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Research on the Construction and Development of Prefabricated Building Industry Chain from the Perspective of Ecological Niche

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Abstract

Taking the prefabricated building industry chain as the research object, a series of studies are carried out by using the niche theory in ecology. Based on the characteristics of prefabricated buildings and the nature of the industrial chain, the construction and operation of the prefabricated building industry chain are analyzed at the macro and micro levels. This research analyzes the future development trend of the prefabricated building industry chain in China from such aspects as policy, economic, social and technical factors and puts forward the countermeasures and suggestions in the development process, providing theoretical reference and constructive ideas for the development of China 's prefabricated building industry chain.

Keywords

Niche Theory; Prefabricated Building; Industrial Chain; Industrial Development.

1. Introduction

With the development of economic transformation and upgrading and urbanization, green production, eco-friendly lifestyle and consumption patterns are gradually integrated into urban construction. At present, China 's construction industry is still dominated by extensive production, bringing about severe pollution, high energy consumption, high emissions and other issues which need to be eliminated or improved greatly.

As an emerging construction mode, the introduction of building assembly basically solves the existing problems of the traditional mode. It has significant effects on resource conservation, energy conservation and emission reduction, noise reduction and environmental pollution. However, China 's prefabricated construction industry is still in the initial stage, but the development potential is very huge. It’s true that it is greatly affected by such factors as policy, social environment and economy. So it is urgent to clarify the construction mode and development of the prefabricated building industry chain in combination with the industrial environment and its stage of development.

First of all, foreign research on the prefabricated building industry mainly focuses on the technology, production system, resource utilization and environmental protection of prefabricated buildings[1]. Benro and Duarte[2]put forward the idea of building assembly integration system to realize mass customization of building products, improve production efficiency and reduce production costs. Nahmens and Ikuma [3] proposed the concept of lean construction; Bari[4] proved that prefabricated buildings can help improve economic and environmental benefits through cost analysis. Robert Agre and Rober D.Wing [5] summarized several milestones of the development of the prefabricated construction industry. China 's research mainly focuses on technology, policy, cost and industrial chain construction. Wang Guilin [6] has carried out in-depth research on the industrial chain, benefits and sharing mechanism of prefabricated buildings; Li Wei[7] studied the method of improving the value of

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each link in the development of the whole industry chain of prefabricated buildings through the value chain model.

At present, niche theory has been widely used in the research of various industries. Lim [8] used the theory of population niche to study the strategic decision-making of international shipping trade routes ; Yuan[9]used niche theory to study and analyze the structural characteristics of marine industry. Susur E[10] used niche theory combined with the concept of industrial clusters to study the development of industrial parks ; He Xiaorong[11]established the evaluation index system of tourism industry niche through the study of the competitiveness and development of tourism in various regions. Liu Yan[12]studied the growth stage and development suitability of the logistics industry ; in addition, niche theory has been widely used in the research of emerging industry competitiveness [13], the coordinated development of regional industries [14][15]and other fields.

In general, the development of prefabricated buildings in western developed countries is relatively mature, while China is in the initial stage. Although the niche theory has been widely used in various fields, the existing researches mainly focus on the micro level of technology and cost, lacksing the analysis and research of macro industrial chain and are still mainly based on quantitative measurement analysis with few studies on the construction of industrial chain based on the concept of niche. Thus, this research introduces the niche theory, analyzes the structural form of the prefabricated building industry chain, constructs a complete industrial chain framework, and puts forward countermeasures and suggestions for the development of its industrial chain niche, providing a theoretical and practical basis for the integration and development of the niche concept and the prefabricated building industry chain

2. Related Concepts and Theoretical Basis

2.1. Related Concepts

2.1.1. Industry Chain

From the micro level, the industrial chain can be summarized as the relationship between supply and demand, input and output among different links based on the industrial correlation and the relationship between the industrial chain and the value chain, Different enterprises undertake different value creation functions to achieve value growth. From a macro perspective, based on the function of the industrial chain, the existence of the industrial chain not only realizes the production and circulation of products, but also enhances the competitiveness and anti-risk ability of the industry, which can often contribute to and promote the regional economy.

