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Countermeasure and Interaction of Common Techno-innovation and New Energy Industry Development

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Abstract

There is an endogenous response process between common technology innovation and new energy industrial development. This article proposed the concept of common techno-innovation response to the new energy industrial development and comprehensive response degree model of common techno-innovation response to the new energy industrial development.

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1. Introduction

The common technology is a technology in pre-competitive stage, and it can be widely used in one or more industry. In common technical research achievements, according to their own production or the product demand enterprises can conduct the follow-up commercialization of R&D, and formed competing technology or product among enterprises. The supporting and guiding role of common technology in the process of independent innovation is irreplaceable. Any industry's growth and development are based on common technical foundation. The development of new energy industry is the development of energy industry technology in large level. Especially in today's international energy environment, new energy and energy efficiency improving becomes the key guarantee of energy security^[1].

The New energy industrial common technology is the deciding factor, which leads the development direction of new energy industry. It is not only a key element of country's (region) industry, but also the

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necessary condition of industry sustainable development. Therefore, compared with the characterization techniques, the common technology determines the country's (region) new energy industry development. In China's economic development model transformation request and strategic emerging industry's guidance, the formation of new energy common technology innovation networks is the guarantee of sustainable development of new energy industry. Since 1970s, N.Abernathy (1978)^[2] in Harvard University and J. M.Utterback (1999)^[3] in Massachusetts Institute of Technology have done a series of investigation to the product innovation, technology innovation and organizational structure correlation. They used product life cycle theory (PLC) as a foundation by analyzing many industries and innovation cases, and found they not only follow different development law, but also have organic connection. Their dynamic development affects industrial evolution. By introducing a concept of dominant design, product innovation as the center, they put forward the dynamic process model of industrial innovation, which is Abernathy-Utterback innovation process model, or traditional A-U model. The traditional A-U model reveals the intrinsic relationship between technical innovation and industrial development in a particular technology track; it's a short-term dynamic process model of industry innovation. The improved A-U model researches the intrinsic relationship between technical innovation and industrial development from industry structure evolution process, which is a long-term industry innovation dynamic process model. But the A-U model is lack understanding of mutual influence process between technical innovation and industrial system evolution^[4].

The Nelson & Winter model is the cornerstone model of economic growth evolution. Test results and analysis of Nelson & Winter model shows that, the model basing evolution economics theory can explore macroscopic phenomena, although the price is its complexity swathes than the neoclassical model. Because of the increasing complexity, the explaining capacity to the phenomenon characteristics of common technical change is strengthened. This explanation is closer to the empirical study results of common technical change phenomenon. Cheng Zhao-Han and Jiang De-Peng then their development model of industry evolution^[5], they assume that technological difference is the major source of enterprise diversity, and industry is composed by several competitive enterprises which production function is basically the same. The model analyzed the enterprise decision-making behavior and industrial evolution influence every moment, and expounded the major source enterprise diversity, which is namely technology innovation mechanism, and described the enterprise survival influence and decision-making process for enterprises in investment, production and sales. The both enterprise thought of competition and cooperation was also reflected in the decision rules. Due to the complexity of industry evolution model, we use the computer experimental simulation method to solve the model. Through assignment the basic parameters and design the operating mechanism and operated the model, we discovered the common characteristic which industry evolution appear, and analyzed some total index which reflects industry level and their relational characteristics.

The innovative capacity has become an important index that measuring core competitiveness of an industry, and motility that promoting economic growth. The realization of innovation depends on many factors, including institutional environment, R&D input and human capital, etc. In developing countries, where innovation system environment was still imperfect, the industry development process along with economic development was an important factor promoting common technical innovation. Because of industry development was able to provide continuous demand to common technology innovation. So, if the common technical innovation ability has any apparent ascension? In the growth and development of Chinese new strategic industry, what relationship between the two extents, if the role of new energy industry in promoting industrial generic technology innovation is obvious, etc. To answer these questions, this article using Chinese new energy industry overall development level and industrial common technology innovation data analyzed the correlation and dynamic development, in order to understand their interaction mechanism and effect, and get some policy implications.

2. Relation of commonness techno-innovation and new energy industry development

The characters of industrial common technology and high-tech content of new energy industry made common technology sustainable supply become the key factor of new energy industry development.

2.1. Development of new energy industry promote common technical innovation

In the development of new energy industry, technology innovation is never easy for every individual business. Funds, intelligence and infrastructure limited conditions and the risks of research restrict enterprise's independent innovation ability, even hurt the enterprise's technology innovation enthusiasm. Breakthrough the core technology will certainly need close cooperation even industry alliances, in order to improve the operation efficiency and new energy industry's core competitiveness.

2.2. Common technical innovation diffusion accelerate development of new energy industry

After diffusion source appearing, common technology impact new energy industry growth through various channels, and new energy source industry response. That is the diffusion effects of common technical innovation. The diffusion effect of common technical innovation mainly includes industry association effect, industry before and after association effect and accumulation effect. Now the evolution of new energy industry division system makes common technology innovation realized in any link. They all may cause technology innovation realized in whole industry chain. This phenomenon is called the industry before and after association effect of common technology innovation structure effect. And common technology according to quality rank size of different effects between new energy industry internal structure upgrading and industrial structure upgrading is called the level effect of common technical innovation structure effect. The effect that developed along new energy industry chain promotes the formation of new industrial cluster zone in certain space. This phenomenon is called the accumulation effect of common technology innovation structure effect.

