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## Research on green supply chain in textile and apparel industry

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**WORLD MARITIME UNIVERSITY**

Shanghai, China



**Research on Green Supply Chain in Textile and  
Apparel Industry**

By

**Kang Shiyao**

**China**

A research paper submitted to the World Maritime University in partial  
Fulfillment of the requirements for the award of the degree of

**MASTER OF SCIENCE**

**(INTERNATIONAL TRANSPORT AND LOGISTICS)**

2018

## **Declaration**

I certify that all the material in this research paper that is not my own work has been identified, and that no materials are included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

**Signature:**

**Date:**

**Supervised by**

**Professor Sha Mei**

**Shanghai Maritime University**

## **Acknowledgement**

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## **Abstract**

**Title of Research Paper:** Research on Green Supply Chain in Textile and Apparel Industry

**Degree:** MSc

With the development of economy, manufacture industries have grown a lot. These days, the trend of fast fashion has risen around the world. However, environmental problems follow. Retailers continue to produce more cheap clothes to induce consumers. People are unaware of purchasing too much clothes that they do not actually need. People wear these cheap clothes for only a few times, even they forget them after they buy the cloth, which results in a lot of waste. On the other side, production of these clothes also consumes a huge amount of natural resources. Moreover, some fast-fashion factories have harsh working conditions. If people do not change the way of production and consumption, the expansion of the clothing industry will greatly increase the pressure on environmental protection.

As a big industry, the clothing industry cannot be underestimated in every country in the world. Therefore, how to reduce the pollution of the clothing industry and how to better develop the garment industry has become a challenge as well as a difficult topic. In current research and literature, most of the research on green supply chains has focused on a broader theoretical introduction. There is no specific supply chain structure for a particular industry.

This paper aims to design a specialized clothing green supply chain framework for the apparel industry based on the theoretical basis of universal green supply chain management. Through a detailed analysis of each part of the green supply chain management, the paper try to find out the most suitable environmental protection method for the apparel industry.

**Keywords:** Green Supply Chain ; Textile and Apparel Industry ; Sustainable Development

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## **Chapter 1 Introduction**

### **1.1 Background**

Economy environment all over the world has developed rapidly these years. In China, resources are consumed increasingly and economy has continued to grow fast. At the same time, cases resources waste and environmental damage increase a lot, while most of us ignore the impact of these behaviors. For example, steel-making furnaces that is below 1000 liters belongs to small steel-making companies. Steel-making furnaces that is above 1000 liters can be defined as large steel-making companies. Large steel-making companies only use 0.5 tons of coke to produce 1 ton of iron. While for those small steel-making enterprises, they must use 1 to 2 tons of coke to produce the same amount of iron, which is obviously a waste of resources. In other cases, excessive use of various types of plastic products has become another problem for the environment. At present, most supermarkets and retail stores charge for plastic bags. Also, these markets encourage people to use paper bags instead of plastic bags for environmentally friendly reasons. Paper bags can be recycled easily while plastic cannot be recycled.

In order to face the issue of environment protection and meet the needs of the present situation, human society raise a sustainable development strategy, which could do good to next generations. The development of the whole society should be measured by the ecological environment and economic environment. The sustainable development strategy regards both the development of ecological environment and economic environment. They are indispensable. As a result, supply chain management is an important approach to achieve sustainable development.

The supply chain is made up of both upstream and downstream companies involved in demand chain network. In supply chains, products are produced and delivered from raw materials suppliers to end users. At present, the definition of supply chain is based on customer demand. Supply chain management is aiming at improving quality and efficiency, integrating resources and organizing and coordinating the whole processes of product design, procurement, production, sales and service. The supply chain is not only a product chain, but also an information chain and a capital chain. If you can start with the overall supply chain and consider environmental protection when designing the supply chain, then sustainable development can be achieved.

As a result, the implementation of Green Supply Chain Management (GSCM) is an effective way to achieve sustainable development with both “environmental awareness” and “economic development”. The purpose of common supply chain management is to optimize supply chain operations with minimal cost, while green supply chain concerns about not only traditional cost constraints and supply chain optimization as well as the negative impact of economic activities on the environment. In each aspect of the whole supply chain, environmental awareness is involved in.

The green supply chain pursues a balance between the economy and the environment through product life cycle. Different life cycle stage of the product will affect the green supply chain management. Good green supply chain management should have a positive effect on the ecological effect during every stage of one product. In the product introduction stage, the design has a great impact on the product. If the environmental performance is considered when designing the product, it is easy to control the subsequent stages. Other factors include the recycle of materials used, the long-term effects of materials on the environment, the energy used in product production, the durability of the product and the ultimate disposal of waste. In declining and recycle stage, it is important to improve the processing and efficient reverse logistics systems. When companies make decisions and strategies, the whole

product life cycle is relevant to the environment protection.

With the development of economy, manufacture industries have grown a lot. These days, the trend of fast fashion has risen around the world. However, environmental problems follow. Retailers continue to produce more cheap clothes to induce consumers. People are unaware of purchasing too much clothes that they do not actually need. People wear these cheap clothes for only a few times, even they forget them after they buy the cloth, which results in a lot of waste. On the other side, production of these clothes also consumes a huge amount of natural resources. Moreover, some fast-fashion factories have harsh working conditions. If people do not change the way of production and consumption, the expansion of the clothing industry will greatly increase the pressure on environmental protection.

## **1.2 Meaning**

In the era of information and technology, people use more and more resource in various part of life. At the same time, people are increasingly aware of environment protection day by day. The society starts to pay attention to sustainable development of both economy and environment. Under this situation, supply chain management is not only a network made up of suppliers, manufacturers, warehouses, delivery center and middlemen. It is also an effective method to manage the environment. In the new era, no matter for international or domestic, for government or enterprises, research on green supply chain management is significantly meaningful on both practice and strategy. What' more, as public people are putting more emphases on environmental protection, green supply chain management has become one of important methods for companies to better increase competitiveness and raise reputation.

Green supply chain management includes several different parts which involves all companies in the whole chain. Through green design, green materials, green

production and technology, green package, green logistics and green recycle, companies are able to minimize the positive effect to the environment. In China, green supply chain is still a new concept for most industries and companies and still need to be developed.

For garment industry, public has doubt about the sustainability of it. On stages, the models are dressed in beautiful clothes. People in the audience look at it with relish. Fashion parties seem to be a trend. However, this beautiful appearance requires a huge price for the environment. In 2017, garment industry was the second largest polluting industry in the world. Every year, trillions of clothes was produced and wasted. The rapid development of garment industry does play an important role in economy and society development. However, the environmental issues caused by garment industry cannot be ignored anymore.

The global fashion industry produces about 3 trillion dollars annually, making the garment industry the second largest in the world. But it also produces 20% of the world's waste water and generates 10% of global carbon emissions, which exceeds the total emissions of all international flights and shipping. Although the raw materials in the fashion industry use only 3% of the world's cultivated land, pesticides used in cotton plants account for 24% of the world's total amount.

It takes more than 10,000 liters of water to produce 1 kilogram of cotton, which is equivalent to the total amount of drinking water for a person for 10 years. However, 1 kilogram of cotton is only enough to produce a pair of blue jeans. In addition to environmental impacts, the fashion industry is also facing a problem of severe work environment. Because of unsafe work processes and hazardous materials used in the production process, cases of long working hours, low wages and poor working conditions occur frequently.

As a big industry, the clothing industry cannot be underestimated in every country in the world. Therefore, how to reduce the pollution of the clothing industry and how to better develop the garment industry has become a challenge as well as a difficult topic. In current research and literature, most of the research on green supply chains has focused on a broader theoretical introduction. There is no specific supply chain structure for a particular industry.

This paper aims to design a specialized clothing green supply chain framework for the apparel industry based on the theoretical basis of universal green supply chain management. Through a detailed analysis of each part of the green supply chain management, the paper tries to find out the most suitable environmental protection method for the apparel industry. For example, in the Green Design section, designers are trained and educated for sustainable fashion design. In terms of green raw materials, companies can invest more in research and development departments to actively support research on new materials and technologies. At the same time, we must ensure that the framework of this green supply chain is implementable.

Furthermore, this paper also hopes to encourage other researchers to use the same research method. Research on green supply chains should not only stay on the appearance, but should conduct in-depth analysis and research for different industries. Specific and professional supply chain management frameworks and methods are proposed for different industries.

### **1.3 Research methodology**

The main research methods that I adopt in this study are literature documentation method and practice and research method. The literature research method mainly refers to the methods of collecting, identifying, and collating the literature, and forming a scientific understanding of the facts through the research of the literature.

The literature method is a classic and error-free scientific research method. literature documentation method is used in chapter 2 to summarize the existing theories and research about supply chain and green supply chain. There are many different versions of the definition and interpretation of the supply chain in available literature. Therefore, in order to carry out the subsequent research more accurately, this paper reviews the literature in many different periods, analyzes the documentation and summarizes the evolution of the definition of supply chain. It also points out the importance of supply chain management for business and society.

This paper uses practical research methods when analyzing the existing green supply chain structure and designing the green supply chain structure of the apparel industry. The purpose of this paper is to achieve better practice results in real business operations. Therefore, all the research conclusions in this paper are based on practice. Find problems and ask questions in practice. Summarize and summarize the existing practice operations. Then test the theory through practice. This is the basic principle of social science research.

