Proceedings of ICEMGD 2024 Workshop: Innovative Strategies in Microeconomic Business Management
DOI: 10.54254/2754-1169/109/2024BJ0102

Green Supply Chain Technology Innovation and Enterprise Synergy in the Context of Sustainable Development: Challenges and Strategie

Jialan Jiang[1], Jingyu Wang[2], Jingtong Zhang[3,a,*]

[1]*School of Architectural- engineering, Wuhan University of Bioengineering, Wuhan, 431400, China*
[2]*School of Transportation, Shanghai Maritime University, Shanghai, 201306, China*
[3]*School of Civil Engineering and Architecture, Wuyi University, Jiangmen, 529000, China*
a. 202110613047@stu.shmtu.edu.cn
**corresponding author*

Abstract: This study explores the synergistic development between technological innovation and enterprises in green logistics supply chains from the sustainable development perspective. The study first introduces the latest progress of China's environmental policies and technological innovation and analyses the importance and necessity of green logistics supply chain management. Subsequently, through case studies and theoretical research, this paper discusses the policies and regulations of green supply chain management, collaborative management among enterprises, and the development path of technological innovation. It further analyses the contents of policies and regulations, enterprise collaboration management, and technological innovation in green logistics supply chain management. It proposes strategies and suggestions to solve problems by combining cases and theories. Finally, this study summarises the development status of green logistics supply chain management. It looks forward to future development trends, emphasizing that more enterprises should strengthen cooperation to jointly promote green logistics supply chains, environmental protection, and sustainable economic and social development.

Keywords: Sustainable development, Green supply chain technology innovation, Enterprise collaboration

1. Introduction

As a populous country, China has always needed to pay attention to the problems of environmental pollution and resource shortage and to ensure that the damage to the natural environment is minimized and sustainable development is achieved while promoting economic development. Under the development of industrialization, enterprises gain revenue through the supply chain to achieve social and economic prosperity but neglect environmental protection; nowadays, the green supply chain transformation is the general trend, enterprises with the help of more scientific and environmentally friendly means to complete the management of the supply chain. Establishing green supply chain management can realize environmental protection and rational use of resources from all aspects of the supply chain and, simultaneously, improve the reputation of enterprises and industry competitiveness. Green supply chain management focuses on the enterprise's environmental

DOI: 10.54254/2754-1169/109/2024BJ0102

protection actions and the entire supply chain, from selecting suppliers, purchasing, logistics and processing and other environmental protection considerations. Optimizing the supply chain system reduces energy consumption and delays and improves efficiency so that enterprises can reflect the concept of environmental protection in their operations. Through understanding, China's green supply chain logistics also has great potential and development prospects, and compared with foreign green supply chain logistics, China still has a long way to go.

As China's environmental protection requirements continue to improve, consumers have begun to pay attention to the environmental protection of products, and the green supply chain has thus emerged. By implementing green supply chain management, enterprises can better meet the needs of consumers, which can help enterprises improve their image and competitiveness. At the same time, the green supply chain can reduce waste and pollution emissions, which benefits the environment and ecosystems and guarantees enterprises' sustainable development. Reducing energy consumption, minimizing waste generation, and improving operational efficiency can greatly reduce enterprises' production costs and overall efficiency. In addition, a green supply chain can minimize the risk of accidents and losses in the logistics process and reduce the cost and risk of enterprises. Finally, the green supply chain is the embodiment of global social responsibility. Under the background of increasingly deep exchanges in the global economy, meeting the social responsibility requirements of various countries and markets can win a greater reputation for enterprises in the international arena and promote their international development. (Excerpts from the web article "Research on the significance and implementation program of green supply chain management")

The research theme of this paper is to explore the synergistic development of green supply chain technology innovation and enterprise under the concept of sustainable development. This paper takes the policies, laws and regulations that have been introduced in China and have a certain influence on society as a reference and uses them as a starting point for analyzing the synergistic development of technological innovation and enterprises in this research, finds the vacancies and short boards that exist in China's current green logistics supply chain, and analyzes them, as well as using the literature research method and the case study method to conduct an in-depth research on the theme. The goal is to explore and innovate the green supply chain management model to promote enterprises to realize the coordinated development of environmental and social benefits while safeguarding economic benefits. This includes reducing the consumption and waste of resources, improving resource utilization efficiency, reducing the carbon emissions of enterprises and supply chains, and promoting the application of environmentally friendly technologies and innovations to promote the development of a low-carbon, circular economy.

