

Literature review - Guillaume RICHARD

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Developing a more sustainable food supply chain

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1. Introduction

1.1. Background

The food supply chain is a succession of activities from different companies which work together to supply products at consumers. This chain could be short or longer according to the channel of distribution. The short-chain involves producers and retailers. Long-chain involves many parts to provide merchandises, it begins at the producers continue with wholesalers then carriers will transport products to retailers or supermarkets. These twice chains involve almost all peoples as providers, workers or consumers. In the European Union, the food supply chain represents 44 million workers for the delivery of products at 500 million customers (EC Europ, 2017).

The number of people involves in this chain shows the importance to have as much as possible a sustainable food supply chain for the population, the economy and the environment because everybody needs to feed. The sustainability is obtained with the development of three fields : the environment, the economy and the social.

The environment dimension is devoted to developing projects which respect the ecosystem in terms of carbon emission, noise and visual pollutions, therefore, do not cause damages to the environment (Emas, 2015).

The economic dimension refers to a development which allows to make benefits on durability and enable to earn a decent salary for every person as for certain farmers who earn not enough money to meet their needs (Emas, 2015).

The social dimension refers to the well-being of the population in terms of accommodation, health and nutrition, also it includes their rights and the reduction of inequalities (Emas, 2015).

Due to the natural needs of feed and all workers involve for her operations, the food supply chain must be the more sustainable as possible, to create a virtuous circle for the economy and give appropriate salary at each employee of this chain ; reduce the footprint impact for the protection of the worldwide environment.

“Food is responsible for approximately 26% of global GHG (greenhouse gas) emissions.”. And on this 26% of polluting emissions, 18% come from the supply chain (Rtichie, Roser, 2020).

Therefore, the purpose of this dissertation is to analyze how the food supply chain could more sustainable with the use of new technologies to get decrease of gas emissions, enhance social and economics results for companies and population.

1.2. Aims and objectives

The study aims to analyze how the food supply chain could be more sustainable using the application of new technologies, different operations and other processes.

The objectives of this dissertation are to°:

1. Describe the current relations between the food supply chain and the sustainability
2. Identify the impacts of pandemic Covid-19 on the food supply chain and on the sustainability
3. Examine how the supply chain can be more sustainable with new technologies and different process of distribution

1.3. Justification of the research

The food supply chain is a field that we ever needed for fed population and we will ever need. But the difference between the old food supply chain and the actual is the impact on the environment due to all chemical fertilizers, pesticides which destroy biodiversity, the transportation, the packaging and the storage. Also, the globalization has an impact with the transport due to the use of fossil energies which reject carbon in the atmosphere. Therefore, this dissertation will identify new processes and technologies to obtain a food supply chain more sustainable.

1.4. Overview of the research

Chapter 2

The second chapter defines the principals' notions of the topic dissertation, it describes the impacts of the Covid-19 pandemic on the supply chain and on the sustainability and finally, it sets out few types of technologies which increase the sustainability of the food supply chain.

Chapter 3

The third part defines the methods and approaches, data collection methods and the strategy used for this research work.

Chapter 4

The fourth chapter presents and analyzes the primary data collected obtained by the questionnaires and surveys.

Chapter 5

The last part of the dissertation is a conclusion of the aims and objectives according the topic, it answers to the question research. Also, it gives limitations of the study and a few ideas for further research.

2. Literature review

2.1. Introduction

This literature review will present and explain concepts of the sustainability and food logistics in order to achieve the first aim of the project that is providing an understand of the link between the food supply chain and sustainability.

Nowadays, the supply chain can be view as a huge succession of companies interconnected by the path of a product, which start with the material and creation of the product until the delivery to the customer. The globalization of trades enables to extend the supply chain of many companies (Meca, and Temmer, 2008). So a provider of raw marterial can be in Ghana, a factory in Vietnam for a product which will be sold in Spain.