#### **1.4 Outline of the paper**

There are seven chapters in this article. The first chapter is introduction. It mainly introduces the research background of this paper. The development of the global economy has triggered environmental problems that cannot be ignored. The construction of a green supply chain has gradually become a hot topic. The garment industry has become a world-wide industry and has contributed enormously to the GDP of all countries. However, more and more people are paying attention to the environmental threats to the apparel industry. The significance of this paper is also to make the clothing industry better sustainable development, and propose a green supply chain practice plan with high feasibility. In addition, the first chapter also introduces the research methods used in this paper. They are the literature data method

and the practice research method.

The second chapter is the introduction of the literature. The supply chain is a long-established concept, but the green supply chain is still a relatively new concept. This paper describes in detail the development and differences between the supply chain and the green supply chain. At the same time, it also introduces the characteristics of the clothing supply chain, paving the way for later research.

The third chapter is the introduction of the universal green supply chain. This chapter divides the influencing factors of enterprises in the construction of green supply chain into two categories, namely, driving factors and obstacle factors. Drivers are factors that enable companies to proactively develop green supply chains. The obstacle is the reason why companies refuse to adopt green supply chains.

The fourth chapter is the main content of this article. This chapter first analyzes the achievements and shortcomings of the current apparel industry in the green supply chain. Then, based on the characteristics of the clothing industry, based on the general green supply chain structure, a green supply chain structure specially designed for the clothing industry was designed. It provides a practical plan for the garment enterprises to develop a green supply chain.

The fifth chapter mainly expounds the challenges and difficulties that China has encountered in the process of implementing green supply chain. From the inside of the enterprise, the lack of economic benefits, the low environmental awareness of enterprises is the reason for the slow development of the green supply chain. These two points can also be summarized as insufficient driving factors. From the external factors, the imperfect government management and supervision system and the incomplete incentive factors are the main problems.



Chapter six presents solutions and recommendations for the challenges identified in the previous section. Strengthening government guidance and incentives is the most direct approach. In addition, it is also one of the solutions to focus on developing leading enterprises in the industry and then let them lead other SMEs to continue to develop green supply chains. In addition, green supply chain finance, as a newly proposed concept, is also a channel to help enterprises develop green supply chains better and faster.

## **Chapter 2 Literature Review**

### **2.1 Definition of supply chain management**

#### **2.1.1 Supply chain management**

These days, the definition of supply chain is very common in various researches. Many authors proposed their own understanding of supply chain. The concept of supply chain was originally derived from the "economic chain" proposed by Peter Drucker. He also proposed a concept of goal management, and management became a formal discipline. This laid the foundation for the subsequent supply chain management. Later, Michael Porter developed it into "value chain" and raise the value chain analysis. Eventually, it evolved into the "supply chain". La Londe and Masters proposed that a supply chain is a set of firms that pass materials forward to customers. These concepts of supply chain include the final consumer as a part of the supply chain. Another definition notes a supply chain is the network of organizations that are

involved in. Through upstream and downstream linkages, the different processes and activities produce value in the form of products and services and finally value is delivered to the ultimate customers. Latest definition of supply chain not only focus on the flow from manufacturers to customers but also the reserve flow from customers back to manufacturers. This process is also called reverse logistics. Reverse logistics plays a big role in improving customer satisfaction and increasing customer experience.

There are three goals of supply chain management for companies. First, supply chain management is aimed to optimize the structure of company's supply chain in order to increase efficiency and reduce risks of supply chain. Secondly, by eliminating unnecessary processes like reduce too much inventory, cost can be reduced a lot. At last, better supply chain could provide customers a better experience and improve customer satisfaction. The above goals can be achieved by establishing a strategic partnership between suppliers and manufacturers.

The ultimate goal of supply chain management is to meet customer needs and gain more profit. This is the ultimate goal of supply chain optimization. This goal is also fundamental to the survival of the company. There are three advantages for a company to invest in supply chain management. First, corporate management can also be improved by redesigning the business processes and avoid waste resources. This has an indispensable effect on improving the management level and management process of the enterprise. At the same time, with the promotion, implementation and application of the enterprise supply chain management, enterprise will establish a standard system of enterprise management. Third, enterprise could save transaction costs between companies in the supply chain and shorten transaction time. In addition, maintaining good partnerships with other companies in the supply chain can better share information and reduce other costs.

There are several advantages for enterprises to implement supply chain management. Enterprises can improve relationships of the upstream and downstream parties, share and integrate important information and technology, make capital and cash flow more transparent in the supply chain. These are all ways to obtain competitive advantage of the enterprise. Supply chain management optimize a company's business process based on its development strategy and tactics. All resources and information are integrated and allocated for better efficiency and results of business among suppliers, manufacturers and retailers. Products are produced and sold in right quantity, with the right quality, in the right place, at the right time and at the best cost. All parties in the chain can benefit from good supply chain management.

#### 2.1.2 garment supply chain management

The garment supply chain is mainly based on the operation model of the apparel industry. It is a dynamic alliance that helps to maximizes the profits for companies in the alliance and continually meets the uncertain needs of the market and customers. Integrate traditional garment manufacturers, material suppliers, clothes distributors and retailers to manage them systematically. In the start of the supply chain, the customer is regarded as the center of the whole process, so that order quantity from customers of the manufacturing company will has no significant difference during peak season or off-season. Garment supply chain is roughly divided into three basic types based on how apparel suppliers get products: a vertically integrated supply chain, a sourcing supply chain and a third-party coordinated supply chain.

Vertical integration refers to a company that controls the same company at different stages in order to improve its market position. This company is responsible for both the production and sales process of products. In the entire vertically integrated apparel supply chain, these companies are usually retailers and they are the coordinator of the entire supply chain. It is not only responsible for sale, but also responsible for

production.

Sourcing apparel supply chain is different from the vertically integrated supply chain. In sourcing apparel supply chain, clothing retailers purchase products from apparel manufacturers for sale. Manufacturers and retailers are two independent companies. In this case, apparel retailers not only have their own brands, but also have their own design teams. But the production process is usually handed over to other garment manufacturers.

Third-party coordinated apparel supply chain is another supply chain in garment industry. Clothing trading company mainly plays as a coordinator. They integrate the entire clothing supply chain. On one hand, they provide the final product to the retailer. And on the other hand, they control the suppliers. Usually, they do not have their own factory. They are primarily responsible for helping retailers to choose right suppliers, managing all production processes, which includes product quality control and even designing. Their greatest competitiveness is a strong supply network and their good communication skills. This kind of supply chain can also be named as service provider or a temporary agent for supply chain management.

## **2.2 The development of green supply chain management**

Green supply chain management is also known as environmentally conscious supply chain management. GSCM considers environmental issues in all aspects of the supply chain and put emphases on make positive efforts on environment. It focuses on environmental protection and promotes coordinated economic and environmental development. Although there are many different kinds of definition of green supply chain management and experts have not given an exact answer, researches and development of green supply chain are continuous.

In 1994, green procurement was first proposed by Webb. He studied the environmental impact of some products and proposed to choose “green” raw materials and focus on recycling and reuse of resources based on environmental situation. Later in 1996, the concept of a green supply chain was introduced by the National Science Foundation (NSF) in an Environmentally Responsible Manufacturing (ERM) study. In this study, green supply chain was an important research subject. In 1999, Beeman introduced a new method to design supply chains by introducing some environmental factors into the supply chain model. In the same year, Hock focused on how to maintain an ecological balance in the actual operation of the supply chain. The first person to propose a system of green supply chain is Danbin. He integrated the aims, subjects, technology basis and contexts of green supply chain in a GSC model. In 2003, some Chinese researchers took social factors, like regulation, culture and ethics, into account and studies their impact on the development of green supply chain management.

Although there are so many different definitions and explanations for green supply chain management, the general point of view is to increase the awareness of environmental protection on the basis of supply chain management, which means no waste, no pollution and no bad ingredients. A green supply chain should bring no side effect on environment.

### **2.3 Current issues in supply chain management of garment industry**

In today's apparel industry, fast fashion seems to be a new trend. All major companies are rushing to speed up and continue to produce new ones. For some companies, it is even up to 52 new seasons a year. According to the Wall Street Journal's 2016 report, it only takes 25 days to produce a coat in ZARA, from the picture on the draft of the design to the production process and finally to the retail stores. Fast fashion industry giant, ZARA, has created a mature clothing supply chain. The secret of success for

ZARA is the sensible capture of the latest fashion elements in the market and the quick response to the market. On the other hand, its own factories and logistics system makes it possible for ZARA to realize quick response and zero inventory models. ZARA achieves an integrated production model by acquiring or merging raw material suppliers, establishing its own factories and logistics system. ZARA has 22 factories in Spain, which completes 50% of its products in its own factories. Through comprehensive control over the upstream of the supply chain, Zara strengthens its control over the entire supply chain. As a result, its core competitiveness is consolidated.

In another case, Japan's clothing giant Uniqlo has adopted the SPA supply chain model, which is the ultimate use of its own branded clothing retail stores. It has achieved great success through global material procurement, new fabric development, foundry processing and global flagship store sales. Uniqlo uses global procurement methods to negotiate with local raw material suppliers to establish long-term and stable partnerships to ensure that a large amount of stable materials can be obtained at a lower cost, laying the foundation for subsequent deep processing. At the same time, Uniqlo adopts a more traditional production outsourcing model and 80% of its production processes are placed in Southeast Asia. This is because the labor price in Southeast Asia is generally low, which helps to lower the cost.

