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Identifying Strengths and Opportunities for Development in the Supply Chains of Plant-based FMCGs

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Bachelor's thesis
April 2020
Logistics Engineering
Degree Program in International Logistics

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jamk.fi

Author(s)	Type of publication	Date
Zamora Mesén, David	Bachelor's thesis	April 2020
		Language of publication: English
	Number of pages 79	Permission for web publication: x

Title of publication

Identifying Strengths and Opportunities for Development in Supply Chains of Plant-based FMCG

A study of Nordic food producers

Degree programme

Logistics Engineering

Supervisor(s)

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Assigned by

Shifting consumer behaviour towards food is having a significant impact globally. While there is an upward trend in consumption of plant-based food in western countries, increasing levels of affluence in developing countries are driving demand for meat and dairy at a much faster rate. There is compelling evidence of the detrimental effects of intensive livestock farming on the environment and on public health.

Nordic food producers have seen the environmental awareness of a small portion of the population as a business opportunity to develop innovative products that are appealing, convenient and sustainable. This research project investigated the growth of the plant-based market in Finland. As there is limited research on this novel industry, the main objective of the study was to gain insight into the situation of emerging businesses in the plant-based market.

A sample of small to medium-sized food producers from the Nordic countries participated in the implementation of the study. Qualitative research methods allowed to identify strengths, opportunities, and challenges in their supply chains. In addition, this study evaluated the effectiveness of a life cycle assessment as a method for continuous improvement.

Keywords/tags (subjects)

Miscellaneous (Confidential information) Confidential information must be marked clearly stating which appendixes are confidential and what the confidentiality is based on and how long the period of secrecy is. For example***: Appendixes 1, 4 and 7 are confidential and they have been removed from the public thesis. Grounds for secrecy: Act on the Openness of Government Activities 621/1999, Section 24, 17: business or professional secret. Period of secrecy is five years and it ends 18.5.2022.***

Contents

Figures

Tables

Terminology

CSR: Corporate social responsibility

GHG: Greenhouse gas

LCA: Life cycle assessment

MTS: Make to stock

MTO: Make to order

NPD: New product development

SCM: Supply chain management

SKU: Stock keeping unit

SME: Small and medium-sized enterprise

SRM: Supplier relationship management

S&R: Service, repair, replacement and spare

UVP: Unique value proposition

1 Introduction

1.1 Preface

The impact of private consumption is often belittled when discussing global challenges such as climate change mitigation. As consumers we have become disconnected with the implications of producing goods and services. Therefore, it is essential that we educate ourselves on the impact of the western lifestyle. According to Salo and Nissinen (2017), Seppälä, Mäenpää, Koskela, Mattila, Nissinen, Katajajuuri, Härmä, Korhonen, Saarinen and Virtanen (2009) found that domestic final consumption specifically, accounts for 68% of the greenhouse gas emissions in Finland. In addition to this, the Ministry of the Environment acknowledges that food consumption will account for an increasingly large share of GHG emissions as housing and transport will decrease through transitions towards low-carbon energy systems (Ministry of the Environment (Ympäristöministeri) 2017). Unfortunately, reinventing the energy sector is simply not enough to comply with the climate targets for the following decades (Vainikka 2018). The world population is projected to reach 9.8 billion by mid-century, and the fact that it is growing wealthier and more urbanized, will put a massive strain on the earth's resources and societies.

One effective solution to improve the environmental sustainability of food production systems, is to shift demand by encouraging consumers to incorporate more plant-based products in their diets through a wider offer of low-carbon products. In this age of developing technology, plant-based alternatives to food and materials are becoming cheaper and more productive by the year. Finland has seen some of the fastest developments in the world in terms of food innovation and new product development. There are plenty of benefits in utilizing crops that are cheap, nutritious and endemic to the region such as oats and pulses. Another prime example of Finnish innovation is the recent development of Solein®, a product that disconnects food production from agriculture entirely by creating protein from air and electricity through a unique bioprocess.

These innovations have a promising future, but at the same time, they face a series of challenges. This project investigated the corporate perspective of Nordic SMEs in the plant-based food market. Identifying strengths and challenges in their supply chains was hoped to lead to a better understanding of what measures should be taken in order to thrive in this growing industry.

1.2 Thesis Structure

This thesis analyzed the growth and diversification of the plant-based food market in Finland from the perspective of businesses and entrepreneurs. To achieve this, environmental, economic, and logistical aspects of food production in a global scale and domestically were reviewed. The study aimed to identify the benefits and shortcomings of plant-based supply chains by applying two different qualitative research approaches.

The study begins by presenting the context, identifying the problem, and introducing the research questions. Chapter 2 explains the theory behind the concepts used in the implementation of the project. Chapter 3 reviews the literature of three main theory themes:

- Agricultural production and environment
- Basic principles of economics and innovation
- Logistics of food supply chains

The scope of this project has not been studied in great detail before and because of that, there is very limited research on this topic for Finland specifically. Chapter 3 compiles theory and facts that were relevant for the study and that were eventually used to support the findings. Chapter 4 describes the implementation of the study by expanding on the methodology and presenting the results. Chapters 5 and 6 contain the discussion of the results and the conclusion respectively.

1.3 Context

Life has never been as comfortable as it is in the present day. Globalization and developing technology have given us access to food, shelter, medicine, and transportation in a way like no previous generation has ever seen. Yet many of us ignore the impact that our daily choices have on the environment, and even worse, many ignore the severity of the climate catastrophe that we face in the direction to which we are going. According to Salo and Nissinen (2017), Seppälä and colleagues (2009) agree that consumption is a deciding factor in climate change mitigation and households' domestic final consumption specifically accounts for 68% of the greenhouse gas emissions in Finland. The remaining 32% comes from government consumption and investments. This means that there is great potential to mitigate climate change through modifying consumption patterns alone.

The plant-based market is surging around the world, but it has seen important growth particularly across the western countries. Finland has not been an exception and the country's innovative nature has led to a boost in new product development. The proliferation of plant-based food products in Finland over the last few years reveals some important facts:

1- Growth in flexitarian diets has stimulated manufacturers and entrepreneurs to innovate in response to demand.
2- Consumers, especially young and middle-aged, are modifying their consumption habits due to increased awareness of the climate impact of foods.
3- Health conscious consumers have incorporated plant-based whole foods and processed foods.

Paradoxically, increased levels of affluence among the population are also supporting steady consumption levels of animal protein. These discrepancy in consumption trends exemplifies the social and cultural intricacies of food consumption. Weckroth (2018) identified the barriers against and drivers for change towards a plant-based

diet among Finnish consumers. According to the study by Weckroth (2018), material-related barriers focus on the availability and quality of plant-based food products. Image-related barriers focus on the perceptions of meat and plant-based foods and the nutritional aspects associated with the consumption of a specific diet. Skill-related barriers were the lack of knowledge on plant-based cooking.

There has been considerable research that links animal agriculture to environmental degradation, squander of resources and early mortality. Furthermore, animal products are the most inefficient ways to feed humans when considering the input of resources versus their caloric supply to the average person (Poore & Nemecek, 2018). Almost three quarters (72.2%) of livestock units in the EU-28 were reared on very large farms in 2013 according to Eurostat (2016, qtd. in Greenpeace European Unit., 2019). This number is expected to grow as intensive animal farming is more productive than traditional methods of rearing. However, livestock products still have the largest impact out of any food group and just through emissions alone, they amounted to 12–17% of total EU-28 GHG emissions in 2007 (Bellarby, Tirado, Leip, Weiss, Lesschen, & Smith 2013). The expansion of intensive animal farming in Europe and around the world poses a series of risks not only to the natural environment but to public health as well. Several EU health authorities (ECDC, EFSA and EMA) have emphasized on the importance of responsible use of antimicrobial agents which are used primarily in livestock farms with their high densities of confined animals. In 2014 the number of antimicrobial agents used in EU-28 livestock animals more than doubled the use in humans according to a 2017 report (European Centre for Disease Prevention and Control, European Food Safety Authority and European Medicines Agency 2017).

As a result, several companies around the world have built their core business around the production of sustainable food products derived from plants that act as alternatives to people interested in a more sustainable consumption. At the same time, the increment in the number of health-conscious consumers has further increased demand for plant-based food products. The position of the Academy of Nutrition and Dietetics and the British Dietetics Association is that an appropriately planned plant-based diet is healthful, nutritionally adequate, and it may provide

health benefits for the prevention and treatment of the main fatal diseases in western societies: hearth disease, type 2 diabetes, hypertension and certain types of cancer (Melina, Craig, & Levin 2016). The study continues by stating that these diets are appropriate for all stages of life, including pregnancy, lactation, infancy, adulthood and for athletes (ibid.).

Plant-based staples, such as legumes, whole grains, seeds and nuts are some of the cheapest, and most readily available products in most countries around the world. Trends suggest increased interest in consuming whole foods but a major rise in the popularity of processed plant foods. For instance, the Los Angeles-based producer of plant-based meat substitutes, Beyond Meat, was one of the first brands to be featured in the headlines of global news reporters. Beyond Meat, which is listed in the Nasdaq, was the best performing stock of 2019 after it surged by 500% in the same year (Lucas 2019). It had the best performing initial public offering of 2019 and one of the best of all time. This is, indeed, an incredible accomplishment for a business that was founded in 2009. Beyond Meat has now expanded its product range, and it can now be found in many establishments in over 50 countries around the world (ibid.). While the exploding price of their stocks in 2019 does not guarantee long-term success given the competitive landscape in the food industry and the low margin nature of the business, it is certain that plant-based food is no longer a niche, but a growing trend that will continue to consolidate in years to come.

1.4 Objectives

This study looked for answers the following questions about plant-based innovations and food processing in the supply chains of a sample group of Nordic SMEs:

- What value proposition do Nordic plant-based food producers offer to consumers in the Finnish market?
- What are the main strengths and challenges in logistics for Nordic producers of plant-based FMCGs?

- What solutions are being implemented by firms and entrepreneurs in the industry to develop their supply chains?

The research focused on sustainability and profitability through added value of plant-based food products in Finland. Besides seeking answers to the research questions, this study also looked to promote more sustainable consumption patterns by presenting factual evidence on the supply chain implications of different product categories. The study included a select group of Nordic companies of different sizes in the business of plant-based fast-moving consumer goods. Through qualitative research methods, this study aimed to compile information and recommendations for entrepreneurs to increase the success rate of future business endeavors.

1.5 Research Boundaries

The scope of the study was Nordic small and medium-sized enterprises that develop plant-based food products. Fast-moving consumer goods are preferred by many due to their practicality and convenience. The market for plant-based products of the FMCG category is experiencing unprecedented growth in many western countries. The research dived into the environmental and logistical aspects of producing plant-based FMCGs in the Nordic countries, primarily by Finnish and Swedish producers.