At the beginning of the globalization, sustainability was not an important aspect for companies. But today, the customers are more and more eco-friendly therefore companies try to reduce their footprint impact with reorganizing their supply chain (maybe a change of provider, relocate a factory...) and with new technologies they can decrease their impacts on environment and be more efficient.

This first part of the dissertation will firstly define and describe the evolution of the food supply chain. Secondly, it will describe the positives or negatives impacts of the Covid-19 on the supply chain and on the environment. Thirdly, it will speak about the technologies which could help stakeholders of the food supply chain like producers, suppliers, carriers and sellers to obtain a chain more efficient and sustainable.

2.2. The food supply chain

2.2.1. Definition

“A supply chain consists of all parties directly or indirectly involved in the implementation of a customer’s request (Chopra and Meindl, 2007). ” (*Aghili, Sedghi, 2012*).

“Participants, including suppliers, manufacturers, warehouses, traders, transporters and even customers are connected by information, material and financial flows.” (*Aghili, and Sedghi, 2012*). The supply chain is a huge succession of actors who can be in different countries and

belong to the same company or subcontractors. The aim is to get a good product, at the right time, at the right place at a good price with well quality.

Companies can decentralize some operations at suppliers because they have not competencies in certain fields or it could be with the goal of decrease costs. According to each company strategy and agreements, firms share more or less information with collaborators to obtain well continuity and coordination. Optimize the supply chain with all parts enable to reduce out of stock, decrease costs, meet the demand in right time... (Meca and Temmer, 2008).

2.2.2. Evolution and history

Chastity Wilke who is vice president of National accounts at Storage solutions said “ Our early ancestors were self-sufficient and got their food by picking it from the ground, branches and vines or by killing it. In other words, they had to go out and find it. ” (Wilke, 2014).

At the beginning of the human race, people followed the environment to find food and drink. Since many centuries, people developed agriculture and arrived to be self-sufficient. Today, we have got supermarkets and do not have to move for foods. It describes two opposing circumstances, the first where humans move to find foods and the second where the foods move to humans.

The feed can make a long trip earlier than purchase by the consumer. It is possible through preservation technical which started to appear in Egypt with the dried food. Later, in the 19th century, the appearance of « canning and the development of better insulating materials » enhanced the preservation length and the transportation length, therefore, the distance between exporter and importer improved at the same time. Moreover, the appearance of electric refrigeration in 1930 improved the maintainance of freshness over a longer transport time (Wilke, 2014).

2.3. Sustainability

2.3.1. Definition

According to the Cambridge dictionary, sustainability is “ The quality of being able to continue over a period of time ”.

The Bruntland report defined in 1987 the sustainable development as : “ development that meets the needs of the present without compromising the ability of future generations to meet their own needs ” (Eur-Lex.eu, 2020). Sustainable development is based on three pillars : the environment, economic and societal. Governments and companies have to work on these pillars to create the most eco-friendly development as possible (Baker, 2006).

2.3.1. Evolution of the sustainability concept

Sustainability is very important for the preservation of the fauna and flora. The footprint impact increased since a century and one of the most important factors is the consumer society present in the developed countries. The realization and the importance of the impact on the environment are relatively recent compared to the appear of the human race.

The sustainability started to be analyzed in the 1970s with a report from the Massachusetts Institute of Technology which concluded : “ that, if present trends in population growth, food production, resource use and pollution continued, the carrying capacity of the planet would be exceeded within the next 100 years. ” (Baker, 2006). These conclusions were relayed with huge size in the Bruntland report in 1987. Today, we still heard about these possible results, it is one of the main issues of the twenty-first century therefore every person need to be involved (Baker, 2006).

2.4. Covid-19 impacts on the food supply chain

2.4.1. Operations

The pandemic of Covid-19 had an impact on the economic world and either in the food supply chain and for other products chain because many workers affected by the virus were not able to work and new legislations appeared to extend the social distancing. “The pandemic has upended the food and beverage industry, reducing its operational capacity in production, processing, packaging and distribution.” (Food engineering, 2021). For example, it created issues as lack of labour in the factory so it reduced the production flow therefore delivery time was not respected.

