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Construction of Evaluation Index System for Technological Innovation Ability in Manufacturing Industry

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Keywords: Manufacturing, Environment technology innovation ability, Environment technology innovation guarantee, Environment technology innovation investment, Environment technology innovation output.

Abstract. With the shortage of resources and the increasingly serious environmental pollution, environmental technology innovation has become an important symbol of a company's sustained competitive advantage. Considering the influential factors of environmental technology innovation ability of manufacturing industry in our country, this paper constructs the evaluation index system of technological environment innovation capability of manufacturing industry from three aspects: environmental technology innovation guarantee, environmental technology innovation investment and environmental technology innovation output. The index of measure is constructed to further explain the technological innovation ability of manufacturing environment in China.

Introduction

November 30, 2015 The convening of the UN Climate Change Paris Conference once again brings countries all over the world to focus on key words such as climate change, resources and the environment. Low-carbon economy and sustainable development have become the best economic mode and mode of development to deal with these environmental problems. Therefore, how to promote the low-carbon economy and realize the sustainable development of natural resources, ecological environment and human society has become one of the most important issues to be solved in the world. In order to achieve a low-carbon economy and sustainable development, more and more stringent environmental regulatory tools have been applied to environmental issues. Environmental technology innovation is an important means of coping with environmental regulation and can promote the realization of the harmonious, sustainable development of economy, environment and society. It has gradually become the focus of competition among various countries. Therefore, environmental technology innovation has become a starting point and fundamental motivation to solve the problem[1]. Manufacturing plays an important strategic position in the economic development of all countries. It can drive the development of the surrounding industries, determine the overall competitiveness of the entire industry and the level of a country's independent innovation capability. However, its own energy consumption and the proportion of pollutant emissions Higher, how to reduce manufacturing energy consumption and pollutant emissions is one of the key issues in China's development of low-carbon economy. Environmental technology innovation is an important means for manufacturing to achieve its environmental goals while obtaining economic benefits. Environmental technology innovation behavior that meets the requirements of environmental development Through the development of new technologies, development of new products, improvement of production processes and other activities to improve resource utilization, production efficiency and profit margins, and reduce the loss of environmental externalities in production and consumption, Cost to solve environmental problems and promote the sustainable development of the entire manufacturing industry and low carbon level[2]. At present, the environmental technology innovation of manufacturing industry in China is still in its infancy, and how to improve its environmental technology innovation capability needs to be further studied. Constructing an index system of technology innovation capability in manufacturing industry can strive for it under the

increasingly stringent environmental regulation Market position, to gain a competitive advantage to provide the basis.

Since the 1990s, some scholars abroad have conducted research on environmental technology innovation. Porter and others pointed out that environmental technology innovation is an innovation that can improve the production efficiency of enterprises, save resources, reduce costs and reduce the adverse impact on the environment[3]. In recent years, foreign scholars conducted a more in-depth study of environmental technology innovation. Worthington believes that the time and resources invested by senior managers in environmental innovation have a significant impact on whether enterprises adopt environmental innovations, and the impact of corporate executives on environmental technology innovation will be more pronounced after the enterprises have reached the bottom line of compliance[4]. More and more domestic scholars also study environmental technology innovation. Zhang Haiyan et al. Pointed out that the circular economy industrial chain is an effective way for enterprises to implement the initiative environmental technology innovation strategy, and the interpretation by managers is the guarantee for enterprises to take the initiative in environmental technology innovation[5]. Wenpu Wangconcluded that pollution reduction has a significant positive spillover effect on environmental technology innovation and also has an insignificant negative spillover effect. Finally, it is concluded that pollution emission reduction is not significant and positively promotes environmental technology innovation[6].

Through the above-mentioned domestic and foreign literature analysis, it is found that the related research of environmental technology innovation mainly focuses on the following two aspects: First, it defines the meaning of environmental technology innovation; second, it studies the influencing factors of environmental technology innovation. All of these researches have important reference for the research of this article. However, at present, most researches on environmental technology innovation both at home and abroad focus on regional or broad corporate research, and there are few researches on environmental technology innovation in a particular industry, especially for manufacturing with high energy consumption and high pollution Research on environmental technology innovation is even more rare, ignoring the impact of resource consumption and environmental pollution on technological innovation capability of manufacturing environment. Manufacturing is the leading part of the process of industrialization and an important force for promoting the development of the national economy. Its high energy demand and high energy consumption have greatly hindered the development of a low-carbon economy. Therefore, it should take more responsibility for environmental protection. This article builds the environmental technology innovation ability evaluation index system, and puts forward the corresponding countermeasure suggestion.