2.1.2. Prefabricated Building Industry Chain

The prefabricated building industry chain refers to the dynamic value-added industrial organization that takes the prefabricated building as the final product, aims to maximize the benefits, takes the participating enterprises of the prefabricated building industry as the carrier, and applies the construction process of development, design, production, transportation, installation, construction, operation and maintenance to ensure the operation of each link of the prefabricated building according to the market rules and regional environmental layout. The whole industrial chain includes various enterprises with different functions, whose cooperation in the whole life cycle is carried out in an orderly manner with each stage interrelated through supply relationship, value growth, science and technology, and supportive policies, being vertically integrated into the industrial chain to maximize the overall interests.

2.2. Niche Theory

The industrial chain, a complex system, composed of different enterprises and organizations, will be affected by the external environment, corresponding to the nature like an ecosystem.

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According to the theory of ecological niche, any unit in nature has ' state ' (the state of biological unit) and ' potential ' (the dominance or influence of the environment). Niche is the relative position formed by the interaction between biological units and the environment in a specific ecosystem, which is a combination of these two attributes. For every creature, it can get an environment suitable for its own growth. Although there will be competition, the competition state is benign and the ecological environment is in a stable state. Enterprises should identify their own ' niche ', realize complementary advantages through differentiated positioning, avoid inefficient competition, and thus enhance the overall competitiveness of the industrial chain.

3. The Structural Form of the Prefabricated Building Industry Chain

3.1. Macrostructure of Prefabricated Building Industry Chain

At the macro level, it is necessary to pay attention to all aspects of the industrial chain from the beginning to the end, and comprehensively and systematically understand the overall goal of the prefabricated building industry chain, that is, to complete a full life cycle of prefabricated building products. The macro structure can be seen in Fig. 1. In the macro structure, the prefabricated construction industry chain has two characteristics : (1) Each link of the industrial chain is very clear, and the links rely on the cooperative relationship between enterprises to achieve convergence. However, if it is necessary to further improve the efficiency of cooperation and highlight the overall advantages of the industrial chain, the connection between the links needs to be realized through advanced technology and efficient management ; (2) The prefabricated building industry chain has industrial relevance. In the industrial system, each enterprise can exist independently in the form, but in the operation system of the industrial chain, each enterprise must form a close production cooperation relationship and become an interdependent production association within the chain.

