

# Inventory Management and Strategy Optimization from The Perspective of Green Supply Chain Management

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**Abstract:** With the increasing severity of global environmental problems, the business community has begun to seek more sustainable business models. Green Supply chain Management (GSCM), as an important strategy to achieve this goal, emphasizes the integration of environmental protection and resource conservation concepts throughout the supply chain. This paper analyzes the impact of traditional inventory management on the environment, discusses the new model of inventory management under the perspective of GSCM, and puts forward the corresponding optimization strategy. This paper finds that green inventory management not only helps to reduce resource consumption and pollution emissions, but also improves the competitiveness and social image of enterprises. Therefore, the promotion of green inventory management is an important way to achieve sustainable development of enterprises and environmental protection.

**Keywords:** Green supply chain, Inventory management, Environment.

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## 1. Introduction

### 1.1. Research Background

With the rapid development of industrialization and urbanization, global environmental problems have become increasingly prominent, including resource depletion, ecological damage, and pollution intensification. These problems not only pose a threat to human health, but also seriously restrict the sustainable economic and social development. Environmental protection has become a global consensus, and governments, international organizations and enterprises are actively exploring and practicing sustainable development paths.

Green supply chain management (GSCM Green Supply Chain Management) as a new management idea, emphasized throughout the supply chain into the concept of environmental protection and resource conservation, so as to realize the coordinated development of economy, society and environment. GSCM reduces the environmental impact of supply chains by optimizing supply chain processes, adopting environmentally friendly materials, and improving resource utilization efficiency, and promotes sustainable development of enterprises.

As an important part of supply chain management, inventory management has an important impact on the operation efficiency and cost control of enterprises. Traditional inventory management often only pays attention to economic benefits, ignoring the impact of environmental factors. However, from the perspective of green supply chain management, inventory management also needs to consider environmental factors in order to achieve green transformation. With the improvement of consumer awareness of environmental protection and the increasingly strict environmental regulations, more and more enterprises begin to pay attention to green inventory management. Green inventory management can not only help enterprises reduce environmental risks, enhance brand image, but also enhance the market competitiveness of enterprises.

### 1.2. Research Significance

Firstly, from a theoretical point of view, this study helps to enrich and expand the theoretical system of green supply chain management and inventory management. Through in-depth analysis of the new model of inventory management and its impact on the environment from the perspective of GSCM, the internal mechanism and operation law of green inventory management can be revealed, and new perspectives and ideas can be provided for relevant theoretical research.

Second, from the perspective of practice, this study provides theoretical basis and practical guidance for enterprises to formulate green inventory strategy. Through case analysis and empirical research, we can sum up the experience and lessons of the successful implementation of green inventory management, and provide a reference for enterprises. The implementation of green inventory management can help enterprises reduce resource consumption and pollution emissions, and improve their environmental performance and economic benefits. At the same time, it can also enhance the corporate social responsibility and brand image, for the enterprise to win more consumer trust and support.

Thirdly, from the perspective of society, this study is of great significance for promoting the sustainable development of society. The promotion and application of green inventory management will help to reduce the waste of resources and environmental pollution in the whole society, and promote the coordinated development of economy, society and environment. At the same time, it can also improve the public's environmental awareness and participation, and form a good atmosphere for the whole society to jointly promote green development.

### 1.3. Research Content

This study aims to deeply explore inventory management and environmental impact analysis from the perspective of green supply chain management (GSCM), including the following aspects:

In the first part, this paper expounds the concept, development history, core concept and main practice fields of

green supply chain management, analyzes the theoretical basis, model and method of traditional inventory management, and discusses the new perspective and theoretical support that green supply chain management can provide for inventory control and management of enterprises.

In the second part, this paper summarizes the negative effects of traditional inventory management from the aspects of environment and enterprise development. Including the waste of resources and environmental pollution; Enterprise inventory capital occupation, management costs increase, market competitiveness decline and enterprise management problems may be covered up.

