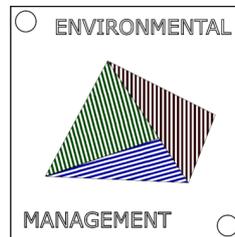


## GREEN SUPPLY CHAIN MANAGEMENT

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### ABSTRACT

*With the importance and priority of the protection of the environment and the sustainability of natural resources, businesses have to be environmentally sensitive in all their production processes and post-production activities, starting with their relations with suppliers. This sensitivity, which is considered as environmental management, was previously addressed with reactive approaches, forcing laws and regulations. Nowadays, the necessity of researching the economic benefit of this as well as reducing the damage to the environment has started to be addressed proactively. In this context, environmental management for businesses is accepted as a concept whose main goal is to minimize the impact on the environment and to provide sustainable competitive advantage. Green Supply Chain Management arising from the intersection of sustainability, environmental management and supply chains; It is a holistic and effective tool that enables businesses to balance their economic and environmental performances in terms of cost, speed and planning.*

*The purpose of study is to answer; why businesses should think "green" and what are the advantages/disadvantage of green supply chain management.*

**KEY WORDS:** Environment; Green; Supply Chain; Management

### 1.Introduction

Green supply chain management has emerged as an organizational philosophy that aims to reduce environmental risks and impacts while improving the ecological effectiveness of businesses and their partners and aiming to collaborate in profitability and market share (Zhu, 2007). Green supply chain management is becoming more and more important in the world. Environmental degradation such as decreasing raw material resources, filling of landfills and increasing pollution make green supply chain management an important competitive factor.

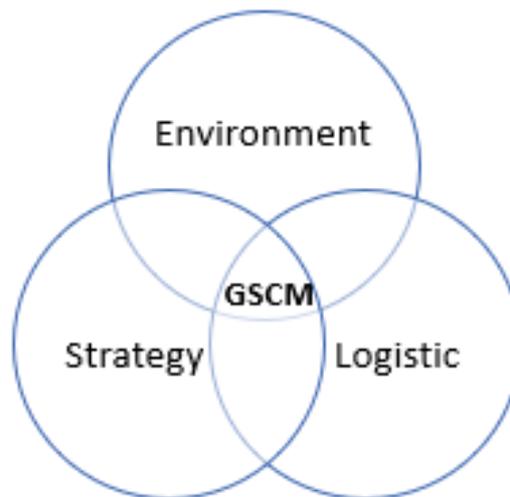
Green supply chain management covers (Srivastava, 2007) various topics such as distribution, consumption, re-consumption, production-related design, waste reduction, re-operation, renewal, recycling, re-production, reverse logistics, of products and services of enterprises. The green supply chain is the extended form of the traditional supply chain, which includes actions aimed at minimizing the environmental impact of the throughout product-life, such as product recycling or consumption, reduction of harmful substances, resource saving, green design.

The goal of the green supply chain is to improve both environmental and economic performance along the chain by creating long-term buyer-seller relationships, reducing or eliminating waste and adverse environmental impacts resulting from the recovery of used materials and disposal of products (Khorasani, 2018). In order to achieve sustainable economy and ecological competitive advantage, businesses can achieve the above-mentioned goals by improving their relations in the supply chain. It refers to the management plans and activities of suppliers integrated into the environmental management process. Adding green components to supply chain management stems from an environmentally conscious mindset or competition.

According to Yu, W., Chavez, R., Feng, M. and Wiengarten, F.; there are three dimensions in green supply chain management. Green supply chain management has been associated with logistics as it includes approaches such as procurement, material procurement, distribution, storage and recycling. In addition, since the main long-term purpose of green supply chain applications is to protect the environment, the strategy has been expressed as the interface of environment and logistics (Yu, 2014).

