ISSN 2616-7433 Vol. 2, Issue 2: 27-31, DOI: 10.25236/FSST.2020.020207

A Study on the Evaluation of Regional Circular Economy Development Model and Its Path Evolution

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ABSTRACT. *The Development Model of Regional Circular Economy is a Hot Topic Currently Being Explored in Both Academic and Political Circles. in This Study, the Author Has Initially Established a Model for the Development of Regional Circular Economy Based on the Exploration of the Concept of Regional Circular Economy and Influencing Factors. Based on the Characteristics of the Model, the Author Discusses the Model Evaluation and Model Path Evolution, Aiming to Provide a Reference for Follow-Up Studies.*

KEYWORDS: *Regional circular economy; Development model; Model evaluation; Path evolution*

1. Introduction

The new economic growth model formed after the introduction of the concept of “circular economy” in the development of regional economy is called the “regional circular economic model”. Therefore, “circular economy” is actually the subject. There are many discussions about circular economy, which are divided into 3 types by discussing the economic development and the nature, economic development and recycling technology and the emerging nature of circular economy [1]. In this article, the author quotes the concept proposed by Dr. Liu Yi, who believes that circular economy is a new economic development model, which is based on the concept of ecological benefit and sustainable development, using the closed loop flow pattern to efficiently use the waste to achieve the reduction and utilization of production materials and the recycling of waste.

The conceptual model of regional circular economy should be based on the establishment of a regional circular economy system, which consists of economy, environment, resources, social subsystems and a support system. In this framework, the internal systems of regional circular economy function effectively, and a regional circular economy development model is established after outer relations are gradually established [2].

Specifically, the central subsystem of this model is an economic subsystem, which carries out material circulation and information transfer with the other 3 major subsystems (environment, resource and social subsystems), and builds an

Internal exchange system centered on the economic subsystem. In addition, the external environment and other systems act on the internal exchange system formed by 4 major subsystems, exchange values with them and construct a framework for the development model of regional circular economy. Technical support, infrastructure support and social support jointly constitute a support system for the conceptual model of the regional circular economy system, which provides support when its development is hindered. In this model, resources, environment, economics and social subsystems are considered as variables in the development process and are assigned within a certain interval. In different regional economic development models, the proportion of the 4 major subsystems is biased, which constitutes the differences and changes in the development of circular economy between different regions. Specifically,

The development of regional circular economy depends on the support of major subsystems, which mainly include: (1) ecological support: including the impact resistance and support capabilities of the regional resource environment[3]; (2) economic support: it refers to the comprehensive use of the region's existing resources, energy, information and other contents. In general, economic support should cover part of the connotation of ecological support, because the integration of economic development needs to use natural resources as a material basis; (3) social support: its promotion of regional circular economy is mainly reflected in the ability to maintain social stability; in addition, through social

ISSN 2616-7433 Vol. 2, Issue 2: 27-31, DOI: 10.25236/FSST.2020.020207

security and ethical constraints, it can also provide a friendly external environment for the development of regional circular economy by building a stable society.

The regional circular economy can be hindered by the following constraints: (1) containment by ecological conditions[4]: If regional development is highly dependent on resources, the degree of containment by ecological conditions is high. For example, the North and South regions are very different in the climate, temperature and humidity, which directly affects the promotion of some circular economy models; (2) economic development limit: According to the concept of the Environment Kuznets Curve, the relationship between environmental quality and economic level in a region is U-shaped. In reality, because of poor economic conditions and poor ecological environment, there are vicious circles in most regions of China. (3) hinders from regional policies and planning: The planning and design of a region is by the local government and mainly driven by the administrative methods such as policies and systems. The extensive development model is a typical obstacle due to policies and planning. The government sacrifices the environment for the blind pursuit of high GDP, which is not conducive to the development of circular economy. (4) defective technical strength: the development of circular economy depends on scientific and technological progress, such as clean technologies, pollution control technologies and supply chain integration technologies. At present, limited by the late start of technology research and the low starting point, the development of circular economy in most regions in China lacks scientific and technological support, which restricts development by leaps and bounds. (5) Low ecological awareness: Awareness determines behavior. Due to the lack of ecological awareness in the public and management aspects, it leads to the lack of attention paid by enterprises to environmental protection and circular economy, which leads to less environment-friendly and irrational consumption and production methods on a large scale and directly increases the resistance in circular economy development[5].

2. Evaluation of Regional Circular Economy Development Model

Through the evaluation of the development model, it is able to complete the monitoring and reflection of the operational status of each level of the circular economy in a certain area. For example, what the support and obstacle factors of the functional departments and the public are can be feedback through evaluation. Based on the monitoring and reflection, it can provide early warning on the development of regional circular economy[6]. Through horizontal comparison and historical comparison between regions, the problems existing in the development model of regional circular economy can be continuously reconsidered, and improvement can be promoted.

2.1 Principles of Evaluation

2.1.1 3Rs Principle

The so-called 3Rs principle refers to the reduction of inputs for production, the reuse of raw materials for production processes and the recycling of waste materials for production output. The 3 loops form a closed material loop, which is the core indicator for evaluating development model of regional circular economy.

2.1.2 Principle of Scientificalness and Practicality

The principle of scientificalness and practicality requires that the assessment of regional economic development models should establish standardized and measurable indicators and use figures to illustrate the issues [7]. At the same time, the decision basis for evaluation methods, indicators, standards, etc. is based on the indicators of authoritative departments and is derived from scientific calculations.