2. Status of Green Supply Chain Development

2.1. Policies and Regulations

In recent years, China's awareness of green environmental protection has been increasing, and the logistics industry, as one of the pillar industries of national economic development, naturally shoulders the important task of reducing carbon emissions. China has formulated policies and guidelines to build an environmentally friendly logistics supply chain system to realize this goal. In this paper, some representative policies, laws, and regulations are excerpted to illustrate the importance of policy support for developing green logistics supply chains and the necessity for enterprises and technological innovation.

At the 2021 National People's Congress, carbon peaking and neutrality appeared in a government work report for the first time. This work illustrates how limiting carbon emissions is set to impact the economy in the future [1] significantly. Immediately after, in 2022, the General Office of the State Council issued the "14th Five-Year" Modern Logistics Development Plan notice; the work of China's

DOI: 10.54254/2754-1169/109/2024BJ0102

logistics industry still exists to analyze the problems and pointed out that the development of logistics innovation and the level of green development should be continuously improved. The same year, the government issued the "Energy Saving and Low Carbon, the Development of Green Logistics" article, aimed at illustrating the strengthening of green packaging applications, increasing the promotion of energy logistics vehicles and strengthening the scientific and technological means of empowerment in the logistics sector. This series of policies, the direction of this paper, provides sufficient theoretical and policy support; there are some laws and regulations for developing enterprises and technological innovation to provide protection. For example, tax subsidies should be given to enterprises that choose low-carbon vehicles; tax concessions should be given to logistics enterprises that use clean energy, renewable energy and clean or reusable materials as packaging, and heavy taxes should be levied on those that are not conducive to the development of the environment and those that use non-renewable resources; preferential loans should be provided to green logistics enterprises for the purchase of environmentally friendly materials and facilities required for green logistics activities; government departments should provide financial support for the construction of logistics information network platforms and related logistics facilities, and so on. The government should provide funding and financial support to construct logistics information network platforms and related logistics facilities [2].

2.2. Enterprise Collaboration Management

Supply chain management generally needs to involve multiple enterprises, and cooperation and synergy among enterprises is an important part of completing supply chain management. To realize the overall development of green supply chain management, it is necessary to emphasize the cooperation and synergy among enterprises in each supply chain link. The mechanism of collaborative management of green supply chain enterprises at home and abroad is still unsound, which, on the one hand, will lead to poor information sharing and communication channels between enterprises, resulting in the relevant information on green supply chain management not being effectively transmitted and shared. On the other hand, the willingness and motivation for cooperation between enterprises need to be increased, and long-term and stable cooperation mechanisms are needed. This makes the implementation effect of green supply chain management subject to certain limitations.

Collaborative management of green supply chain enterprises needs to be realized with the help of advanced technical means. However, there is still a certain gap between domestic and foreign technology research and development and application in green supply chain management. Some enterprises need more advanced environmental protection technology and equipment to operate a green supply chain efficiently. At the same time, the existing technical support system could be better and meet the demand for collaborative management of green supply chain enterprises [3].

3. Analysis of the Development of Green Supply Chain Management

3.1. Development Path of Technological Innovation

Under the guidance of sustainable development, green supply chain technology innovation is not only upgrading and transforming the traditional supply chain but also actively exploring the future sustainable development model. It aims to implement the concept of environmental protection, reduce the supply chain's environmental impact through technological innovation, improve resource utilization efficiency, realize the coordinated development of the economy, society and environment, and integrate it into the supply chain management of enterprises.

The technological innovation of the green supply chain involves the green transformation of all supply chain links. This includes raw material procurement, manufacturing, logistics, sales and

DOI: 10.54254/2754-1169/109/2024BJ0102

services throughout the supply chain. In the raw material procurement process, technological innovation is reflected in the search for and adoption of environmentally friendly materials, reducing the use of harmful substances, and improving the sustainability and retrievability of raw materials. In manufacturing, technological innovation is reflected in introducing energy conservation and emission reduction technology, optimizing the production process, reducing energy consumption and reducing waste emission [4]. In the logistics and transportation link, technological innovation is reflected in the promotion of clean energy transport tools, optimization of transportation routes, reduce energy consumption and environmental pollution in the transportation process [5]. In the sales and service link, technological innovation is reflected in the use of traceability technology to promote the circular economy model and implement green marketing.

3.2. Case Analysis

Apple, for example, has been committed to promoting innovation in environmental technologies and has taken several concrete measures to achieve environmental sustainability in its product design and production process. Here are some of Apple's specific environmental technology practices.

3.2.1. Use of Recycled Materials

Apple has actively promoted using recycled materials to reduce its reliance on natural resources. Apple, for example, has used recycled cobalt and rare earth elements in several products derived from recycled materials. Apple has set a goal to regenerate 100% cobalt in all Apple-designed batteries by 2025 and to fully regenerate rare earth elements from magnets in its product devices. In addition, Apple plans to use 100% recycled tin solder and recycled gold plating in its printed circuit boards.

