Abstract

The development of recycle economy often relies on the industrial development. The change of industrial development pattern promotes the development of recycle economy. Therefore, the industrial path is one of the main ways to promote the development of recycle economy. From the perspective of industry, we use the indices of Location Gini Coefficient, Industrialization Rate and Location Quotient to evaluate the situation of industrial development at Shandong province. Then we propose a phase-path model for the development of industrial recycle economy at Shandong province, and point out a direction for the development of recycle economy in the future.

Keywords: Recycle Economy; Industrial path; Shandong province

1. Introduction

Since 1950s, the game between environmental protection and economic development has become a big issue in the scholars’ and experts’ study. The development pattern of recycle economy is an entry point for further research on sustainable development. It is not only a new theory of economic and environmental development, but also a specific practice of sustainable development. The recycle economy requests clean energy, cleaner production, low-carbon emission, green consumption, ecotourism, and so on. The “PRC Recycle Economy Promotion Law” was adopted on August 29, 2008 in China, mentioned the “3R” principles of recycle economy, “Reduce, Reuse, Recycle”.

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How to coordinate the development of recycle economy and the development of regional economy? From the perspective of industry, we propose phase-path model for the development of recycle industry by using the theory and practice of recycle economy. As the characteristics of eastern, central and western regions of Shandong province are similar to the characteristics of the regions of China, we choose Shandong for our study.

2. Retrospection of the Theory

Kenneth E. Boulding proposed “recycling economy” originally. He believed that we must eliminate traditional unsustainable “cowboy economy” [1]. Club of Rome published a research report entitled “The Limits to Growth”. It presented the view of “The Limits to Growth”. In 1987, the United Nations Commission on Environment and Development submitted the research report entitled “Our Common Future”, formally proposed the concept of “sustainable development”. Since 1990s, foreign scholars have done extensive research on recycle economy, such as Mikael Skou Andersen [2], Subhas K. Sikdar [3], Macro A. Janssen and Wander Jager [4], Gorm. Kipperberg [5], Pierre Desrochers [6]. The researches mainly focus on the collection and recycle of garbage and waste through incentive policy, including the coordination mechanisms between the policy mechanism restriction (taxes, fees) and social behavior, community recycling programs, firms behavior, household recycling, green consumer behavior and others. In practice, there are some well-known development patterns of recycle economy, for example the Kalundborg Eco-Industrial Symbiosis at Denmark, the Duales System Deutschland (DSD), the Dupont model of chemical company in the U.S.A, and the recycle economy legislation and building recycling society in Japan.

In late 1990s, China started research on recycle economy. Many scholars did a lot of comprehensive and systematic study, such as Zhu Dajian, Feng Zhijun, Wu Jisong, Wang Songru, Ci Fuyi [1]. They have done many studies on recycle economy, including industrial ecology and ecological modernization theory, recycling-oriented society, eco-industrial parks and cleaner production. In practice, regions such as Zhejiang, Liaoning, Jiangsu, Guangdong, Guigang Eco-Industrial Park, Nanhai Eco-Industrial Park and Shihezi Eco-Industrial Park [7] are prominent at the development of recycle economy in China.

3. Status Quo Survey of Regional Industry

The level of economic development and industrial structure are quite different in 17 cities of Shandong province. We survey the status quo of industrial development by using the indices of Location Gini Coefficient of industry, Industrialization Rate and Location Quotient.

Industry Location Gini Coefficient [8] (G) is calculated as:

\[
G = 1 - \frac{1}{n} \left(2 \sum_{i=1}^{n-1} D_i + 1 \right)
\]

Assuming a number of regions order in line from low to high according to the industrial added value, the regions are divided into n groups. The proportion of regional accumulative total industrial added value from group 1 to group i to total regional industrial added value is Di.

Location Quotient Coefficient (LQ) by the following formula:

\[
LQ = \frac{(E_{ij} / E_i)}{(E_{kj} / E_k)}
\]

Here, \(E_{ij}\) refers to the output value of j industry in i region. \(E_i\) means the gross output value in i regions. \(E_{kj}\) refers to the output value of j industry in k nation. \(E_k\) means the gross output value in k nation.

