

LETTER TO THE EDITOR

The Operating Mechanism and Evaluation of Manufacturing Green Innovation System Based on Niche Theory

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As the main body of national economy, manufacturing industry is an important part of industrial production. However, under the background of the large degree of ecological environment destruction, the innovation, development, diffusion and large-scale application of ecological means and green technology are the lasting guarantee for the sustainable development of manufacturing industry. Based on niche theory, this paper studies the operating mechanism and evaluation method of manufacturing green innovation system. For manufacturing the green innovation system operating mechanism and the theory of ecological niche of a comprehensive introduction, in order to realize the running mechanism structure of the constituent elements of the model and function between the conjunction and matching, operation mechanism, innovate green manufacturing system are analyzed in details of the mechanism of green innovation system analysis, it is concluded that the mechanism of the structure, manufacturing support the operation of the green innovation system and propulsion. niche theory; green innovation in manufacturing; operational mechanism; evaluation

1 Background and related theoretical explanations

At present, mandatory GHG emission reduction requirements for developed countries and voluntary emission reduction calls for developing countries have led to the global countries to formulate corresponding national and industrial low-carbon development plans. Under the background of the sustainable development of ecological environment, the developed countries on imported products, such as energy efficiency indicators, as well as our country in the process of production of pollutants and greenhouse gases, such as energy consumption control, make the green transformation and development of the manufacturing in our country important premise to realize the sustainable development of economy and environment, green innovation is more and more as a strategy of sustainable development of enterprises (Sun and Cao 2017).

Manufacturing green innovation system is in low emissions, low energy consumption, low pollution marked green ecological economy mode, by the enterprises, universities, research institutions, government and agencies and so on the existence of the relationship between the main body, in order to realize environmental protection and ecological balance as the goal, to build low-carbon clean energy systems and improve energy utilization efficiency as the essential feature, in green technology, industry innovation, and the transition of the green supply chain innovation aspects of closely integrated with

the complex large system as the core. In the field of manufacturing green technology and industry, except for a few relatively mature emerging green industry innovation systems, such as wind energy industry innovation system, most of Chinese green technology and industry are still in the initial stage and have not yet formed a benign interaction of green innovation activities of different industries with system functions (Shi and Tian 2018). For the green innovation system of Chinese manufacturing industry, as it involves many industries and technical mechanisms, the development mode and stage of innovation systems in different industries are different. Obviously, the effective operation of Chinese manufacturing green innovation system needs to rely on the joint action of different system operating mechanisms, that is, to build a synergistic relationship between the system operating mechanisms and combine different sub-mechanisms of mutually independent operating mechanisms to promote their interaction (Mi et al. 2015, Pashentsev et al. 2019, Zurano-Cervello et al. 2018). Especially for emerging green technologies and industries, the realization of emerging green technologies and industrial innovation requires the synergistic effect of green technologies, green industries and green supply chain. Otherwise, the formation of green innovation system will be incomplete or impossible to achieve. Obviously, the system operation mechanism of benign synergy plays an important role in realizing the good operation of China's manufacturing green innovation system.

Xin He, Shi-Zheng Huang, Ka-Yin Chau, Hua-Wen Shen, Yan-Liang Zhu published an article in the journal *Ekoloji* Issue 107, 2019, it entitled: "A Study on the Effect of Environmental Regulation on Green Innovation Performance: A Case of Green Manufacturing Enterprises in Pearl River Delta in China". The literature pointed out that green innovation has become the theme of sustainable development of enterprises. All countries around the world have developed environmental regulations to promote green innovation in enterprises, but companies have lost their way in the choice of environmental regulations and innovation strategies. The Reference examines the impact of environmental regulation on exploration innovation, development innovation, and green innovation performance. Through the questionnaire survey of 220 green manufacturing enterprises in the Pearl River Delta region, the structural equation model was used for analysis. The empirical results show that the impact of environmental regulation on green innovation performance is not significant, environmental regulation does not directly affect green innovation performance; exploratory innovation requires more environmental regulation support than developmental innovation, while developmental innovation shows better green benefits. Innovation performance is higher than exploration and innovation, and the double interaction of exploration and development has a positive and significant impact on green innovation performance. Therefore, enterprises should develop the double interaction of exploration and development, and environmental regulation is the driving force and guarantee of green innovation.