In the third part, this paper studies and analyzes GSCM, and puts forward the optimization of inventory management strategy from the perspective of GSCM. This paper analyzes and discusses three aspects: GSCM guiding enterprises to develop green inventory strategy, its influence on inventory management decision-making process and its influence on inventory management performance.

The fourth part is the analysis of the positive impact of green inventory management on the environment and the enterprise itself. It can not only promote the sustainable development of the environment, energy saving and emission reduction, but also effectively enhance the market competitiveness and brand image of enterprises.

## 2. Literature Review

Zhu Hongbin (2024) first explored the impact of green supply chain management from three aspects: society, economy and environment; then, based on the goal of green supply chain management carried out by energy enterprises, explored effective strategies to achieve this goal; finally, he formulated a series of practical coping strategies for the problems exposed in the process of green supply chain management of energy enterprises. It is expected to provide reference for improving the green supply chain management of energy enterprises and helping to realize the goal of "double carbon".

Shan Lianhong (2024) et al., starting with the logistics model of feed supply chain, further analyzed the importance of developing green logistics in feed supply chain, and put forward several suggestions from the application level, aiming to reduce the resource consumption of logistics in the supply chain management of feed industry and reduce the negative impact of feed economic business activities on the environment.

Dai Haotian et al. (2024) studied the relationship between supply chain digitization and green supply chain management performance by using differential differential model system. It is found that supply chain digitization can enhance enterprises' environmental awareness and responsibility, strengthen enterprises' green innovation ability, and thus improve enterprises' green supply chain management performance. Heterogeneity test shows that the higher the degree of supply chain concentration and enterprise digitization, the more obvious the improvement of supply chain digitization on green supply chain management performance.

Zhang Shengmei (2024) adopted the case study method, selected BYD as the case study object, calculated the evaluation index of BYD's green supply chain management according to the Evaluation Index System of Green Supply Chain Enterprises in the Automobile Industry issued by the Department of Energy Conservation and Comprehensive

Utilization of the Ministry of Industry and Information Technology, and analyzed the impact of BYD's green supply chain management on the enterprise based on the five dimensions of green supply chain management evaluation. The research results show that effective green supply chain management is helpful for enterprises to enhance enterprise value.

Hu Jing (2024) pointed out that there are some problems in the construction of green supply chain in petroleum and petrochemical enterprises, such as imperfect system, difficulties in technology upgrading, insufficient coordination mechanism and low digitalization degree. Based on the above problems, he proposed some reference strategies, such as improving relevant system, giving play to the role of market players and accelerating the digitalization process of enterprises.

Scholars have studied the importance of green supply chain in the context of current social development, and analyzed it in combination with specific industries or enterprises. However, there are few researches on inventory management and strategy optimization from the perspective of green supply chain management, so this paper conducts further analysis and research based on this.

## 3. Relevant Theoretical Basis

### 3.1. Green Supply Chain Management

Green supply chain management (Green Supply Chain Management, GSCM), also known as environmental awareness, supply chain management is a comprehensive consideration of the environmental impact and efficiency of the resources of modern management mode. It runs the concept of environmental protection and resource conservation through the whole process of the enterprise from product design, raw material procurement, production, transportation, storage, sales, use and scrap treatment, and manages the upstream and downstream supply relationship of the enterprise, making its economic activities coordinated with environmental protection, so as to promote the green development of the whole industry chain and the whole life cycle of the product. Green supply chain management is based on supply chain management, increase the awareness of environmental protection, the "no waste and no pollution", "no adverse ingredients" and "no side effects" throughout the entire supply chain, to achieve the balance of environmental benefits, economic benefits and social benefits. From the perspective of product links, green supply chain management covers the whole life cycle of design, material selection, procurement, processing, transportation, storage, use and final disposal; From the main point of view, green supply chain management covers suppliers, manufacturers, distributors, logistics providers, and end users.