Index System Construction

Based on the principles of scientificity, operability, comparability, validity, appropriateness and so on, the evaluation index system of technological innovation ability in manufacturing industry is established, including the environment Technological innovation support ability, environmental technology innovation investment ability, environmental technology innovation and output capacity of three aspects.

Environmental Technology Innovation to Protect Ability

Environment technology innovation ability to provide enterprises with environmental technology innovation environment, a higher environmental technology innovation ability to support environmental technology innovation can proceed smoothly under the basic conditions and prerequisite basis. Mainly reflected in the technical level, science and technology institutions and financing environment in three areas. First, technical level. The level of technology in an enterprise can reflect the degree to which an enterprise understands a new technology, its ability to recognize innovative opportunities and its ability to stimulate innovation[7]. Equipment and personnel are two important aspects that reflect the technological level of an enterprise[8]. First of all, the advanced

equipment and equipment are the carriers of environmental technology innovation activities. And through the research, it is found that the microelectronic control equipment plays an important role in environmental technology innovation activities of many manufacturing enterprises. A large number of innovative activities rely on it To achieve. Second, engineers and technicians in manufacturing enterprises are mainly engaged in scientific research, technology development and technology management, they are the main commitment of enterprise knowledge creation and technological innovation. Therefore, the level of technology with instruments and equipment and engineering and technical personnel accounted for the proportion of employees measure these two indicators. Second, science and technology agencies. Science and technology institutes are fixed places for conducting scientific research and technical services. They provide a platform for enterprise engineering and technical personnel to implement environmental technology innovation activities and promote the improvement of environmental technology innovation ability. To a certain extent, the more enterprises attach importance to the implementation of environmental technology innovation, the more the number of science and technology institutions[9].The number of scientific and technological institutions and scientific research institutions of enterprises accounted for the proportion of all enterprises to measure these two indicators. Third, the financing environment. A good financing environment can provide financing opportunities, standardization, diversified financing methods and financing channels for enterprise environmental technology innovation, and ensure that enterprises have sufficient funds for environmental technology innovation. Measured by the three indicators of government funds, enterprise funds, foreign funds and other funds raised through scientific and technological activities.

Environmental Technology Innovation Investment Ability

The input capacity of environmental technology innovation reflects the quantity and quality of enterprise innovation resources input, which is the key factor of the success of environmental technology innovation, which can significantly affect the environmental technology innovation ability. According to the common practice in the world, an industry's ability to invest in technological innovation is measured by complementing each other with R & D inputs and non-R & D inputs in order to reflect as accurately as possible the input of technological innovation in the industry. Therefore, this paper divides environmental technology innovation investment ability into R & D input capacity of environmental technology innovation and non-R & D investment capability of environmental technology innovation, among which R & D investment ability of environmental technology innovation is measured by R & D expenditure and R & D personnel full time equivalent measure Environmental technology innovation Non-R & D investment capability is measured by the four indexes of introducing technical funds, digesting and absorbing funds, purchasing domestic technical funds and technical reconstruction funds.

Environmental Technology Innovation and Output Capacity

The ultimate goal of environmental technology innovation is to improve economic efficiency while improving environmental benefits. Therefore, with the output of economic benefits and environmental benefits output to reflect the environmental technology innovation output capacity. As the main product in the process of creation of technological innovation knowledge in enterprise environment, patent is the core part of enterprise science and technology assets, including invention, utility model and design. Compared with the other two types, the invention patent has more technical content, innovation degree and higher economic value[9]. The number of patents includes both the number of patent applications and the number of patents granted. The ability of patent examination institutions has a greater impact and restriction on the number of patents granted, which may cause a sudden change in the number of patents. The number of patent applications generally does not come from other aspects, and more Can reflect the true level of technological innovation output capacity. Therefore, the number of invention patent applications to measure the index of environmental technology innovation economic benefits output. However, the patent is only a reflection of the potential market returns, and cannot accurately reflect the market value and transformation ability of

innovation. Only using this indicator to measure the output capacity has greater limitations and errors. The revenue from sales of new products can better reflect the market value and transformation ability of innovation achievements. Therefore, the new product sales revenue is used as a supplementary indicator to measure the output of economic benefits of environmental technology innovation. Environmental Technology Innovation Environmental benefits mainly include pollutant emissions, energy consumption and other aspects. Therefore, the environmental benefits brought by environmental technology innovation are measured by the five indicators of the total amount of industrial wastewater discharge, industrial waste gas, industrial solid waste generation and unit energy consumption per unit of output. The comprehensive energy consumption per unit of industrial output = Total energy consumption / gross industrial output.