Fig. 1 Macrostructure diagram of prefabricated building industry chain

3.2. Microstructure of Prefabricated Building Industry Chain

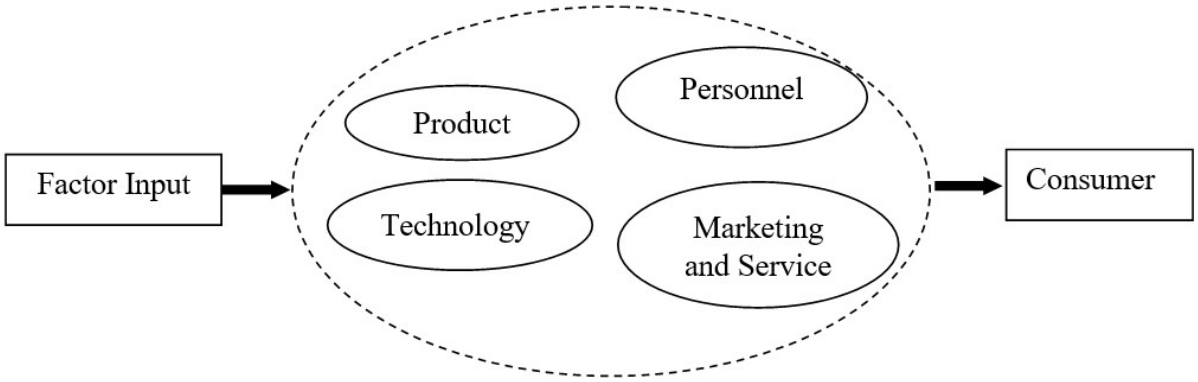

Fig. 2 Microstructure diagram of prefabricated building industry chain

The micro level mainly lies in payin attention to the role of individual enterprises in the industrial chain. The enterprise can be regarded as a basic unit in the huge industrial chain system, but as an organization that can operate systematically, it also has a complete production system, including raw materials, technology, information, personnel, management, sales and

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other aspects, as shown in Fig. 2. In order to enable enterprises to successfully play a role in the industrial chain, it is necessary to coordinate the various parts of the internal operation, including the management of talents, the use of technology and innovative development, the precise production of products and creative marketing, as well as consumer-oriented quality services and so on. Only when enterprises complete their tasks with quality and quantity in the division and cooperation of the industrial chain and manage the ' niche ' in the industrial chain, can they ensure the profitability of enterprises and promote the operation and income of the industrial chain.

4. Construction of Prefabricated Building Industry Chain

4.1. Dynamic Mechanism of Prefabricated Building Industry Chain Construction

4.1.1. The Drive of Government Support

From the current reality, the government 's drive can be divided into mandatory promotion and incentive promotion.

1) Mandatory promotion is mainly reflected in some mandatory provisions in policies and planning. At the national level, it is proposed to achieve 30 % assembly rate requirements for new buildings by 2020 and 50 % assembly requirements by 2025 ; at the regional level, localities have also put forward requirements that are equivalent to or stricter than those of the state according to their own basic conditions.

2) Incentive promotion is mainly reflected in the use of relevant policies or regulations to promote the development of the prefabricated building industry through multi-dimensional support. The first is to encourage the use of prefabricated buildings in some social public projects and infrastructure projects according to the current situation and objectives of regional development, so as to open up its market application. The second is to give policy tilts in terms of construction land, fiscal and taxation policies, personnel training, etc., thus greatly mobilizing the enthusiasm of enterprises and providing more impetus for the development of the prefabricated construction industry chain.

4.1.2. The Drive of Social Progress

1) The promotion of scientific and technological progress.

Prefabricated building is the result of technological innovation in the construction industry. Scientific and technological progress is the basis for the development of prefabricated buildings and an important driving force for their practical application. In the prefabricated building industry, the greatest changes brought about by technological innovation are mainly reflected in the design, production and construction stages. Each stage has its necessity and corresponding goals. Therefore, it is very important to have an integrated information management system, which can realize the information exchange of each participating unit and do a good job in the management of the life cycle of the prefabricated building.

2) Social needs for a better environment.

The public’s demand for life often corresponds to the stage of social development. At present, China’s economic construction has achieved great success, and the pursuit of economic aspects has changed from quantity to quality. Therefore, the construction industry also needs to be transformed into industrialization and modernization. Prefabricated buildings not only have better advantages in construction efficiency and mechanization, but also have great improvement in energy saving and environmental protection green performance compared with traditional buildings, which can meet the needs of the society for ecological environment construction and the needs of the masses for green and healthy houses.

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4.1.3. The Driving Force of Market Competition

In the market economy, the market is the channel and platform for producers and consumers to trade, the bridge between the two, and the key to realizing the value of products. For the market of prefabricated construction industry, the existence of industrial chain plays a more significant role in the competition system of enterprises. The operation of the industrial chain can improve the coordination of cooperation between enterprises, which is conducive to the development of professional advantages of enterprises, reduce the cost of cooperation, enhance the benign competition of enterprises and maintain a good atmosphere in the industry.