The flow of information and data in green supply chain management is two-way interactive, and the connection between suppliers, manufacturers, recyclers, law enforcement and users is realized through the support of the network. This facilitates real-time data sharing and collaborative decision making. It applies the idea of parallel engineering, so that the production of materials, product manufacturing process and recycling and reuse are considered in parallel. Green design is mainly studied from the standardization, modularization, disassembly and recyclable design of part design to reduce environmental impact and resource consumption. Green supply chain management research from raw material

production, manufacturing to the whole process of recycling, in fact, is the whole process of product life cycle research. It requires that the impact of the product on ecology and the environment be fully considered in the design stage, so that the design results in the whole life cycle of resource utilization, energy consumption and environmental pollution are minimal.

### **3.2. Inventory Management**

Inventory management refers to a series of activities that an enterprise plans, organizes, coordinates and controls the quantity, structure, distribution and storage location of inventory items in the process of production and operation. The purpose of inventory management is to reduce inventory costs and improve inventory turnover as much as possible, so as to optimize the allocation of resources and improve the economic benefits of enterprises on the premise of ensuring the smooth progress of production and operation activities of enterprises.

Inventory management involves the following key aspects:

One is inventory planning. According to the production and sales plan, market demand forecast and supply chain situation, make a reasonable inventory level and inventory structure. This includes determining what items need to be in stock, how much stock should be in stock, when to replenish and how much to replenish. The second is inventory control. Through a series of methods and means, such as Economic Order quantity (EOQ) model, time order method, quantitative order method, etc., the quantity of inventory is monitored and adjusted to ensure that the inventory level is neither too high nor too low. Too high an inventory will increase storage costs, while too low an inventory may lead to the risk of being out of stock. The third is inventory counting. Regular inventory of inventory items to verify the accuracy of inventory quantity, timely detection and handling of inventory discrepancies. Inventory counting helps to ensure the accuracy of inventory data and provides a reliable basis for enterprise decision-making. Fourth, inventory analysis. In-depth analysis of inventory data to understand the inventory turnover rate, inventory cost, stock shortage rate and other key indicators, in order to find the problems in inventory management, and take corresponding measures to improve. Fifth, inventory optimization. Through the use of advanced inventory management technology, methods and tools, such as lean inventory, JIT (Just-In-Time) production, VMI (Vendor Managed Inventory) supplier management, constantly optimize the inventory structure and inventory level, improve the efficiency and benefit of inventory management.

Inventory management plays an important role in enterprise management. It directly affects the enterprise's cost, capital occupation, customer satisfaction and market competitiveness. Therefore, enterprises need to formulate reasonable inventory management strategies according to their actual situation and market environment, and constantly improve and optimize, in order to improve the level and effect of inventory management.

### **3.3. Green Supply Chain Management Provides a New Perspective and Theoretical Support for Inventory Management**

Full life cycle management. Green supply chain management emphasizes the management of the whole life cycle of products from raw material procurement, production,

transportation, storage, sales, use to scrap treatment, which requires inventory management to consider not only the current inventory level and cost, but also the impact of inventory items in the entire life cycle on the environment, such as the recyclability of packaging materials, energy consumption during storage. At the same time, in inventory management, priority is given to environmentally friendly, recyclable or degradable materials for packaging and storage to reduce environmental pollution.

Energy conservation and waste management. Energy-saving and environmentally friendly building materials and technologies are used in the design and construction of warehouses, and energy-saving storage equipment and lighting systems are introduced to reduce energy consumption. At the same time, the rational use of natural light and natural ventilation, reduce the use of artificial lighting and air conditioning. Establish a sound waste management system to classify, recycle and treat waste. Encourage employees to participate in waste management and improve the recycling rate of waste. Introduce advanced waste treatment technologies, such as biodegradation, heat recovery, etc., to reduce the impact of waste on the environment.

The application of information technology. Use modern information technology means to realize the information sharing between all links of the supply chain, including inventory status, production schedule, sales forecast, etc., in order to adjust inventory strategy in time, reduce inventory overstock and waste. Intelligent inventory management system is adopted to monitor inventory status in real time, predict inventory demand and improve the accuracy and efficiency of inventory management through technical means such as the Internet of Things and big data.