2 Methodology

2.1 Types of Research

This research studied the relationship between innovation and corporate social responsibility by looking into the logistical, environmental, and economic aspects of food production. Quantitative research attempts to specify the relationship between interrelated variables through numerical means (Labaree 2020). This study reviews data and figures from Finnish and foreign institutions such as:

- Statistics Finland (The national statistical institution of Finland)
- LUKE (Luonnonvarakeskus, Natural Resources Institute of Finland)
- The Food and Agriculture Organization of the United Nations (FAO)
- The Intergovernmental Panel on Climate Change (IPCC)

Quantitative research has advantages, such as accuracy, forecasting ability and control, but it fails to factor in the complexity of human behavior. This study indirectly addressed the sensory experience of consumers, and therefore, subjectivity could interfere with the results when drawing conclusions based on numbers alone. While quantitative research, based on the sources mentioned above, is examined in the theoretical framework and is later used in the discussion, a qualitative approach was preferred.

Creswell (Creswell & Poth 2018) explains qualitative research in the following way: *"Qualitative research begins with the assumptions and the use of interpretive/theoretical frameworks that inform the study of research problem addressing the meaning individuals or groups ascribe to a social or human problem"* (p.7). Qualitative research allows to increase overall understanding of the quality, characteristics and meanings of a research topic, as it answers the why and how of a specific phenomenon.

Three key elements that define the qualitative research according to Labaree (2020), are:

1. Naturalistic: Study of real-world situations as they unfold naturally from an unbiased perspective.
2. Emergent: Acceptance of adapting inquiry as understanding deepens. Flexibility to study new paths as they emerge in the research.
3. Purposeful: Objects of study (e.g. people, organization, event) are selected based on relevance and ability to provide important information.

With this in mind, this project complied with the three elements presented by Labaree (2020). In terms of qualitative approaches, Creswell and Poth (2018, 10) outline five approaches to qualitative research: ethnography, narrative, phenomenological, ground theory and case study. Two of these approaches were of special interest to this project, the phenomenological and caste study.

- *Phenomenological research is primarily used to study areas where there is little prior knowledge and it focuses on commonality of a lived experience within a selected group. In order to analyze a phenomenon, this approach explores the experiences and perceptions of the selected group. A phenomenological study uses a combination of methods such as conducting interviews, reading documents, watching videos or visiting places and events.* (Sauro 2015)

- *A case study is an in-depth examination of a study subject (the case), in a predefined context. The focus of a case study can be an organization, entity, individual or event. Data can be collected through interviews, documents, reports or observation.* (ibid.)

From the qualitative approaches selected, several qualitative methods were implemented in the study. The next section explains each of the approaches and the steps taken.

2.2 Description of the phenomenological study

The phenomenological study featured a selected phenomenon and a roster of organizations that participated in the study. The subjects were selected based on relevance (see 3. Purposeful), availability and willingness to cooperate. The organizations were studied, and their supply chains were briefly described. A member of the organization then participated in an unstructured interview. At the end of the interview, the participant was asked to answer a survey presented in a tablet device. The input of the interview was then merged with the answers of the survey for further analysis. The findings are presented in the Results section.

2.3 Description of the case study

The case was selected based on a relevant, real-life story of one of the companies in the sample. The company applied a method to evaluate the performance of their supply chain. The case was narrated, and some key points were highlighted. A member of the organization then participated in an interview to include the perspective of the sustainability department. Finally, the story was presented in an interactive format. This study reviewed the solution implemented by the company.

3 Theoretical Framework

3.1 Agricultural production and Environment

3.1.1 The role of agriculture in anthropogenic climate change

According to an assessment carried out by Supran and Oreskes (2017) from the department of the History of Science at Harvard University, scientists hired by Exxon in 1980 provided ground-breaking evidence that burning fossil fuels would influence the climate as carbon dioxide is released into the atmosphere causing a green-house effect. Two years later, scientists came back with even more compelling evidence of the consequences of fossil fuel extraction and burning such as a warming climate, sea level rise and draughts. Despite the internal assessments carried out by their own scientists and a call to majorly reduce fossil fuel combustion, fossil fuel companies ignored recommendations such as diversifying the energy sector to renewable energy and instead focused on growing the business (ibid, 15). These companies deceived the public by creating doubt and scepticism around climate change.

Almost 40 years later, the planet faces unprecedented changes in global temperature. A large portion of the population is not aware of the devastating effects of climate change if no action is taken. As Neil deGrasse Tyson, astrophysicist and science communicator, pointed out during a CNN interview in September of 2017, *"for an emergent scientific finding to become an objective truth, it requires a whole system of people's research all leaning in the same direction and all pointing to the same consequences".* There is an overwhelming scientific consensus that human activity is a direct contributor to climate change.

Some studies have placed the consensus percentage as high as 97% of the scientific community. Cook, Nuccitelli, Green, Richardson, Winkler, Painting, Way, Jacobs and Skuce (2013) examined over eleven thousand climate change studies between 1991 and 2011 and quantified that 32.6% of the studies explicitly endorsed anthropogenic global warming while only 0.7% rejected the idea. The largest portion of the studies

did not express an explicit position regarding the link between human activity and climate change. Nonetheless, when the authors were asked to rate their own papers, the amount of studies endorsing anthropogenic global warming grew to 97.2%. (See Figure 1).

Position	% of all abstracts	% among abstracts with AGW position (%)	% of all authors	% among authors with AGW position (%)
Endorse AGW	32.6% (3896)	97.1	34.8% (10 188)	98.4
No AGW position	66.4% (7930)	—	64.6% (18 930)	—
Reject AGW	0.7% (78)	1.9	0.4% (124)	1.2
Uncertain on AGW	0.3% (40)	1.0	0.2% (44)	0.4

Figure 1. Abstract ratings for each level of endorsement, shown as percentage and total number of papers (Cook et al. 2013).

The position regarding anthropogenic global warming has gained much more support since 2011. This matches the conclusions drawn by Cook and colleagues (2013) stating that papers rejecting consensus have decreased to a negligible degree. This provides reassurance that anthropogenic global warming is not only real but also the greatest existential threat in the present time.

Through establishing the association between human activity and climate change, it is important to address the pretence notion that climate reacts to drivers of change at a moment in time and that at this particular time humans just happen to be the main driver. Lacis, Schmidt, Rind and Ruedy (2010) explain how noncondensing greenhouse gases, such as CO_2, N_2O, CH_4 and CFCs, amount to a quarter of the total terrestrial greenhouse effect. These gases help stabilize temperature by keeping a delicate balance with atmospheric water vapor and clouds. At almost 150 million kilometres from the sun, the earth should be frozen solid at an average temperature of -18°C without any possibility for complex life to survive. Without these noncondensing gases, the balance would collapse and plunge the globe into an icebound earth state When the balance changes in the opposite direction with rapid increases in carbon emissions, the result is global warming. Climate has changed before through changes in global temperature, and scientists have associated those changes in global temperature with increased carbon dioxide release (ibid.). This rate of increase in atmospheric carbon dioxide is unprecedented and since the 1950's its

release has exploded. Figure 2 illustrates the increase in atmospheric carbon dioxide by region. Concentrations of carbon dioxide now exceed the natural range of the last two million years by 25%, of methane by 120% and of nitrous oxide by 9% per cent (IPCC 2007 a: 447).

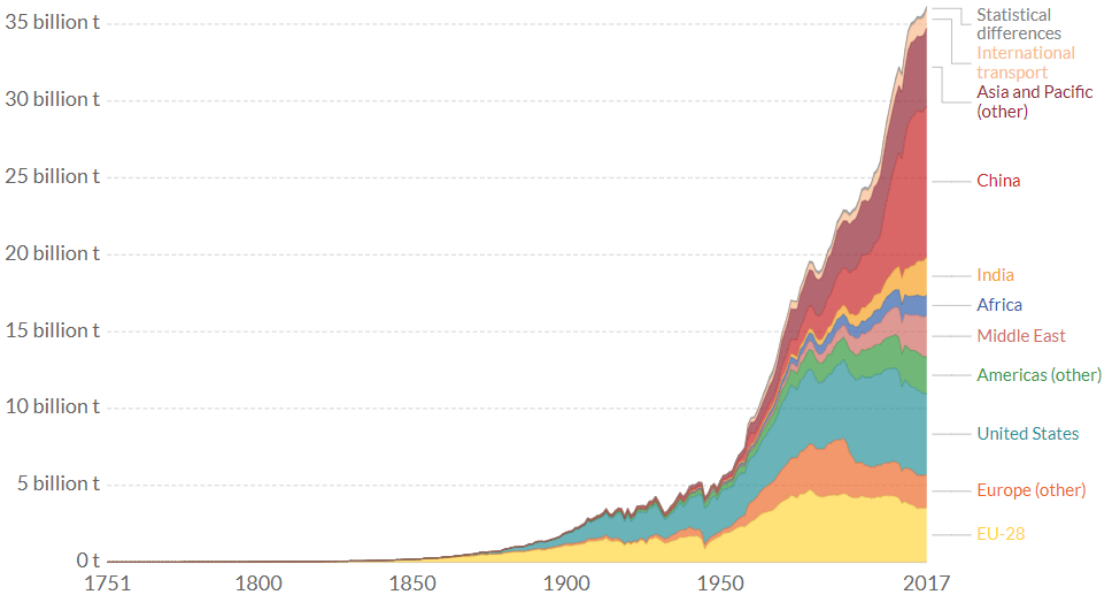


Figure 2. Annual total CO2 emissions by world region. Source: Carbon Dioxide Information Analysis Center (CDIAC): Global Carbon Project (GCP)

Methane has the second highest impact out of the greenhouse gases after carbon dioxide and it remains in the atmosphere for about 12 years (Clark 2012). Methane has a shorter atmospheric lifetime but a stronger warming potential than carbon dioxide (Saunois, Jackson, Poulter & Canadell 2016). Even though the concentration of methane in the atmosphere is some 200 times lower than that of carbon dioxide, methane is 34 times stronger and more destructive as a heat-trapping gas over a 100-year period (Dean 2018). The IPCC has deemed this 100-year timescale as obsolete and misleading as it is easier to underestimate the impact of methane emissions in the future. For this reason, methane is now understood to have a global warming potential of 84 to 105 over a 20-year period according to a Greenpeace report (Stone n.d.). This means that the during the first two decades of methane release, it will have between 84 to 105 times more power than carbon dioxide to destabilize the climate. The role of methane in global warming can be understood through the methane in the global carbon cycle. Methane is produced by natural

systems as well as by human activity, the latter being known as anthropogenic methane emissions. Scientists estimate anthropogenic methane emissions to be 60% of the total methane emissions (Saunois et al. 2016). At 1.4 billion cattle currently in the world, livestock supply chains are responsible for 44% of the methane from human activity (FAO, 2013).