3.2.2. Product Recovery and Recycling

Apple has established a sound recycling and recycling program to encourage users to send back devices they no longer use. These devices are professionally processed, and their valuable elements are recycled to reduce the need for raw materials. Apple also offers recycling services through its retail stores and other channels to facilitate users' participation in the recycling program [6].

3.2.3. Software Optimization and Carbon Footprint Reduction

Apple is not only environmentally friendly on the hardware level but also optimized at the software level to reduce carbon emissions. For example, by optimizing the energy-saving Settings for IOS, Apple devices can reduce energy consumption while maintaining the user experience. In addition, Apple also uses cloud computing and other technologies to improve the efficiency of data processing and storage and reduce the carbon emissions caused by data transmission and storage [7].

To sum up, Apple constantly promotes the greening of its products and supply chain through several environmental technology practices. These measures not only help to reduce environmental pollution and resource consumption but also set an example for green development for enterprises and promote the sustainable development of the whole industry.

3.3. Specific Implementation of Technological Innovation

The innovation of green supply chain technology is also reflected in the application of information technology. By introducing advanced technologies such as the Internet of Things, big data, and artificial intelligence, enterprises can monitor each link in the supply chain in real-time and realize the transparency and intelligent management of the supply chain. This can not only improve the

DOI: 10.54254/2754-1169/109/2024BJ0102

operational efficiency of the supply chain but also help enterprises identify better and manage environmental risks and take timely response measures.

Green supply chain technology innovation also includes cooperation with suppliers and partners. Enterprises can jointly develop environmental protection products with suppliers, share environmental protection technology and experience, and form a joint force of green supply chain. Through cooperation with partners, enterprises can jointly cope with environmental challenges and promote the green development of the entire industrial chain [8].

Technological innovation in the green supply chain also needs to consider the construction of standards and certification systems. Through the development and implementation of strict environmental standards and certification systems, to ensure the effective implementation and promotion of green supply chain technology can be achieved. This can improve enterprises' environmental image and market competitiveness and promote the whole industry's green development [9].

It can be seen that the technological innovation of a green supply chain is a comprehensive process involving the green transformation of each supply chain link, the application of information technology, cooperation and the construction of standards and certification systems. By effectively implementing these technological innovation measures, enterprises can promote the sustainable development of the green supply chain and achieve a win-win situation with economic and environmental benefits.

4. Inter-enterprise Synergy Development

Driven by the policy, some leading enterprises in China have begun to explore the practice of green supply chain management actively and have achieved certain results. These enterprises have promoted the green transformation of their supply chains by introducing green procurement, production, logistics, and other concepts and technologies. At the same time, more and more enterprises have established green supply chain synergy mechanisms with suppliers, customers and other partners to promote green supply chain development jointly.

Procter & Gamble (China) Co., Ltd. is one of the world's largest consumer goods companies headquartered in Guangzhou City, Guangdong Province, with branches and factories in Beijing, Shanghai and Chengdu. P&G China actively builds a green supply chain. It takes green compliance as a condition when selecting suppliers to work with, using the Center for the Public Environment's IPE Blue Map to assess suppliers' environmental compliance, which includes real-time monitoring of suppliers' emissions testing, requesting non-compliant companies to report the cause of the analysis and carry out corrective actions; and monitoring the environmental performance of upstream companies; Include suppliers' carbon reduction performance in the scoring criteria; and make public information disclosure to social sustainability platforms (e.g., IPE). As a result, nearly 150 domestic suppliers have already made improvements when cooperating to improve environmental compliance testing, promoting the development of green supply chains across the industry.

In addition, Danone (China) Food & Beverage Co., Ltd. has actively responded to the goal of carbon neutrality, put forward the construction of a green information-sharing platform for the green supply chain management of the enterprise, and provided training on carbon emission, green energy and energy efficiency improvement for the establishment of cooperative suppliers, to realize better cooperation and communication with the suppliers and distributors, which plays a role in promoting the development of the green supply chain. Danone China Beverages also provides a "Danone Lecture Hall" interactive platform for distributors and customers to promote good communication and share Danone's working methods and excellent experience, reflecting good corporate synergy, taking social responsibility as its responsibility, and promoting the overall development of China's green supply chain.

