# Research on Green Logistics Development Strategy Supported by Digital Technology

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**Abstract: In the context of increasingly prominent global environmental issues, green logistics is of great significance to reduce carbon emissions, reduce resource waste, and improve supply chain efficiency. With the rapid development of digital technology, green logistics is facing huge challenges. How to improve the visualization ability of data, intelligent decision-making ability and optimal configuration ability of logistics network is an important way to realize the development of green logistics. This paper summarizes the application of digital technology in green logistics. The Internet of Things, big data analysis, artificial intelligence, blockchain and other digital technologies are promoting the digital transformation of the logistics industry, and the role of digital technology in improving the efficiency of green logistics is discussed. With data-driven decision-making and smart logistics systems, businesses are able to better plan the movement of goods, reduce waste in transportation, optimize warehouse management, and reduce inventory levels. This can reduce the consumption of resources, and enhance the sustainable development ability of enterprises. Finally, this paper puts forward several countermeasures on how to promote the application of digital technology in green logistics.**

**Keywords: Digital Technology; Green Logistics; Sustainable Development; Supply Chain**

## 1. Introduction

### 1.1 Background

With the acceleration of global economic integration and industrialization, the issue of environment and climate change has become increasingly prominent. On a global scale, with the emphasis of society on sustainable development, green logistics and low-carbon supply chain management have gradually become an important part of sustainable development. Green logistics refers to the sustainable development of freight transport and supply chain under the premise of saving resources, reducing carbon emissions and improving resource utilization. Digital technologies, such as the Internet of Things, big data analysis, and blockchain, have become the main force to promote the development of green logistics. This technology can realize real-time monitoring and management of supply chain, and is applied to supply chain operation, optimal allocation of logistics and resources, traceability and transparency of supply chain, etc.

Moreover, national strategies play a pivotal role in digital technologies and sustainable development. In order to promote the wide application of digital technology in social life, enhance national competitiveness, and achieve sustainable development, all countries have taken digital transformation as one of the important contents of national strategies. Integrating digital technology into green logistics will help enhance the sustainable development capacity of our ecosystem and promote our economic development and innovation. For this reason, this paper makes a systematic study on the supporting role of digital technology to the development strategy of green logistics.

### 1.2 Research Objectives and Problems

This paper will focus on the two core issues of "green logistics" and "low-carbon supply chain", take "green logistics and low-carbon supply chain" as the entry point, and focus on the core scientific issue of "green supply chain", focusing on the connotation of "green logistics and low-carbon supply chain". How to apply digital technology to green logistics to

save energy and protect the environment? In the process of sustainable development, how does the national strategy promote the application of digital technology in green logistics? On this basis, the development strategy of green logistics supported by digital technology is put forward.

## 2. Literature Review

### 2.1 Green Logistics and Sustainable Supply Chain

"Green logistics" is a kind of logistics management idea, its core is to reduce the impact on the environment. In order to achieve sustainable development, it is necessary to reduce energy consumption, waste and carbon dioxide emissions in all aspects of the freight transport and supply chain. In our country, the implementation of "green logistics" is an important measure to achieve sustainable development. In the case of increasingly prominent international and domestic environmental problems, the government has introduced a series of policies to encourage enterprises to use greener and energy-saving logistics models [1]. Specific content includes: promoting the development of green transportation, optimizing transportation networks, improving supply chain traceability, and reducing carbon emissions [2].

Sustainable supply chain management is an important development direction of green logistics [3]. Our country has put forward higher requirements for the sustainable development of supply chain management, such as social responsibility, resource management, environmental protection, etc. Enterprises have a strong sense of social responsibility in reducing plastic pollution, resource recycling and other aspects. At the same time, in supply chain management, more attention is paid to the efficient use and traceability of resources to ensure green and controllable products. These practices reflect a growing trend in sustainable supply chain management.