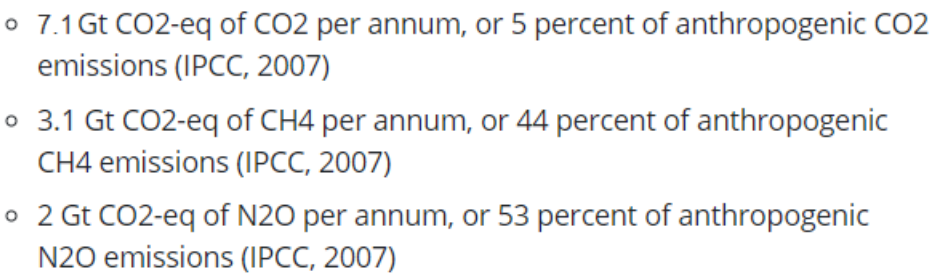


Figure 3. Livestock emissions as a percentage of total anthropogenic GHG (FAO, 2013).

Methane is produced by livestock through a process known as enteric fermentation but also through manure waste (Haque 2018). Enteric fermentation is a digestive process that happens in the animal's rumen, where microorganisms breakdown carbohydrates to be processed into smaller molecules that can be absorbed by the bloodstream for energy (ibid.). Animal agriculture accounted for 12-17% of the EU's greenhouse gas emissions in 2007 (Bellarby et al., 2013). On a global scale, livestock is responsible for 14.5% of all anthropogenic GHG emissions (Gerber, Steinfeld, Henderson, Mottet, Opio, Dijkman, Falcucci, & Tempio 2013, 14). This figure has been compared to the 14% GHG emissions of the transport sector that includes all cars, trucks, ships and planes combined (Intergovernmental Panel on Climate Change 2015). Figure 4 displays the GHG emissions by economic sector according to the Intergovernmental Panel on Climate Change. Agriculture, forestry and other land use accounts for one quarter of direct global emissions, while transportation represents 14%.

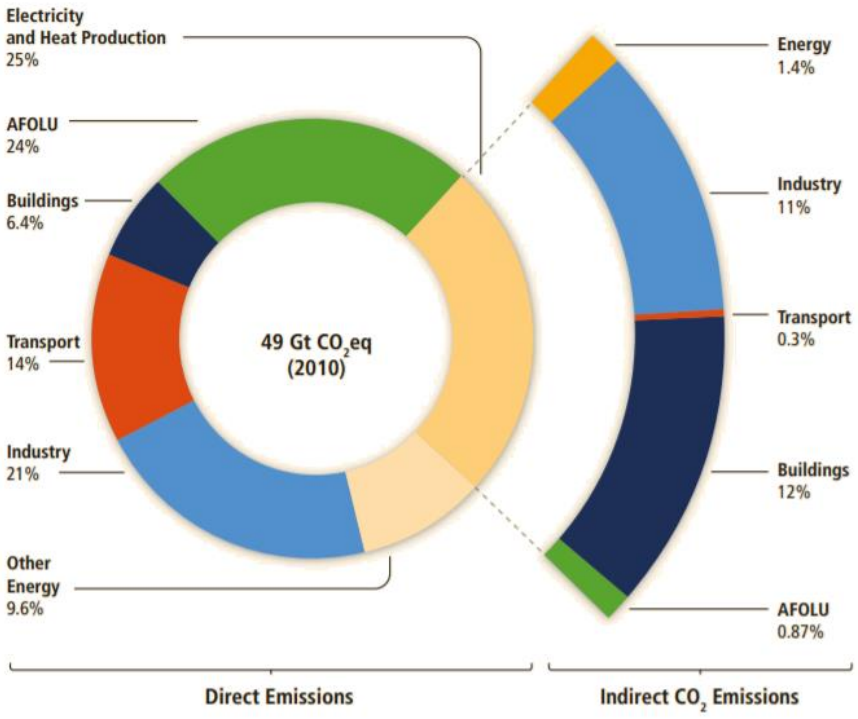


Figure 4. Greenhouse has emissions by economic sector (Intergovernmental Panel on Climate Change 2015)

Critics of this comparison have pointed out that transportation and livestock cannot be compared because different methods were used to calculate emissions for each case. The FAO's calculations for livestock were drawn through a life-cycle assessment, but in the case of the transport sector in the IPCC study, only fossil fuel combustion was considered. While this is a valid observation, it is important to note that the same analysis cannot be applied to the transport sector as its complexity would not return an accurate value for CO_2 eq. According to the IPCC's report on climate change (2015), both sectors have mitigation pathways for climate change.

Understanding the primary sources of anthropogenic GHG emissions is crucial to curb the rise of global average temperature. Figure 5 shoes the by graphing yearly global average temperatures, several reputable institutes and agencies around the world concur that the earth's average temperature has risen by 1°C throughout the 20th.

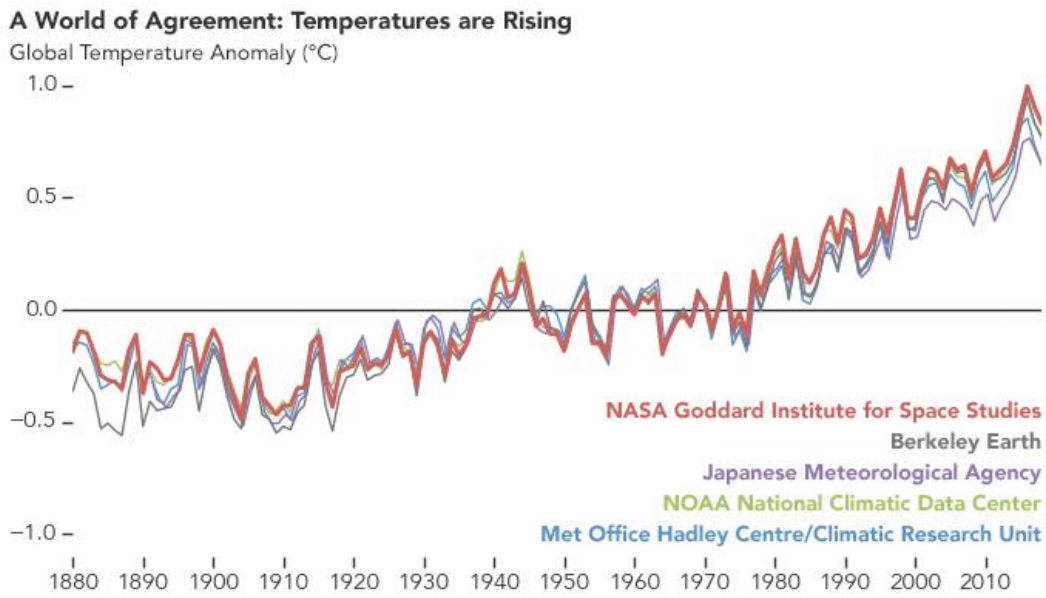


Figure 5. Records on rise of global average temperature 20th century

NASA's website article "The effects of climate change" (2019) relates this small but significant increase in average temperature to phenomena in nature, such as loss of sea ice, accelerated sea level rise affecting coastal communities and more intense heat waves. Each phenomenon brings its own series of effects such as the droughts that facilitated the 2018 California wildfire season which was the deadliest, most destructive wildfire season ever recorded in California (Shugerman 2018). More recently, the devastating Australian bushfire season began in September 2019, and spanned over 107,000 square kilometers of burned area by January of 2020. (Chiwaya, Wu, & Muccari 2020). The key factors to the severity and extension of the wildfires were attributed to record-breaking heat and record-breaking drought, direct effects of climate change. While bushfires are common in Australia, the post-apocalyptic intensity of the latest bushfires was unprecedented. However, this level of intensity and destruction was predicted more than a decade ago in a report published in 2008 in The Garnaut Climate Change review by Ross Garnaut. In respect to bushfires, Garnaut (2008) suggests that fire seasons would begin earlier, end slightly later and generally be more intense. "The effect increases over time, but should be directly observable by 2020". (ibid.)

The rising temperature of the planet should be a cause for concern to all. The effects of climate change will exacerbate over the following years. This will impact agricultural yield worldwide and will lead to an overall deterioration of ecosystems and the environment.

3.1.2 Freshwater use in agriculture

The daily drinking-water requirement per person is 2 – 4 liters. However, it takes 2000 - 5000 liters of water to produce a person's daily food (High Level Expert Forum 2009). According to an article published by the United Nations Food and Agriculture Organization (Pluschke, Unver, DeSouza, & Mansur 2016), agriculture accounts for 70% of global freshwater withdrawals and up to 95% in developing countries. Although numbers vary throughout the world depending of the agricultural conditions, meat and dairy production alone accounts for 27% of freshwater consumption (Hoekstra & Mekonnen 2012). Freshwater scarcity will become an issue in agriculture with a growing population projected to reach 9.6 billion by 2050, as demand for food is expected to grow by 50% (High Level Expert Forum 2009). As countries become wealthier and more urbanized, dietary choices and habits are shifting towards so called "high-value" products such as meat, dairy, fruits and vegetables; products that require large amounts of freshwater. Hoekstra and Mekonnen (2012) carried out a study on the water footprint of humanity which is the third global assessment of quantified national water footprint and is one of the most comprehensive studies of its kind. The methodology categorized water footprint in 3 classes: rainwater (green), ground and surface water (blue) and volumes of polluted water (gray). The study assessed the water footprint of different products.

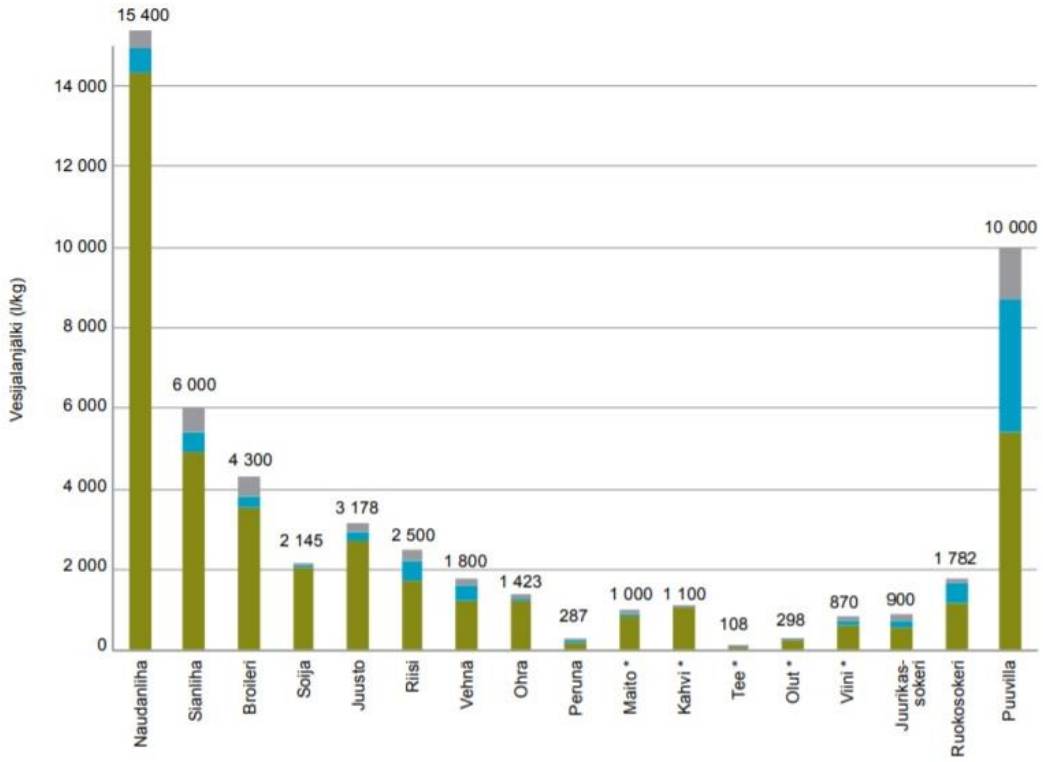


Figure 6. Water footprint of consumables in (Hoekstra & Mekonnen 2012)

Figure 6 displays some of the main findings by Hoekstra and Mekonnen (2012), the findings reveal an overwhelming disparity in the freshwater requirements for animal derived products as compared to plant foods. A similar situation is observed in Finland when evaluating the water footprint of different product categories.