However, behind the great success and rapid rise of fast fashion, over-consumption is gradually becoming a common phenomenon. Excessive consumption by consumers and excessive production by enterprises have led to an increasingly serious environmental pollution in the apparel industry. As an important part of the global economy, the garment supply chain is closely related to reasonable use and consumption of natural resources. The global garment supply chain involves millions of people and tons of water, chemicals, crops and oil. Due to the relatively large structure of the clothing supply chain, there are many industries and enterprises in the

whole chain. And different individuals are involved at each production level. So, it's hard to know where the different parts of a product come from.

This also raises some related issues. If the society does not strictly control the clothing supply chain, then some unscrupulous businesses are likely to damage the environment for economic benefits and even endanger people's health. For example, cotton is used as a raw material for cotton and hemp materials. In the process of planting cotton, in order to control the damage of pests to crops and ensure the yield and quality of crops, it is necessary to use a large amount of insecticides and fertilizers. This is highly likely to result in pesticide residues that remain on the subsequently produced garments. In addition, these textile materials also require some chemicals such as preservatives and anti-fungal agents when stored. Residues of these chemicals on clothing may cause skin irritation and respiratory illnesses in consumers and even cause cancer in severe cases. What's more, some factories use some illegal chemicals to achieve their own purposes in the process of manufacturing garments for better economic benefits. For example, the use of oxidants, catalysts, and whitening fluorescing agents in the weaving process can have harmful effects on the human body. Among all processes, the problems caused by the printing and dyeing process are the most serious. In the printing and dyeing process, manufacturers use formaldehyde and heavy metals to improve the anti-wrinkle and anti-shrinkage effect of the garment. These formaldehyde-containing textiles gradually release formaldehyde molecules during the wearing process, causing inflammation of the respiratory tract and skin through contact with the human respiratory tract and skin, and irritating the eyes. In severe cases, it can even cause cancer.

In addition to the direct or indirect damage to the human body, the clothing supply chain that has not been strictly controlled will cause serious pollution to the environment. The textile industry usually uses a large amount of water and those water is rarely recycled. It is basically discharged after simple treatment, which still

remains some harmful contents. The waste water produced by printing and dyeing processes, which are complex in composition, may contain a variety of harmful substances.

These days, news has exposed that many domestic and foreign well-known clothing companies is suspected of polluting the environment. However, only a few companies have responded to this. The cause of this phenomenon is fundamentally insufficient in environmental awareness of the main body of business activities. To be more precise, companies only regard environmental protection as an external restriction imposed on them. They fail to recognize the ethical legitimacy of environmental protection and do not consider violations of environmental laws to be morally condemn-able. With this idea in mind, some enterprises will not hesitate to reduce the economic cost at the price of violating the requirements of environmental protection supervision.

### **Chapter 3 Analysis of general green supply chain**

Universally, definition of green supply chain includes many economic activities involved in upstream and downstream enterprises. Many people tend to think that the most important part of designing a green supply chain should be the production process. In fact, to implement the concept of environmental protection, we should fundamentally change people's thinking.



In order to better understand the influencing factors of enterprises in the construction of green supply chain, this paper divides the influencing factors into two categories. They are driving factors and obstacles. The driving factors mainly refer to the reasons that drive enterprises to actively and spontaneously build green supply chains. The obstacle factor refers to the factors that influence the enterprise from the outside and force the company to change. Or it refers to factors that may cause negative or negative returns in the course of business operations.

These two factors exist and influence each other in the actual operation and operation of the enterprise. Therefore, in real life, companies have a certain incentive to actively build green supply chains to gain more benefits. At the same time, companies will encounter various obstacles in the process of establishing a green supply chain.

### **3.1 Driving factors**

#### **3.1.1 Market factor**

The first factor is market pressure. Consumers are the original source of the green supply chain. Because the product comes from the market demand. Consumers are paying more and more attention to environmental issues because of the promotion and promotion of the concept of green consumption by the government or sociologists. Some consumers may also show support for developing green supply chain companies. With the continuous promotion of environmental protection and green in the society, consumers have more goodwill towards green products and environmental protection companies, and enterprises can win the long-term trust of customers. Green products not only protect the environment, but also mean safer for consumers and green benefits for customers. On the contrary, in order to gain the favor of more green consumers, the company actively develops sustainable strategies and improves environmental management performance.

This means that if the government wants to develop a green supply chain more efficiently, the publicity of ordinary people cannot be ignored. For example, holding a publicity meeting in the community, popularizing environmental protection knowledge in the news, and strengthening the public's awareness of environmental protection, so that enterprises are more motivated to actively develop green products and green production.

### 3.1.2 Risk factor

There are many different kinds of risks that will occur during business operation. At present, the government is vigorously promoting the development of green supply chains. Therefore, new relevant provisions and regulations are often introduced. This creates a risk to the continued supply upstream of the supply chain in disguise. And once the supply is interrupted, in a highly competitive market, companies will lose their competitive edge and survive.

On the other hand, among the whole supply chain, individual company tends to expect that their partners will contribute to achievements in green supply chain development. Companies with a strong supply chain are able to become an alliance and get more competitiveness in the market. Some leading enterprises in some industries can take advantage of their higher management level, and force a large number of small and medium-sized enterprises to do by setting some environmental compliance thresholds in procurement.

### 3.1.3 Government factor

The third point is government incentives. At a stage where technology is still mature, implementing a green supply chain is too costly and expensive for some SMEs. They often don't have enough motivation to make changes. In this case, the role of government incentives is great. It is a government incentive to directly formulate

regulations or make economic compensation for enterprises.

It can be said that at this stage, China's green supply chain development is still in its infancy. Enterprises with weak financial capabilities must slowly develop green supply chains driven by government incentives. At the same time, the relevant explicit provisions must be introduced as soon as possible, and the development of a green supply chain under the dual means of policy and reward is the best choice.

### **3.2 Obstacle factors**

#### **3.2.1 Cost factor**

In traditional supply chain management, maximizing profit is almost the ultimate goal pursued by all companies. In order to save costs, some companies do not hesitate to illegally discharge pollutants. When aiming at maximizing their own interests, the core enterprises will not take the initiative to pay attention to the environmental violations in the supply chain. Even if they know, they will not require relevant enterprises to carry out rectification. The green supply chain integrates the requirements of ecological environmental protection into the supply chain management work, enriches the connotation and transforms the positioning, and is a sustainable supply chain.

For small-scale enterprises, such investment is unreasonable if the invested capital cannot be repaid in the short term. Therefore, the cost issue is one of the limiting factors that most companies cannot implement green supply chain management.

#### **3.2.2 Confidentiality factor**

Green supply chains have higher requirements for the coordination of enterprises on the chain. Therefore, the operation of the green supply chain often requires members

to share information on environmental protection. This may lead to the disclosure of some confidential information and the risk of trade secret exposure. In addition, in addition to the problem of information sharing, the company's frequent evaluation and monitoring of suppliers' performance will cause suppliers to have negative emotions and influence the relationship.

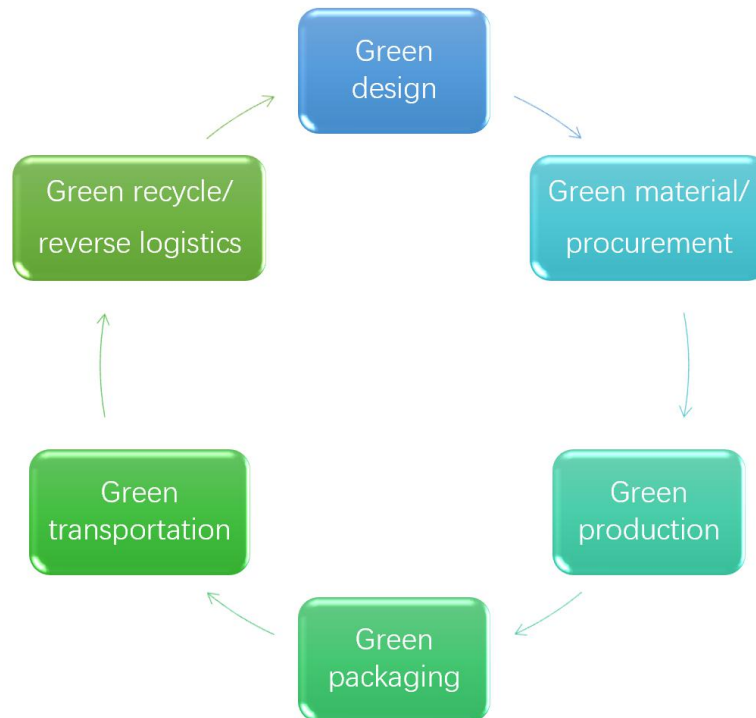
### 3.2.3 Technical barriers

In fact, as far as the current situation is concerned, technological barriers are the biggest obstacle to the development of green supply chains. The root cause of the cost problem is not enough for the development of science and technology. For example, for the apparel industry, how to break down the recycled garment fabric and extract useful parts is a difficult part. Similarly, for the smart phone industry, recycling old machines and decomposing rare metals or harmful metals out there for reuse or recycling is a major technical problem. At present, Apple has made a breakthrough in this regard, but this is not enough.