### 2.2 The Application of Digital Technology in Green Logistics

2.2.1 Internet of Things technology

The application of Internet of Things technology in the field of green logistics has made great progress. The Internet of Things refers to the way that physical objects interact and interact on the Internet, which provides the possibility for real-time monitoring and tracking in the logistics process. In China, the Internet of Things technology has been widely used in transportation equipment, storage facilities and all aspects of the supply chain. Through sensors and data collection, the location and temperature and humidity of the goods can be tracked in real time to ensure the quality and safety of the goods [4]. At the same time, through the Internet of Things to achieve the optimization of traffic routes, reduce energy consumption, reduce carbon emissions [5]. China's large logistics companies and e-commerce companies are actively using the Internet of Things to improve their operational efficiency and reduce environmental pollution [6].

2.2.2 Big data analysis

At the same time, green logistics management based on big data has also received widespread attention. In the process of production, China's logistics enterprises have produced a large number of orders, transportation and inventory data [7]. With the help of big data analysis, enterprises can better grasp the operation of the supply chain and realize data-based decision-making [8]. For example, through the analysis of big data, the company can provide the optimal traffic route, reduce unnecessary distance and time, and thus achieve the purpose of emission reduction. On this basis, big data is used for supply chain forecasting and demand management to reduce the waste of inventory and resources [9].

2.2.3 Blockchain technology

With the passage of time, the possibility of utilizing blockchain technology for supply chain management is increasing. Blockchain is a decentralized digital ledger that ensures information transparency and security. In China, the use of blockchain technology to improve traceability, trust and other issues on the supply chain has been widely used. Especially in the fields of food[10], medicine[11] and so on, the use of blockchain technology can trace the origin of goods and the transportation process, so as to ensure the quality and safety of goods. On this basis, this paper proposes a supply chain financing model based on blockchain technology, and applies it to supply chain management.

## 2.3 National Strategy and Digital Transformation

Driven by digital technology, our government is actively promoting the development of digital technology. At the same time, this paper also put forward the use of digital technology to improve the production efficiency and innovation ability of enterprises. In terms of logistics, the government has introduced a series of policies to promote the application of digital technologies, including the establishment of digital logistics platforms, encouraging the digitalization of supply chains, and popularizing the Internet of Things. On this basis, the development mode of green logistics supported by digital technology is put forward.

## 3. The Application of Digital Technology in Green Logistics

### 3.1 The Application of Internet of Things Technology

3.1.1 Real-time monitoring and environmental data collection

Iot sensors are widely used to monitor environmental information such as the location, temperature and humidity of goods. With these sensors, merchants can track products to ensure quality and safety. This is necessary for transporting items that are easily spoiled and valuable. At the same time, it can also provide scientific basis for traffic environment evaluation and carbon emission reduction.

3.1.2 Optimization of transportation and resource utilization

Iot technology can provide merchants with real-time transportation data to optimize transportation routes, reduce transportation costs, and reduce energy consumption. By analyzing the data transmitted by iot sensors, companies can make instant decisions to avoid traffic jams, choose the best energy use patterns, and improve transportation efficiency. This can not only reduce the impact on the environment, but also enhance the competitiveness of enterprises.

### 3.2 Application of Big Data Analysis

3.2.1 Data-driven decision making

China's logistics enterprises are increasingly relying on big data analysis to support their business decisions. Through big data analysis, it can provide an important basis for enterprises to comprehensively grasp the operation status of the supply chain, timely discover problems, and formulate countermeasures. With this data, companies can better manage resources, reduce waste, and enhance sustainability.

3.2.2 Reduce waste and carbon footprint

Through big data analysis, problems such as resource waste and inefficiency can be effectively found in the supply chain. At the same time, it allows companies to optimize inventory management, reduce packaging and material waste, and reduce carbon dioxide emissions. It provides a new way to realize "green logistics" and "reduce the impact on the environment".

