Research on the Evaluation of Construction Regional Development Level Based on the Whole Industry Chain

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Abstract. From the perspective of the whole industry chain, this article divides the construction industry from the construction process, construction products, and participants into the whole process, all-round, and full-staff principles, and divides the construction industry of each province into upstream industries and midstream industries based on all links of the entire industry chain. This paper constructs the evaluation index system of three dimensions of downstream industry. Based on valid statistical data, the development level of the construction industry in 28 provinces in my country in 2019 was analyzed based on combination weighting and principal component analysis, and the development level of the construction industry in each region was ranked. The results show that there are obvious regional differences in the development of construction regions. The development level of the construction industry in the eastern and coastal provinces and cities is significantly better than that in the western and central provinces and cities, which is consistent with the status and verifies the validity of the model.

1. Introduction

The "full industry chain" model of R&D, manufacturing, marketing, and service has a strong theoretical logic for weakening the dilemma of "low-end lock-in", which is embodied as an "industrial community" at the micro level of the enterprise [1]. The “full industry chain” model of R&D, manufacturing, marketing, and service has a strong theoretical logic for weakening the “low-end lock-in” dilemma. A mature domestic industry chain should have its own ecosystem, including upstream and downstream related companies and related industries, embodied as a kind of "industrial community" at the micro level of the enterprise [2]. In this paper, through the construction of the whole industrial chain, effective management and control of each link of the industrial chain is of great significance for the realization of effective and accurate supply and traceability of building product quality and safety, and the improvement of construction efficiency and quality [3]. Carrying out regional evaluations based on the entire construction industry chain and improving the overall synergy of the construction industry chain have important guiding and practical significance for promoting the development of my country's construction industry.

The foreign discourse on the industrial chain can be traced back to Adam Smith’s division of labor in "The Wealth of Nations" [4]. In recent years, literature research has mainly focused on production chain, value chain and supply chain [5]-[8]. Many domestic scholars have carried out research from different perspectives on the subject relationship and performance management of architecture [9]-[11].
In recent years, many scholars have conducted research on the development of architectural regions. Among them, Zhao Likun [12] (2019) analyzed and evaluated the prefabricated construction industry in 7 regions of China, including North China, East China, and South China; Zhang Miao [13] (2018) constructed a comprehensive evaluation index system for the sustainable development of the construction industry in the new region; Liang Hao [14] (2017) studied the classification of construction industry enterprises; Xu Xinwei [15] (2017) constructed an evaluation index system for the level of residential industrialization. The research article found that the development level of my country's construction industry is significantly different and the evaluation index system based on the construction of the entire industry chain has not been established. Most of these studies take a certain area as the overall research object, or the evaluation method is relatively simple, and the evaluation of each link of the industry chain has not been evaluated. In-depth study. By constructing a whole-industry chain building evaluation system, this paper uses the combined weight method and principal component analysis method to evaluate the development level of building industrialization in 28 provinces and cities in my country for each link in the industry chain.

2. Analysis of the whole construction industry chain structure and key nodes

2.1. Analysis of the whole construction industry chain structure

The industrial chain is the material basis of the supply chain. The industrial chain is expressed through the products of enterprises and enterprises. The industrial chain is a material basis of the supply chain, that is, the industrial chain has two nodes, the enterprise and the product, while the supply chain has only one node for the enterprise. With the extension of the roundabout production industry chain, the division of labor and cooperation in the construction industry has developed from not only coordinated within the enterprise to more extended to enterprises. The whole construction industry chain consists of three industries: upstream industry, midstream industry and downstream industry. The government is in a core leading position in the entire construction industry operation process. The basic structure of the entire construction industry chain is shown in Figure 1:

Figure 1. Composition of the whole construction industry chain.

First, the design institute conducts the modeling; then, the building material supplier provides the raw materials, and the prefabricated component processing plant inputs the raw materials to mass-produce the prefabricated components according to the component model provided by the design institute. The logistics company is entrusted to produce the prefabricated components according to the on-site construction schedule and the prefabricated component factory. The component progress is carried out for the transportation of prefabricated components. The construction company completes the construction of the building project through a highly mechanized construction process, and then
the professional service team improves the product sales operation management, etc, and finally the building demolition company dismantles and reuses.