## **4. Adverse Effects of Traditional Inventory Management**

### **4.1. Adverse Impact on The Environment**

On the one hand, resources are wasted. Traditional inventory management models tend to purchase and store based on conservative forecasts, which can lead to a large backlog of products in warehouses. A long backlog of inventory not only occupies valuable storage space, but also may be abandoned due to expiration, damage and other reasons, resulting in a great waste of resources. At the same time, too much inventory means more packaging materials and transportation needs, increasing the burden on the environment. The production, use and disposal of packaging materials may cause pollution to the environment, and carbon emissions during transportation also aggravate the greenhouse effect.

On the other hand, the pollution is serious. Overstocked products may need to be disposed of due to expiration or damage. The disposal of these products, such as incineration or landfilling, can pollute soil, water and air. In addition, the operation of storage facilities may also have a negative impact on the environment, such as the energy consumption of storage equipment, waste disposal, etc.

### **4.2. Adverse Impact on the Enterprise**

First of all, the inventory funds occupy a large. Inventory is an important part of enterprise assets, but too much inventory will occupy a lot of working capital. This not only limits the ability of enterprises to invest in other aspects, but also may increase the financial costs of enterprises, such as

interest expenses and inventory depreciation. Improper inventory management will lead to the ineffective precipitation of a large number of funds, and reduce the capital turnover rate and use efficiency of enterprises.

Second, administrative costs increase. This includes warehouse rental, equipment depreciation, maintenance costs, and warehouse staff salaries. As inventory increases, these costs will increase accordingly. Moreover, in order to maintain and manage inventory, enterprises need to invest a lot of humans, material and financial resources. This includes inventory, inventory adjustment, inventory analysis and other work, will increase the management costs of enterprises.

Then, market competitiveness declines. Excessive inventory may cause enterprises to slow down the response to new market demand, affecting the market competitiveness of enterprises. And the rapidly changing market demand may lead to the inventory of products outdated, unable to meet the needs of consumers, and then affect the sales performance and market position of enterprises.

Finally, management problems are glossed over. High inventory levels may mask the shortcomings and problems of enterprises in supply chain management, production planning, market forecasting, etc. If these problems are not solved in time, it will have a long-term adverse impact on the development of enterprises.

## **5. Optimize Inventory Management Strategies with GSCM**

### **5.1. GSCM Guides Enterprises to Develop Green Inventory Strategies**

#### **5.1.1. Promote green procurement and supplier management**

GSCM encourages companies to build long-term relationships with suppliers and promote the greening of supply chains. In inventory management, this means that enterprises should give priority to the selection of raw materials and products that meet environmental standards for procurement, in order to reduce the environmental risk of inventory items. At the same time, enterprises should conduct environmental assessment of suppliers and select those suppliers that pay attention to energy conservation and emission reduction, waste management and resource recycling in the production process. This helps to ensure the green properties of inventory items and lays the foundation for the implementation of the green inventory strategy.

#### **5.1.2. Lean inventory management**

Drawing on the ideas of lean production, GSCM encourages enterprises to adopt lean inventory management methods to reduce inventory costs by reducing inventory overstock, improving inventory turnover, and reducing energy consumption and waste caused by excessive inventory. This helps to achieve both economic and environmental benefits. At the same time, enterprises can conduct classified management of inventory items and implement stricter inventory management strategies for items with poor environmental performance, such as shortening the storage cycle and increasing the frequency of inspections, in order to reduce their environmental risks. Use big data and artificial intelligence technology to improve the accuracy of demand forecasting in order to more accurately control inventory levels and avoid overproduction and storage.

#### **5.1.3. Improving energy efficiency**

In the design and construction of the warehouse, energy-saving and environmentally friendly building materials and technologies, such as solar photovoltaic panels and green roofs, are used to reduce energy consumption. Energy-saving storage equipment and lighting systems, such as LED lighting and intelligent temperature control systems, are introduced to reduce energy consumption. At the same time, the warehouse layout and operation process are optimized to reduce unnecessary energy consumption.