### 3.3 The Application of Blockchain Technology

3.3.1 Supply chain traceability and security

The use of blockchain technology to achieve supply chain traceability, security and other functions. In China, a number of pharmaceutical companies have used blockchain technology to track the origin and transportation process of goods. This is beneficial to ensure the quality and safety of goods, reduce the spread of counterfeit goods, and increase the trust of customers.

3.3.2 Smart contract compliance

Blockchain technology can also be used in smart contracts and compliance management. Smart contracts enable automated fulfillment of contracts along the supply chain, reducing disputes and delays. In addition, blockchain can provide real-time and transparent information to supply chains to help ensure compliance, such as environmental regulations and tax regulations.

## 4. Data Analysis

### 4.1 The Application of Internet of Things Technology (Iot) in Green Logistics

4.1.1 Real-time monitoring and tracking

The popularity of Internet of Things technology enables logistics companies to monitor the location, status and surrounding environment of goods in real time. According to IDC statistics, in 2020, the global iot sensor market size is about $31 billion, and by 2025, the market is expected to reach about $65 billion.

4.1.2 Intelligent fleet management

The use of Internet of Things technology to track and manage cars can effectively reduce vehicle mileage, reduce fuel consumption, and reduce exhaust emissions. The Iot-based fleet management market is reported to be worth $6 billion by 2020.

4.1.3 Temperature control and energy management

The use of iot sensors to monitor the temperature of items in the logistics process to ensure the quality of important commodities such as food and medicine. At the same time, they also help optimize the energy consumption of logistics equipment. According to Statista, the smart building market will reach $577 billion by 2020.

## 4.2 Application of Big Data Analysis in Green Logistics

4.2.1 Demand forecasting and inventory optimization

Use big data analysis technology to analyze historical sales data, market trends and consumer behavior, so as to achieve accurate prediction of market demand and optimal inventory. According to the company, the global big data analytics market is worth $49 billion in 2020 and is expected to reach $180 billion in 2028.

4.2.2 Transportation route optimization

Through big data analysis, logistics enterprises can work out the optimal transportation path according to traffic, weather, road conditions and other information, so as to achieve the purpose of energy saving and emission reduction. According to the survey, by 2020, the global big data analysis market size will reach about 16 billion US dollars.

## 4.3 The Application of Blockchain Technology in Green Logistics

4.3.1 Supply chain transparency

Blockchain technology is used to build a transparent supply chain that ensures the provenance, quality, and sustainability of goods. According to the International Data Center (IDC), the global blockchain-based supply chain management market will reach $2 billion in 2020.

4.3.2 Carbon emission tracking

Using blockchain technology, carbon dioxide in the logistics process can be tracked to achieve the purpose of environmental protection. According to Gartner, the global blockchain market size is about $4 billion in 2020 and is expected to reach about $20 billion by 2025.

## 5. The Green Logistics Development Strategy under the National Strategy

## 5.1 National Strategy and Digital Transformation

The government has always regarded digital transformation as an important national strategy. In China, the application of digital technology has become an important factor in promoting rapid economic development and achieving sustainable development. The following are the key measures our country has taken in its digital transformation:

5.1.1 " Internet Plus "plan

To promote the wider use of digital technologies in various industries, the government has launched the "Internet Plus" programme. The project will encourage enterprises to use technologies such as the Internet of Things, big data, cloud computing and artificial intelligence to enhance production efficiency and innovation. In terms of green logistics, the "Internet +" model is used to promote the application of digital technology in reducing carbon emissions and reducing resource waste.

5.1.2 " Belt and Road "Initiative

China proposed the Belt and Road Initiative, which aims to promote international cooperation and improve logistics and trade links. On this basis, China will continue to promote the development of e-commerce in the field of international logistics. In the context of the Belt and Road Initiative, the realization of supply chain digitization and cross-border logistics collaboration is of great significance to improve the overall efficiency and sustainable development of supply chain.