Three-dimensional of Green Supply Chain:

- Supply Chain, internal change materials, data etc. to improve. It is a design network that connects suppliers and customers.
- Environmental risk includes risks related to output waste, energy and environment.
- Management is the organization of business movements



*Figure 1: Dimensions of Green Supply Chain Management*

Green supply chain management is based on the green production and supply chain management of technologies that includes vendors, manufacturers, suppliers and users. The aim is to minimize environmental impact and use resources in the most efficient way.

There are 3 types of Green Supply (Min, 1997):

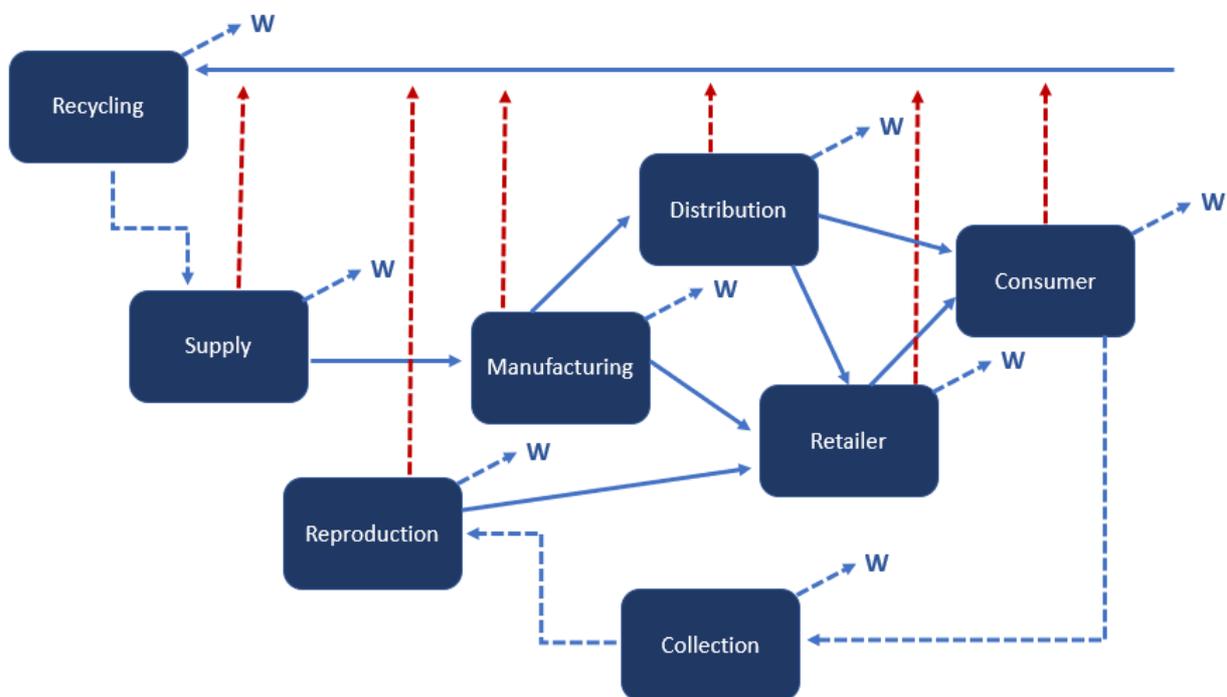
- 1) Recycling initiatives; It is a green procurement process that involves collaborating with suppliers to eliminate packaging, representing the adaptation of suppliers to management activities.
- 2) It is the management of supplier inputs and products such as packaging.
- 3) It is an advanced green supply that includes proactive approaches such as the participation of suppliers in clean technology programs and the use of environmental criteria in the performance evaluation and risk sharing of buyers.

The green supply chain controls the external processing of the business and focuses on logistics and packaging. While purchasing the materials required for production in the green supply chain, materials that cause the least harm to the environment should be preferred, the displacement of the purchased materials within the enterprise or their removal from outside the enterprise should be made within a certain plan and environmental impacts should be minimized. While the products are packaged, a small amount of packaging raw materials should be used and the packaging materials with less time to remain in nature should be preferred.

Green supply chain management includes the organizations that evaluate the necessary suppliers and the environmental performance of their suppliers to evaluate the costs of waste in systems and undertake the measurements that ensure the environmental quality of the products. However, green supply chain management practices have the potential to directly or indirectly reduce the

environmental impact of the final product of each enterprise in order to reduce the impact on the natural environment.

Figure 2. In accordance with the green supply chain management, an expanded supply chain structure is provided (Beamon, 1999). As it can be seen, the green supply chain starts with the extraction of raw materials and ends with the manufacturer, wholesaler, retailer and customer respectively. The chain includes re-consumption or recycling of the product. "W" in the figure symbolizes the waste materials generated at the end of the processes. The green supply chain includes vendors, producers, suppliers and users that maximize resource efficiency in utilization, transportation, storage, packaging material recovery for scrap in the process and aim to minimize the negative impact of scrap on the environment. It is a modern management model that basically addresses the supply chain theory and green production, extensively increasing resource efficiency and reducing environmental impact throughout the supply chain.

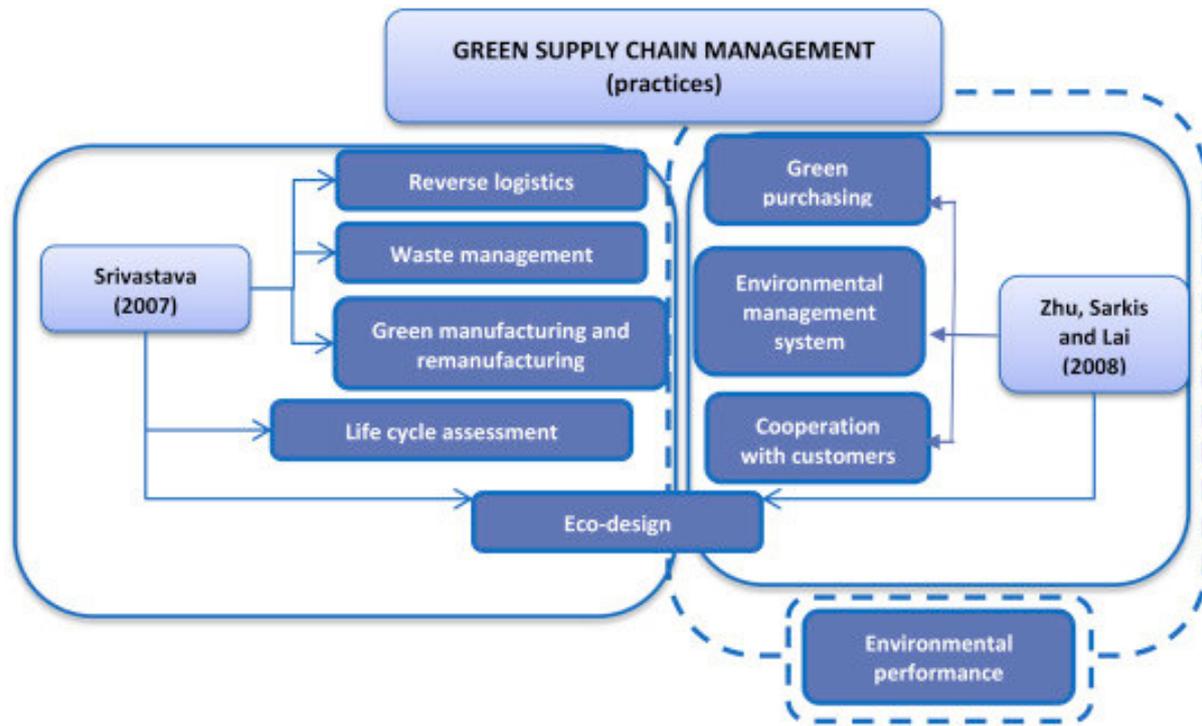


**Figure 2:** Comprehensive Green Supply Chain Model (Beamon, 1999)

It can be said that supply chain management is generally discussed under the heading of green design and green operations in the literature. While green design refers to environmentally friendly design, taking into account the life cycle assessment of the product or process; green operations are similarly used in reverse logistics and network design (collection, inspection / sorting, pre-processing), green production and remanufacturing (reduction, recycling, production planning and scheduling, inventory management, re-production, re-consumption, product and material reclaim). recovery and waste management (resource reduction, pollution prevention, disposal).

Many of the environmentally conscious practices, green design (marketing and engineering), green procurement practices (such as suppliers' certificates, environmental purchases of products and materials), total quality environmental management (internal performance measurements, pollution prevention), environmentally friendly packaging and transportation, It is expressed as reduction, re-consumption, re-production, recycling. Many of the organizational relationships can be expanded in this way. There may be several stages of this model, including suppliers and their chains as well as customers and their chains. Figure 3 graphically illustrates the green supply chain management

network of the reverse logistics and supply chain cycle, including materials that are reused, remanufactured and / or recycled into new materials or market values and other products. The purpose here is to reduce or eliminate waste (energy, emission, chemical / hazardous solid wastes).



**Figure 3: Green Supply Chain Management**(Scur, 2017)

## 2. History of the Green Supply Chain

In the period starting from the 1900s to the 1960s, logistics is not seen as a competitive advantage for businesses, but as basic physical distribution functions such as storage and transportation. In this period, enterprises did not pay enough attention to logistics, marketing, sales and production functions. They see it as a tactical activity that carries out activities such as inventory, transportation, storage, order processing. The fact that computers are not developed and widespread and the economic stagnation in the markets can be considered as the reasons for the underdevelopment of logistics(Murphy & Poist, 1996). Businesses have vertical organization structures in this period and the optimization of activities is completely focused on functions. Production systems also focus more on Material Requirements Planning (MRP).

After the Material Requirements Planning (MRP) system was introduced in the 1970s, managers have realized the importance of in-process work, production cost, quality, new product development and distribution lead times. During this period, enterprises established a central physical distribution division to carry out distribution activities related to marketing, production and financing, and they understood the necessity of unifying the logistics management of the whole system instead of optimizing the logistics of each activity separately. Thus, instead of reducing the cost of each process, the whole logistics services cost approach has been developed that addresses the cost of the whole system as a whole. As a result of this approach, storage, transportation and customer service levels were integrated and the physical distribution management phase, which is called the first step of supply chain management development, was passed.

In the 1980s, the concepts of competition and quality improvement have gained importance in the business world. During this period, enterprises turned to the applications of Just In Time (JIT) and Total Quality Management (TQM), which are two important management philosophies. Just in time production and supply chain management focuses on waste reduction and increasing operational

efficiency. In this period, enterprises pursue new concepts that can be used as competitive advantage, such as high quality, low price, short product development and launching time, more flexible and lean production processes, and creative and participatory workforces. In this new global competition environment, businesses attach importance to the integration of logistics functions that they did not attach much importance to before but understood that they could use it as a competitive advantage in this period (Murphy & Poist, 1996).

Since the early 1990s, businesses respond to the changes in the markets by using the new production capabilities developed by the enterprises cooperating in the supply channel and by expanding the integrated logistics functions. The effect of globalization, increasing expectations in service quality, partnerships, restructuring of businesses and the development of information communication technologies have pushed businesses to make significant changes. Third period of logistics management; It is based on the combination of internal logistics activities and strategies with the strategies of the business partners in the channel in order to increase customer service at the lowest cost. In the fourth period, which can be defined as a new competitive advantage, it is a matter of developing close relations with the channel partners rather than just a logistic merger.

While other periods in the development of supply chain management see logistics as the best internal strategic resource to apply to provide the resources needed to achieve marketing and sales goals; In the supply chain management era, logistics merger activities connect talents that can gain competitive advantage. This period has also been called the integrated supply chain management era. The green supply chain initially started with more managerial, less technical scope, logistics and purchasing. Later, reverse logistics in environmental focus has been integrated with logistics, marketing, transactions and purchasing (Zhu & Sarkis, 2004).

### 3. Components of Green Supply Chain

**Green Purchasing**; it is the integration of environmental issues into the purchasing process. Green purchasing activity is the most important activity in green supply chain management. Green purchasing is defined as choosing the material purchased from recyclable, reusable and environmentally friendly materials (Ceres Education, 2013).

**Green Production/Manufacturing**; also known as environmentally conscious production, is a process where there is little or no waste or pollution, high efficiency, and uses inputs with low environmental impact (European Commission, 2020). Green production provides opportunities for re-investment, cost reduction, higher quality, increasing productivity, technological innovations, profitability, and overall improving production processes. Thus, has a positive effect on business performance.

**Recycling** is the introduction of recyclable wastes such as paper-cardboard, metal, plastic, glass into the production process as secondary raw materials after physical and / or chemical processes. The main purpose of the recycling application is to reduce the need for waste area and pollution and to save energy costs (OECD, 2001).

**Reproduction** means the repair, remodeling or rebuilding of parts or equipment for the sale or internal use of reclaimed products. The remanufacturing process basically involves the disassembly of components, inspection and testing of renewable components, fusion with any new development, and reassembly of components with new systems (UK essays, 2018). After the product is assembled, it is tested, packaged and distributed as in the new product. The only advantage of remanufacturing is that, unlike reuse and recycling, the overall value of the materials used is not reduced.

**Reuse** is the repeated use of wastes until their economic life is completed in the same way without any processing other than collection and cleaning. Reuse is the process of collecting materials, products, and components from the production site and distributing and selling them as used. In the meantime, although the actual value of the product decreases, no additional processing is required (EPA, 2020).

**Reduction** is considered as a proactive process by businesses, can be explained as the reduction of the amount of hazardous wastes generated during production and processes or processed, accumulated and disposed of afterwards (EPA, 2020).

**Disassembly** serves to remove harmful substances from systems in order to minimize the amount of waste disposed of and reuse components and valuable raw materials in products (Habibi & Battaia,

2016). The main purpose of disassembly is to separate product specifications that allow a more efficient and faster recycling process.

**Eco design** also called as environmentally conscious design. It refers to the work carried out during product development that aims to minimize the environmental impact of the product during the entire life cycle from the use of materials for production to final disposal without comparing basic product criteria such as cost and performance(Iberdrola, 2020).

**Green marketing** can be defined as the marketing activities that include the production, pricing, distribution and promotion of nature-friendly products that will ensure that the consumers reach their goals while fulfilling their needs and desires(Thebalancesmb, 2020).

**Green logistics** measures and tries to minimize the negative impact of all activities on the environment by carrying out logistics activities with the least damage to the environment(Interlake, 2019).

**Reverse logistics** is also referred to as the process of recycling products and wastes in enterprises for disposal, recycling, reproduction, resale, reuse or disposal. Reverse logistics includes the transportation and stock management process of traditional logistics. However, it focuses on product recycling from customers rather than product movement for customers(Robinson, 2014).

**Waste management** consists of the disposal of a product or material that has reached its design, production or use purpose, and the control of wastes and measures taken to reduce the environmental damage caused by wastes.

**Eco label or green label** is a document showing that a product is environmentally(GEL, 2020). Eco-labeling is a tool that works for customers to understand the content of the product, which minimizes the negative effects of production methods and processes on the environment, increases the environmental quality and protects the environment, consumers as well as employees.

**Packaging** is the coating the products with a material that can be partially or completely disposable. Although they differ depending on the industry and size of the business packaging is an important issue for the supply chain.

The relationship between green supply chain management and environmental management systems has important implications for the environmental performance of the enterprise. Because when these are applied together, it increases environmental and economic performance of the businesses while creating sustainability between enterprises.

## **4. Analysis of Green Supply Chain Management Application**

### **4.1 Reasons of GSCM Application**

The aim of the green supply chain is to prevent various pollution caused by the products produced both during and after production at various stages of the supply chain. Businesses reduce their costs by reusing the materials contained in the recycled products. Secondly, they discard both legal and social liabilities that may come with environmental pollution(Stolze, Tate, & Murfield, 2010). While material recovery forms the basis of green supply chain management, it includes waste management and environmental awareness within itself. The main purpose of green supply chain management is to cause the least damage to the environment and to use natural resources in the most efficient way. This creates a good opportunity for businesses.

Sustainable development is an environmentalist world view that aims to ensure economic development without sacrificing the principle of using environmental values and natural resources with rational methods that do not cause wastefulness, taking into account the rights and interests of present and future generations. Sustainability minimizes waste, energy and natural resource usage. Businesses aiming at sustainable development also use green supply chain management indirectly.

Today, factors such as globalization, increasing competition, business ethics, environmentalism, laws, etc. have led the existing marketing managers in businesses to find solutions that can meet the demands of consumers, businesses and society. Green supply chain management can also be considered within this scope. Eco-efficiency, which is defined as "Making environmentally friendly production" by the European Commission, is in parallel with the objectives of green supply chain management in that it has an important place in environmental management with its activities such as

resource reduction, reuse and recovery (European Commission, 2020). Some businesses gain competitive advantage by increasing their environmental performance through environmental regulations in order to reduce the environmental impact of products and services and prevent customers' environmental concerns.

Business managements need to take into account the money they spend to control waste disposal and pollution, as well as the fines that can arise in the case of mismanagement of environmental issues, and the slowdown in business when trying to overcome the barriers imposed by legal obligations. Everything, big or small, that a business can do to avoid legal obligations will result in a reduction in costs. Considering environmental expenditures, businesses can easily find new, low-cost and fast ways of doing business. With the emergence of the green supply chain concept, it has been accepted by businesses that the generation of waste and pollution can be reduced. Creative green supply chain programs will help suppliers reduce their own risk.

Today, consumers are acting more and more with environmental protection awareness. Business owners and managers, who are more concerned with the environment, become increasingly environmentally friendly in order to improve their relations with the society. There may be various forces that encourage or force a business to implement green policies. The most important force that drives institutions to green practices is the state and its parallel laws. Customers increasingly make purchasing decisions by looking at whether the companies that offer their products and products to the market fulfill their environmental responsibilities. Therefore, businesses can strengthen their environmentally friendly image to attract more customers with green products.

## 4.2 Implementation of GSCM

The Environmental Protection Agency (EPA) stated that there are four basic processes for the implementation of a green supply chain. These stages can be listed as follows (EPA, 2000):

1-) **Cost Determination:** Systematic examination of a facility or process is done to determine whether and where significant environmental costs will occur.

2-) **Opportunity Determination:** At this stage, changes in functional areas and processes that reduce environmental impacts and provide significant cost savings are taken into consideration. Potential changes; The type of environmental barriers is assessed by criteria including barriers for change and the amount of potential costs incurred.

3-) **Benefits Calculation:** Calculation of benefits and costs of selected project groups as a result of their qualitative and quantitative analysis.

4-) **Application and Control Decision:** It is the evaluation of the teams from the beginning to the application. The ideal is to adapt and implement the green supply chain to best suit the business needs and culture.

### 4.2.1 Barriers for GSCM Implementation

Consumer's desire for low prices can hinder the implementation of green supply chain management. Green purchasing, costs and economic reasons are among the most important obstacles to green supply chain practices. Especially, the increase in transaction costs may turn into a negative effect on the financial performance of the business. Changing existing investments, information systems and old habits is difficult and costly (Lee, 2008). Process redesign may be required for manufacturing businesses. Existing plant, machinery and systems may not be suitable for new production and process. Not only in terms of investment, it takes a long time to install new systems, to adapt to the facility, to install or adjust new equipment. At the same time, businesses should also train employees to adapt to a new environment.

