



A study of the green retrofit industry chain



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ABSTRACT

Existing building area in China is about 46 billion m² accounted for a large proportion of the total building area. Therefore, green retrofit for existing building plays an important role in the development of green building construction. However specialists involved in existing building retrofit projects, such as designers, consultants and all other relevant partners are accustomed to work separately in China. And it has been recognized that this kind of working states have several demerits, thus a exploration of effective working methods allows no delay. This study is to explore such operation modes and combine them into a chain to solve related problems in existing building retrofit projects, along with further analyses in its economical, environmental and social benefits.

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1. Background

1.1. Domestic development of green retrofit in existing buildings

Developing green building, reducing consumptions of energy, land, water and material in maximum as well as protecting environment are the urgent task for China at present. By the end of 2007, the total areas of existing building in urban and rural area is estimated to 46 billion m², while the area of new building growing with 2 billion m² every year at same time. Because of a larger proportion of total building area in existing building, existing building green retrofit has the priority for further improvement in construction market.

In recent years, China has carried out existing building retrofit projects and accordingly achieved initial results across the country. In 2007, Beijing released *Existing building energy saving renovation in Beijing special executive program* (Zhang, Wang, & Chen, 2011). According to total energy consumptions and their characteristics, the energy conservation transformations had been conducted in different types of building. At the same period, Shanghai also launched energy-saving retrofits in large and medium-sized existing buildings, such as office, commercial and tourism buildings, and set up related standards, energy-saving mechanism, and monitoring system for energy consumption progressively. By the end of

2010, Shanghai has already finished 20 million m² green retrofits in public buildings and projected to do retrofit in residential buildings.

Tracking back to 2005, China launched the existing building energy-saving retrofit projects with the cooperation of Germany technologies. These projects constituted with the energy-saving retrofit demonstration projects for existing residential buildings in the North heating region, and the survey of basic condition in existing residential buildings among several provinces and cities, which provided abundant and accurate reference data for carrying out a large-scale existing building energy saving retrofit later. The *construction, survey and design consulting industry technology development program in 2011-2015* then set clear ambitions on the implementation of existing building retrofit to improve people's livelihood and security (China Academy of Building Research, 2011). During the 11th five-year plan, China has executed and completed the major project named demonstrative existing building retrofits and its key technology research, which owned 48 items national patents, including 11 items of invention patents, 13 items of national standards development, 18 items of industry standards establishment, and more than 55 cases of technological achievement applications. These achievements have greatly promoted the comprehensive technological applications for the existing building retrofit throughout domestic construction industry. During the 12th five-year plan, the authority of China plans to initiate project for further researching on complete sets of technologies and more demonstrative green retrofit projects, which are able to provide more technical support for promoting widespread green retrofit among domestic existing buildings.

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1.2. Problems in existing building green retrofit

Recently, China has already carried out plenty of researches of existing building green retrofit in the filed of retrofit concept, technology application, talent training, and consequently obtained some achievements. But it was also admitted that the exploration of industrial operation mode is still at its beginning stage. At present, the existing building green retrofit industry is immature that interior consulting, design, construction and other functional parts works individually with respective operating modes. Even if a single part has the ability to develop advanced core technologies, the asymmetry information distribution, limited technologies and administrations in formation among scientific research units, manufacturers, design and construction enterprise make it difficult to break through itself and gain a long-term development for each part in a traditional building industry. Hence it is essential to look for a new development mode to put each other's strength together in this industry.

This paper therefore raises a concept of industry chain in existing building green retrofit and suggests to unite all links, such as consulting, design, construction, operation, property management in building retrofit process. By means of industrial structure regulation, innovative researching and other useful methods, the industry chain is expected to have inspirations of more growth in both value and conformity but less in competition, providing more convenient ways for the development of existing building green retrofit and making effort to bring more economic, environmental and social ecological benefits for this industry.