As the basic theory of ecology, niche theory has been widely applied in the fields of ecology such as interspecific relationship, species diversity and stability, community structure and its evolution, and population change. Niche theory has become one of the hotspots of ecological research in the past 20 years (Bi and Shen 2016). Along with the development of the concept of niche, the niche theory permeates gradually to other social sciences, make it not only in terms of sociology, economics, management science has been widely used, but also get the city science related to the attention of scholars.

Therefore, on the basis of the research of He and others, this paper proposes a green

manufacturing innovation system operation mechanism based on ecological niche theory, and evaluates and analyzes it.

2 IDEA DESCRIPTION

2.1 The connotation of operation mechanism of green innovation system

“Mechanism” exists in a specific system, which is a coordination mode among elements under the changing conditions of the external environment of the system. It specifically refers to the relationship of interconnection, interdependence and mutual restriction among elements within the system. The operation mechanism of the green innovation system refers to the operation mode in which the green innovation subjects, organizations, systems and other elements within the manufacturing green innovation system and other elements inside and outside the manufacturing green innovation system cooperate and interact with each other.

2.2 The function of the operating mechanism of the manufacturing green innovation system

As a complex system, the operation mechanism of green innovation system includes four functions: generation, integration, long-term effect and diffusion. To be specific, the operation mechanism of green innovation system has the functions of business integration, new resource allocation and risk avoidance.

(1) Integration of functions. For the manufacturing industry, the operation mechanism of the green innovation system in the integration of green innovation business is to collect, feedback and integrate information, and finally distribute the green innovation business within the system reasonably, so as to improve the overall operation ability of green innovation.

(2) Resource allocation function. In essence, the operating mechanism of the green innovation system is to achieve good resource allocation and continuously improve the quality of green innovation resources by coordinating relevant personnel, financial resources, materials and information, so as to improve the allocation efficiency of green innovation resources.

(3) Risk aversion function. The risks in the process of green innovation mainly include research and development risks, financing risks, technical risks and market risks. Therefore, the operating mechanism of the green innovation system ADAPTS to the external environment through internal and external synergies, so as to reduce risks and ensure the smooth progress of innovation activities.

(4) Coordination function. The function of the operation mechanism of the green innovation system is to put each sub-mechanism into the operation mechanism of the green innovation system of the manufacturing industry, so as to achieve internal integration and external integration, thus promoting the ultimate realization of the manufacturing strategy.

2.3 Five elements of operating mechanism of green innovation system based on niche theory

The green innovation process of the manufacturing industry is the driving force of green innovation → green technology acquisition and process integration → technology innovation implementation and expansion → innovation performance diffusion and output (Bi et al. 2016). According to this process, it can be concluded that the five elements of the operating mechanism of the green innovation system based on the ecological niche theory are the ecological mechanism, the generation mechanism, the integration mechanism, the long-term effect mechanism and the diffusion mechanism.

(1) Elements of ecological mechanism. According to niche situation theory, ecological niche contains two basic attributes: the state of biological units (energy, biomass, individual quantity,

resource occupancy, adaptability, etc.) is the result of the accumulation of growth, learning, socio-economic development and interaction with the environment in the past; The potential of ecological niche is the actual influence or dominance of biological units on the environment, such as the rate of energy and material transformation, productivity, growth rate, economic growth rate and the ability to occupy a new environment (Tian et al. 2016).

(2) Generation mechanism. Generation mechanism can be divided into endogenous and exogenous. Endogenous mechanism mainly refers to the interaction among entrepreneurs, technology strategy and innovation resources in manufacturing low-carbon innovation system, including generation mechanism, incentive mechanism, constraint mechanism and evaluation mechanism. The exogenous mechanism is mainly the interaction of government, science and technology service intermediary, university and scientific research institute, including guarantee mechanism and supervision mechanism. These two mechanisms work together to provide a good supporting environment for the green innovation system of manufacturing industry.