## 3.3 Structure of green supply chain

When building a green supply chain and implementing green supply chain management in an enterprise, there are mainly seven steps or contents. They are green design, green material/procurement, green production, green packaging, green transportation, green consume and green recycle/ reverse logistics. This is a universal green supply chain structure that can be applied to most businesses. But if you want to achieve more efficient supply chain operations, companies must make specific explanations and actions for this supply chain structure based on the characteristics of their industry. In this article, we will make a specific analysis of the green supply chain structure of the apparel industry for the apparel industry.

Figure 1. Green supply chain structure



Source: Sustainable Supply Chain Management Model - Green Supply Chain Management

## **Chapter 4 Establish a GSCM in apparel industry**

### **4.1 Meaning of implementing GSCM in apparel industry**

If a company seeks for sustainable development in the long-term operation, green

supply chain which is based on the principles of environmental protection is a good choice. For the apparel industry, the demand for natural resources is large, and the production process and the products produced have a great impact on the natural environment. Therefore, for the apparel industry, in the fierce market competition, in order to obtain an irreplaceable competitive advantage, environmental factors must be added to the supply chain management. This will not only bring sustainable development to the company, but also achieve huge economic benefits in long-term operations. In addition, society can also obtain better environmental and social benefits, and human beings can better carry out the road of sustainable development.

For the apparel industry, enterprises could gain four main aspects of economic and social benefits when they adopt green supply chain management. First, good green supply chain management encourages companies to allocate natural resources more rationally, reduce the use of hazardous materials, and reduce pollution by-products. This can reduce the cost of processing hazardous materials in the apparel industry. For example, hazardous materials waste water treatment processes and environmental treatment costs. As a result, the company's operational efficiency is improved and the total cost is reduced. Second, green supply chain management can effectively extend the green achievements of any member in the value chain to other downstream individuals. Even in some cases, the green success achieved upstream of the supply chain will be amplified in subsequent steps, thus expanding the advantage. Third, green supply chain management speaks of consumers as a link in the supply chain. Consumers are encouraged to make green consumption and reduce the purchase of environmentally unfriendly products. There is no harm without consumption. As a result, companies implementing green supply chains can gain a better reputation and brand image and gain more potential consumers. Fourth, various regional governments have introduced many green manufacturing related terms and regulations. Companies that proactively implement green supply chain management can better meet government requirements.

## **4.2 current situation**

At present, major companies in the fashion industry are paying more and more attention to environmental issues. Companies have also made a lot of efforts in environmental protection. For example, the closing the loop project launched by Zara. Zara believes that in the natural environment, the growth and extinction of all things are balanced, dust and dust, and soil returns to earth. Therefore, clothing manufacturing should be the same. The goal of closing the loop project is to create a stable and sustainable system in which natural resources are not wasted and everything can be renewable. Actually, since this project is put into effect, the result is significant.

In the Sustainable Balance Sheet of ZARA in 2017 (table 1), we could see that compared to 2016, more and more retail stores are involved in the Closing the Loop. In 2017, 734567 kWh renewable energy is used in production and the emission of carbon dioxide is reduced a lot. In addition, recycling of products has covered 18421 tons clothes.

Table 1. Circularity and efficient use of resources

CIRCULARITY AND EFFICIENT USE OF RESOURCES		
	2017	2016
Number of stores participating in the Programme <i>Closing the Loop</i>	598	394
Tonnes of garments collected through <i>Closing the Loop</i>	12,229	7,102
Global relative power consumption (MJ/garment) <sup>(3)</sup>	4.40	4.83
Generation of renewable energies and purchase of renewable energy (kWh)	734,567	520,678
Emissions of CO <sub>2</sub> per garment placed on the market (g CO <sub>2</sub> eq/garment) <sup>(4)</sup>	315.57	405.83
Products recovered to be sent for recycling (t) <sup>(5)</sup>	18,421	16,848

Source: sustainability balance sheet of ZARA, 2017

In addition, Zara has set up a detailed supplier grading system to better manage its suppliers. All suppliers are divided into A, B, and C according to whether the supplier meets Zara's corporate execution requirements. The detailed definition of supplier classification is shown in table 3. The best supplier is the A level. Zara will evaluate all suppliers on a regular basis, and if the supplier's performance declines, the supplier will be downgraded. From the table 2, we can see that compared to 2016, the number of A-level suppliers in 2017 has decreased, while the number of suppliers in the B-class has increased. In the future, Zara will not only need to evaluate suppliers, but also participate in the process of supplier development and progress. Strive to make your supplier list better meet the requirements of sustainable development and green supply chain construction.

Table 2. Classification and production volume of suppliers with purchase(2017)



	2017		2016	
	No. of suppliers	% Suppliers	No. of suppliers	% Suppliers
A	661	36%	694	38%
B	962	53%	917	51%
C	101	5%	83	5%
Subject to CAP	71	4%	61	3%
PR	29	2%	50	3%
<b>Total</b>	<b>1,824</b>	<b>100%</b>	<b>1,805</b>	<b>100%</b>

Source: sustainability balance sheet of ZARA, 2017

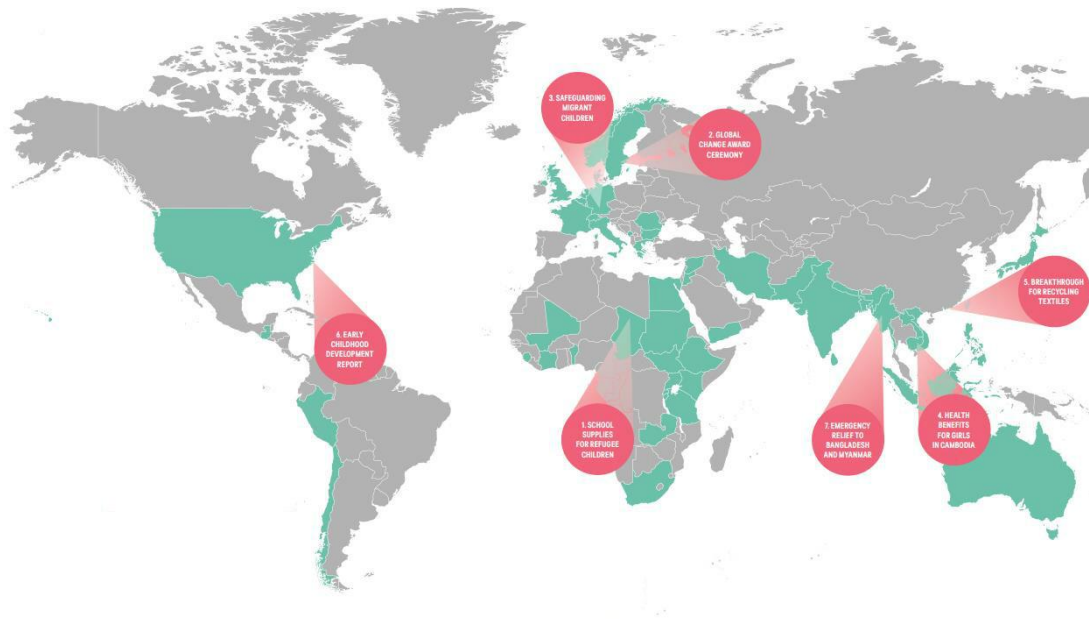
Table 3. Definition of the classification of suppliers

Classification of suppliers	Definition
Supplier A	Complies with Code of Conduct.
Supplier B	Does not comply with some non-material aspect of the Code of Conduct.
Supplier C	Does not comply with some sensitive aspect of the Code of Conduct.
Supplier Subject to Corrective Action Plan (CAP)	Breaches of the Code of Conduct triggering the immediate implementation of a Corrective Action Plan.
Supplier PR	Undergoing an auditing process.

Source: Sustainability Balance Sheet of ZARA, 2017

Similarly, H&M also launched the H&M Foundation in 2007. It is a non-profit international foundation. The foundation was established to hope to lead the world to make some positive changes. The H&M Foundation has a clear commitment to the global goals set by the United Nations. Since 2013, \$177 million dollars has been donated to the H&M Foundation and the Foundation is making real changes for the whole world. In figure 2, we could see that different regions are involved in initiated projects of H&M Foundation regarding education, water and equality in 2017. H&M aims at a larger cover of regions in the future.

Figure 2. Global impact 2017 of H&M Foundation



Source: H&M Foundation report 2017

### 4.3 GSCM system

#### 4.3.1 Green design

Today, economic benefit is not enough for enterprises and experts who seek for eco-effectiveness. They want to achieve the balance between economic, social and the environment. How to contribute positive impacts on these three aspects is a new challenge. The latest solution is to achieve sustainable development through cooperating with companies in supply chains. Customers, as the end part of the value chain, will be encouraged to purchase greener and environmentally- friendly products. As a result, companies will also be encouraged to invest in develop green supply chain to increase competitiveness advantages.

Currently, apparel companies are making great efforts to reduce their impact on the environment as much as possible. For example, they are trying to use less harmful

materials and chemicals in production. But green supply chain shouldn't only focus on how to reduce the negative impact. Instead, positive goals should be designed at the beginning. That means, companies should put more emphases on how they start each piece of their products.

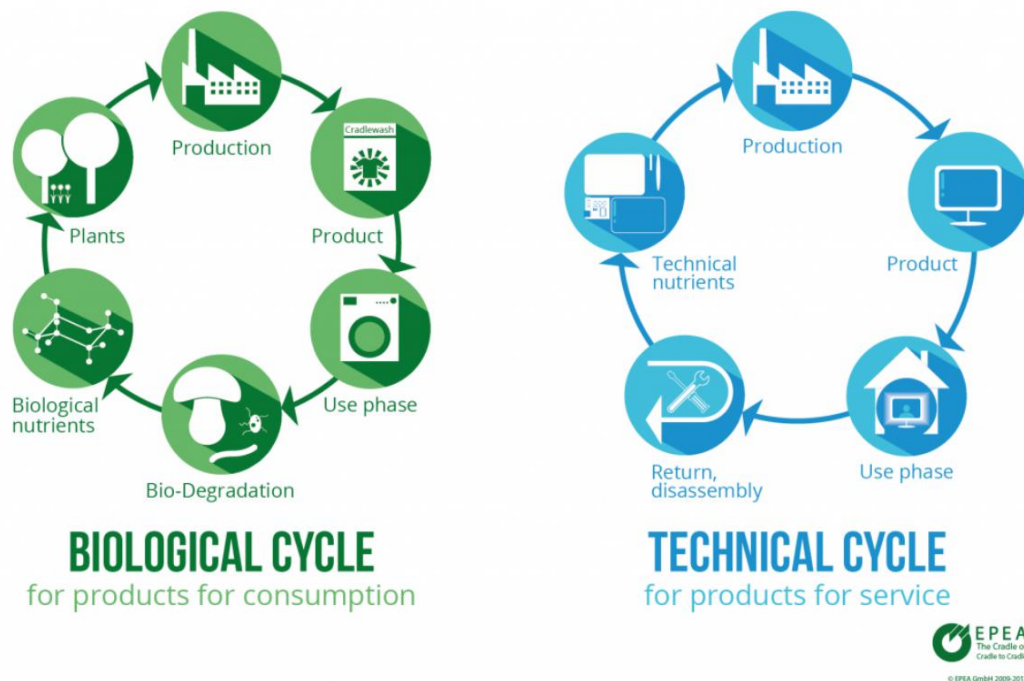
In order to make up for the exhaustion of resources, the slogans of recycling and protecting the environment have been shouted in the past, but these strategies have not changed the current situation from the source. Excessive resources are still used in the production process and toxic substances are still easily discharged. Moreover, with the existing science and technology of energy conservation and recycling in the society, the life cycle of the product can only be prolonged and the resource consumption can be reduced. However, the ultimate resource is inevitably going to the end of the grave. To this end, the concept of Cradle to Cradle has become popular. Resources start from the cradle and eventually return to the cradle. This also means that no resources are wasted. Cradle to Cradle advocates encourage people to learn from nature, all of which are nutritious and return to nature. Starting from the concept of nutrient management, from the very beginning, that is, product design, the product outcome is carefully conceived, so that the material can continue to circulate.

Cradle to Cradle® is a perfect choose for companies who want to develop green design. This is a design concept derived from mother nature and was developed in the 1990s by Prof. Dr. Michael Braungart, the scientists of EPEA in Hamburg. Cradle to Cradle products are environmentally friendly through all their life cycle. Cradle to Cradle is different from conventional recycling concept. It requires more innovation and more Eco-effectiveness. Nature resources are infinitely used through products life cycle and waste material of old products may become useful again for new products. As a result, companies who implement Cradle to Cradle strategy will be less sensitive to price fluctuations in raw material markets and thereby companies could gain more economic profits. Implementation of Cradle to Cradle creates equal economic, social

and ecological benefits.

Biological and the technological cycles are two kinds of product life cycle in Cradle to Cradle concept. In the biological cycle materials are returned to the biosphere in the form of compost or other nutrients, from which new materials can be created. In the technical cycle materials that are not used up during use in the product can be reprocessed to allow them to be used in a new product. In figure 3, we could see that in two cycles, products are produced and recycled in a closed loop and only different products turn into different nutrients. Biological nutrients constitute products of use, such as textiles and car tires. Technical nutrients constitute products are made of rare raw materials, like washing machines or bicycles, which should be kept out of the environment.

Figure 3. Different cycle for products in Cradle to Cradle

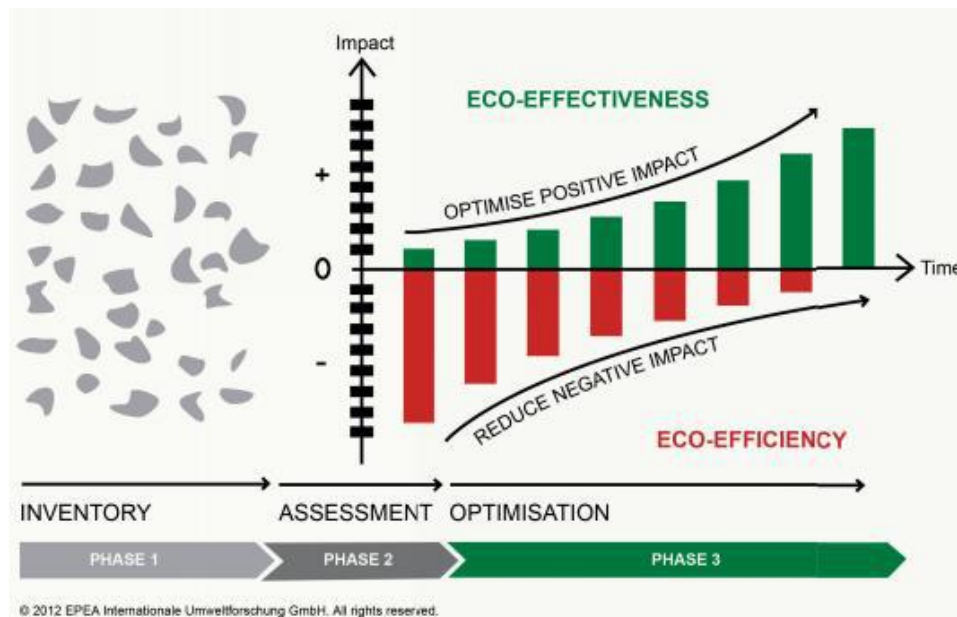


Source: <https://www.c2ccertified.org/>

To start with this new concept and put into effect, companies should follow three basic principles to design a business mode. First, the core part of Cradle to Cradle design concept is that nutrients become nutrients again and no waste present. Like in nature, organisms live by eating other organism or nutrients. After they die, they will turn into others' nutrients and food. All creatures in ecological environment contribute to the health of the whole living system. Secondly, use renewable energies as much as possible during both operation and daily administration processes. Fossil fuels and coal fuels have been used by human society for millions of years, but side effect of burning these energies is far more serious than people believe. For example, solar energy or wind power can replace traditional energies in the construction of products and systems.

For apparel companies, clothes and apparel are mainly made of biological nutrients and should implement the biological cycle for their products. By implementing Cradle to Cradle strategy, companies will gain eco-effectiveness in the long-term operation. The concept of eco-effectiveness is different from efficiency. Eco-effectiveness is a criterion used to measure how much a product or the production of it is done for the effort of sustainable development. Figure 4 shows how eco-effectiveness grows in different stages of Cradle to Cradle strategy.

Figure 4. Cradle to Cradle design process



Source: Effectiveness as a new approach for analysis and test-equipment

#### 4.3.2 Green material

After the product design is completed, the procurement of raw materials will follow. The concept of green procurement emerged earlier than the concept of a green supply chain. In 1994, after studying the environmental impact of some products, Webb suggested selecting raw materials according to environmental guidelines and enhancing the regeneration and reuse of resources. Here, he proposed the concept of green procurement, while emphasizing the importance of green procurement. Later, in 1996, the Michigan State University Manufacturing Research Association came up with the concept of a green supply chain.

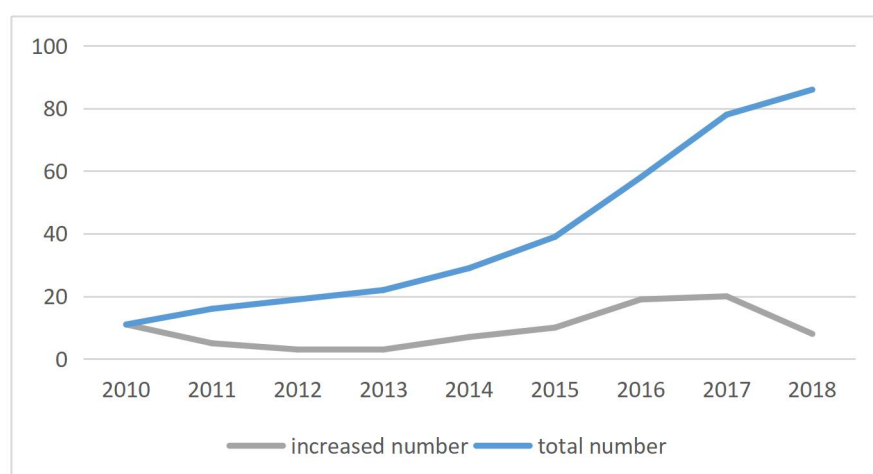
The growth of consumer purchasing power in emerging economies and the rise of the fast-fashion industry have led to a significant increase in the number and frequency of people buying clothing. These changes have not only contributed to the flourishing

development of the textile industry, but have also made the environmental impact of the garment production process increasingly serious.

In addition to changing bleaching technology, one of environmentally friendly solutions is to use “better cotton” on apparel raw materials. Compared to traditional cotton, better cotton is planted with less pesticides, less water resources and less harmful chemicals. The Better Cotton Project contributes to make positive impact on people who produce it (mainly farmers), the environment the cotton grows and the whole society. The ultimate goal of this project is to develop better cotton standard system and produce Better Cotton as a sustainable mainstream commodity. In order to realize the mission, the global cotton supply chain is involved in the Better Cotton project and many stakeholders are make great effort to improve the technology and promote farming communities in cotton-producing areas.

In the list of members and brands who joined the Better Cotton project, the author has found many famous apparel brands. As is shown in below figure 5, every year, there are more and more members join in the project.

Figure 5. Increased number and total number of BCP members



Source: <https://bettercotton.org>

In addition, this paper chooses some of famous brands to public people among all the members of the Better Cotton Project and shows them in the below table (table 4). We all know the celebrity effect. When adopting the strategy of better cotton, in the beginning, companies may increase costs by investing in new technologies, resulting in lower economic benefits than using traditional cotton. But in the long run, using better cotton can bring more long-term economic benefits to the company. Therefore, in order to better promote the development of the plan, the society should actively cooperate with some famous brands, which will lead to the celebrity effect and attract other small enterprises to participate.

Table 4. Famous retailer and brand member

Retailer and Brand Member	Joined BCI
adidas AG	2010
Hennes & Mauritz AB	2010
Ikea Supply AG	2010
KappAhl Sverige AB	2010
Levi Strauss & Co.	2010
Lindex AB	2010
Marks and Spencer PLC	2010
Nike, Inc.	2010
Sainsburys Supermarkets Ltd.	2010
Inditex	2011
American Eagle Outfitters, Inc.	2015
Burberry Ltd	2015
C&A AG	2015
G-Star RAW C.V.	2015
Gap Inc.	2016
PUMA SE	2016

Source: <https://bettercotton.org>

Green procurement is one of the important links in the supply chain. To achieve green procurement, we must pay attention to the choice of suppliers. Understand the environmental issues of the supplier's production process, toxic waste pollution, product packaging materials, and waste discharge. If a company purchase recyclable



raw materials to produce clothes, then it will cost less when the company try to recycle finished clothes from customers. So, it is easy to understand that supplier sourcing and management is very important. It is best for companies to choose vendors with ISO14000 certification, BCI (Better Cotton Initiative) members or Cradle to Cradle certification because working with these vendors will reduce both cost and risks. At the same time, it can encourage more suppliers to take the initiative to optimize the sustainable development.

#### 4.3.3 Green production

As we all know, the production process of a product consumes the most resources and is the most likely to cause pollution. Therefore, an environmentally-friendly and green manufacturing process is important for the composition of the entire green supply chain. The manufacturing process of the product includes the input and output of raw materials, resource consumption, and waste generation. The green manufacturing process should focus on energy saving, pollution reduction and consumption reduction, and achieve high economic and environmental benefits by simplifying the process system and optimizing the configuration. The production phase affects the green supply chain in many ways including the ability to use renewable resources, the ability to combine re-manufactured or reused components into the overall system, the ability to disassemble parts and so on.

For clothing companies, if they want to make breakthroughs in green production, they must invest a lot of money in scientific research. For example, the Chinese Jiangsu SILK-Group focused on innovative research at the beginning of its establishment. The continuous introduction of a variety of new fabrics makes the company a leader in the industry. In 2011, the Jiangsu SILK-Group developed a new type of different shrinkage composite silk fabric. The traditional "two-step" spinning process has low quality stability and can only be used for roving. And the production efficiency is not

high; and the “one-step method” adopted by the composite yarn avoids the defects of the two-step method, saving 46% of the land occupation, reducing the plant area by 57%, saving 830 kWh per ton of product, saving electricity. About 41%. Using the latest one-step spinning, the cost per ton of product is reduced by more than 1,000 yuan compared to the traditional two-step method. This greatly reduces the energy consumption and cost of production. However, behind the success, the Silk Group has paid a huge price for innovation and research. Since the beginning of research and development, it has invested nearly 100 million yuan. It took five years and went through hundreds of experiments. Even the experts from Japan and South Korea were reluctant to retreat. However, the Serge Group finally succeeded.

However, not all companies have the ability and capital to invest in scientific research. Therefore, in addition to developing new technologies by themselves, clothing companies that focus on sales can choose more mature suppliers in green production as their own clothing manufacturers. In this way, compared to investing in research, it can save a lot of money and manpower for the company. For example, Zara works with a Spanish supplier, Jeanologia, to replace traditional chemical bleaching with new supplier technologies. Jeanologia, founded in 1993, is committed to using the latest technology to reduce the use of water and chemicals required for traditional garments after printing and dyeing. Figure 6 shows that Jeanologia is now covering his business in 60 countries across 5 continents. They also build an international team to provide professional information and technology by training or cooperation for international companies. Its customers include famous apparel companies like H&M, Gap, Levi's and Nike.

Figure 6. Regions that Jeanologia covers

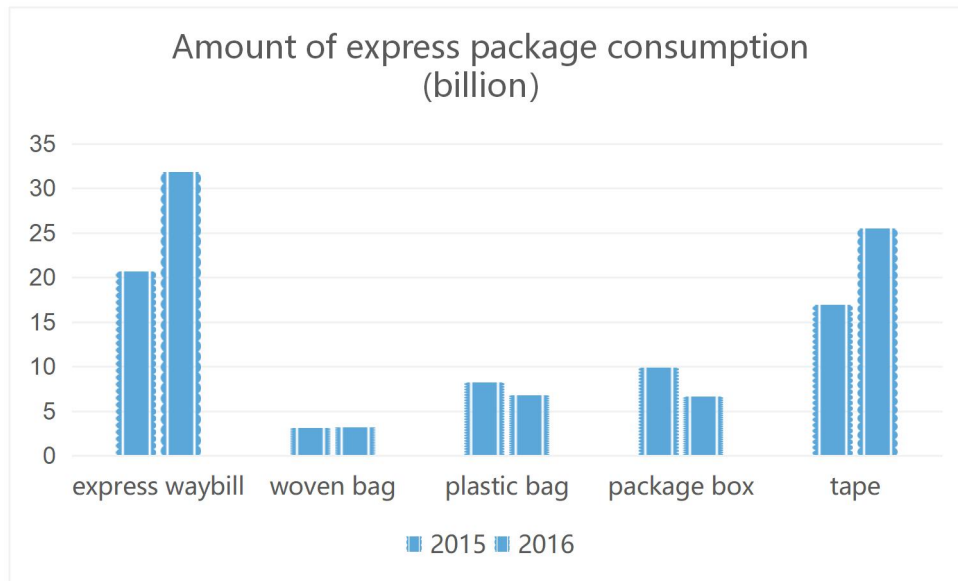


Source: <https://www.jeanologia.com>

#### 4.3.4 Green package

Packaging only takes up a small portion of the life of the product, so it is often overlooked. However, the environmental pollution caused by over-packaging is indeed unimaginable. Online shopping has become an important part of people's daily life. Table 5 shows the amount of express package consumption in 2015 and 2016. In China, the average daily express delivery has exceeded 100 million. However, behind the massive amount of express delivery business, it is a huge waste of resources and environmental pollution caused by packaging waste. Courier packaging pollution has also followed. In addition to this, there is a popular gift between interpersonal contacts in contemporary society. Many products have the same content. After changing a gorgeous package, the price will increase a lot, making people feel that gifts are more decent. However, this phenomenon of over-packaging is actually a waste of resources and also produces a lot of environmental pollution. In normal life, most of the packaging cannot be degraded, causing environmental pollution. In green packaging, you should choose a recyclable, recyclable, detachable packaging material, and implement simple packaging and zero-degree packaging.

Table 5. Amount of express package consumption



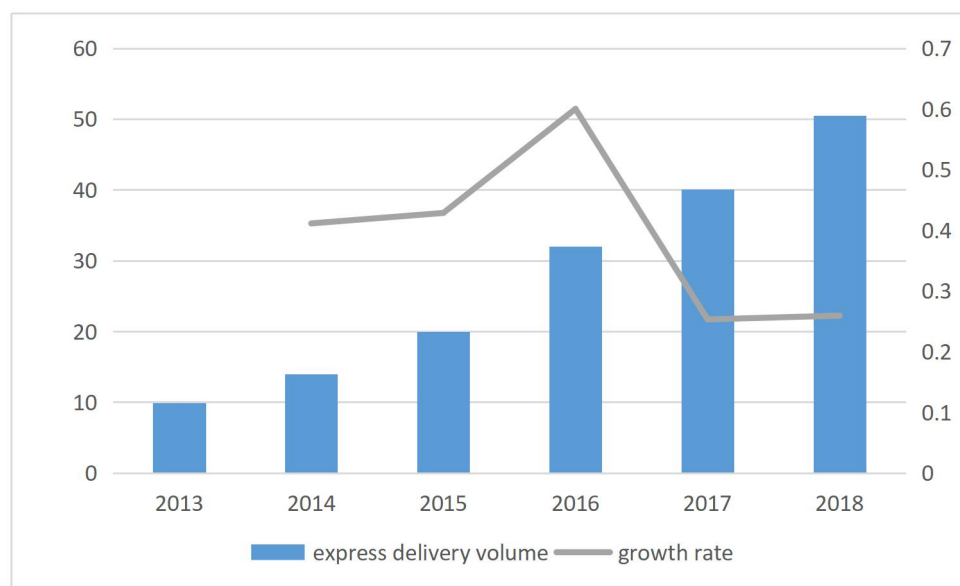
Source: Logistics Times Weekly

Cainiao alliance and Jingdong respectively launched the "Green Action Plan" and the "Blue Flow Plan". Both projects are aim to develop and promote the use of environmentally friendly degradable packaging materials. In 2017, Cainiao alliance launched 20 green warehouses around the world in the activity of “double 11”. Packages in these green warehouses are packed with tape-free courier boxes and 100% degradable courier bags. In 2016, Jingdong took the lead in the use of fully biodegradable packaging in the self-operated fresh-keeping business. This packaging material can be decomposed into carbon dioxide and water in only 3-6 months under composting conditions, and there is basically no pollution to the environment.