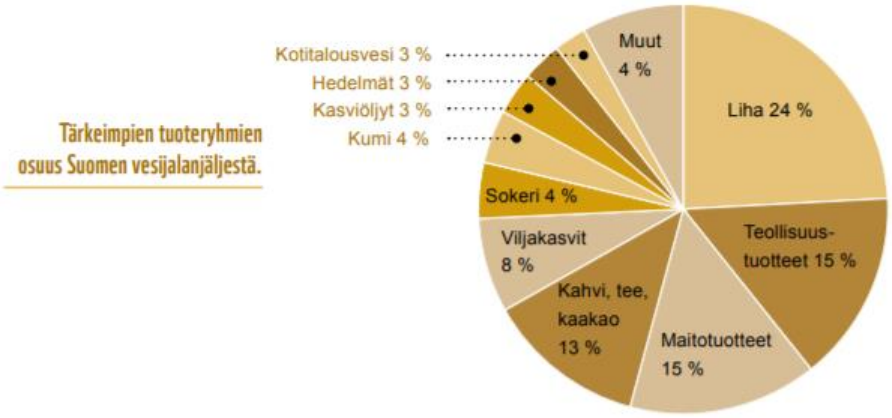


Figure 7. Finland's water footprint by product category (Hoekstra & Mekonnenn 2012)

Webster & D'Silva (2010) argue that food-related water footprint of a consumer in an industrialized country can be reduced by 36% by shifting from an average meat-based diet to a more plant-based diet according to calculations. Hoekstra and Mekonnen (2012) also evaluated differences in countries that have significantly externalized their water footprint. As they point out, governments look for ways to satisfy water users without questioning the total amount of water demands. For instance, when countries engage in trade of water-intensive products, importers often disregard water depletion or pollution in the producing country. According to a report published by WWF Finland on water footprint (Nikula 2012), 47% of Finland's water footprint is found abroad. While there is a relative abundance of fresh water in Finland, nearly half of the water needed to produce all goods and services consumed in the country comes from abroad. Nikula (2012), head of WWF's Ecological Footprint Program and author of the report concludes that "meat and dairy products are the biggest individual contributors to the country's water footprint".

Sarni and Grant (2018) suggest that there is recent evidence of corporate awareness for water issues especially in logistics and supply chain management. Sarni and Grant (2018) state that in a European context, food authorities in the UK created the Water Stewardship Working group back in 2012 with the sole purpose of running workshops to research the impact of water scarcity and its inherent risk for business. Even though preliminary findings were convincing enough to further investigate the issue, the group concluded that there weren't enough financial and legislative drivers for the industry to cooperate by managing risks. In Finland, one of the most significant developments for water risk management was the implementation of the Finnish Water Stewardship Commitment in March of 2017 (Sojamo, Wessman-Jääskeläinen, Usva, & Nikula 2018). This commitment is composed of 5 steps that try to address 7 of the sustainable development goals of the United Nations. Figure 9 displays the 5 steps surrounding the 7 of the UN's sustainable development goals.

Figure 8. The five steps of Finnish Water Stewardship Commitment (Sojamo et al. 2018)

This commitment has been welcomed by Finnish authorities and companies. Leading companies such as Fazer, Finlayson, Sinebrychoff and UPM of different industries have embraced the water stewardship commitment and though they are sometimes constrained due to limited resources and attention focused on other climate issues, management of freshwater consumption is rising to become one of the most important points of discussion (ibid.).

3.1.3 Management of agricultural land

Vainikka (2018) argues that, from a technical standpoint, carbon neutrality can be achieved by reinventing the energy sector gradually as it produces eighty per cent of anthropogenic carbon emissions. However, Vainikka (2018) emphasizes on the fact that a reinvent of the energy sector is simply not enough to comply with the Paris Agreement targets or with the recommendations of the Intergovernmental Panel on Climate Change. This means that there must be a change in the way food is produced because between one fifth and one quarter of human caused GHG emissions comes

from the agriculture sector. For Finland's goal to reach carbon neutrality by 2035, changes in food production systems must also be implemented (ibid.). According to the United Nations' Food and Agriculture Organization statistics (Gerber et al., 2013), half of all habitable land on earth is dedicated to agriculture and the current agricultural system threatens to exhaust the fertile land that remains. Even more surprisingly, 77% of all the land used for agriculture is exclusively for livestock.

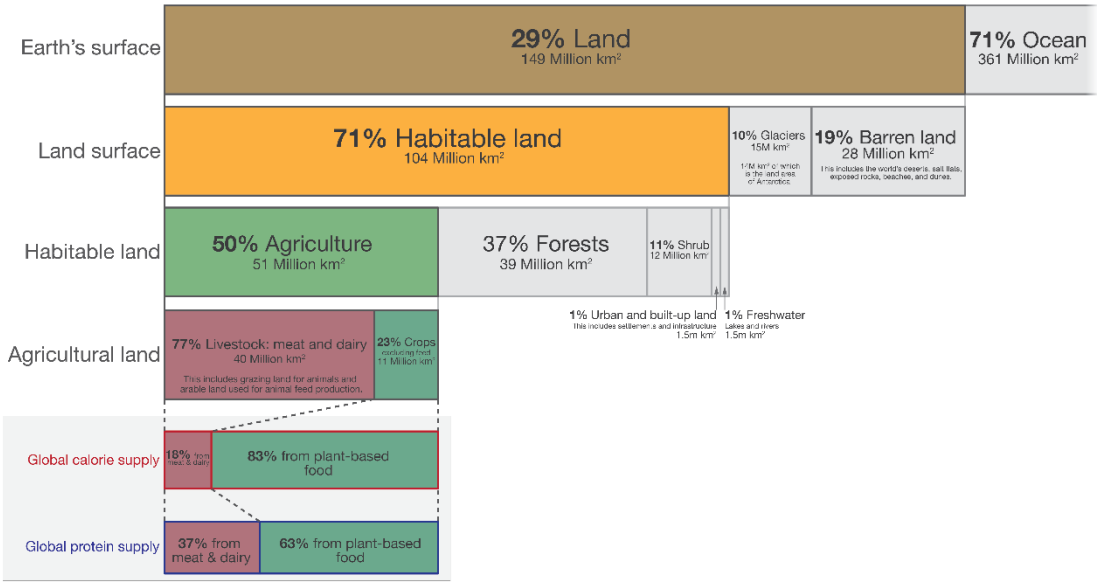


Figure 9. Global land use for food production (FAO)

Yet paradoxically, animal products only contribute 18% of the caloric supply of global food consumption (Poore & Nemecek 2018). A greater cause for concern is that feeding a world population of 9.6 billion people by mid-century would require raising overall food production by between 50% - 70% between 2005 and 2050 as reported by the projections of the Food and Agriculture Organization of the United Nations (High Level Expert Forum 2009). Development trends such as urbanization and increased wealth in developing countries will lead to major challenges for food security and productivity of agricultural systems. Finland's geography differs greatly to other parts of the world and even to European geography. Forest cover is more extensive that in any other European country as three quarters or 76% of the land is covered by forest ("State of Finland's Forests 2012: Finnish Forests in European

context demonstrated with selected indicators", 2012). Agricultural land extends 22750 km^2, which corresponds to 6.8% of the total surface area or 7.5% of the total land area, which is small by comparison to the EU average.

Agricultural land is required either for grazing or to grow fodder and crops to feed livestock and humans. Research found that 71% of EU farmland was used to feed livestock in 2017 (Greenpeace European Unit 2019, p.13). The research also concludes that 63% of arable land in Europe is dedicated exclusively to grow crops for livestock (ibid, 14). The Natural Resource Institute Finland claims that Finland's self-sufficiency regarding protein feeds in only 15% as the country relies on imported rapeseed-based feed and soybeans from Brazil and the United States for the most part ("*Animal Feeds and Feedings*" Luonnonvarakeskus). However, according to an article by Yle News "Agriculture minister: Finnish animal feed to be soy-free by 2025" (2019), soy only makes up a small percentage of animal feed. The minister of agriculture and forestry J. Leppä, calls for a complete halt of imported soybeans by 2025. Soybeans in animal feed would be replaced by increasing domestic production of fava beans by 4% of agricultural land (ibid.). These are very ambitious plans considering the livestock sector is already the largest user or grain in Finland. According to information by the Finnish cereal committee (Vilja-alan yhteistyöryhmä 2014), over the 2012-2013 time period, 67% of the crop yield was used as livestock feed while 15% was used for food for human consumption.

3.1.4 The situation of domestic final consumption

In Finland, housing is the single largest source of consumption-related emissions, followed by food consumption and transport (Ministry of the Environment 2017, 101). However, because emissions from housing and transport will decrease through transitions towards low-carbon energy systems, food consumption will account for an increasingly large share of GHG emissions (ibid.). Figure 11 shows a small reduction in emissions from housing and somewhat constant emissions for food and transport.