5.1.3 Environmental protection policy

At present, China has introduced a series of environmental protection policies to reduce pollution and reduce carbon emissions. These include establishing carbon markets, improving energy efficiency, and reducing plastic pollution. The use of digital technology is considered to be an effective method. For example, through the digital management of the supply chain, carbon emissions can be effectively tracked and reduced to achieve China's goal of "carbon neutrality."

**5.2 Green Logistics Development Strategy**

In China's "green logistics" development strategy, it is necessary to study it scientifically and systematically. This section will discuss some of the important strategies and measurements that are needed to achieve sustainable logistics management.

5.2.1 Digital transformation

In order to realize green logistics, the supply chain must be digitally transformed in order to effectively manage the supply chain, reduce the consumption of resources and reduce the impact on the environment. In this context, enterprises should actively use the Internet of Things, big data analysis, blockchain and other technologies to improve the efficiency of business operations, so as to achieve sustainable development of the environment. The Government should provide support and incentives for enterprises to apply and innovate in digital technology.

5.2.2 Green supply chain cooperation

Cooperation between enterprises and industries will become an important way to achieve green logistics. In this process, the government can play an active role in promoting cooperation among enterprises and providing effective ways to solve supply chain environmental problems. For example, shared logistics networks, common renewable energy sources, and the promotion of environmentally friendly packaging can all be achieved through collaboration.

5.2.3 Environmental standards and certification

Governments can incentivize companies to adopt "green logistics" practices by establishing standards and certification systems for environmental protection. The standards may address carbon emissions, resource efficiency, and waste management. Once a company has achieved certification, it will be incentivized in terms of environmental protection and thus be more competitive in the market.

5.2.4 Education and training

In order to promote the green logistics of enterprises, the training and education of enterprises play an important role. Government and industry organizations can provide practitioners with training in digital technology and environmental protection. The training program also promotes environmental awareness among supply chain practitioners.

## 6. Case Study and Empirical Analysis

**6.1 Manufacturing Case Studies**

The manufacturing industry plays an important role in China's national economy, and it is also an important force to promote the development of China's logistics. In this section, we will present a few case studies of manufacturing companies, focusing on how they are using digital technologies to achieve their green logistics goals.

6.1.1 Automobile manufacturing

The car industry has made significant progress in the manufacture of electric vehicles. According to the International Energy Agency, since 2016, the number of electric vehicles in the world has increased by 40% per year, and there will be 83 million by the end of 2020. China has become the world's largest auto industry and the largest carbon emitter. Several of the world's largest car manufacturers are already using iot technology to monitor vehicle performance and improve fuel efficiency. Through real-time data collection and analysis, opportunities can be identified to reduce energy consumption and emissions, thereby improving environmental logistics practices.

6.1.2 Electronic product manufacturing

There have been great improvements in the productivity of electronic products. According to the International Energy Agency (IEA), since 2016, the energy efficiency of global home appliances and electronic devices has increased by more than 20%. At the same time, the supply chain management of electronic manufacturing enterprises also faces many challenges such as the complexity of the supply chain and the risk of the environment. In order to improve the traceability and security of the supply chain, many electronics companies have begun to introduce blockchain technology into the supply chain. This can effectively reduce the loss rate of fake goods and enhance the ability to sustainable development.

**6.2 Retail Case Study**

The retail industry plays a pivotal role in China's consumer market, and also plays a pivotal role in terminal logistics. In this section, we will analyze examples of retail companies to show how they use digital technology to

achieve green logistics.

### 6.2.1 E-commerce giants

Most e-commerce giants are powering their data centers and logistics operations with renewable energy. Amazon, for example, has announced that it will run entirely on renewable energy by 2025. By the end of 2020, Amazon has invested in more than 65 solar projects around the world, and an additional 140 wind projects. China's e-commerce giants have become the backbone of the logistics industry. Through big data analysis, they optimize logistics routes, thereby reducing logistics costs and reducing carbon emissions. At the same time, some e-commerce companies have also introduced sustainable packaging and transportation solutions to reduce their environmental impact.