2. Analysis of existing building green retrofit industry chain

2.1. Conception of industry chain

At present, there are many studies on industry chain in China, and its definition is also various. Guohua Fu, a Chinese scholar, put forward "industry chain" when he did a research on the development of Hainan hotspot agricultural from 1990 to 1993. And therefore he has been considered as the first person that proposed the industry chain in China (Li, Li, & Lan, 2004). Later, researches about industry chain emerged in successively. Because of the differences in perspectives, professional background and concentrated points, the definition of industry chain has multiple representations. Gong pointed out that the enterprises were connected with the relations in techniques and economy, and industry chain was the objective statue with certain logical and special relation among each industrial part (Gong, 2004). Li and Li's opinion was the strategic chain formed with products, technology and capital among enterprises with core competitiveness, and the chain itself has the value-added function. While in Zhou's opinion, industry chain was developed on the basis of labor division and supply demand inside the industry, and it has two types, one is the vertical supply chain and the other is the horizontal collaboration chain (Zhou, 2001).

Based on the above definitions, common part within these interpretations is that chain contains a number of related parts, which has a certain relationship of upstream or downstream, and carries trading activities around final product to meet customers' needs. To sum up, it can be concluded that industry chain is a chain shaped organization that covers several related links. It treats product as the ultimate object, directed by value-add benefits, guided by supply and demand and taken investments and productions as contact.

2.2. Existing building green retrofit industry chain

Though the isolated operation mode in each part limits its own development and resists the progress in existing building

retrofits. It is therefore necessary to create a new kind of industry operation mode to eliminate defects resulting from the lack of information and weakness in both technology and resource in each link. Plus it is advisable to construct industry chain especially for the existing building green retrofit with abundant resources, like information, capital, talent, technology and management from each link for a better and faster development. Fig. 1 shows the flow chart in the industry chain in existing building green retrofit.

The industry chain in existing building green retrofit is constructed on the background of life cycle concept. It can be divided into several parts such as consulting, production, construction transformation, maintenance and putting into service. As the upstream of this industry chain, consulting and production provide design guidance scheme, policy advice and building materials products for construction in existing building green retrofit. Both design scheme and construction materials are not only the output in this phase, but also the input in next reconstruction step. The midstream of this industry chain is the construction transformation part, which is critical to transform design ideas into practical outcomes. Last but not least, the inspection, feedback and improvement from retrofitted results are also crucial. Finally, the downstream of this industry chain is a property management company to provide maintenance during daily operation. Only taking these into consideration, it is available to profit the customer maximum in existing building green retrofit projects.

Furthermore, each link in the chain also possesses respective sub-chains. Taking consulting for instance, it involves the project survey, feasibility analysis, project design and scheme optimization. This kind of formation in sub-chain makes the responsibilities in each branch industry more clear. And the sub division in each branch industry refines resource distribution so that decision makers are clear to know detailed status within each link.

From a micro point of view, the enterprise's vertical integrated strategy is the same operation strategy that takes the industry chain as a platform. The enterprise can make up with consulting, design, construction, property and other departments. As a result, the vertical integration not only broadens the scope of business and brings income from more aspects, but also facilitates internal industrial chain management.

The formation of the industrial chain provides a series of green achievements for the existing building green retrofit, such as green products, green technology, green management mode, and green jobs as well. The resulted economic, environment and social benefit improve ecological efficiency of whole existing building green retrofit industry and also promote its development.

The analysis above is a brief description of the green retrofit industry chain. From a macro point of view, the industry chain is open at its both ends instead of closed. It completes a whole industrial chain by cooperating with upstream and downstream enterprises mutually with common interest. It is important for the enterprises from the branch industry in chain to have a clear and accurate understanding of the whole industry chain and adapt to development of whole industrial chain system to maintain a competitive advantage. Then industry chain breaks out the value limitation in a single industry, its basic activities create the value for system and shape the project value together (Zhao, Ding, & Luo, 2004). There has been a large amount of information interaction in every link, such as most of consulting design work can be completed before construction, but related information exchange may be continued until project is accepted. Before the establishment of industry chain, it always occurs with the information-isolated phenomenon due to the barriers in each link's information exchange. Whereas within an industrial chain, it is a win-win situation that increases enterprise's profit point without reducing costs and achievement yet.

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