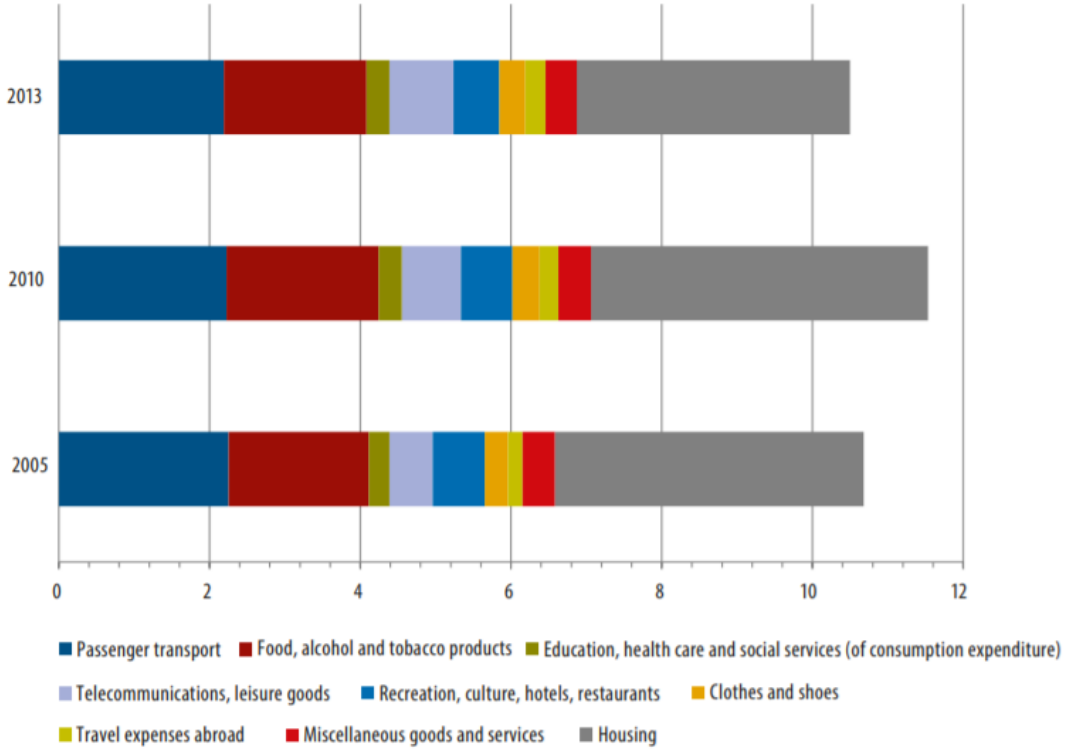


Figure 10. Consumption-related GHG emissions in Finland (Ministry of the Environment 2017, 101)

Salo and Nissinen (2017) point out that the per capita carbon footprint of food in Finland is of 1.8 tonnes per year. Up to a 50% decrease is possible through flexitarian diets with vegan diets having the least impact at 0.7 tonnes of CO_2e per year (Salo & Nissinen 2017, 18). From this same report by the Finnish Environment institute, the conclusions state that avoiding meat and dairy and incorporating mostly plant foods, is the single most effective measure to reduce personal consumption footprint on a day-to-day basis (ibid. 18). Even though evidence on emission levels is conclusive, disagreements at a political level remain. An article from Helsinki Times (Teivainen 2019) exposes disagreements in the government after the release of a report on land use and climate change by the IPCC. E. Kari, chairperson of the Green Parliamentary Group, emphasized in press release about the importance of changing food production to become more sustainable and direct government subsidies to increase the volume of plant-based food production. Meat and dairy producers defend their industry, but at the same time feature prominently among the top recipients of

government subsidies to stay in business (Maatalousministeri sai 116 000 euroa maa-taloustukia – yhteensä tukia maksettiin noin 2 miljardia [The Minister of Agriculture received 116,000 euros in agricultural subsidies - a total of about 2 billion subsidies were paid] 2019).

Poore and Nemecek (2018) compiled data covering five environmental indicators from 38 000 farm, 1600 processors, packaging types and retailers from around the world. Their research is the most comprehensive peer-reviewed study of its kind on the global impacts of food production. Findings show that impact can vary 50-fold among producers of the same product and most strikingly, impacts of the lowest-impact animal products exceed those of vegetable substitutes. The findings provide evidence of the benefits of dietary changes towards a plant-based diets (Poore & Nemecek 2018). Additionally, animal products have the highest-associated GHG emissions, land use, freshwater consumption as well as the highest potential for eutrophication and ocean acidification.

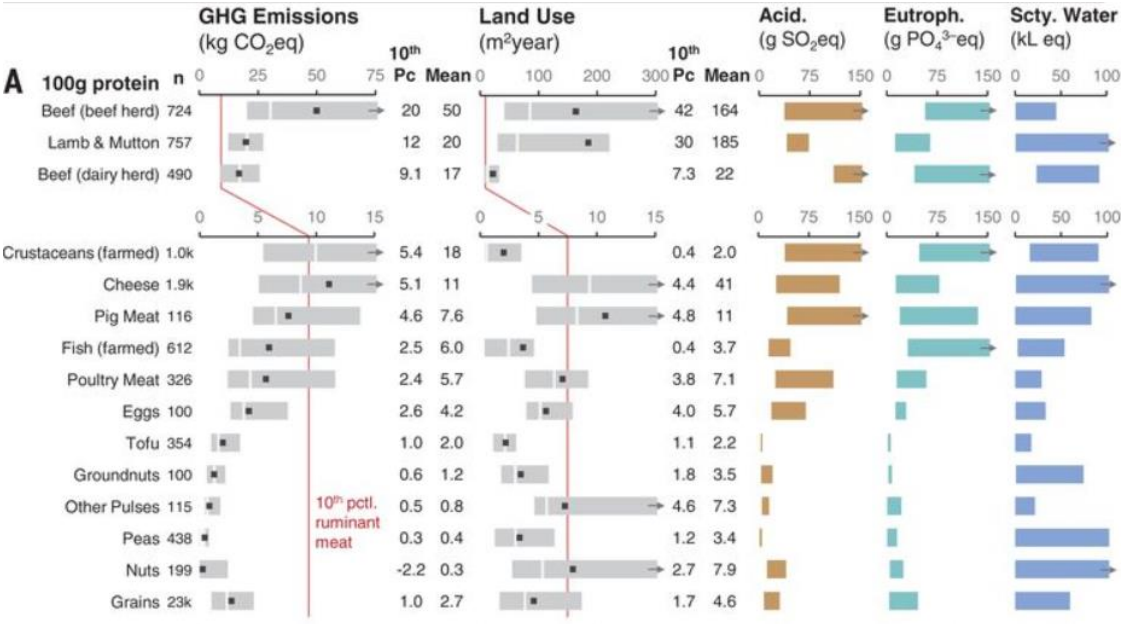


Figure 11. Esimated global variation in GHG emissions, land use, terrestrial acidification, eutrophication and scarcity-weighted freshwater withdrawals (Poore & Nemecek 2018)

The figure above summarizes the findings by Poore and Nemecek (2018) for the five indicators in the study. From the study, comparisons between dairy milk and other

commonly consumed non-dairy alternatives are shown in figure 13. These comparisons will be useful for the implementation of the project.

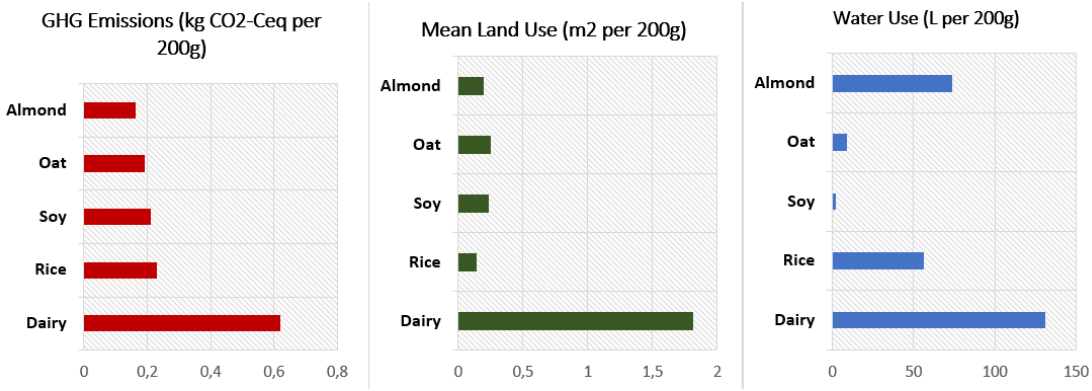


Figure 12. Comparison of dairy and alternatives by impact and use of resources (Poore & Nemecek 2018)

3.2 Basic principles of economics and innovation

3.2.1 Supply and demand model applied to food commodities

A competitive market is a market in which there are many buyers and sellers of the same merchandise or service (Krugman, Wells, & Graddy 2014, 70). The key characteristic of a competitive market is that no individual actions have a noticable effect on the price at which a product or service is sold. This is true for most foodstuff products as in the industry of FMCG (fast moving consumer goods), the wide range of options available to consumers make it so that in most cases, brands are not able to influence the price at which a specific food group is sold. Exceptions to this generalization are cases in which a limited number of brands has an overwhelming share of the market. For example, Coca-Cola and Pepsi own the vast majority of the marketshare of cola softdrinks.

Moving consumer goods are goods that are sold and replenished very quickly and purchased constantly by consumers (Kenton 2019). Their popularity is related to

their practicality and convenience. Some examples of foodstuff FMCGs are processed foods, prepared meals, beverages, baked goods, frozen goods and produce. FMCGs differ between the consumer's perspective and the producer's perspective.
From the consumer's perspective, FMCGs are purchased frequently, have low costs, short shelf life and a rapid consumption. For producers FMCGs represent high volume production, low contribution margins, high stock turnover and a need for maximized logistical efficiency (Kenton 2019).

The food industry features a complex network of food supply chains that goes beyond borders because of globalization and trade. The globalized agricultural system provides easier access to cheaper raw materials and it enables countries with agricultural surplus to benefit from exports. Global food trade is responsible for the sourcing and distribution of commodities that can be transformed into high-value foodstuff items. These foodstuff items differ in their price elasticity according to their individual supply and demand curves. Even though no country has a pure market economy because of price controls, taxation, subsidies and regulations; the success or profit potential of any given product in the market is given by the simple supply and demand model.

The supply and demand model is composed of five key elements: the demand curve, the supply curve, factors that cause the curves to shift, market equilibrium and the way market equilibrium changes from shifts in supply/demand curves (Krugman et al. 2014). The demand curve shows the relationship between the quantity demanded and the price. Similarly, the supply curve shows the relationship between the quantity supplied and the price. The supply and demand curves converge in the point of equilibrium, and this interaction is known as the market equilibrium. The equilibrium price in any market is the price at which the quantity demanded equals with the quantity supplied (Rittenberg 2012). A visual representation of the supply and demand model can be seen in Figure 14.