## **5.2. Influence of GSCM on Inventory Management Decision-Making Process**

### **5.2.1. Improvement of environmental awareness**

GSCM's emphasis on environmental awareness and efficient use of resources and energy has prompted companies to be greener in their inventory management decisions. When companies choose inventory materials, packaging and storage methods, they will prioritize environmental factors to reduce the impact on the environment. GSCM also pushes companies to implement sustainability principles in inventory management, such as using recyclable packaging materials and optimizing inventory turnover to reduce inventory overruns and waste.

### **5.2.2. Optimization of inventory cost**

GSCM emphasizes close collaboration across the supply chain, and by sharing information and data, companies can more accurately predict market demand, thereby avoiding overproduction and inventory overhang. Accurate demand forecasting can reduce storage costs, capital occupancy costs and inventory depletion caused by excess inventory. Under the guidance of GSCM, enterprises will re-examine the inventory structure, prioritize the retention of high-demand, high-turnover inventory goods, and reduce the inventory of low-demand, low-turnover goods. This can reduce the total cost of inventory and improve inventory turnover. By scientifically forecasting the sales volume of goods and reasonably determining the economic batch of each purchase, the procurement cost and storage cost can be reduced while ensuring the supply. The calculation formula of economic batch is: Economic batch =  $2 \times$  annual purchase quantity of a certain commodity  $\times$  one-time purchase cost/storage cost of unit material. By improving the warehouse layout and optimizing the operation process, the warehouse operation efficiency and inventory management level are improved. For example, the use of high-stack storage, reducing the width of the channel, reducing the number of handling methods, can save storage space and reduce storage costs. In order to better implement GSCM, enterprises may need to upgrade their inventory management systems to enable real-time monitoring and accurate analysis of inventory data to further optimize inventory costs.

### **5.2.3. Strengthening of supply chain coordination**

GSCM emphasizes cross-integration and information sharing across the supply chain. In the inventory management decision-making process, enterprises will strengthen the exchange of information with suppliers, distributors and other partners, jointly develop inventory plans and strategies, and improve the overall efficiency of the supply chain. Through supply chain coordination, enterprises can more accurately predict market demand and inventory demand, so as to make more reasonable inventory decisions. This helps to reduce inventory overhang and out-of-stock phenomena, improve

customer satisfaction and market competitiveness.

#### **5.2.4. Improvement of risk management capability**

Enterprises will strengthen their ability to identify and assess environmental risks. For example, in the process of inventory management, enterprises will consider the potential impact of inventory materials on the environment, such as whether they contain harmful substances and whether they are easy to degrade. At the same time, companies will also be concerned about the inventory risk that may be brought about by changes in environmental policies, such as policies restricting the use of certain materials or raising emission standards. Risk management is no longer just the responsibility of one department, but requires collaboration and joint efforts across departments. Driven by GSCM, inventory management, purchasing, production, sales and other departments will strengthen communication and cooperation to jointly develop and implement risk management strategies. GSCM emphasizes supply chain synergy and resilience. Enterprises will strengthen the risk assessment of all aspects of the supply chain, including the stability of suppliers, the safety of transportation methods, and the compliance of storage conditions. Through comprehensive supply chain risk assessment, enterprises can find potential risk points in time and take corresponding countermeasures. By strengthening supply chain synergy and risk management, companies can improve the resilience of their supply chains to cope with the impact of unexpected events and market volatility on inventory management.

### **5.3. Influence of GSCM on Inventory Management Performance**

#### **5.3.1. Cost optimization**

Inventory holding costs are reduced. By increasing supply chain synergy and transparency, GSCM enables companies to more accurately predict market demand, thereby reducing inventory overhang and waste and reducing inventory holding costs. For example, adopting strategies such as JIT (just-in-time production) and VMI (vendor managed inventory) can reduce over-storage and capital tie up of inventory. Purchasing cost savings. GSCM emphasizes green sourcing, that is, selecting raw materials and packaging materials that are environmentally friendly, recyclable or have low energy consumption. This not only helps to reduce procurement costs, but also reduces additional costs incurred by purchasing non-environmentally friendly materials, such as environmental taxes or waste disposal fees.

#### **5.3.2. Efficiency improvement**

Inventory turnover increases. GSCM improves inventory turnover efficiency by optimizing inventory structure and layout, as well as adopting advanced inventory management technologies such as WMS (Warehouse Management System). This helps reduce inventory overflows, accelerate the repatriation of funds, and improve overall operational efficiency. Supply chain collaboration efficiency is enhanced. GSCM requires greater communication and collaboration among all parts of the supply chain to jointly develop and execute inventory plans. This collaborative work can reduce information asymmetry and communication barriers, improve the overall efficiency of the supply chain, and further improve the performance of inventory management.

## **6. Benefit Analysis of Green Inventory Management**

### **6.1. Promote Environmental Sustainability**

First of all, green inventory can reduce energy consumption. Green inventory management significantly reduces energy consumption through the adoption of energy-efficient storage equipment and systems, such as energy-efficient lighting, energy-efficient air conditioning, etc. For example, a well-known e-commerce company has reduced the energy consumption of the warehouse by more than 30% by implementing environmentally friendly warehousing practices and adopting energy-efficient LED lighting systems and intelligent air conditioning control systems. Such energy conservation and emission reduction measures directly reduce greenhouse gas emissions and play a positive role in alleviating global warming.

Secondly, it can improve the efficiency of resource utilization. Green inventory management focuses on optimizing warehouse layout and item placement, improving warehouse space utilization and inventory turnover. By reducing inventory overhang and waste, businesses are able to use resources more efficiently and avoid over-exploitation and consumption of natural resources.

Then, there will be less waste. Green inventory management emphasizes the sorting, recycling and reuse of waste. By establishing a strict waste management system, enterprises can reduce the generation of waste and reduce the pollution of the environment. At the same time, the promotion of the use of recyclable and degradable packaging materials, such as environmentally friendly tape, cartons, etc., also further reduces the impact of packaging waste on the environment.

Finally, it can reduce carbon emissions. Green inventory management not only focuses on the green management inside the warehouse, but also actively promotes the green transportation mode. By optimizing transportation routes, reducing transportation miles, and adopting green transportation methods such as new energy vehicles, companies can reduce carbon emissions and environmental pollution during transportation.

### **6.2. Enhance the Market Competitiveness and Brand Image of Enterprises**

Green inventory management has a comprehensive effect on enterprises through cost optimization, efficiency improvement, risk management and brand image improvement, so as to significantly enhance the competitiveness of enterprises. Enterprises implementing green inventory management will pay attention to environmental protection and social responsibility, which helps to enhance the green image and brand value of enterprises. When the green image of an enterprise is recognized by the society, the market competitiveness of its products and services will be correspondingly enhanced. With the increasing attention of consumers to environmental protection and sustainable development, more and more consumers tend to choose enterprises and products with green image. Moreover, successful cases of green inventory management are often concerned and reported by the media. This also helps to expand the visibility and influence of the company and enhance the brand image. Therefore, enterprises that implement green inventory management are able to

attract more environmentally conscious consumers and increase brand loyalty and market share.

## 7. Conclusion

This paper discusses inventory management and strategy optimization from the perspective of green supply chain management (GSCM) in detail, and analyzes the negative impact of traditional inventory management on the environment, such as resource waste and environmental pollution, as well as capital occupation and management cost increase at the enterprise level. On this basis, this paper puts forward the strategy optimization of inventory management from the perspective of GSCM, emphasizing the application of environmentally friendly materials and the improvement of resource utilization efficiency to reduce the impact of supply chain on the environment. This paper also reveals the internal mechanism and operation law of green inventory management, pointing out that it cannot only reduce resource consumption and pollution emissions, but also improve the competitiveness of enterprises and social image. The final emphasis of this paper is that promoting green inventory management is an important way to achieve the win-win situation of enterprise sustainable development and environmental protection, and it is of great significance to

promote the sustainable development of society.

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