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**Literature review: Analysing the development and the
framework of green supply chain.**

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Bsc – Logistics and Supply Chain Management

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1. Introduction

1.1. Background

Ecology is a hot topic of our time, and unquestionably one of the issues of the century. Rising temperatures and changes in biodiversity have brought the world's sustainability into imminent danger. The melting of ice, changes in animal habits, the evolution of plants, the changing seasons over the years... all these elements are questioning the world. Many researchers, academics, practitioners and scientists have come together to propose ways to preserve environmental sustainability. (Ming-Lang Tseng et al., 2019)

Human action on the planet, including unplanned and irresponsible actions by industries, are potential threats to sustainability (King and Lenox, 2000). This is why it is important to develop sustainable industry in our society, and this should be undertaken by nations and companies who should set more sustainable goals.

The supply chain and logistics in general is a sector that pollutes enormously, mainly due to transport and industry. That is why companies in the sector must go "green", i.e. they must integrate environmental actions into their processes.

Contrary to popular belief, the green supply chain does not prevent companies from growing, it contributes to it. In reality, it is rather a real competitive advantage and a strategic issue enabling companies to develop. (Alain bagnaoud, 2018)

1.2. Aims and objectives

The objective of this study is to analyse the development and current framework of the green supply chain.

The following objectives should have to be achieved:

- Describe the current state of art on the supply chain, the sustainable development and also the green supply chain management.
- Have a good understanding of the importance of sustainable development within companies today.
- Identify the important aspects related to the green supply chain, as well as these main practices.

2. Literature review

Introduction

The global supply chain has undergone enormous changes over the last 100 years. Every phase of the supply system, from production to transport, the way of doing business has changed. From the introduction of new handling procedures to the evolution of land, sea and air transport, and from containerisation to computerisation, global supply chains are both increasingly complex and increasingly efficient. (Blume global, 2015)

The rise of global supply chains and increased stakeholder awareness has led to an increased interest in sustainability, influenced by growing concern about climate change and resource depletion. As a result, companies need to move from a conventional business perspective to a more sustainable business model.

In recent years, the effects of human activity on the environment have become increasingly worrying.

Stakeholders are increasingly putting pressure on companies to take responsibility for any negative effects that their business activities may also cause. More and more researchers and scientists from all fields consider that adaptation to climate change will be the main economic, social and environmental challenge of the 21st century (Acteos, 2015). And this inevitably involves the implementation of innovative strategies to combat CO2 emissions and the development of a new way of managing companies.

The growing attention paid to greener solutions does not leave logistics out of the picture, as it plays a very important role, being one of the main sources of pollution and a user of resources. On a global scale, the transport sector accounts for 24% of global CO2 emissions. (Beth Howell, 2020, *Therecoexperts*)

The aim of this report is to see what the trends are in terms of sustainable logistics, in the different areas of this sector, but also to see what the next practices in this field could be.

First, I am going to talk about the history of the supply chain, the sustainable development and the green supply chain management, and analysing their evolutions over time. Then I will talk about green logistics operations, and finally I will talk about green logistics systems, analysing the best practices that allow us to respect the environment as much as possible.

2.1. Supply chain management

2.1.1. Defintion

Supply chain is a term that first appeared in 1958. Jay Wright Forrester had indeed evoked this concept without ever explicitly naming it. Jay Wright Forrester was American, and he is the founder of "systems dynamics", which deals with the simulation of the interactions between an organisation and its environment.

In none of his works, the term supply chain appears, even though it has been coined by the community, particularly the Anglo-Saxon community, as an essential theorist for this discipline. (Diego Viega et al., 2017, *Jay Wright Forrester*).

The term supply chain appeared a little later, in 1982, in an interview with Keith Olivier for Finantial time. Indeed, Keith Olivier was one of the first to talk about SCM and give a definition of it. He defined SCM as "the process of planning, implementing, and controlling the operations of the supply chain xith the purpose to seize customer requirements as efficiently as possible. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-in-origin to point-of-comsupton" (Kransdorff, 1982).

2.1.2. History and evolution

In order to fully understand the subject, it is important to be familiar with the history and evolution of logistics and supply chain. I have therefore decided to analyse its history and evolution chronologically.

Even if we can date logistics before the Second World War, it is during this period that it had a very important meaning. Indeed, military organisations needed efficient supply chains to manufacture military equipment and supplies as quickly as possible. Some like to think that it was the good logistics of the allies that won the war.

It was also during this period that the development of pallets, material handling and storage systems took place. The aim was to use storage space more efficiently and to optimise shelving and layout. (Abdelkebir Charkaoui, 2008)

Then, in the 1950s, the supply chain developed again, with the standardisation and introduction of containerisation. Indeed, containerisation was one of the inventions that revolutionised the supply chain. The fact that the maritime container is intermodal and is pulled by road on a truck, transported by rail or shipped abroad on a container ship, has made the transport and handling of these containers quick and easy. This has resulted in reduced costs, time and improved efficiency and profits. (Blume, 2020)

However, it was not until the 1960s that this became standard practice. The invention of containerisation was one of the main factors that made world trade cheaper and more efficient.

Between the 1960s and 1980s, there was a change in the means of transport of goods from distribution via rail to distribution on the road with trucks. At the same time, there was a change in handling equipment and pallets. (Vincent Criton, 2012)

Furthermore, it was during these years that computerisation became popular with the appearance of the first management information and forecasting systems. Computerisation brought greater precision and storage efficiency in the logistics and transport sector. At the same time, barcodes made it easier to read products, making it possible to abandon the manual entry of article numbers and product codes. (Vincent Criton, 2012)

In the 1980s and 1990s, there continued to be an improvement in efficiency and the development of globalization. In 1982, the term "Supply Chain Management" was coined, and information technology continued to make its way into the workplace, with the creation of new software, such as mapping, spreadsheets, route planning, which led to lower costs and improved margins, despite the investment this represented. It was also during these years that RFID chips appeared, which revolutionised the sector, allowing electronic tracking of products. (Blume, 2020)

Furthermore, during this period, air freight developed, bringing more general distribution and multiplying international trade.

Since the 2000s and up to the present day, we are in the midst of globalisation, with a continuous transformation of the Supply Chain, due in particular to the rise of Asian manufacturing industry, which has flooded the world market, making this region the world's leading supplier and exporter of goods.

With the advent of artificial intelligence, the development of machines, which are becoming more and more technical and efficient, forecasts are more accurate, cost and inventory management is better, leading to many productivity gains. The supply chain is evolving towards a more data-driven, networked and collaborative supply chain ecosystem that generates real value and growth for all participants. (Vincent Criton, 2012)

However, as the supply chain and the industry evolve, so does the world, and environmental issues are increasingly important and present. This is the major challenge facing companies in the sector, as consumers are increasingly curious about what they buy and increasingly want to consume in ethical and sustainable ways, respecting the environment and workers' rights.

2.2. Sustainable development

2.2.1. Definition and History

The term "sustainable development" was introduced at the World Commission on Environment and Development in 1987. The term appears officially in the report "Our Common Future" by Norwegian Prime Minister Gro Harlem Brundtland. (Coeur d'Essone, 2015)

Sustainable development means that "the needs of present generations must be met without compromising the ability of future generations to meet their own needs". It is a fundamental objective of the European Union, in order to achieve a dynamic economy, full employment, a high level of education, health protection, social and territorial cohesion and environmental protection in a peaceful and safe world, respecting cultural diversity. It calls for a change in the behaviour of everyone (citizens, businesses, local and regional authorities, governments, international institutions) in the face of the threats facing mankind and the planet (social inequalities, industrial and health risks, climate change, loss of biodiversity, etc.). (Solidarité Santé.gouv, 2019)

In 1992, at the Earth Summit in Rio de Janeiro, 178 countries adopted "Agenda 21", which sets out a programme of actions for the 21st century in a variety of areas in order to move towards development. Thus Agenda 21 lists more than 2,500 recommendations concerning health, pollution, water resource management and sanitation, waste management and many, many other subjects. (United nations, 1992)

Then, in 1997, the Kyoto Protocol set greenhouse gas emission reduction targets for industrialised countries for the period 2008-2012. It will enter into force in 2005. (INSEE, 2016)

In 2015, the Paris Agreement is implemented. Its objective is to limit global warming to a level well below 2, preferably 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature target, countries aim to reach the global peak in greenhouse gas emissions as soon as possible in order to achieve a climate-neutral world by the middle of the century. (United Nations, *Climate change*, 2020)

In order to understand the definition of sustainable development, we can make a diagram of it, with a link between the three dimensions of sustainable development which are the environment, the social and the economic.



Sustainable development scheme (*European Regional Development Fund*)

2.3. Green Supply Chain Management (GSCM)

2.3.1. Definition

The concept of GSCM is defined differently by all researchers, so it is difficult to give a single definition. But even if these definitions are different, many common terms are used between them, such as "environmental supply chain management", "green purchasing and procurement", "green logistics and environmental logistics" and "sustainable supply network management". (Ming-lang Tseng et al., 2018)

This is why we will see below the different definitions given by some specialists on the subject:

- Application of environmental management principles to all activities throughout the entire customer order cycle, including design, procurement, manufacturing and assembly, packaging, logistics and distribution. (Handfield et al., 1997)
- An important new archetype that enables companies to achieve their profit and market share objectives by reducing their environmental risks and impacts while increasing their environmental efficiency. (Zhu et al., 2005)
- Plans and activities of a purchasing organisation that integrate environmental issues into supply chain management in order to improve the environmental performance of suppliers and customers. (Lee and Klassen, 2008)
- An approach that aims to integrate environmental issues into the SC management process from product design, through material sourcing and selection, manufacturing processes, delivery of the final product and end-of-life management. (Wu and Pagell, 2011)

2.3.2. Important aspect

The GSCM, brings together a number of aspects and practices related to the framework that we will see below:

- Green purchasing, which aims to choose suppliers taking into account environmental criteria, or to put pressure on them to take environmental measures. It also aims to purchase raw materials in an environmentally friendly way. (Kannan et al., 2014)
- Green production, which aims to produce a minimum of waste and reduce environmental pollution, re-manufacture and produce in a leaner and cleaner way. In addition, improve capacity utilisation, reduce the cost of raw materials, increase production efficiency and improve their image. And in a green production approach, consider increasing the quantity of goods delivered on time, and not using hazardous or restricted materials during manufacturing while minimizing waste during production. (Tseng and chiu, 2012)
- Green warehousing, aims to reduce the level of stocks, to recover investments from surplus stocks/materials, but also to sell surplus capital goods. (Zhu et al., 2008)
- Green packaging, aims to use ecological, returnable, reused and recyclable packaging. (Gonzalez-Torre et al., 2004)
- Reverse logistics is a practice, with the objectives of recovering objects at the end of a company's life, reselling or reusing used parts or components, or reconditioning and refurbishing used parts or components. (Govindan et al., 2015)

2.4. Green Logistics Operations

2.4.1. Green purchasing

Green purchasing is an important factor in achieving a sustainable supply chain. If one had to define this process, it would be said to be "the practice of public authorities or private companies taking into account the environmental performance of products and processes of suppliers when purchasing products and services" (Mulder, 1998).

It is therefore with actions and purchasing policies implemented by companies that they choose their raw materials, suppliers, means of distribution, packaging, recycled products, the quantities and types of energy and resources used in the production of these materials, the cleanliness of manufacturing processes, with the aim of having the lowest environmental impact. (Zsidisin and Siferd, 2001).

Moreover, with the current consumer awareness, they are more careful about what they buy and they want products with a low ecological impact. This is therefore becoming a strategic choice. For companies because the growth potential is greater for companies that buy recycled products (Corzine & Jackson, 2006).

2.4.2. Green production

More than a fifth of CO₂'s worldwide emissions come from the manufacturing sector. Therefore, the companies concerned must approach the subject of greenhouse gas reduction with all the more determination, especially as legal regulations are becoming more and more demanding. (Destaco)

According to the United Nations Environment Programme, green production is defined as "the implementation of preventive environmental management strategies integrated into the

production process, eliminating risks to human health and environmental values and improving efficiency". The notion of producing goods and services with less waste has entered the business world as "green production" (Yücel & Ekmekçiler, 2008).

As Stuart Hart, Director of the Corporate Environmental Management Program at the University of Michigan, has said, "Green business strategies based on the principle of environmental sustainability can provide a critical foundation for competitive advantage in the decades to come". In addition to being focused on sustainability, green production is becoming a business strategy for companies.

2.5. Green logistics system

2.5.1. Green Transportation

Transport is a service within companies, which requires significant greening. Definitions of green transport are difficult to find, but it can be described as "A transport service that does not endanger public health or ecosystems, both in the short and long term, that minimises the impact on land use, and the users of the system pay the full social costs of the activity" (Dudow, 1998).

Transport is a very important logistical activity which, unfortunately, has a strong negative impact on the environment. Indeed, this sector is the largest emitter of greenhouse gases, and its impacts on the environment are numerous: air and water pollution, noise pollution, landscape modification and contribution to climate change. (Hélène, *Ekwateur*, 2020)

Trends indicate that, despite technological advances, the environmental impacts of transport will increase unless action is taken by governments, businesses and individuals. There is still a need to reduce the environmental impacts of certain modes of transport, such as road and air transport, and to promote more environmentally friendly transport options. The economy and society as a whole depend heavily on efficient road transport, with 44% of goods being transported by trucks and 85% of people by cars, buses or coaches. (Green Logistics manager, *LogInGreen Best Practices*, 2019)

In order to improve the situation, there are a number of practices that could enable the transport sector to reduce its impact in the future. In particular, in the area of urban transport. Indeed, we talk about "e-mobility", with the application in urban areas of different types of electric vehicles, which would allow the urban logistics sector to reduce its CO2 emissions but also to be economically viable. (Green Logistics manager, *LogInGreen Best Practices*, 2019) This is the case, for example, with the EMILIA project (Electric Mobility for Innovative Freight Logistics in Austria), a freight logistics project using bicycles and alternative fuel road trains as vehicles.

Other practices are possible, such as reducing road freight and promoting freight by inland waterway, sea or rail (Verdura, 2018), but also reducing the use of fossil fuels and increasing the use of alternative fuels.

2.5.2. Green Warehousing

Warehouses are important nodes in every supply chain and in almost every industry. Since 2010, many companies have had to expand or build new warehouses as a result of growth in the e-commerce and electronics sector. (Angel et al., 2006) However, these large spaces are rich in energy and in order for them to be sustainable, these energies must be well managed.

Warehousing activities contribute about 11% of the total greenhouse gas emissions generated by the logistics sector worldwide (Doherty and Hoyle, 2009). As a result, companies no longer focus only on operational and economic objectives, as today there are real environmental and social issues related to warehousing.

In order for a warehouse to be sustainable, it must meet several criteria. Firstly, a green warehouse must be energy efficient, i.e. heating, lighting, air changes and mechanical handling equipment must be managed in such a way that they do not pollute.

Then there is the introduction of renewable and green energy sources to reduce CO2 emissions. At a more advanced stage, it is possible to envisage that a sustainable warehouse is capable of generating its own energy from renewable sources such as solar panels, wind turbines and biomass. It is conceivable that in the coming years the majority of warehouses will use these practices. (Green Logistics manager, *LogInGreen Best Practices*, 2019)

2.5.3. Green Packaging

Green packaging, also known as "ecological packaging", is packaging that promotes human and animal health and the environment throughout its life cycle, using reusable or recycled materials made entirely from natural plant materials. (Büyükoçkan & Vardaloğlu, 2008)

Green packaging solutions often include biodegradable and recyclable materials in preference to materials such as plastic and polystyrene foam. In addition, green manufacturing processes take steps to reduce their energy production and reduce the amount of greenhouse gas emissions they produce. (Bulk Bag reclamation, 2019)

The biodegradable and recyclable materials used in ecological packaging can take different forms:

- Bioplastics, or plastics of plant origin
- Recycled paper and plastic
- Post-consumer products, such as recycled bulk bags

2.5.4. Reverse Logistics

According to the U.S. Executive Council on Reverse Logistics, reverse logistics is defined as "the process of planning, implementing and controlling the efficient and cost-effective flow of raw materials, work-in-process inventory, finished goods and related information from the point of consumption to the point of origin, with the goal of recovering value or disposing of them properly" (Rogers and Tibben-Lembke, 1998).

Reverse logistics is a process that attempts to recover end-of-life products in the most environmentally friendly way possible. This creates a situation where products are never thrown away, they are always transformed, leading us to closed-loop supply chains (CLSC).

This allows unsatisfied customers to return their products and get their money back, and it also allows companies to change product-related problems. Moreover, if a product is at the end of its life, companies recover it and appropriate processes are then implemented, such as repair, disassembly, remanufacturing, recycling and environmentally sound disposal (Soleimani and Kannan, 2015).

Reverse logistics, therefore, plays an important role in good environmental practices, and is even a strategic issue for companies.

Summary

Through this document, it has been possible to define the main aspects and practices that contribute to a greener and therefore more environmentally friendly supply chain. The research of this document has focused on a good understanding of the history of the supply chain and its evolution over the years, but also on a good understanding of sustainable development and green supply chain management. Indeed, thanks to a good understanding of the subject, I have been able to identify important aspects and practices in this sector, with different activities that each have a role to play in the development of a greener and more eco-responsible supply chain. Today, environmental issues are present and of concern to stakeholders in this sector, but we can already imagine that in the years to come, concerns will be increasingly present within companies.

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