According to the data in Table 6, the volume of China's express delivery business reached 50.71 billion in 2018, an increase of 26.6% over the previous year. The daily average express handling capacity is 140 million pieces. The per-capita express mail usage is 36 pieces. However, with the increasing emphasis on environmental protection issues in China in recent years, the green wind of the express delivery

industry has gradually emerged. The electronic face sheet is gradually replacing the traditional express list. In 2016, the total express usage of express delivery orders in the country was 31.28 billion, and the use of electronic waybills reached 20.96 billion, accounting for nearly 70%. Compared with the traditional carbon paper handwriting sheet, the electronic surface sheet is only one sheet, which is directly printed and generated, which saves paper and does not require handwriting, which greatly improves the delivery efficiency.

Table 6. Express delivery volume in CHINA (billion)



Source: State Post Bureau

Today, the fashion industry is not just focusing on offline store sales. Enterprises are beginning to pay attention to the business opportunities of e-commerce. For apparel companies, opening online buying channels means attracting more potential customers and ignoring geography and language challenges. However, the development of e-commerce is inseparable from the support of transportation and express delivery services. Consumers who buy only one piece of clothing or buy ten pieces of clothing on the Internet need to pack the clothes and send them out. Buying a piece of clothing also costs the same plastic bags, express cartons and tape. Considering the sheer volume of online transactions, we can imagine how serious the

resulting packaging waste and pollution. Therefore, clothing companies must pay attention to the implementation of green packaging when developing e-commerce. Use paper bags instead of plastic bags whenever possible. Collaborate with express delivery merchants that meet the requirements of green supply chains, using green transportation methods and green packaging to reduce environmental pollution.

#### 4.3.5 Green transportation

Compared with the above links, green transportation is more convenient and easier to understand. At present, the mainstream logistics and transportation methods are road transportation, railway transportation, water transportation, air transportation and pipeline transportation.

Among them, road transport is a traditional means of transporting passengers and goods. It is now partly replaced by many other new transportations means but it is still one of the most important parts for short-distance passenger and cargo transportation. The transportation vehicles used in modern times are mainly automobiles. In the remote and economically backward areas where the terrain is rugged, sparsely populated, railways and water transport are underdeveloped, roads are the main mode of transportation and serve as transport trunks.

Rail transport is usually used to transport social cargos like daily commodities and raw materials used in manufacture industry. There are many advantages of rail transportation. For example, it could transport large amount of cargo for one time for long distance. In addition, rail transport is cheap and is more flexible to different climate. The old Chinese railway transportation capacity is very weak. There are only 22,000 kilometers of railways in the country. Not only the number is small, the quality is poor, the technical equipment is backward, the layout is unreasonable, and more than 90% are controlled by foreign countries or controlled by foreign capital.

Waterway transportation is arguably the oldest mode of transportation. In ancient China, some people used the canal to transport salt and other materials. Waterway transportation is today one of the most important modes of transportation worldwide. Waterway transportation can transport important materials such as coal and iron ore.

Air transport is usually used to transport some products that are time-critical. Air transport is safer and faster than other modes of transport. For some fast-responding supply chains, air transport is an essential part. However, being expensive is one of the most important obstacles.

Pipeline transport is a long-distance transport method for transporting liquids and gaseous materials using pipelines as a means of transport. It is a transport method that transports petroleum, coal and chemical products from the production site to the market. It is a unified transport network. A special component of medium trunk transportation.

Green transportation requires enterprises to rationally allocate limited resources, that is, to centralize distribution and plan transportation routes, reduce unreasonable transportation times, and reduce energy consumption of transportation vehicles to reduce pollution to the atmosphere. In addition, green transportation also advocates the society to use more environmentally friendly transportation tools. For example, reduce the use of fuel vehicles, and use electricity to start the car. At present, electric power launching ships that are being researched and developed all over the world are also planned to be put into practical use to reduce the pollution of shipping to the environment.

In general, it is difficult for clothing companies to involve green transportation. Or it is difficult to make any contribution to the development of green transportation.

Because companies must focus on their core competencies, they must give up on others. Just like green packaging, companies could choose better suppliers to cooperate and regularly evaluate their green performance. What's more, as garment companies, they could give their own suggestions or advices to help their suppliers to improve.

#### 4.3.6 Green consume

The biggest difference between green supply chains and green procurement is that green supply chains also includes consumers as part of the supply chain. Green consumption is also called sustainable consumption. It is mainly to guide consumers to consume non-polluting green products, avoid pollution to the environment during consumption, and resist products that are dangerous to the environment and ecology. The concept of green consumption promotes the environmental protection of other processes in the supply chain. Because more environmentally friendly companies will gain more consumers' favor.

#### 4.3.7 Recycle/ reverse logistics

The final stage of the product life cycle is green after-sales, which is green recycling. For example, Haier, a well-known home appliance brand, pays special attention to green recycling when building a green supply chain. Haier has established three recycling channels. First, the non-conforming products and testing machines produced in the production process are all handed over to a special recycling company which is a professional third-party enterprise to disassemble and process. This contributes to Haier's 100% recovery rate of non-conforming products. The second strategy is an online service platform on which customers could replace the old ones with new products. In addition to the home appliance industry, most of the current industry's green recycling methods are mainly based on old-for-new or recycled old products.



For example, Apple has also introduced a trade-in service, and even its recycling business covers other products that are not Apple's own products.

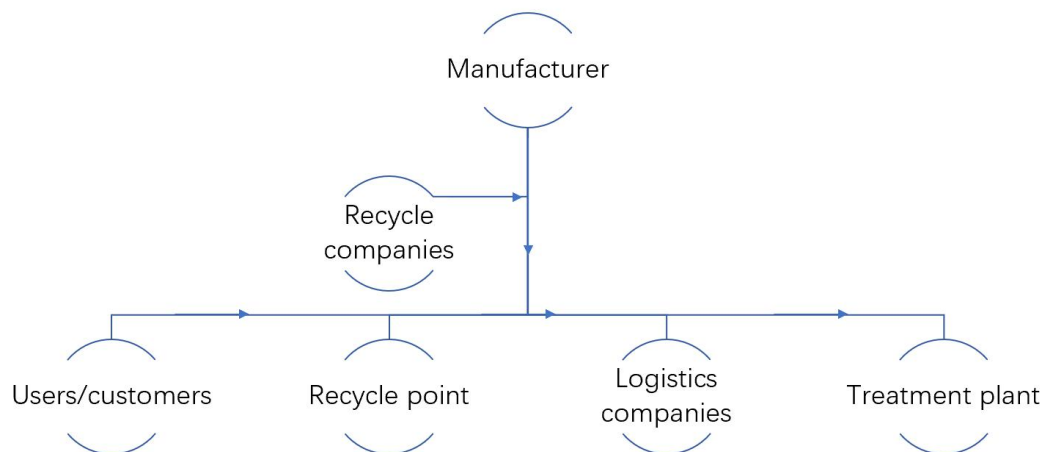
Green recycling is also a disposal of the final phase of the product's life cycle. Mainly for the recycling, recycling and recycling of product waste. It is of great significance to environmental protection and resource conservation and is an indispensable part of the green supply chain. When establishing a green supply chain, enterprises should choose the recycling method according to the characteristics of the organization and products.

The recycling methods of products mainly include: reducing resource use, reuse, re-manufacturing, renewable resources and waste disposal. Reducing resource use can be controlled in advance by the production organization. The main difference between reuse, re-manufacturing and renewable resources is the extent to which materials are reused. The use of the original physical structure of the product is generally maintained, and the replacement of the product material is rare. Re-manufacturing requires some disassembly and replacement of some accessories in order to make the performance of the product consistent with the new product. Renewable resources change the original physical or chemical structure. All these processes require processes and techniques. For example, disassembly techniques are important in the re-manufacturing process, and reuse processes require more cleaning processes. Therefore, when establishing a green supply chain, enterprises should select the treatment methods for recycling products according to the characteristics of the organization and products, in order to maximize the utilization of recycling resources and enterprise advantages.

In the process of developing green supply chain management, reverse logistics has gradually become a new concept in the public's sight. The main content and main body of reverse logistics are shown in the figure below. At first, reverse logistics is

defined as a movement of goods from a consumer towards a producer in a channel of distribution. Later in 1998, Stock said that reverse logistics involves the role of logistics in product returns, source reduction, recycling, materials substitution, reuse of materials, waste disposal and refurbishing and re-manufacturing. Hoek said in 1999 that greening can start right at the source with supply conditions and can work its way through storage and packaging practices to distribution and to end-consumer.