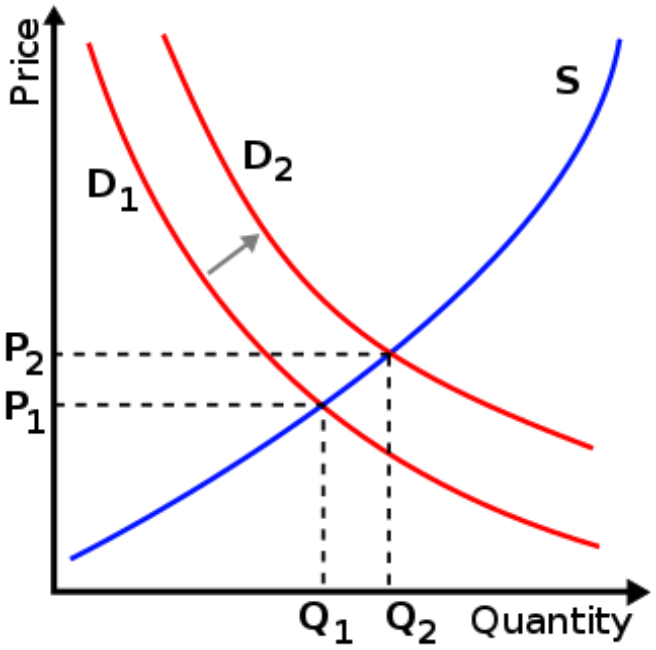


Figure 13. Shift in demand in relation to the supply curve

The quantity demanded can be defined as the actual amount consumers are willing to buy at a specific price (Krugman et al. 2014, 71). In contrast, a shift of the demand curve shows the change in the quantity demanded at any given price when the whole demand curve changes its position. In addition, there are several factors that cause shifts in the demand curve either to the left or to the right. According to Krugman and colleagues (2014, 77), economists agree that the five most important factors that shift the demand for a product or service are:

- Changes in the **price** of related goods or service
- Changes in **income**
- Changes in **taste**
- Changes in **expectations**
- Changes in the **number of consumers**

The Food and Agriculture Organization of the United Nations concurs with the position expressed my Krugman and colleagues (2014) regarding the determinants of demand and consumption patterns by stating that demand is subject to change over time by factors such as levels of income, population tastes and preferences, end

market indicators and by the availability and price of substitute goods (Waggener & Lane 1997).

Fast growth within an industry does not only account for growth of individual demand, but more importantly, growth in market demand. “At any given price, the quantity demanded by the market is the sum of the quantities demanded” (Krugman et al 2014, 73). Furthermore, Krugman and colleagues (2014) argue that a change in tastes also has a predictable and significant impact on demand. Consequently, when tastes change to favor a specific product in the market, a larger number of people will be willing to purchase that product at any given price. This will cause the market demand curve to shift to the right (as shown in Figure 14). Similarly, the supply curve is the graphical representation of the supply schedule. It shows the correlation between price and supply. In other words, it shows the way in which suppliers respond to a change in price by how much they are willing to produce at a certain price point. Shifts in the supply curve for goods or services can be attributed to five main factors:

- Changes in **input prices**
- Changes in the **prices of related goods**
- Changes in **technology**
- Changes in **expectations**
- Changed in the **number of producers**

However, it is fair to ask just how much a change in the quantity demanded affects changes in the price of the related goods or changes in the input price. Price elasticity measures the responsiveness of a product’s demand to price change (Krugman et al. 2014, 153). Price elasticity of demand is influenced by the availability of substitutes, necessity vs luxury, brand loyalty and cost relative to income (ibid.). A demand curve is said to be elastic when an increase in price reduces the quantity demanded by many or when a decrease in price increases the quantity demanded many. An

inelastic demand is less responsive to price changes. Price elasticity for two points along the demand curve is given by the following formula:

$$\boldsymbol{Price\ elasticity\ of\ demand} = \frac{\%\ \Delta \boldsymbol{Q_d}}{\%\ \Delta \boldsymbol{P}}$$

where

$$\%\ \Delta Q_d = \frac{change\ in\ quantity\ demanded}{initial\ quantity\ demadned} \times 100$$

and

$$\%\Delta P = \frac{change\ in\ price}{initial\ price} \times 100$$

For a single price, the elasticity of demand is considered by the point-price elasticity of demand which is calculated by the product of the slope of the tangent line to the point given and the price over quantity or:

$$\boldsymbol{E_d = \frac{dQ}{dP} \times \frac{P}{Q}}$$

Table 1. Relationship between elasticity of demand

$\lvert E_d \rvert < 1$	**Inelastic demand**
$\lvert E_d \rvert > 1$	**Elastic demand**
$\lvert E_d \rvert = 1$	**Unit elastic demand**
$\lvert E_d \rvert = 0$	**Perfectly inelastic demand**

The price elasticity of demand helps understand product demand in a specific market when price is factored, and it gives an idea of changes in consumer behaviour over a period of time. Income is important to consider as well for the income elasticity of demand, as it measures how much the demand for a good is affected by changes in consumer's income (ibid, 156). This allows to determine if goods are normal or inferior by whether they respond positively or negatively to increase in income. Furthermore, income elasticity of demand allows us to classify products as necessity or luxury. The following formula shows the relationship between income elasticity of demand and the rate of change of quantity demanded and income.

$$\boldsymbol{Income\ elasticity\ of\ demand} = \frac{\%\ \Delta \boldsymbol{Q_d}}{\%\ \Delta \boldsymbol{I}}$$

Edgerton, Assarsson, Hummelmose, Laurila, Rickertsen, & Vale (1996) studied the consumption of food in the Nordic countries and described its development by analysis of trends and relative pricing. They classified private consumption according to product categories and the sales outlet.

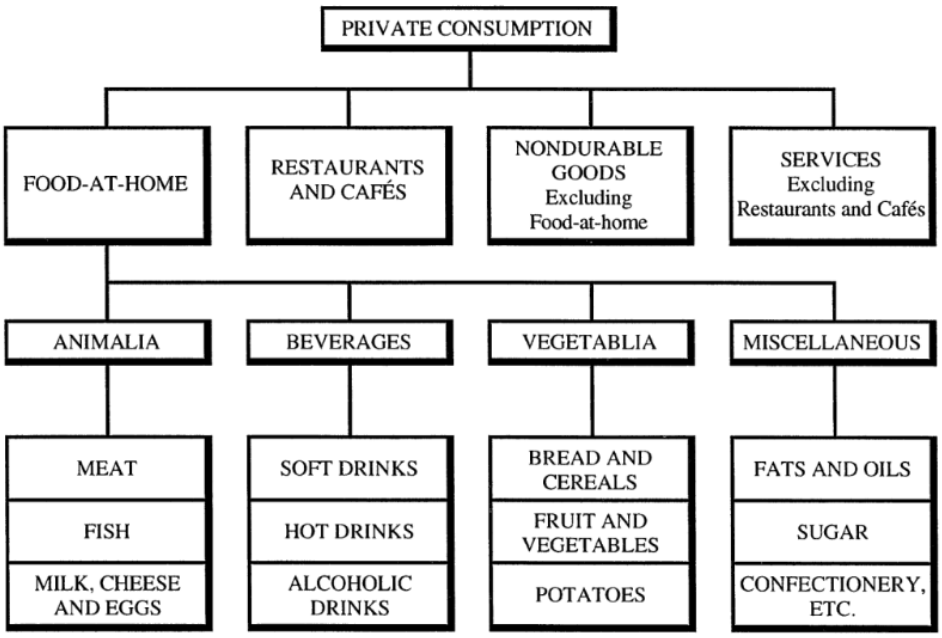


Figure 14. Utility tree used in the study by Edgerton and colleagues (1996, 7)

By using data from annual time-series of consumption statistics published by governmental offices across the Nordic countries, the authors compared own-price

elasticity for food categories between the countries and found that Finland has food commodities with larger expenditure elasticities and lower price elasticities than other Nordic countries (ibid, 115). Food groups were placed according to their own-price elasticity and expenditure elasticity for each country. Income refers to money flowing in and expenditure is money flowing out. Edgerton and colleagues (1996) used the latter as data available was based on expenditure. Assuming income equals expenditure implies a zero net financial gain i.e. no deficit nor surplus. This is an unrealistic scenario for households but a useful approah to consumer behaviour and goods considered necessity vs. luxury.

		Total Own-Price Elasticities			
		≥ –0.2	(–0.3, –0.5)	(–0.6, –0.8)	≤ –0.9
Total Expenditure Elasticities	≤ 0.4	Milk, Cheese and Eggs Bread/Cereals	Potatoes Fats and Oils		
	(0.5, 0.9)	Hot Drinks	Fish Fruit and Vegetables		
	≥ 1.0	Meat	Sugar Confectionery	Alcoholic Drinks	Soft Drinks

Figure 15. Commodities classified according to elasticity (Finland). (Edgerton et al. 1996, 114)

The food groups analyzed are mostly price inelastic according to the values and thus not responsive to price change. While the results for total own-price elasticities are as expected in comparison to world average values, one key takeaway is the variation in expenditure elasticity. Quantity demanded for meat and alcoholic drinks is more responsive to changes in income. Since these products are income-elastic ($\epsilon_d > 1$), they are considered luxury goods. On the other hand, dairy products and cereals are considered necessity goods due to their low expenditure elasticity and highly inelastic own-price demand. Further cross-price analysis is needed to evaluate the demand situation of goods, but when talking about plant-based innovations as alternatives to conventional food products, pricing and income are decisive factors to consider in NPD.

3.2.2 Value creation

Value-adding innovations, alongside with a series of other trends in the market, illustrate the principle of shifts in supply and demand. Mowery, Nelson, Sampat and Ziedonis (2004) looked at a series of empirical studies on technical change in individual firms and concluded that even though market demand is the main force that influences innovation, both supply and demand influences are crucial to understanding the innovation process. Merriam-Webster dictionary defines innovation as *"the introduction of something new".* While this definition is accurate, it is also very vague as it is not applied into something useful. Perhaps a more practical definition of innovation is *"a process through which ideas are generated, developed and implemented to formulate incremental improvements or radical products, processes and services that add value within the supply chain"* (Dani 2015). Innovation involves three main elements: technology, business and human. Their relationships are depicted in the figure below.

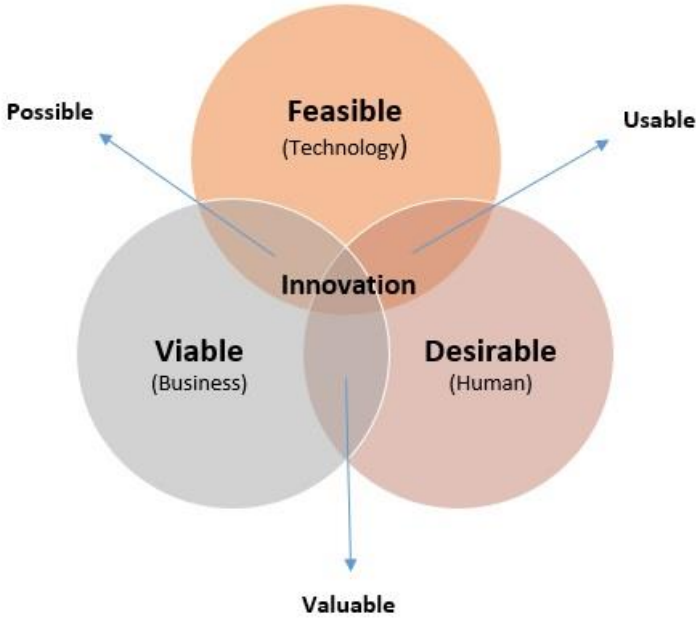


Figure 16. Diagram: The elements of innovation

While companies have different methods to innovate and perhaps a different outlook into the innovation process, innovation stems from identifying needs.

Needs can be solving problems, adapting to change, optimization, facing competition, changes in customers' preferences, etc. Regardless of what the needs may be, the objective of innovating is to create value for end customers and consequently, to generate revenue. From the above definition of innovation by Dani (2015), we highlight the importance of value and the concept of value creation which is at the core of any business' strategy. In simple terms, value is what the customer is willing to pay for. Value creation seeks to create and deliver added value efficiently to generate profit after cost. These concepts can be traced to Michael Porter's classical approach to the value chain and innovation. *"Firms gain competitive advantage from conceiving of new ways to conduct activities, employing new procedures, new technologies, or different outputs"* (Porter 1990, 41). Porter (1990) also presented a very helpful and systematic way to view the value chain. He suggests looking at the wider picture of value transfer and coined the term of value system. The value system includes suppliers, distribution channels, customers and each of their respective value chains.

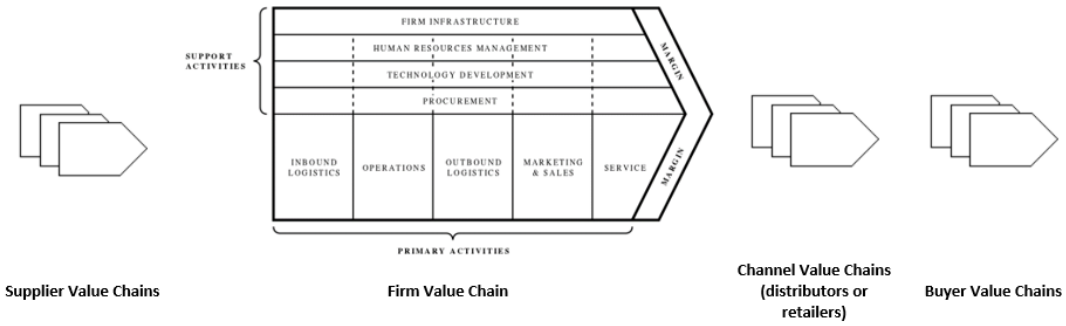


Figure 17. Porter's Value System (1990)

The purpose of the value system is to enable firms to gain a wider understanding of the system by considering the value chain of each party present at each step of a product's life cycle. Through this way of thinking, value can be maximized by optimizing processes individually and reducing their costs and environmental impact. Therefore, it is essential to evaluate processes throughout the supply chain from a value-creating perspective to gain competitive advantage.

After describing the importance of value creation in the innovation process, it is necessary to draw a connection between value creation and the main drivers for innovation which are influenced by the ever-changing nature of processes and new needs in the market. The food industry contains a high number of variables and new challenges that arise constantly. Dani (2015, 191) classifies a series of innovation methods according to their applications within the food industry. This classification is useful as it will help identify the types of innovation methods relevant in the study. The innovation classification can be seen in the following table:

Table 2. Classification of innovation methods (Dani 2015, 191)

Innovation methods	Examples
Institutional innovation	• Institutional procedures • Policies and regulations • Business standards • Relationships with external organizations
Technological innovation	• Applied scientific knowledge into new ideas • New technologies
Social innovation	• Improvements in ideas and organizations for the well-being of individuals and communities
Product innovation	• Changes or additions to goods and services
Process innovation	• Changes or additions to the way goods are produced or delivered
Marketing innovation	• Changes in the methods of conditions of marketing of goods or services
Organizational innovation	• Changes in organizational structure • New or improved activities • New or improved processes • New or improved relationships with stakeholders

As shown in the table above, innovation methods exist at any level of an organization and its activities. Under these circumstances, there is high possibility for development in food production throughout the whole supply chain. In the Harvard Business Review magazine, Hansen and Birkinshaw (2007) argue that to improve innovation, it is useful to think of the innovation process in terms of a value chain. In other words, “to view the process of transforming ideas into commercial outputs as an integrated flow”, in the same way raw material is transformed into a finished product through the value chain. Ideas must be planned, designed and executed for the need identified. Hansen and Birkinshaw (2007) also defined three major steps in the innovation process: generation, conversion and diffusion.

The idea generation begins with identifying needs outside the organization and within the organization. Needs for innovation can be identified through cross-unit collaboration and by combining knowledge from different parts of the company. Companies must also assess if they are bringing enough outside influence in the form of knowledge and insight from inventors, competitors, universities, researchers, entrepreneurs, investors or suppliers (ibid.). From this we see the importance of a well-managed SRM in the innovation process. Moreover, companies should also consider feedback from end users and any other relevant form of customer experience. Once needs are identified and possible ideas have been generated through collaboration, idea conversion surges as the phase to turn ideas into a revenue-generating system or product (ibid.). For this to occur, the idea requires further research as well as screening and funding mechanisms from stakeholders. This will include all the necessary phases such as scheduling, design, prototyping, etc. The idea diffusion is the last step of the innovation process and it deals with the expansion of concepts that have been sourced, vetted, funded and developed (ibid.). Idea diffusion requires the support of stakeholders to gradually expand the innovation across desirable geographical locations, distribution channels and customer groups. According to Gotter (2019), a unique value proposition is also essential for the branding of the product in order to succeed in the diffusion of the innovation. A simplified way to visualize the unique value proposition, sometimes also referred to as a unique selling proposition, is shown in Figure 19.

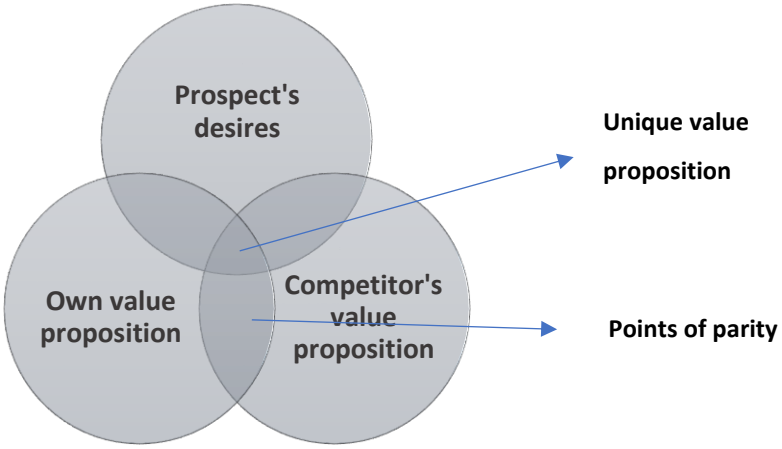


Figure 18. Unique selling proposition illustrated in a venn diagram

A unique value proposition stems from a firm's own value proposal that cannot be found elsewhere (ibid.). It delivers a straightforward message to consumers on the benefits of the product and its added value, in other words, the value a firm can offer that others do not. A clear UVP for consumers is an important factor for sales performance. Profitability is a firm's ability to put resources into processes that will generate revenue in excess of costs ("*what is profitability?*", n.d). A positive net profit margin from operations is part of analyzing financial statements and it is also an indicator of company's overall performance. The two main aspects of profitability are revenue and costs. Revenue is business income from operations and costs are all the expenses associated with running those operations (fixed costs, variable costs, hidden costs). Growth is the measure of a company's performance over a period of time which will determine business success or failure (ibid.).

3.3 Logistics of food supply chains

Christopher (1992) defines supply chain as “a network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer.” The understanding of supply chain management has changed since its earlier stages. It evolved from being purely economical to a model in which environmental and social aspects are equally important. Studies have shown that consumers around the world are modifying their consumption patterns and certain sectors of the population are becoming more conscious about the environmental impact of their purchases, and with this, creating a demand for traceability in supply chains (Moralez 2020). Corporate social responsibility plays a crucial role in the development of sustainable products as companies are under increasing pressure to be accountable and transparent towards stakeholders and consumers.

There is high variability in the paths of foodstuff items from supplier to consumer. Therefore, it is essential to review the main steps of the life cycle of goods. This chapter will study major phases of food supply chain such as procurement, production, processing, warehousing, distribution and reverse logistics.

3.3.1 Procurement

Procurement is a process that includes sourcing and purchasing of raw materials for further processing. It is a vital activity and its management is a decisive factor for the performance of an organization. Prior to the purchase, sourcing is the stage where the organization must locate and vet suppliers that are reliable, affordable and able to provide the commodities needed at the right quality (Biedron 2019). The purchasing stage deals with generating the purchase order after a flow of sub-activities:

- Request for information (RFI) is an open inquiry to collect the capabilities of different suppliers.
- Request for quotation (RFQ) is an inquiry to potential suppliers to competitively cost the required goods or services.
- Request for tender (RFT) is an invitation for potential suppliers to submit an offer to supply the goods required against a detailed tender.

(Mhay & Coburn 2019)

Depending of the size of the enterprise, procurement can be handled by a single individual in a SME, or by entire departments in larger enterprises. For food supply chains specifically, Dani (2015, 115) lists a series of procurement challenges in the food sector such as sustainability practices and their influence on public policy, price volatility in food commodities, food availability, climatic impact, traceability and food safety. With this in mind, the term sustainable procurement becomes more appropriate in the food industry. As it was previously discussed in the first chapter of the literature review, agriculture carries an important share of GHG emissions when we consider the entire food supply chain. Therefore, sustainable procurement considers other variables such as GHG emissions, energy consumption and type of energy, water consumption, effluent treatment, child labour, living wage, packaging waste, among others (ibid., 128). A procurement strategy that takes these variables into account will more successfully improve traceability and transparency of the supply chain.

3.3.2 Food Processing

Food manufacturing includes a wide range of activities that transforms food crops into products for consumption. Food processing is of utmost importance for food supply chains and it serves several different purposes.