If \(LQ > 1\), it means that the industry of the region is relatively specialized or centralized. If \(LQ > 1.12\), it means that the industry of the region has a high level of specialization and centralization [9].
Table 1: Location Gini Coefficient (LG) of Industry, Industrialization Rate and Location Quotient Coefficient (LQ) of the 17 cities in Shandong province

<table>
<thead>
<tr>
<th>Indices</th>
<th>Regions</th>
<th>Income Gini Coefficient</th>
<th>LG of Industry</th>
<th>LG of the Primary Industry</th>
<th>LG of the Tertiary Industry</th>
<th>LG of the HNTI</th>
<th>LQ of Industry in ETDZ and HNTIDZ</th>
<th>LQ of the HNTI in ETDZ and HNTIDZ</th>
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**Material source:** the results come from calculation on date of Shandong Statistical Yearbook 2008.

Notes: HNTI refers to the High and New Technology Industry. ETDZ refers to Economic and Technological Development Zone. HNTIDZ refers to High and New Technology Industrial Development Zone.

According to the statistical data from Table 1, we find that the status quo of industrial development in Shandong Province has the following characteristics:

1. The income gini coefficient and location gini coefficient of industry are all in a reasonable range. So the distribution of industry is more balanced, and the regional division is more reasonable.
2. Each region has its own characteristics. The centralized effect is obvious of leading industry, for example, Dongying’s oil, Laiwu’s steel, and Zibo’s heavy industry.
3. The industrial structure upgrades evidently from the western to eastern region.
4. All the LQ coefficients of development zone overstep the guard line. So the development level of the development zones is quite distinctive, it needs to be enhanced.
4. Phase-Analysis on Industrial Path of Regional Recycle Economic Development

4.1. The First Stage (Initial Stage): Make a Rational Planning of the Industrial Distribution

Rational layout of industrial distribution needs to combine the resource endowment and leading industry of the region. We plan the industrial distribution of Shandong province as “three circles and one strip”, (See figure 1).

4.2. The Second Stage (Growth Stage): Optimize and Upgrade the Industrial Structure

Optimizing and upgrading the industrial structure is the premise and the aim of developing industrial recycle economy. In order to achieve equity and efficiency, and improve the overall level of industrial structure in Shandong Province, we should propose different strategies according to the characteristics of each region.

The western region of Shandong province should speed up the process of industrialization, extend the industrial chain of agriculture and increase the added value of agricultural products. The central region should break through the limitation of industrial development, develop the new–type industrialization, increase the service industry and optimize the industrial structure. The eastern coastal region should rely on the regional advantages to develop new services, advocate blue economy.

4.3. The Third Stage (Mature Stage): Construct Recycling Industry Chain

Recycling industry chain requires lateral coupling of different industries, imitating the food chain, then forms an industry network gathering production, distribution, consumption, recycling, environmental protection and capacity building. It requires setting up multi-grade network and new closed loop of material \[10\]. The development model of Recycling industry chain shows in Figure 2.

The development model of recycling industry chain in Shandong province should follow three steps. First, act according to circumstances, set pilot projects, promote gradually. Second, promote cleaner production, establish green cooperative game, integrate industry systematically, cooperate with each other, ultimately establish high efficiency, low waste development model of recycling industry chain. Finally, improve the building of eco-industrial parks.
5. Conclusion

Based on the conditions of Shandong province and ensured economic development, the industrial path of recycle economic development should be put forward in stages, promoted gradually. In order to form competitive advantages of scale, promote economic and environmental benefits together, and ensure the long-term sustainable development of regional recycle economy, Shandong needs to integrate industries systematically, improve the efficiency of resource use, build eco-industrial park according to the industrial chain, complete the construction of recycle economic industrial network, improve the level of eco-industrial parks.

Market mechanism can realize the optimal allocation of resources and ensure the economic benefit of recycle economic development. Government regulations can restrict misconduct and protect the environmental benefits. The development of regional recycle economy from the industrial path should adopt both of market-oriented operation and government regulation. We also look forward to a further study on the rational policy and perfect market mechanism for the development of regional recycle economy based on the industry path.

References: