

Study of China green supply chain management policies and standard

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Abstract. With the highlight of the environment issues, manufacturing industry needs to be environmentally managed with integrated methods in system aspect. Green supply chain management, integrating the environment aspect into each step of the implement of supply chain management, is the key measure to improve the efficiency of environmental management and to remit the pollution. It also helps to make best use and configuration of the resources and has been attracting much attention from our government, enterprises and academia in recent years. This paper introduced the definition and content of green supply chain management, concluded the research progress of green supply chain management by domestic scholars, stated the characteristic and achievement of the implement of green supply chain management in China as well as analyzed the current existing problems and suggestions in the future.

1. Introduction

Green Supply Chain Management (GSCM) was primarily proposed by Manufacture Study Association in Michigan State University in 1996, also known as Environmental Conscious Supply Chain (ECSC) or Environmentally Supply Chain (ESC) Management, is a modern management model that considers the environmental influence and resource efficiency in whole supply chain [1, 2]. It is based on the green manufacture theory and supply chain management technique, involving supplier, manufacturer, seller and user, aims to minimize the negative effect on environment and maximize resource efficiency during the whole life cycle of products from obtaining material, machining, packing, restoring, transporting, operating to scrap disposal[3,4]. The study of GSCM in China started relatively late and was originally used in the manufacture industry [5]. This paper concludes the government policies, enterprise encouragement and standard research based on the current GSCM in China, and provides recommendations for improvement.

2. Research status of green supply chain management

2.1. Research status of overseas

Governmental green procurement is the key method of encouraging enterprises to conduct GSCM. In order to enter the governmental green procurement scope, enterprises will have to adopt the green raw material, develop new environmental friendly processes and take other measures to improve the environmental property of products and make positive effects to sub-suppliers, thus green consuming market can be promoted [6]. United States is the initiator and advocator of GSCM while European Union, Japan, Singapore as well as other countries and organizations accepted the idea of GSCM in succession afterwards. This idea started with the scientific research, setting up the feasible and



thorough scientific law system to instruct the environmental protection and industry behaviours. In institution aspect, supporting measures are relatively perfect, the involved industries are of a wide range with a strong binding force. In the supervision, punishment and incentive policy aspect, the execution is ensured to support the GSCM implement and improve the supervision level [7,8]. Developed countries succeed in carrying out the governmental procurement by legislation. In 1991, United States published presidential decree to specify the governmental procurement green products list. On September 27, 1994, the Recycling Economy Law was approved by Germany government, of which Section 37 specified principle of governmental procurement recycling economy, the durability, assurance, recyclability, waste usability and other properties of the environmentally friendly products and service should be satisfied and procured accordingly. In 2000, Japan government published Green Procurement Law which specified that all the affiliations of central governments should formulate and implement annual procurement plan. In 2013, five new items were added into this law to expand the procured objects to 266, and 57 items purchasing criterion were adjusted to have this law revised [9]. Besides, in many countries, environment label products are connected with the government procurement products. The formulation of government procurement guide is based on the environment label products. Governments are required to purchase such labels like the German Blue Angel Label and Japanese Ecology Label [10].