2.1.3 Principle of System Hierarchy

The existence of many subsystems has led to the development of regional circular economy as a complex organism. Therefore, the overall system evaluation and the hierarchical sub-elements evaluation should be taken into account[8]. At the same time, it should establish different levels of evaluation weighted ratios, and the decomposition evaluation from high to low levels, so as to form a relatively complete and comprehensive evaluation structure.

2.1.4 Principle of Dynamic and Static Balance

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To find a dynamic and static balance in the development model of the ever-changing regional circular economy, it is necessary to take into account the static and dynamic indicators of multiple states at a given time. This requires that the evaluation model of the regional circular economy be established on the time axis, and evolution should be evaluated in chronological order.

2.2 Use Topsis to Evaluate Regional Circular Economy Model

TOPSIS (technique for order preference by similarity to an ideal solution) is a method of compensatory aggregation that compares a set of alternatives by identifying weights for each criterion, normalizing scores for each criterion and calculating the geometric distance between each alternative and the ideal alternative, which is the best score in each criterion[9]. Before the introduction of this method for the evaluation of regional circular economy model, it is necessary to establish a matrix to process the raw data in a unified manner. According to the difference between the evaluation object and the evaluation index, a linear ratio is used for standardization, and all the evaluation objects are transformed into the same evaluation index [10]. The parameters are weighted according to the weight of each index, and finally the most positive and negative ideal solutions are obtained. The two ideal solutions frame the evaluation scope at the ends, the evaluation indicators to be evaluated are included in the evaluation system and ranked according to the value of the ideal solutions of the evaluation target, and the comprehensive solution of the comprehensive positive solution is the best one.

In short, the economic, social and technical indicators involved in the regional circular economy model are included in a well-designed evaluation matrix for conversion, and then the values of the positive ideal solutions are combined to conclude the best solution [11].

3. Path Evolution of Regional Circular Economy Development Model

3.1 Path Evolution of Dynamic Mechanism

The structure of the dynamic mechanism has already been described in detail above, and will not be repeated here. Its evolution is mainly reflected in: (1) ecological support evolving toward 3Rs: the limited resources have strengthened the evolution of the carrying capacity of resources. The 3Rs principle requires that in the event of a reduction in the use of resources, the waste of resources should be reduced and the recycling of resources should be carried out. In addition, it also emphasizes the evolution of the environmental buffer capacity. Although the environment has a certain ability of self-purification, it needs to reduce pollution emissions and ensure that the environmental buffer capacity gradually stabilizes[12]; (2) economic support evolving toward sustainable development: economic development requires the gradual evolution of history, while regional economy represents the change of economic value within a certain period of time. Therefore, economic growth does not emphasize the growth of numerical value alone. It should also be optimized and evolved at the level of industry and spatial structure, and the evolution of economic stable development path should be promoted by integration of resources, materials and information; (3) social support evolving toward development in a stable direction: First of all, by optimizing the constraints of resource acquisition, it seeks social capabilities that are more equitable. At the same time, it provides protection for disadvantaged groups that cannot receive general social support so as to maintain social stability. Finally, the enforcement of hard conditions is effective, but the development of connotation is the inherent low-cost constraint. Therefore, it should emphasize the evolution of the moral binding force, so that enterprises have a sense of social responsibility and the public has a moral pressure [13].

3.2 Path Evolution of Model Construction

The construction and evaluation of the model is not immutable but should constantly adapt to social needs and changes rapidly [14]. The evolution of the regional circular economy model refers to the gradual transition from the initial construction of the primary model to the development stage, the stable stage and the mature stage, and promotes it to become a model that has regional and phase universality, which can provide forward-looking opinions for the development of regional circular economy. The evolution path of the model mainly includes: (1) visualization: the development and refinement of the model can be more straightforward and easy to understand, and the use of a 3D model makes the model law more clear; (2) to be objective and scientific: it refers to the data collection process and the

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calculation process of the model construction and processing are true and accurate, and undergo a rigorous quantitative evaluation for screening and processing; (3) to be strategic: the model provides ideas, and the direction of future model development is more strategic and guides the value, so that the model can be used as a reference, correction and creative change for the decision-making of regional circular economy development; and (4) universality: regional circular economy has different characteristics, but it should also increase the general applicability of the model on the basis of horizontal regional comparison and vertical time comparison. Whether it can serve the construction of circular economy in multiple regions is an important criterion for inspecting the success of the model [15].

4. Conclusions

The exploration of the evaluation and evolution path of the regional circular economy development model can help improve the theoretical research system of the regional circular economy. Through continuous exploration and studies, it can enrich the theoretical connotation of the regional circular economy development model. The regional circular economy as an important research direction in the future has important and positive significance for building an environment-friendly society and energy-saving and high-efficiency economy. Through some empirical studies, it is easy to find that the regional circular economy model has a practical value for guiding regional economic development.

Acknowledgement

Scientific Research Fund Project of Zhaoqing University:Feasibility Analysis and Research on the Establishment of Special Cooperation Zone between Zhaoqing City and Hong Kong and Macao Region(201950).

Zhaoqing Education Development Institute Key Project: Research on the Countermeasures of Zhaoqing Vocational Education Serving the Development of County Economy (ZQJYY2019026).

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