Data are from China Statistical Yearbook 2012-2015, China Science and Technology Yearbook, China Statistical Yearbook on Industrial Economics and China Statistical Yearbook on Environment. As the third revision of the National Standard for the Classification of National Economy was made in 2011, the standard (GB / T 4754-2011) has been adjusted and revised for categories, categories, categories and subcategories, 2013-2015 The above statistical yearbooks of all year are classified according to the new standard (GB / T 4754-2011), which is different from that of the Statistical Yearbook of 2012. Therefore, this paper selects two categories of 21 manufacturing industries with the same standard classification. In addition, due to the change in the calculation methods of industrial added value above designated size, no more industrial output data of industrial sub-industries above the annual scale will be released from 2012 onwards. In order to maintain the continuity of data, this article selects the industrial sales output to replace the gross industrial output value of industrial output value of comprehensive energy consumption per unit of this variable.

Table 1. Manufacturing environment technology innovation ability evaluation index system.

	Level 1 indicator type	Level 2indicator type	index	Indicator unit	The nature of the indicator
Evaluation Index System of Manufacturing Industry Environmental Technological Innovation Ability	Environmental technology innovation to protect ability	techinque level	Equipment and equipment expenditures A1	Million	Benefit
			Engineering and technical personnel accounting for the proportion of employees A2	Percent	Benefit
		R & D institutions	Number of scientific and technological institutions A3	Each one	Benefit
			A research institutes enterprises accounted for the proportion of all enterprises A4	Percent	Benefit
		Financing environment	Government funds A5	Million	Benefit
			Enterprise funds A6	Million	Benefit
			Foreign funds A7	Million	Benefit
			Other fundsA8	Million	Benefit
	Environmental technology innovation into ability	R & D investment	R & D fundingA9	Million	Benefit
			R & D staff full-time equivalentA10	Year of the people	Benefit
		Non-R & D investment	The introduction of technical fundsA11	Million	Benefit
			Digest and absorb fundsA12	Million	Benefit
			Buy domestic technical fundsA13	Million	Benefit
			Technical renovation fundsA14	Million	Benefit
	Environmental technology innovation output capacity	Economic benefits output	Number of invention patent applicationsA15	Item	Benefit
			New product sales revenueA16	Million	Benefit
		Environmental benefits output	Total industrial waste water dischargeA17	Tons of tons	Cost
			Total industrial emissionsA18	Billion cubic meters	Cost
			Industrial solid waste productionA19	Tons of tons	Cost
			Comprehensive energy consumption per unit of industrial outputA20	Ten thousand tons of standard coal / hundred million yuan	Cost

Conclusions and Recommendations

This article constructs the evaluation index system of technological innovation ability of manufacturing environment from three aspects: environmental technology innovation guarantee, environmental technology innovation investment and environmental technology innovation output. Environmental technology innovation ability to support mainly reflected in the technical level, science and technology institutions and the financing environment, the technical level of equipment and equipment expenditures and engineering and technical personnel accounted for the proportion of these two indicators to measure; scientific and technological institutions with the number of scientific and technological institutions and have Scientific research institutions of enterprises accounted for the proportion of all enterprises to measure these two indicators; financing environment with scientific and technological activities funding raised by the government funds, corporate funds, foreign funds and other funds to measure these three indicators. R & D investment ability of environmental technology innovation can be divided into environmental technology innovation R & D investment capability and environmental technology innovation non-R & D investment capability. Among them, environmental technology innovation R & D investment ability is measured by R & D expenditure and R & D personnel full time equivalent measurement. Innovative non-R & D investment ability to use the introduction of technical funds, digestion and absorption of funds, the

purchase of domestic technical funds and technological transformation of these four indicators to measure. Environmental technology innovation and output capacity of economic output and environmental benefits and output of two aspects to reflect, so with the total discharge of industrial wastewater, industrial waste gas, industrial solid waste generation, energy consumption per unit of industrial output of these five indicators To measure the environmental benefits of environmental technology innovation.

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