2.2. Domestic research status

Compared with the overseas, Chinese government began slightly later in green procurement. In 2002, Chinese government published Government Purchase Law and Clean Production Promotion Law to propose the principle and requirement on green procurement. At the end of 2004, Ministry of Finance and National Development and Reform Commission (NDRC) jointly formulated Government Procurement Implement Suggestion of Energy Saving Products required that government shall prior purchase energy saving products [11,12]. In November 2006, Environmental Protection Administration (EPA) and Ministry of Finance jointly published Government Procurement Implement Suggestion of Environment Label Products and the first version of Government Procurement List of Environment Label Products, which has put into effect in January 2008. This indicated the formal implement of green procurement of Chinese government. Nowadays, some Chinese local governments and enterprises are promoting the implement of GSCM. Tianjin government started to conduct green supply chain in 2011, published Tianjin Green Supply Chain Experimental Implement Scheme, Tianjin Green Supply Chain Products Government Procurement Management Method, Tianjin Building Materials Green Supply Products Chain Management Method and so on in succession. In 2013, three large-scale enterprises in Shanghai (Shanghai Bailian Group, Shanghai GM and Ikea Shanghai) started to conduct green supply experimental work, setting up green supply management regulation. By constructing social responsibility and evaluating enterprise environment credit, supply chain self-disciplined is promoted, combining the establishing of industry park ecology, GSCM is introduced to improve the environmental management level of enterprises in the park. In August 2016, Dongguan government published the notice of Dongguan Green Supply Chain Management Experiment Work Scheme. Referring to the current GSCM model and content, a theory of “promoting ecological civilization, constructing green Dongguan” was proposed and promoted. It mainly involved: (a) promote the green supply chain management and government green procurement; (b) establish green supply chain management system, green supply chain management index assessing system, and green supply chain management and supporting service system; (c) conduct experiment work in furniture, shoes, electronics and mechanism industries; (d) accomplish five missions including promoting government green procurement, green purchaser plan, key industry experiment model, financial support system and management service platform. In 2006, Shenzhen government initiated PengCheng Waste Reduction Action to conduct green supply chain management experiment work. Afterwards, Shenzhen government and some voluntary enterprises conducted some green procurement projects and published Green Procurement Declaration. In 2014, Shenzhen government started to

conduct experiment work in Huawei Technologies Co., Ltd. to deeply detailing the green supply chain management [13].

To preceding green supply chain management in consideration of the products life cycle is the leading subject in current environmental economy and management field [14,15]. ISO14001 Environment Management System Certification is the most accepted voluntary environment management standard. Many research in developed economic entity showed that ISO14001 is the key promotion of GSCM [16, 17]. According to the published data by China National Accreditation Service for Conformity Assessment in July 2015, more than 110,000 enterprises have been attending environmental management certificate (GB/T24001-2004/ISO1 4001:2004). GSCM was contained in the construction, implement, maintenance and constant improvement of above these organizations environment management system [18]. So it can be seen that Chinese enterprises are now throwing themselves into the application and practice of GSCM. The Life-cycle Perspective term was clearly introduced into the newest version ISO14001 published by ISO. It requires the organizations and enterprises consider the effect of environment during the whole product life cycle, instruct organizations and enterprises to reduce the product environmental damage by controlling supply chain. The organization responsibility is widen beyond the physics and law boundary, so is the effected range of environment factor on supply chain by organization. Besides controlling the environment factors of current operation process, purchased products and service in existing requirements by organization, 2015 version also requires the organization to expand the control and effect range to products use and product post-processing [19, 20]. Therefore, with the enhancement requirement of product life cycle in ISO4001, profound changes in supply chain management of such currently being certificated Chinese enterprises may be expected in the future.

The establishment of green standardization is indispensable to promote the effective implement of green supply chain. The environment requirements of design, procurement, manufacture, transportation, consumption and recycling of Chinese manufacturing industry will be satisfied by promoting the green standard of green supply chain. Due to the lack of the basis and accumulation in China, setting up the environment standard and assessing system under Chinese national conditions and promoting the green standard construction of green supply chain will be imperative. Nowadays, some Chinese local governments and enterprises are promoting the implement of green supply chain standard. In order to coordinate with the Tianjin APEC Green Supply Chain to make a network demonstration center, Tianjin Standardization Committee published APEC Green Supply Chain Standardization Working Scheme; on February 28, 2015 Tianjin Green Supply Chain Standardization Technical Committee was established. Afterwards, Tianjin Green Supply Chain Standardization Technical Committee office also formulated and published Tianjin 100 Projects of Green Supply Chain Standardization Plan, and conducted the standard development of green supply chain including green supply chain management, third party assessment and green products government procurement [21].