4.2. The Steps of Assembly Building Industry Chain Construction

4.2.1. Build Industrial Clusters in the Prefabricated Building Industry Chain

Combined with the characteristics and components of the prefabricated building industry chain, the following industrial clusters can be constructed according to the characteristics and resource base of the region : industrial clusters for the production of prefabricated building components and decorative materials, industrial clusters for the production of prefabricated building household products, and industrial clusters for the construction and installation of prefabricated buildings.

4.2.2. Formulate the Stage Development Strategy of the Prefabricated Building Industry Chain

1) Establish a complete industrial chain

In the early stage of the construction of the prefabricated building industry chain, the primary task is to establish a complete industrial chain. Through the integration of its own original construction enterprises or the introduction of foreign construction enterprises, design and production management technology, the region can complete all the functions of the whole process from R & D design to construction operation. The complete industrial chain can meet the basic needs of regional real estate projects, social public projects and infrastructure projects for assembly projects.

2) Develop characteristic industrial chain links.

After completing the basic needs of prefabricated buildings, we should focus on developing the characteristics of regional industries. We can start from the construction cost, construction period, energy saving and environmental protection performance, product development and manufacturing of parts and components, and characteristic decoration products, so as to form the development characteristics of prefabricated buildings, enhance the market 's understanding and understanding of prefabricated buildings, and expand market share. At the same time, the characteristics of the industry are also conducive to expanding the influence of the industrial chain, attracting the market outside the region, exporting products or services, and thus enhancing the profitability of the industrial chain.

3) Improve the overall development ability of the industrial chain.

First of all, we should realize the phased development, strengthen the application and innovation of advanced science and technology, rely on technology to reduce costs, and improve the profitability of the industrial chain. Secondly, encourage the formation of large enterprises with general contracting ability to drive the whole industrial chain to achieve more intensive development, so as to promote the overall coordination of the industrial chain. At the same time, it is necessary to rely on the government and professional industrial regulators to scientifically and effectively supervise the development of the prefabricated construction industry to ensure healthy and sustainable development.

4.2.3. Create a Good Development Environment for Prefabricated Buildings

1) The effective support and promotion of the government

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In view of the high cost and high technical threshold of prefabricated buildings in the early stage of development, it is difficult to rely on the enterprise itself and the market atmosphere to form a sustained and good development trend. For the governmen, establishing a sound and perfect industrial support policy can form a strong driving force in the early stage of industrial development and encourage the gradual development of the prefabricated construction industry.

2) The creation of market atmosphere

As a new type of architectural form and emerging industrial form, prefabricated buildings have a low level of understanding and popularity among the public. It is necessary to strengthen publicity and popularization, highlight the advantages of prefabricated buildings in contrast to traditional buildings, especially the display of its scientific and technological content. Propaganda is carried out by using completed prefabricated buildings to enhance social acceptance of prefabricated buildings and expand the influence of prefabricated buildings.

5. Niche Development and Countermeasures of Prefabricated Building Industry Chain

5.1. Analysis on the Development of Ecological Niche of Prefabricated Building Industry Chain

The niche of prefabricated building industry chain is a reflection of the development status of prefabricated building industry chain in a certain period of time, which can reflect the status and value of the industry chain in the environment. Scientifically predicting the change trend of the niche of the prefabricated building industry chain and finding out the shortcomings of the future development of the prefabricated building industry chain will have important guiding significance for formulating relevant policies for the development of prefabricated buildings.