Figure 7. Reverse logistics structure



Source: <https://baike.baidu.com>

## Chapter 5 Challenges

### 5.1 Lack of financial motivation

We know that resource allocation improvement will reduce cost of materials and increase operational efficiency. But at the beginning of implementing a green supply

chain, companies may see a financial negative effect in short term. Because it takes extra money for companies to do recycle activities and waste water treatment. In addition, members, as business cooperators in the supply chain, usually do not trust others, which becomes an obstacle when implementing green supply chain management. Companies always want their partners to invest in green processes and thus they, as upstream and downstream companies could pay less and gain more.

Environmental standards and taxation systems are still incomplete. Environmental standards vary from country to country, especially China's environmental system is not perfect, and law enforcement supervision is unfavorable.

## **5.2 Low corporate awareness**

The concept of green supply chain management first appeared in the 1990s. Leading companies in many industries have paid a lot for green supply chains and sustainable development. However, for most companies, the green supply chain is still a very abstract and incomprehensible concept. The company's environmental awareness is very weak. They still pursue the maximization of economic benefits, while ignoring the environmental impact of business activities, the so-called environmental costs. Corporate culture and corporate awareness are inextricably linked. If the company's environmental awareness is not strong, then the culture of the company will naturally not pay attention to green development. If two companies cooperate, one wants the project to pay more attention to sustainable development, while the other party only pays attention to economic interests, then it is difficult for such two companies to cooperate.

## **5.3 Immature management systems**

In China, regulations and policies related to green supply chains are not perfect. There is no standardized regulation and guidance on how companies build green supply chains. Therefore, in the implementation of green supply chain management, the

management and supervision of enterprises is not mature. In general, the premise for companies to carry out this work is to establish a complete system. In addition to the policy, the government should also assign relevant management personnel and information management centers and other basic facilities to the management system.

#### **5.4 Imperfect incentive mechanism**

In general, energy-saving work often brings benefits to enterprises. In contrast, efforts to carry out pollution control and resource recycling generally increase expenditures. As energy efficiency levels increase, companies can share energy-saving benefits with third-party energy-saving service organizations. In the relevant green requirements, upstream enterprises' compliance with pollutant emissions and even high standards are often the focus of downstream enterprises. Of course, driven by economic interests, upstream companies will maintain relevant supply relationships with downstream companies to maintain stable supply relationships. These inputs will be reflected in the purchase price of raw materials or parts of downstream enterprises, and will be passed down through the supply chain at the first level, and finally reflected in the price of the end products. In the current situation that has not yet formed a green consumption atmosphere. In most cases, green products do not have large competitive advantage. In response, the state has adopted a series of measures to strengthen support for green supply chain management outstanding enterprises and the proposed green supply chain management enterprises. For example, in recent years, the green manufacturing system integration work carried out by the state has provided corresponding financial support for the excellent green supply chain management system construction enterprises. In other cases, the enterprises that have been included in the green supply chain management demonstration list of the Ministry of Industry and Information Technology, some provinces and municipalities will give certain Reward. However, enterprises that ultimately receive state financial support or incentives are, after all, a

few leading companies. Due to the lack of some stable and universal green financial policies, it is difficult to mobilize the enthusiasm of enterprises to participate in green supply chain management.

## **Chapter 6 Suggestions**

### **6.1 Strengthen government guidance**

The first priority is to establish a mature policy standard system. Considering the complexity of green supply chain management, it is recommended to introduce a special policy. And then it will be promoted to law, comprehensively guide and standardize this work. At the same time, improve the sub-industry standards, Effectively guide green supply chain management practices. The second is to strengthen policy publicity and corporate counseling. In order to improve corporate awareness, it is recommended to organize industry experts and representatives of outstanding enterprises to go deep into local and enterprises as soon as possible, carry out policy publicity and experience sharing, and continue to create an atmosphere to stimulate corporate enthusiasm. The third is to play the role of a third-party organization. Strengthen the guidance and support to third-party organizations such as industry associations and industry alliances, give full play to their role as bridges and ties, condense strength, strengthen coordination of government, industry, research and research, and comprehensively promote this work.

## **6.2 Improve reward system**

In order to promote more enterprises to participate in green supply chain management, it is necessary to further improve the incentive mechanism, especially the need for stable fiscal and taxation financial support policies. On the one hand, force from the supply side. It is recommended to give the corresponding economic incentives to green production enterprises, especially to increase tax credits and lower the threshold for green credit and green bond approval, so that enterprises can benefit from environmental protection work, so as to improve the supply level of green products. On the other hand, from the consumer side. Actively create a green consumption atmosphere, focusing on green products consumption to drive green procurement, and introduce a "Green Procurement Law" that leads the green procurement activities of various market entities. For government procurement, it is necessary to emphasize requirements and standardize procurement procedures for other types of entities. Purchasing focuses on guiding and motivating.

Compared with subsidies to consumers, government subsidies to manufacturers are more conducive to the development of green commodities. When the subsidy intensity is not large, the impact of price subsidies and cost subsidies on the production of green products is not much different, but with the increase of subsidy intensity, price subsidies can promote the establishment of green supply chains more effectively.

## **6.3 Leader role**

WWF research shows that there are about 1 billion producers in 15 commodities around the world, of which 300-500 supply chain companies control about 70% of the market. This work has been most effective in these leading manufacturing companies, large retailers, and large shopping platforms. To this end, we must focus on key

enterprises and rely on their industry influence to achieve maximum results in the shortest possible time. In view of the fact that China's green supply chain management practices are still immature, relevant laws and policies are still in the process of establishing and improving, and should not be fully rolled out in the short term. Therefore, it is recommended to concentrate efforts, integrate resources of all parties, and fully promote the participation of leading enterprises in this work to obtain Do more with less.

Government green procurement is another important way for the government to guide the construction of green supply chain. It has the demonstration effect of regulating the production structure of suppliers, enhancing the environmental awareness of enterprises, promoting the development of green development of domestic brand enterprises, and leading the concept of social green consumption.

In the future, through government procurement to promote the construction of green supply chain, it is necessary to further improve the objectives, implementation methods and supporting measures for the formulation of government procurement, incorporate some major public engineering projects into the procurement scope, and further exert the guidance and regulation functions of government procurement to promote green development; As a breakthrough, the company is the first to implement a green supply chain system in the manufacturing and e-commerce platform industries; to establish a government green procurement information sharing platform with the goal of improving the operational efficiency of the green procurement system and reducing information costs; Departure, improve the construction of the green supply chain indicator system; design and standardize the implementation steps of the government green procurement work.

#### **6.4 Standardization**

As a comprehensive technical support means and management means, standardization is the basic support for implementing green supply chain management, and is an important conversion link for transforming green development and green supply chain theory into actionable concrete actions. In the theoretical research level of the green supply chain standard system construction, the green supply chain standard system should be based on the life cycle thinking, considering the environmental factors and control requirements of the supply chain stakeholders at each stage of the product life cycle, with particular emphasis on the manufacturer organization and its supply. The chain of stakeholders agrees on environmental protection in terms of culture and business philosophy.

The construction of the green supply chain standardization system should follow the principles of clear objectives, comprehensive set, appropriate level, openness and scalability. Some scholars believe that the green supply chain standard architecture should include five parts, namely, green supplier selection, evaluation and control standards, green product standards, green design standards, clean production standards and green logistics standards.

## **6.5 Green supply chain finance**

Green supply chain finance is the product of the combination of green finance theory and supply chain theory, and the implementation of green supply chain management by financial means. Compared with traditional supply chain finance, green finance pays more attention to environmental protection in terms of financing requirements, so as to achieve the combination and coordination of economic production and environmental protection. In terms of the operation of financing mode, it emphasizes that the enterprises in the supply chain form a circular whole in terms of resource utilization, recycling and financing. In the aspect of bank auditing, more emphasis is placed on the review of the environmental licenses of manufacturing enterprises and



the evaluation certificates issued by the ecological and environmental protection administrative departments. The emergence of green supply chain finance is of great significance in solving the financing difficulties of SMEs and promoting the green transformation of SMEs and the whole society.

## **Chapter 7 Conclusion**

With the development of the times, sustainable development is the common goal of human society. Economic development must be based on sustainable development to make sense. To achieve sustainable development, we cannot limit our vision to reducing pollution to the environment and reducing emissions of harmful substances. A green supply chain is the best solution to solve problems at the source. As one of the largest industries in the world, the apparel industry contributes a lot to the economic development of the world. However, the apparel industry is rapidly developing at the expense of environmental pollution. Every year, a lot of water resources and land resources are used, and some are even wasted. At the same time, some poor-quality clothing even poses a threat to people's health. Therefore, the green supply chain construction of the apparel industry cannot be delayed. Based on the common green supply chain structure, this paper analyzes and adjusts the supply chain by analyzing the characteristics of the clothing industry. Through the research and analysis of this paper, the author hopes to propose a feasible and practical program for the development of green supply chain in the apparel industry. At the same time, the author also hopes that other research scholars can use this as an

inspiration to propose concrete analysis and interpretation of green supply chain construction in other industries, and contribute to the practice of sustainable development.

As a member of the society, enterprises must strive to overcome various obstacles, such as short-term economic benefits and limited technology, and actively build green supply chains. On the other hand, the national government plays a very important role in the development of the green supply chain. The government should introduce relevant laws and policies and a complete management system as soon as possible, and provide economic compensation for small and medium-sized enterprises such as small and medium-sized enterprises. At the same time, we must give full play to the leading ability of the leading industries in the industry and promote the sustainable development of small enterprises.

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