(3) Integration mechanism. Under the guidance of national policies and regulations, the manufacturing green innovation system should be planned for energy conservation and emission reduction. It is necessary for the country to formulate different national industrial policies and relevant laws and regulations according to different subjects, select different modes of resource allocation and sharing, establish a safeguard system under the macro-control of the government, carry out necessary integration of innovative resources, vigorously reduce energy consumption, and form a benign operation mechanism of the manufacturing innovation system. This combination plays a role of sharing mechanism, coordination mechanism, incentive mechanism and feedback mechanism.

(4) Long-term mechanism. The purpose of this mechanism is to scientifically plan the operating mechanism value concept, management mode and operating mechanism of the green innovation system based on the ecological niche theory. The government should take the lead, the market should promote, and the whole society should participate. Involving the market operation mechanism, capital investment mechanism, talent training mechanism, and so on. It can stabilize and promote the operation of green innovation system in manufacturing industry.

(5) Diffusion mechanism. Here we mainly study the diffusion factors, processes and rates. The diffusion effect of the manufacturing green innovation system based on the niche theory will affect the relevant regulations and supervision of ecology and environmental protection. The diffusion mechanism of the green innovation system is the green supply chain. In order to improve the innovation performance, we should change this isolated way of thinking and pay attention to the overall way of thinking. Therefore, the operation of the diffusion mechanism also covers the sharing mechanism, competition mechanism, transmission mechanism, promotion mechanism, market forcing mechanism and so on.

2.4 The operating mechanism and framework of manufacturing green innovation system based on niche theory

This paper defines and analyzes the functions of the operating mechanism of the manufacturing green innovation system, expounds the correlation between the operating mechanism elements of the green innovation system, and further constructs the operating mechanism framework of the manufacturing green innovation system based on the ecological niche theory, as shown in Fig. 1.

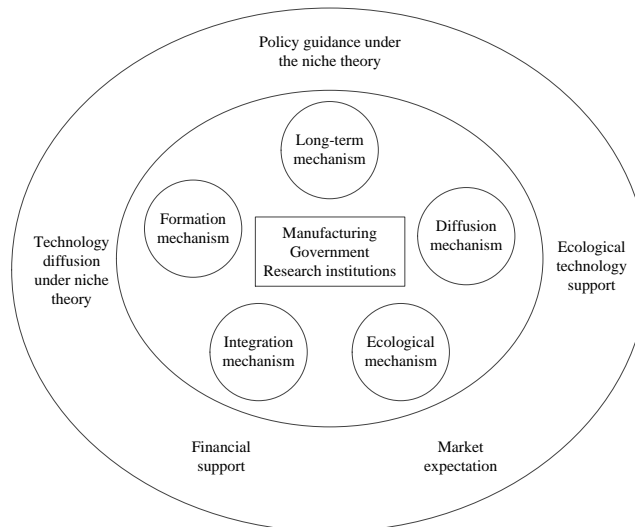


Fig. 1 Operational framework of manufacturing green innovation system operation mechanism based on niche theory

2.5 Evaluation analysis

From the actual situation, the real synergy between the ecological mechanism, formation mechanism, integration mechanism, diffusion mechanism and long-term mechanism of the manufacturing green innovation system can only be truly realized in the mature and transfer stage of the development of the innovation system. The green innovation system of the manufacturing industry not only involves green technology innovation, but also green industry innovation and green supply chain innovation. Therefore, the synergy of the operational mechanism of green innovation system development is essentially the synergy of the five operational mechanisms of the green technology innovation system in the green innovation system, and it is the beginning of the formation of the green industry innovation system, and finally forms the synergy of the five operational mechanisms. The progressive advancement model of green technology innovation system, green industry innovation system and green supply chain innovation system.

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