3. Relevant policies and standards

China has raised the construction of ecological civilization to an unprecedented height since the 18th National Congress of the CPC. To thoroughly implement the concept of ecological civilization construction, China's environmental protection strategy and measures are gradually turning from the end-of-pipe treatment to the control of the whole process. In the fifth Plenary Session of the 18th CPC Central Committee, the "Green Development" is one of the five major development concepts, and "promoting the establishment of industrial development system of green low carbon cycle" was proposed. The concept of green supply chain has been highly valued, because it satisfied the strategic requirement of strengthening the ecological civilization construction in the new era. At the 22nd APEC leaders' informal meeting on November 12, 2014, China proposed the green supply chain issues and initiatives to build green supply chain cooperation network for the first time, and actively promoted the development of Tianjin green development round table conference. The green supply chain issue recommendations were finally adopted. In December 2014, the Ministry of Commerce,

Ministry of Environmental Protection and the Ministry of Industry and Information Technology jointly released the Enterprise Green Procurement Guidelines (Trial). This paper put forward corresponding and maneuverability measures to promote the construction of green supply chain, such as proposing enterprises to avoid purchasing products "blacklist", and encouraging enterprises to purchase through environmental marks or recognized by the state other certification product certification of energy-saving and environmental protection products. On March 24, 2015, the Central Committee Political Bureau of CPC passed the Opinions on Accelerating the Construction of Ecological Civilization which will effectively promote the Chinese enterprises construction of green supply chain.

"Made in China 2025" which was published on May 8, 2015, put forward the strategy for construction of manufacturing power in three decades. It pointed out the necessary to actively build green manufacturing system, establish a green supply chain, carry out the Extended Producer Responsibility Regime, support enterprises to carry out green strategy, green standards, green management and green production, strengthen green supervision, improve the regulations and standards of energy conservation and environmental protection, enhance supervision of energy conservation and environmental protection, and carry out the system of corporate social responsibility reports and green evaluation. The main content includes the following aspects: (1) Establish the green standard of product life cycle from the design, procurement, manufacturing, transportation, consumption and recycling point of view. The typical industry can be considered, such as electronic and electrical appliances, construction industry, resource processing and manufacturing enterprise. Environmental management systems that various types of industry related to were combined, the green standards of each link behavior within the supply chain were established. (2) Establish the management system and standard of green supply chain enterprises. Establish a green management system for all kinds of activities, manufacturing processes, production and emissions. (3) Establish the green standards for the cooperation of the behavior subjects in the supply chain. The coordination of the main behavior subjects in the green supply chain should be ensured. At the same time, the environmental responsibility system and the standard of the product should be established. (4) Evaluate and certificate standards in the green supply chain [22]. On April 18, 2016, Ministry of Industry and Information Technology issued Green Manufacturing 2016 Special Action Plan (hereinafter referred to as the "plan"). The plan was aimed at speeding up the implementation of green manufacturing projects, promoting green manufacturing system pilot, promoting the overall development of green manufacturing system pilot, issuing construction guidelines for a green manufacturing standard system, green plants assessment and green supply chain management the pilot program. At the same time, the plan selected several cities to develop green manufacturing pilot demonstration, and create a number of green demonstration plants with distinctive characteristics in conjunction with the Ministry of Finance in the Beijing-Tianjin-Hebei region, the Yangtze River economic belt and other industrial bases in northeast region.

On the other hand, the construction of China green supply chain standard and system has been gradually carried out. More than one hundred national standards in the field of energy-saving (including more than 30 mandatory energy efficiency standards and more than 20 high energy consuming products mandatory energy consumption limit standards), more than 60 national standards in the energy reduction field (including design and product recycling utilization, ecological environmental protection equipment, clean production, environmental management system and greenhouse gas management, and so on), more than 30 national standards of water saving (including 6 industrial water-saving and management standard, 13 industrial products water quota standards, 6 mandatory water instruments water efficiency standards, 6 water-saving enterprise evaluation standards) related to green supply management have been developed, the relevant standard system of green supply chain management is being established step by step.