### 6.2.2 Supermarket chains

Supermarket chains are also working to improve their green logistics practices. They use iot technology to monitor inventory and sales, thereby reducing overstocking and food waste. This allows for more efficient use of resources and less impact on the environment.

## 6.3 Case Studies of Logistics Service Providers

As the core force in the supply chain, logistics enterprises' behavior will directly affect the green transformation of logistics system. In this section, we will analyze the examples of several logistics service providers to show how they use digital technology to promote green logistics.

### 6.3.1 Logistics technology company

The application of Internet of Things technology in logistics technology companies has been widely used in order to achieve green logistics. According to Statista, in 2019, the global investment in the field of logistics and supply chain management in the Internet of Things will reach $143 billion. Smart Route Optimization: Logistics technology companies have developed smart route optimization algorithms to reduce mileage, fuel consumption, and $CO_2$ emissions in transportation routes. Data show that such optimization can reduce transportation costs by 10% to 30%. Electronic and smart vehicles: Logistics technology companies are making significant investments in electronic and smart vehicles, such as e-trucks and driverless technology. Worldwide, sales of electric trucks

have been on the rise, and by the end of 2020, their sales have exceeded 400,000.

### 6.3.2 Logistics operators

Reduce carbon emissions: Logistics operators are taking steps to reduce carbon emissions. The data shows that some companies have implemented green logistics practices, such as using low-emission vehicles and optimizing transport routes, to reduce carbon emissions. Adoption of electric vehicles: Logistics operators are gradually introducing electric vehicles, such as electric vans and electric fulfillment vehicles, to reduce fuel consumption and air pollution. According to the data, many logistics companies have already invested in electric vehicles and plan to gradually expand their electric fleets.Logistics operators also play an important role in reducing carbon emissions by optimizing transport and warehousing processes. Some operators have adopted blockchain technology to improve the traceability and security of goods, thereby improving the sustainability of the entire supply chain.

## 7. Conclusion

### 7.1 Summarize the Research Results

7.1.1 Application of digital technology in green logistics

Practice has proved that Internet of Things technology, big data analysis technology, blockchain technology, etc. have been widely used in the field of green logistics in China. The research results of this project will help enterprises achieve supply chain optimization, reduce carbon emissions, improve resource utilization, and enhance sustainable development capacity.

7.1.2 The driving role of national strategies

National strategies such as "Internet +" and" One Belt, One Road "have given strong support and guidance to green logistics supported by digital technology. At the same time, the introduction of national environmental protection policy has also promoted the development of green logistics of Chinese enterprises.

7.1.3 Key success factors

Leadership support, collaboration and information sharing, data-driven decision-making and continuous innovation are the keys to digital logistics development. Through case studies, these influencing factors can be clearly

seen.

## 7.2 Policy Suggestions

7.2.1 Formulate green logistics development policies supported by digital technology

On this basis, the development strategy of green logistics supported by digital technology is put forward. These policies include financial incentives, tax incentives, and green certification to reduce the company's investment costs.

7.2.2 Promote cross-enterprise cooperation

On this basis, the government can realize information sharing and collaborative innovation by building trusted collaboration platforms and standards.

7.2.3 Improve the security and privacy protection of digital technology applications

The state should establish relevant laws and regulations to ensure the privacy and security of personal and business data. At the same time, digital technology manufacturers also need to strengthen the security of data to enhance their ability to resist hackers.

7.2.4 Strengthen education and training

On this basis, the government and relevant industrial organizations can carry out relevant training to enhance employees' awareness of digital technology and green logistics. Through training, enterprises can enhance their understanding of environmental protection. The research results of this project will help to promote the development strategy of green logistics supported by digital technology, realize efficient and sustainable logistics management, and have a great significance to promote the development of our environment and economy. At the same time, the countermeasures proposed in this paper have certain reference significance for the development of green logistics in other countries.

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