Green supply chain management requires communication with other departments and businesses, as it is not an application performed in only one department in a business. Top management support is essential for green supply chain management to adopt. A defined corporate purpose is important for businesses. Management at all levels should clearly state their strategies. Support from top managers facilitates the implementation of green supply chain management. Environmental effects may differ

depending on the legal regime in the country. New government policies and regulations are published periodically. Businesses that have followed the rules for many years have less trouble adopting green supply chain management.

Suppliers may not want to make changes as it requires a lot of investment. Moreover, information sharing is an important part of the practice and they do not want to share customer information, so they may not choose to cooperate with businesses. Suppliers do not want their competitors to receive the private information of their customers. Again, activities with high initial investment costs can be perceived as a threat as they will reduce investors' profits in the short term. Therefore, the persuasion of business management and investment groups is very important. Regulations, one of the green supply chain management factors, can sometimes be an obstacle. Environmental laws and regulations can prevent unreasonable time limits, best available techniques and innovations.

Customers may doubt the performance of the products, as environmentally friendly products cannot be produced with the raw materials used all the time. New raw materials or chemicals used in green products may be less efficient than harmful substances. Also, customers who are not interested in green products may prefer non-green products. Specially to improve their environmental performance, businesses may cut some raw material inputs or prefer products for green production that are their substitutes. This situation will cause disputes with the suppliers with whom the company has worked for years. Because suppliers working in a certain system may in some cases have to develop a new strategy to find or produce the product requested by the enterprise. Therefore, suppliers with whom a business is associated can both support and resist the implementation of green supply chain management. Since the investment and use of human resources are necessary in the implementation of green supply chain management, suppliers that are not closely related can also refuse an enterprise's green supply chain request.

It has been determined that businesses in different industries have different factors, barriers and applications. Not every supplier is capable of implementing the green supply chain. Many suppliers have lack of capital and resources, especially smaller ones. Since these suppliers do not have enough knowledge, resources and experience, they may be unwilling to implement green supply chain management. Lack of information is one of the biggest obstacles to green supply chain practices.

## Conclusion

Nowadays, businesses offer new and attractive products to the market in a very short time and consciously shorten the importance of the products, thus triggering consumption. However, they have to take into account the functional features of the products, which will prioritize customer satisfaction, as well as the elements from environmental consumers and legal obligations. They should also be able to do these at low costs and provide flexible, high quality and fast service to their customers. However, while doing all these, it is inevitable that they will encounter situations that conflict with each other from time to time. For example, an enterprise has to both consciously shorten the product life and increase product wastes, and plan to protect the environment, recycle these wastes to the economy or eliminate them with minimal damage. Similarly, while offering low cost durable products to its customers, it should ensure this strength and low cost by using environmentally friendly raw materials and materials. In addition, it should keep the sustainability of resources at the forefront by keeping the use of resources and energy to a minimum in all production and distribution activities. In short, enterprises are expected to plan their activities by taking into account the "green" element throughout the life, starting from the phase of the conversion of a product from raw materials, and to destroy the natural environment with the least damage if the products are restored to the economy or cannot be gained.

Emerging from the intersection of sustainability, environmental management and supply chains, "green supply chain management" is a holistic and effective tool that enables businesses to balance their economic and environmental performance in terms of cost, speed and planning in today's world where network competition is prevalent. With the green supply chain management, which is accepted as one of the proactive approaches in environmental management, businesses ensure that the product they produce with green purchasing, green production, environmentally friendly packaging and

transportation does not harm the environment during the lifetime, and they also contribute to the sustainability of resources with reverse logistics activities such as transformation.

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