4. Measures and suggestions

(1) From the perspective of policy and regulation, drawing lessons from the experience of western countries and combining with China's reality, GSCM in China can be improved from the following

aspects: 1. Develop and improve relevant laws and regulations. In the long term aspect, China should formulate government green procurement like many developed countries, clearly stipulate the subject, responsibility of green procurement, the developing and releasing the green procurement detailed list clearly outlined, and coordinate with government procurement law. 2. Publish green purchasing list and operation specifications. The detailed operational guidelines or specifications should be developed for the purchaser. 3. Strengthen the green information supply. It is necessary to establish a supplier, buyer and consumer information platform, update the latest domestic and international green procurement product information and technical information constantly, and regularly publish the brand list in line with the green procurement and green procurement agency to further strengthen the management of green procurement information.

(2) From the perspective of enterprise incentive, the experience and case of green supply chain management in Europe and America developed countries can provide reference for the development and promotion of Chinese enterprises. In China, enterprises are independent business entities, the risk of increased costs is high and corporate social responsibility is weak, the enthusiasm for the green supply chain has yet to be improved. In addition, due to the dispersion of the entire supply chain enterprises geographically, the surrounding environment and the different problem of the enterprises, and the implementation of the green supply chain operation of the lack of professional knowledge and professional talent support and guidance, the introduction of this new approach also needs to be combined with China's national conditions. The enterprises should fully understand: the green supply chain should be in the process of the concept of environmental protection throughout the supply chain, every enterprise in each link node need to cooperate actively. This will put forward requirements of the technical ability, information level and cooperation ability of the enterprise. Chinese enterprises need to break the short-term thinking, take social responsibility, and build a cooperative mechanism in the whole industry chain link with the upstream and downstream enterprises, to establish information exchange platform between enterprises, solve the problem of enterprise information asymmetry on the chain, enhance the operation of the entire chain of profit maximization through inter firm mutual supervision behaviour, get stronger profitability and competitive advantage and cope with the more changeable environment.

(3) From the perspective of standardization, in spite of the increasing emphasis on the management standards of green supply chain, the implementation and promotion of the green supply chain standard system construction still exist several problems to be solved urgently: at present, the local government and enterprises are actively practicing the establishment of green standards, but a unified national standard is absence. The existing laws, regulations and systems included in the green standard, involving environmental protection, food safety, and many other aspects, are different and lack of unified planning and coordination. Green supply chain standard system still needs to be perfected. Although there is number of related standards of green supply chain, but the complete green supply chain standard system still needs to be further improved. The coordination of the green supply chain links standards needs to be solved, and a large number of standards are still in the missing state, and there is still a great distance between the domestic and international green standards which also impede the competitiveness of China's manufacturing industry in the international market as well as China's consumer green product consumption. To fully consider the urgency reality of the construction of the green supply chain, improvements will be needed in the following aspects:

- Improve and strengthen the understanding of the green supply chain management, accelerate the implementation and promotion. At present, the understanding of green standards by government, enterprises, consumers, industry associations, social organizations and other aspects has not yet to be enough. Integrating the existing standards, laws and regulations relating to environmental management, and establishing and improving the standard system of green supply chain with strength and effort of all aspects can vigorously promote and implement on a national scale.
- Strengthen the construction of standard system and talent cultivation. The standard construction of green supply chain is very difficult and involves many factors, such as policy

level, legal level, professional level and so on. It is necessary to establish a set of norms, integrity, strong operational procedures. To implement and promote these, a large number of highly qualified professional and standardized talents are also needed. With the sustainable development of economy in our country, the enterprise's demand for green technology and talent is increasing. So it is urgent to guarantee the organization and personnel strength.

- Improve the standard system of China's green supply chain. Sort out the existing green supply chain management related standards to preliminary establish China's green supply chain standard system. Achieve collaborative development and coordination through the government and market predominantly formulating. It is necessary to make full advantage of enterprises standards and group standards to shorten the average standard development period and to speed up the improvement of the standard system of China's green supply chain.
- Accelerate the access of China's green supply chain standards to international standards. Under the background of the speeding up of Globalization, the environmental compatibility of manufacturing industry is a significant prerequisite. China can learn from the experience of developed countries, such as EU WEEE and RoHS directives, and establish a corresponding green supply chain management standard involving the related raw material and final product treatment.

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