In addition, the common technology innovation increased the technical content of production, and improved the competition ability and the market shares of production; Common technical innovation improved productivity and prompt production capacity growth and unit cost reduction by transforming production technology and production organization. The synergy effect between common technology innovation and institutional innovation made the system efficiency and promote the industry's growth. By reforming the traditional technology and eliminating the backward technology, common technology innovation promoted the reconstruction of new energy industry, and made the new energy industry internal structure more reasonable.

3. Modeling the common interaction of techno-innovation and new energy industry development

Common technology innovation response for new energy industry development means the adapting and feedback effect of common technology innovation to new energy industry. The connotation of the concept means in certain social economic development process, common technology innovation mode and path promoted the restructure of resources and elements, the gathering of new energy enterprises, the formation and development of new energy industry cluster, and the internal structure upgrading of new energy industry. We can say the sustainable development of common technology innovation is the important supply of new energy industry's development and the engine to promote industry growth. The research about technology innovation response of new energy industrial common technology now is concerned by regional economics, urban economics, industry economics and other disciplines. Foreign

scholars' research considered that the speed and model of common technology innovation directly affect the evolution of industrial structure^[6]. According to the Kuznets Curve Hypothesis, some scholars discussed the relationship between technological innovation and industry development, and revealed that technology innovation level and industry development also followed the Kuznets Curve^[7]. Some Chinese scholar's pointed that improvement of industry common technology innovation depended on the development of new industry and the upgrading demand of industrial, and common technological innovation directly gave out constrains and feedback effects to the industry development. Other scholars revealed in vulgar industrial growth model rapid economic growth will curb common technology innovation.

3.1. Response coefficient

The new energy industrial response intensity of common technology innovation is the function degree that common technical innovation mode and velocity response and feedback to the new energy industry formation. In order to calculate the intensity that new energy industry development response to the common technology innovation, this article introduced "the coefficient that new energy industry development response to the common technology innovation", and we used it to analyze the intensity that of new energy industry development response to the common technology innovation, the model is as follow:

$$R = \frac{TI_D}{TI_O} \bigg/ \frac{f}{F} \quad (1)$$

In formula (1): R is the coefficient that new energy industry development response to the common technology innovation; TI_D stand for the input of common technical innovation; TI_O is the output of common technical innovation; $\frac{TI_D}{TI_O}$ is the input-output rate of common technical innovation; f is new energy industry value, F is total industries value. Using the ratio of input-output rate of common technical innovation and the new energy industrialization, the model showed the responsiveness that the new energy industry development intensity of common technology innovation. Along with the increase ratio, the effect intensity that the new energy industry development response to the common technology innovation is increasing too, and vice-versa.

3.2. Responsibility model

- Responsibility function

To reflect the dynamic influence between common technological innovation and new energy industry development, this article established response model of common technology innovation ($LnTI_t$) and new energy industry development ($LnISE_t$). The Response function model is as follow:

$$\begin{cases} LnTI_t = \sum_{i=1}^k a_{11} LnTI_{t-i} + \sum_{i=1}^k a_{12} LnISE_{t-i} + \varepsilon_{1t} \\ LnISE_t = \sum_{i=1}^k a_{21} LnTI_{t-i} + \sum_{i=1}^k a_{22} LnISE_{t-i} + \varepsilon_{2t} \end{cases} \quad (2)$$

In formula (2), the subscript t stand for the year; k is maximum lag order number, Random perturbations is the error entry. By establishing the response function model between common technical

innovation ($LnTI_t$) and new energy industry development ($LnISE_t$), this article analyzed the problems and source of new energy industry development in the process of common technological elements application.

- Responsibility model

Based on impact model, by using the economic definition of midpoint elastic, this article established the response degrees model of common technical innovation and new energy industry development.

$$\theta_j(t) = \frac{dy_{jt}}{dx_t} \cdot \frac{x_t}{y_{jt}}, (j = 1, 2, \dots, k; = 1, 2, \dots, n) \quad (3)$$

In formula (3) $\theta_j(t)$ is the response degree that j weight of common technology innovation in t year to new energy industry development. x_t is the change index of new energy industry in t year, y_{jt} is a j

component value of common technology innovation in t year, $\frac{dy_{jt}}{dx_t}$ is the derivatives that j weight of common technology innovation to the new energy industry development in t year.

4. Conclusion and discussion

(1) New energy industrial common technology is the deciding factor, which leads the development direction of new energy industry. It is not only a key element of country's (region) industry, but also the necessary condition of industry sustainable development. (2) In the development of new energy industry, technology innovation is never easy for every individual business. Funds, intelligence and infrastructure limited conditions and the risks of research restrict enterprise's independent innovation ability, even hurt the enterprise's technology innovation enthusiasm. (3) After diffusion source appearing, common technology impact new energy industry growth through various channels, and new energy source industry response. (4) Response degrees model can depict a tendency that the dependent variable response to the independent variables in a study period. Using practical data analysis results and model the article explored the new energy industry development caused by common technology innovation in different economic development phase and different common technological innovation level. And revealed the mechanism that common technology innovation response to the new energy industry development, which is the evolution rule of new energy industry development.

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