2.4.2. Footprint

Also, it creates an increase of plastic wastes in some countries like in Singapore where 1,470 tons were consumed with takeouts alone meal during the eight-week lockdown of this country (Food engineering, 2021).

The international food supply chain was stopped during few weeks by policies of countries in order to reduce virus transmission rate and for “food protectionist policies” to avoid lack of food and a possible famine in an extreme case. Closure of the bordures and reduction of transportation by train, aircraft and vessel caused wastes for perishable food which were not able to be shipped or because of waiting in warehouses (Food engineering, 2021).

At the same time, this stop or huge reducing of transportation had a good impact on the environment because it enables to decrease the carbon footprint at the level of 7,3% that is represent 886 million tons of carbon between January and March of 2020 compared to the same period in 2019 (Le monde, 2020).

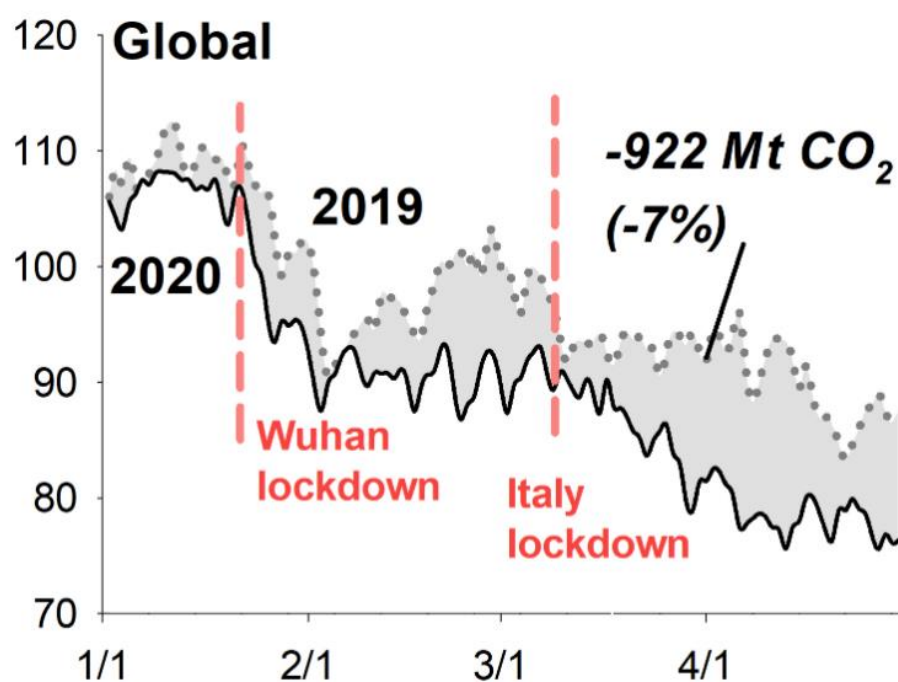


Figure 1- Graph of worldwide footprint impact between January and March 2020

2.5. New technologies for sustainable food supply chain

2.5.1. Internet of things

- Technologies for producers

Farmers obtain wastes when they harvest crops if they did not study their soils because they do not have the same need. This study of soils is important to determine the type of fertilizer and the quantity. To find the differences of composition, a laboratory will take samples of the field and will make analysis to obtain map which describes the differences between areas and recommend the use of fertilizer on each part. These accurate studies of geology enable to reduce the use of fertilizer because of a better location and identify areas for the spreading. Also, it will enable to enhance the harvest. Then, the use of a drone with specific cameras is in a project to determine easier than with samples where are areas which need fertilizer (Shacklett, 2018).

- Traceability

Good labelling and technologies which monitor in real time humidity, temperature and air pressure during the transport, help to reduce wastes and product recalls for a spoilt. If a dysfunction of the fresh environment occurs, it can be know and maintenance could be applied by the truck driver if he has skills, or an emergency solution can be found. For example, delivery in a closer store of fresh food. This kind of traceability enables to decrease the footprint impact of transportation for reverse logistics because of spoil products. Furthermore, the labelling can help customers to know the quality and the origin of the product (Shacklett, 2018).

2.5.2. Big data

- Food delivery

The last miles of customer delivery generate many pollutions because most of the time, it is made by truck with the petrol motor and there are only different destinations to deliver which are not optimized. The big data technology is a collection of data as the environment in real-time, customers details, roads and jams. These information will respect as much as possible the footprint impact because they enable to create an optimized circuit of delivery according to customer address and traffic in real-time (HBS EDU, 2017).

Thus, miles are reduced at a minimum so the cost for deliveries are decrease and the gas emission are reduced as much as possible. DHL was using an application name « Smart Truck » since 2010 which allows decreasing “The number of miles was reduced by 15%. Fuel consumption and CO2 also decreased remarkably.” (HBS EDU, 2017).

2.5.3. The cloud

- Share of information

“The efficiency of a SC depends on the ability of managing the flow of materials, information, and money. Managing this flow is supported by information system” (Turban, Rainer, an. Potter, 2004). The efficiency helps to obtain a more sustainable supply chain because it reduces errors and defects.

The French supermarket brand Carrefour, invested in 2019 on a collaborative cloud with his transporters and suppliers. “the defect of delivery rate passed with 8% at 4% on the supply of warehouses” (Lechat, 2020). This cloud enabled to reduce the lateness of deliveries and increase the compliance of orders. At the same time, reduce delivery errors decrease the carbon footprint because of the reduction of transportation (Stratégie logistique, 2020).

2.5.4. Robots for supply chain

Nowadays, there are a lot of robots in factories, use for production, transportation along the chain, the picking and for the packaging. There could be just one, for a task but in the huge companies all chain could be automated. The use of robots enables to reduce some wastes caused by human errors, because the machine is more accurate than people. “Elimination of damage to bags is another benefit associated with this robotic application” (Khan, Z.H., and al, 2018). Moreover, robots make repetitive task in the factory and allow to reduce accident for the workers because they will make less work on difficult tasks like carrying heavy parcels.

Technologies like transelevator exist and decrease significantly the risk of wastes due to the fall of pallets or merchandises through the precision of the machine. This type of storage does not require employees to move goods therefore it reduces risks of accident.

Furthermore, other robots can ferry and carry goods in a warehouse or storehouse like the “Fetch Robotics’ ” which “can carry payloads up to 1500kg”. These robots replace worker on

difficult tasks to carry the heavy load so it reduces musculoskeletal disorder. Robots are very useful during this time of pandemic where social distances need to be respected and they help to replace task made by employees. There is a growth of companies which use these technologies. One of the most famous is Amazon which invests a lot in new technologies to reduce costs, wastes and enhance delivery time (McGee, 2020).

2.6. Summary

This literature review, allows to understand the functioning of the food supply chain, gives the size of people involves in this chain. The necessity to improve the food chain was explained due to the perpetual need and the aim to obtain a more sustainable supply chain was shown. In the first part of the data collection, the sustainability and the food supply chain were defined moreover, the link between the sustainable development and this chain is highlight. In the second part, the impacts of the Covid-19 pandemic either positive and negative were described with different effects like the difficulties to keep continuity on the chain, the reduction of the gas emissions in the atmosphere. Finally, in the last part, the importance of the new technologies was explained with a few examples as the use of Internet of things, the cloud, or the appearance of robots in the supply. Furthermore, the positives aspects of sustainable development were shown through these examples. Nevertheless, more information could be collected and analyzed to find more answers to the dissertation and fulfil all aims and objectives of the topic.

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