DOI: 10.54254/2754-1169/109/2024BJ0102

Summarizing the above cases, we find that the development of green supply chain enterprise collaborative management is of great significance in reducing environmental pollution and resource waste, improving the economic efficiency of enterprises, and promoting the green transformation of the whole industry. As successful cases, Danone China Foods and P&G China fully demonstrate the potential and value of green supply chain enterprise collaborative management. Collaboration between enterprises can realize the effective development of their green supply chain management and drive upstream. Downstream enterprises to build a green supply chain and promote the development of China's green supply chain [10]. In the future, with the deepening of the concept of sustainable development and the increasing awareness of global environmental protection, more and more enterprises will join the ranks of green supply chain collaborative management and jointly contribute to protecting the environment and promoting sustainable economic and social development.

5. Conclusion

With the severe global climate change and the increasing awareness of environmental protection, the green logistics supply chain, as an important direction of modern logistics development, is receiving more and more attention. In China, the continuous promotion of policies and technological innovation has injected a strong impetus to developing the green logistics supply chain. China has introduced a series of policies and guidelines to promote the development of green logistics supply chains. From the proposal of carbon peak and carbon neutral targets to the issuance of the "14th Five-Year Plan" for modern logistics development to the clear guidance of "energy saving and low carbon, developing green logistics", all reflect the great importance that the state attaches to green logistics. These policies provide theoretical support for developing a green logistics supply chain, a clear direction, and a strong guarantee for enterprise development and technological innovation.

Driven by the policies, enterprises began to explore the practice of green supply chain management actively. By introducing advanced technologies such as the Internet of Things, big data, and artificial intelligence, enterprises can monitor all aspects of the supply chain in real-time, allowing them to realize transparent and intelligent supply chain management. This not only improves the operational efficiency of the supply chain but also helps enterprises better identify and manage environmental risks, realizing a win-win situation for both economic and environmental benefits. Meanwhile, green supply chain technological innovation is also reflected in the synergistic cooperation with suppliers and partners. Enterprises can work with suppliers to develop environmentally friendly products, share environmental technology and experience, and form a green supply chain synergy. This kind of synergistic cooperation helps enterprises cope with environmental challenges and promotes the green development of the whole industrial chain. Enterprises can ensure the effective implementation and promotion of green supply chain technologies by formulating and executing strict environmental protection standards and certification systems and setting up access thresholds for cooperation. This enhances enterprises' environmental image and market competitiveness and helps promote the whole industry's green development.

From a comprehensive point of view, the development of a green logistics supply chain cannot be separated from the support of policies and technological innovation. The promotion of policy provides enterprises with the direction and motivation for development, while the innovation of technology provides the possibility for realizing a green logistics supply chain. With the deepening of the concept of sustainable development and increasing awareness of global environmental protection, the green logistics supply chain will be more widely applied and promoted. We expect more enterprises to emphasize inter-enterprise synergy and cooperation in developing green supply chain management and jointly contribute to protecting the environment and promoting sustainable economic and social development.

DOI: 10.54254/2754-1169/109/2024BJ0102

Authors Contribution

All the authors contributed equally, and their names were listed alphabetically.

References

[1] *Hu Ping, & Li Na. (2021) Overview of the current status of green logistics research in China. Management Science and Engineering, 10(3), 258-264.*
[2] *Yu Haoyue, & Li Wenhua. (2012) Research on Legal System of Green Logistics in China. China Market, 2012(02), 43-45.*
[3] *Lian Jie. (2021) Exploration of green logistics development path based on supply chain management. Business and Economic Research, 2021(09), 94-96.*
[4] *Hu Ling, & Wang Ziyi. (2024) Research on the Operation Mode of Green Supply Chain under the background of low-carbon economy. China Storage and Transportation, 2024(04), 116-117.*
[5] *Gao Xiaoya. (2024) Discussion on the innovation and development path of the logistics enterprises in China from the perspective of green supply chain. The Chinese business theory, 2024(01), 12-15.*
[6] *Xiang Yu Dan. (2016) Research on the green Supply chain system of Apple Corporation [Doctoral dissertation, Shanghai Jiao Tong University].*
[7] *Liu Guanchen. (2022) Green supply chain development in the context of digital economy—takes Apple's green supply chain model as an example. China Informatization, 2022(11), 17-19.*
[8] *Ni Xiaojuan. (2024) Opportunities and challenges of enterprise green supply chain management under the background of "double-carbon" goal. National circulation economy, 2024(05), 80-83.*
[9] *Zhao Kuimin, Du Ping, & Zuo Chaoying. (2023) Problems existing in the green supply chain management system certification and countermeasures. Shanghai Quality, 2023(12), 43-45.*
[10] *Zhu Hongbin. (2024) Design of green supply chain management system for energy enterprises based on suppliers' green evaluation. Logistics Science and Technology, 2024, 47(06), 123-129.*