2.2. Analysis of the whole construction industry chain structure

With the rapid development of the construction industry chain, research from a qualitative perspective can no longer meet the actual needs. The analysis of key nodes in the industry chain should be quantified and evaluated through numerical analysis. This article constructs the entire construction industry chain, and analyzes the key node enterprises in the above-mentioned representative key links in the entire industry chain. Including the government, developers, consulting and design companies, building materials companies, component factories, construction companies, supervision companies, property companies, building demolition recycling companies and other 10 node companies. Figure 2 shows the participants and information exchange of the whole construction industry chain.

3. Building development level evaluation system

3.1. Evaluation System
The industrialization of construction requires a systematic thinking of the entire industry chain, from R&D, design, component production, part production to construction, installation, and delivery and operation. The collaborative work of enterprises in the industry chain is integrated, and the building is regarded as a complete product and is being constructed. In the early stage, issues such as maintenance and renovation during the use of the building were considered. This paper constructs an evaluation index system for the entire construction industry chain according to the key node enterprises in the entire construction industry chain and their impact factors, as shown in Table 1.
Table 1. The evaluation index of the development level of the construction area of the whole industry chain

| Industry composition | content                                                                 |
|----------------------|------------------------------------------------------------------------|
| Upstream industry    | Number of prefabricated construction industry bases                     |
|                      | Consulting design unit                                                 |
|                      | Number of real estate companies                                         |
|                      | The number of China's top 500 building materials companies in 2019      |
|                      | Total production capacity of component plant                            |
| Midstream industry   | Technical equipment rate of construction enterprises                    |
|                      | Number of construction project supervision enterprises                  |
|                      | Total output value of construction industry                            |
|                      | Labor productivity in the construction industry                        |
|                      | Installation project output value                                       |
| Downstream industry  | Number of property companies                                           |
|                      | Number of construction demolition recycling enterprises                  |

3.2. Evaluation method

At present, traditional evaluation methods are usually used for the evaluation of building areas, such as analytic hierarchy process, fuzzy evaluation analysis method, entropy weight method, etc. The evaluation results of these traditional evaluation methods depend on the scientificity and effectiveness of the established evaluation index system. However, in practical applications, due to artificial design reasons, there are often strong correlations between different indexes, causing the same effect to be counted multiple times, The final evaluation result is difficult to achieve satisfactory reliability. Combination weighting method is a comprehensive weighting method that integrates subjective weighting and objective weighting. It not only compensates for the deviation of the weight value caused by a single weighting method, but also takes into account the preferences and recognition of decision makers (experts). Know the limitations.

4. Evaluation system application

This paper selects 28 provinces and cities in my country as the research objects to evaluate the development level of the entire industry chain of the construction area, using a total of 12 indicators in the upper, middle and lower reaches of the construction industry chain in each province in 2018 as the basic data of the evaluation indicators, and unified through the evaluation matrix For processing, the evaluation matrix must be normalized. Through subjective weight and objective weight analysis, the combined weight of each indicator is obtained. If the sum of the weight of each indicator is greater than 0.85, these indicators can be considered effective. Finally, the comprehensive evaluation of entropy method and principal component analysis results in the scoring table of each province as shown in Figure 3.

Judging from the calculation results, the government's guidance to the construction industry and technical standards and regulations have a role in promoting the development of regional buildings. From the perspective of regional rankings, the development of China's regional construction industry is currently unbalanced, showing obvious geographical distribution from strong to weak. From the eastern coastal areas to the central and western regions, there is a stepped distribution from good to bad, and the north-south development is unevenly distributed.
5. Conclusions and Outlook

The eastern coastal area has developed economy, the construction industry started early, the construction industry structure is stable, and the construction industry chain is relatively complete; the construction industry market in the northeast and some central and western provinces started late, and the industrial structure is or needs to be adjusted, but its market demand is relatively high. It is an important area for the development of the construction industry. The report of the 19th National Congress of the Communist Party of China clearly pointed out that the implementation of the regional coordinated development strategy, the extremely unbalanced development of my country's regional construction industry and the accelerating increase in the development of the construction industry in the east and west have been pointed out and are being quickly stopped. As far as the construction industry is concerned, backward regions should give full play to their local advantages, integrate resources, adjust the local industrial structure, improve the market system, and develop faster regions should innovate to lead and optimize the development of the regional construction industry, and establish a more effective new mechanism for regional coordinated development. Only by opening up and perfecting the industrial chain can the adjustment of the industrial structure promote the upgrading of traditional industries, transform the construction mode, and comprehensively improve the quality of construction, and promote the better development of my country's construction industry.

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