important impact on improving project quality, and corresponding suggestions were put forward to improve the quality management level of prefabricated buildings by identifying important influencing factors.

Domestic scholars mainly focus on construction quality problems and quality management methods of prefabricated buildings [16]. For example, Chang et al. [17] summarized the quality problems frequently occurring in prefabricated construction projects from four aspects, including

construction personnel, component quality, construction preparation and organization management, and proposed a four-dimensional space solution to the quality problems. By sorting out the problems in construction quality management, Zhou [18] found that BIM technology can implant information chips in components, and information integrated management is an important part of the quality and safety development of prefabricated buildings, and it is also convenient for the implementation of the responsibility system in project implementation. Starting from the methods of quality management, many scholars have used different methods to study quality management. Li et al. [19] adopted the accident tree analysis method to carry out hierarchical analysis of factors affecting the construction quality of prefabricated buildings, and evaluated the risk weight. Liu et al. [20] combined TQW and BIM information management technology to establish a quality management system from the aspects of multi-links and multi-elements. Wu [21] also used the fuzzy comprehensive evaluation method to divide quality problems into three stages, including before, during and after construction, and carried out hierarchical division and comprehensive evaluation of quality safety problems.

As for the research on the impact mechanism of enterprise quality innovation, Chen et al. [22] believe that technological innovation is an important path to achieve high-quality innovation of enterprises, and only the industrialization of technological achievements or the application of new technologies to the improvement of product quality can realize the improvement of enterprise value. Li [23] conducted research on high-quality development and found that various internal and external factors, such as demand factors, technical factors and organizational factors, can promote technological and organizational innovation of manufacturing enterprises, and then promote enterprises to achieve high-quality development. Chen [24] found that government subsidies positively affect the high-quality development of manufacturing enterprises by encouraging enterprise innovation. Huang et al. [25] found that enterprises' innovation activities usually seek technological breakthroughs in a new environment. The editable characteristics of

digital technologies help enterprises adapt to new environments more quickly, enabling enterprises to effectively select and make full use of resources related to innovation activities according to their own innovation needs.

As a micro carrier to improve the quality of innovation, enterprises are the core force to promote green transformation and build a low-carbon circular economy system [26]. Therefore, maintaining the vitality of enterprise innovation, improving quality innovation, and then improving the core competitiveness of prefabricated enterprises, improving the level of innovation, and promoting the high-quality development of prefabricated building construction enterprises are the development goals of prefabricated building construction enterprises.

4. Conclusion

In the context of the rapid development of the prefabricated construction industry, based on the theoretical research on the quality innovation of the prefabricated construction enterprises, this paper comprehensively analyzes the development, theoretical research and influencing factors of quality innovation, and finds that the quality threshold of enterprises facing the industry and global competition is getting higher and higher, and quality or innovation alone cannot maintain the long-term competitive advantage and excellent performance of enterprises. It is necessary to integrate quality and innovation, integrate innovation into the field of quality management, improve the quality innovation ability of enterprises, and play the coordinating role of quality and innovation have become a consensus, from traditional element-driven to efficiency-driven to innovation-driven, and promote enterprises to lead high-quality development with high-quality innovation.

Therefore, as the basic research of quality innovation theory, the research on the influencing factors of quality innovation provides support for further understanding of the influencing mechanism and action mechanism of quality innovation, and has important reference value for the path selection of enterprises' transformation from the middle and low end of the value chain to the high end of the value chain. It is a beneficial exploration in the development process of China's quality management theory. Promoting the

transformation and upgrading of the construction industry has far-reaching practical significance, and has important theoretical value for exploring the quality management model with Chinese characteristics.

There are still some problems in this study, such as: (1) This paper has conducted a preliminary exploration of the quality innovation of prefabricated building construction enterprises, but the analysis of the influencing factors of the quality innovation of enterprises is not sufficient and needs to be further improved. (2) The impact of quality innovation on prefabricated building construction enterprises has not been investigated on the spot, and the understanding of prefabricated building enterprises is insufficient. The research on its influencing factors needs to be carried out continuously and updated in real time in combination with the characteristics of The Times. In-depth understanding of enterprise research and development has become the direction of future research.

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