According to the current policy, economic, social and technological factors, we can roughly predict the evolution trend of the niche of the prefabricated building industry chain. China 's policies in recent years have always supported the niche of the prefabricated construction industry. According to the general trend of the prefabricated industry, the policy support in the next few years will not change much, but it will not be greatly improved. For economic factors, its contribution to the prefabricated construction industry has also been relatively stable. In recent years, the market share, industrial output value and new construction area of prefabricated buildings have been increasing year by year. With the transformation and upgrading of the industry, the salary of construction workers has also increased. It can be seen that in the next few years, economic factors will continue to support the industry. Relatively speaking, social factors are more complex, involving more subjects and mutual relations, which may cause fluctuations in industrial niche to a large extent. First of all, the output of construction waste and the energy consumption of the industry in China are serious. In the initial stage of industrial transformation, these problems have not been solved. The construction industrialization reform with prefabricated buildings as the main development mode has not yet reflected its real results, and has not exerted its scale and environmental benefits. Secondly, the number of employees in China 's construction industry is not stable enough, the management of employees in the construction industry is relatively extensive, the management of employees ' qualifications is still lacking, and the industry has not achieved a refined management model. However, with the continuous exploration and improvement of China in the field of prefabricated buildings, its own development ability has been enhanced, and the corresponding problems will be gradually overcome. In addition, the improvement of technical factors such as technology research and development ability and production capacity also promotes the development and progress of China 's prefabricated construction industry.

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5.2. Countermeasures and Suggestions for the Development of Prefabricated Building Industry Chain

5.2.1. Policy Dimension

At present, China has put forward a series of industrial development strategic plans for the prefabricated building industry chain, which points out the direction for industrial development, but still needs to formulate more detailed plans for the actual development. The government should combine the current situation and existing problems of the industry, constantly adjust and give corresponding countermeasures, further clarify the short-termand long-term goals of development, and steadily implement the industrial development strategic plan. Besides, each region is also encouraged to independently compile an industrial plan that conforms to the pace of local development, and scientifically and orderly promote the development of the prefabricated building industry chain.

5.2.2. Economic Dimension

Financial support for the prefabricated construction industry chain should be strengthened, and relevant incentives and subsidy measures should be established for prefabricated construction projects. Conduct assembly building project selection, reward excellent projects, and encourage the whole industry to carry out construction reform and upgrading, so as to promote industrial development. At the same time, some funds can be allocated to support the development and promotion of related technologies and products, especially new materials and facilities. Secondly, it can improve the tax policy for the prefabricated construction industry, and implement preferential tax policies for enterprises that actively carry out the research and development of the prefabricated construction industry and product production, so as to reduce the cost pressure of enterprises, enhance the market development momentum, and stimulate the release of market demand.

5.2.3. Social Dimension

The government should increase publicity to enhance people 's awareness of prefabricated buildings and improve people 's understanding of energy-saving materials, energy-saving buildings and industrialization development models. Propagandize and popularize the knowledge of construction industry reform and industrialization transformation, including displaying excellent cases at home and abroad, improving people 's awareness of green life, and letting consumers understand the advantages of prefabricated housing performance. Industry associations and governments can also hold exhibitions of related building products to give consumers close access to environmentally friendly building materials and products.

5.2.4. Technical Dimension

Due to the late start, the research and achievements of prefabricated buildings in China in the fields of manufacturing, construction technology and building materials are relatively backward, and there is a lot of room for technological breakthrough. Therefore, it is necessary to pay attention to the role of technology in promoting industrialization, improve the production efficiency and construction efficiency of components and accessories, reduce the overall construction cost, alleviate the current cost problems, and enhance market competitiveness. At the same time, we should attach importance to building a research platform, and strive to seek technological breakthroughs, ensure the market 's ability to cultivate technology, and enhance the industry 's innovation momentum.

6. Conclusion and Summary

The development of the prefabricated building industry chain is not only affected by its own conditions, but also by the interaction with the external environment. The niche theory just depicts the role and relationship between species, environment and other species in an

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ecosystem, reflecting the survival status of the industry. Therefore, this paper introduces the niche theory, combines the specific environment of the industry, analyzes the structural form of the assembly building industry chain, and constructs the assembly building industry chain according to the research results of the dynamic mechanism, so as to predict the development of the ecological niche of the assembly building industry, and put forward reasonable countermeasures and suggestions for the future development of China 's assembly building industry, so as to provide reference for the development of China 's assembly building industry chain.

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