- Extending the life of foodstuff items through relevant processing and preservation techniques
- Changes the form of food to allow further processing

- Increases dietary variety and provides a larger range of attractive flavours, colours, aromas and textures while maintaining the nutritional value.
- To make foodstuff items available when fresh food is not an option e.g. Food deserts

(ibid., 35)

Foodstuff products can undergo mechanical or chemical processes. While a minimally processed food is usually preferred, processing allows for preservation, food safety, convenience, fortification and variety. A good way to classify food processing is according to thermal conditions. (ibid., 38)

Table 3. Classification of food processing methods (Dani 2015, 38)

Thermal conditions	**Examples**	**Advantages**	**Disadvantages**
Ambient temperature processing	Chopping, cutting, slicing, dicing, blending, milling, emulsification, homogenization, fermentation	Improves quality and functionality of food	Requires further processing for immediate consumption
Processing by application of heat	Baking, blanching, pasteurization, heat sterilization, evaporation, dehydration	Provides a preservative effect by destruction of enzymes and microorganisms	Some methods, such as frying, can have negative health effects
Processing by removal of heat	Freezing, chilling	Maintains sensory characteristics and	Microorganisms are inhibited but not destroyed

		nutritional value of food Preserves food products	Temperature rise will lead to spoilage Requires low storage conditions for storage and distribution
Post-processing	Additives, coating, decoration, packaging	Improves appearance, taste and variety.	Some methods can have negative health consequences

3.3.3 Packaging

Packaging is part of post-processing and it is essential for the protection and containment of the product to ensure safe and efficient delivery. Requirements for packaging are functionality, size and convenience. From a technical standpoint, packaging must also allow for machinability (performance and efficiency in production lines) and communication (identification tags such as barcodes or RFID technology) (ibid, 42). When it comes to fresh food packaging, three different levels are considered. Primary packaging is in contact with the product and it is usually the one brought home from the shop by consumers. Secondary packaging, also known as transport packaging, contain several units of primary packages. Secondary packaging can also be purchased by consumers but is mostly used by retailers to stock up shelves. Tertiary packaging holds primary and/or secondary packages on a pallet (Gustafsson, Jönson, Smith, & Sparks 2006, 71). Foodstuff items and FMCG especially, are a primary source of environmental pollution. Therefore, it is important to understand the life cycle of the packaging of goods to identify ways to reduce waste and to optimize the use of packaging throughout the supply chain. Figure 20 illustrates the packaging cycle (ibid.).

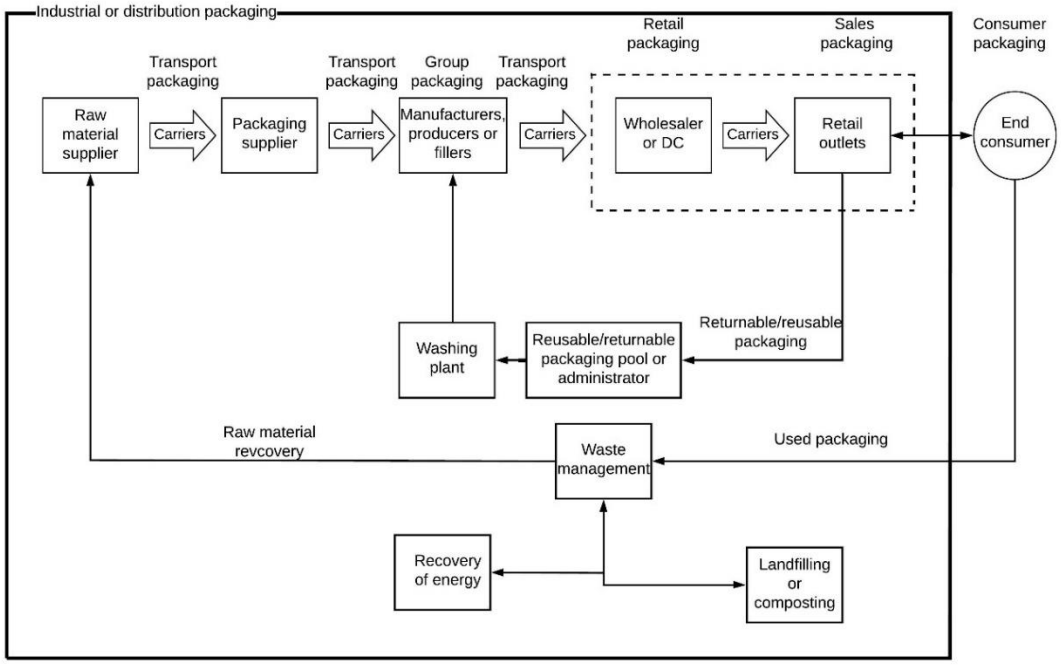


Figure 19. The packaging lifecycle. Adapted from Gustafsson, Jönson, Smith, & Sparks 2006, 71.

The use of packaging in the production of goods must follow a logical from procurement to disposal. Packaging is relevant at all stages of the supply chain and requires efficient logistical planning. Table 4 shows the flow of packaging as suggested by Gustafsson and colleagues (2006).

Table 4. Packaging logistics relationships. (Gustafsson et al. 2006, 103)

Packaging related to:	**Flow of activities**
Production/manufacturing	Produce → Assemble → Fill → Fit
Logistics	Handle → Transport → Store → Distribute
Marketing/sales	Differentiate → Promote → Inform → Sell
Environmental	Reduce → Reuse → Recover → Dispose

3.3.4 Inventory valuation and management

Following sourcing, production and packaging, the next step to analyse is stock level and warehousing. Food producers must pay close attention to stock levels and inventory management as foodstuff products have special requirements depending on the nature of the goods and their level of processing. Food is prone to spoilage and contamination at different stages of the supply chain. By optimizing inventory turnover rate, organizations can reduce their holding costs and prevent hidden costs from spoilage. A good forecasting system is critical to prevent stockouts and emergency buying.

The concepts of push-pull manufacturing are applied to inventory control. The classic push system is one that has no explicit limit on the amount of WIP and it allows for scenarios with presumed and generally stable demand (Hopp & Spearman 2004, 142). MTS is often, but not exclusively, considered to be a push system. This is the case for many foodstuff items that customers purchase regularly and have very low variability in demand. In contrast, a pull system explicitly limits the amount of WIP in the system and the flow is usually triggered by the customer's order (ibid.). MTO is often, but not exclusively, considered to be a pull system. Nonetheless, Hopp and Spearman (2004) argue that virtually all production systems include MTS and MTO. This principle can also be observed in businesses that use a hybrid push-pull model to manufacture and to manage inventory. Inventory management aims to have enough products to satisfy customer demand at any given time through careful planning, standardizing and monitoring (Dani 2015, 43). Inventory management can be defined as a systematic approach to organize stock that is composed of raw material, finished product, WIP (work-in-process), consumables and S&R items (Muller 2019, 4-5). Stock keeping units or SKUs are product codes used to identify and organize inventory. This identification system allows for improved stock availability, product location and a better way to manage the financial aspect of inventory. There are also different methods to determine inventory value. Muller (2019) argues that there are five common inventory valuation methods:

- First-in, First-out (FIFO): First goods purchased are the first to be used or sold regardless of timing.
- Last-in, First-out (LIFO): Most recently acquired goods are the first to be used or sold regardless of timing.
- Average cost method: Calculation of the unitary cost to identify inventory value. $$\bar{C} = \frac{TC}{TQ}$$

  Where the average cost equals the total cost of goods available for sale divided by the total quantity of goods available for sale.
- Specific cost method: Tracking the cost of an item through and out of the facility in order to set the price according to its actual cost or production.
- Standard cost method: This approach assumes the value of an item to use it as standard inside the company but not for accounting purposes.

(ibid, 21)

Inventory valuation must be complemented with tools to manage inventory. There are different models to manage inventory. Dani (2015, 47-48) lists some of the most important for food supply chains.

- EOQ: The economic order quantity method optimizes the cost of ordering inventory and the cost of holding it. Put in a different way, the number of units that should be added to the inventory after each order to minimize inventory costs. A PO is issued when inventory reaches the reorder point. From figure 21, we notice how the point where the total cost is at its lowest (EOQ), is the same point where holding costs and ordering costs are equal.

Figure 20. Economic order quantity graph

- Delayed product differentiation: Empty inventory of finished products until order is received. System creates modular units that can be assembled very quickly as per customer request.
- JIT: The just in time model follows the philosophy of eliminating all non-value-adding activities. It is a pull system of inventory control which involves less inventory determined by a Kanban card system and small production lots.
- CONWIP: Constant work in process is a pull system that limits WIP and has line-specific cards rather than part-specific cards in a Kanban system. A CONWIP system is a single-stage Kanban system.

The food industry differs to other industries in that most food items are perishables. This means that many products require temperature-controlled warehousing and batch tracking. Many businesses in the food and beverage industry prefer to implement push-pull hybrids and JIT methodology to replenish products only when needed to reduce waste from spoilage (Dani 2015, 43). Dudbridge (2011, 146) goes over the seven wastes in the food industry within lean manufacturing systems.

- Defects: Defects cause waste material, extra effort in rework and late deliveries
- Overproduction: Overproduction of short shelf-life products leads to direct spoilage.
- Waiting time: Idle time between finishing once process and starting the next. Waiting time creates costs on resources, wages and productivity.
- Non-value processing: Over processing leads to bottlenecks and backlog.
- Transportation: Unnecessary movement of people, materials or information in the factory.
- Inventory: Space required for stock holding creates additional inventory costs.
- Motion: Travelling time for workers in a factory and physical distance between workstations.

In addition to the managerial aspect of stock keeping, food safety and quality is of paramount concern when it comes to inventory and warehousing. Foodstuff items have different properties and different storage requirements to protect them from contamination. As an example of just how serious contamination can be, certain type of allergens can cause a severe immune response in some people. Cases of trace contamination or mislabelling have resulted in hospitalization and death. Therefore, storage must be tailored to each product's requirements. Warehousing also plays a big role in food's overall environmental impact. According to McKinnon and colleagues (2015, 197) warehousing is an energy intensive activity which follows transportation in terms of GHG emissions and energy consumption. Warehousing temperature, lighting and mechanical handling equipment are all sources of consumption. Temperature-controlled supply chains have high energy consumption. Dani (2015, 75) explains how logistics activities in the food and beverage sector operate across four temperature bands. Table 5 classifies food supply chains according to 4 bands for temperature control.

Table 5. Bands for temperature-controlled supply chains (Adapted from Dani 2015, 75-76).

Class	Temperature	Products
Ambient/Dry	14°C to 18°C	Canned foods, jars, bags of dry products
Fresh produce	5°C to 15°C	Fruit and vegetables
Chilled	4°C to 7°C	Dairy products and ready meals
Frozen	-18°C or colder	Frozen fresh produce, meals, ice cream

3.3.5 Transportation

The logistics of perishables is subjected to specific challenges in warehousing and transportation. Dani (2015, 69) argues that a solid ICT infrastructure is required to control, monitor and track food supply chains. The creation of logistics networks with mappings of suppliers, distribution centers and warehouses allows for an efficient flow of material from supplier to manufacturer to retailer and finally to the customer. Perishables can be transported through air, land or sea but the mode of transport will depend on the required speed of delivery. Some techniques such as innovation in packaging, coatings, controlled ripening and radiation are used in food supply chains to extend food deterioration (ibid, 77). Dry food and perishables are transported mostly by container freight. In order to transfer freight to 'greener' transportation modes, it is necessary to first look at the impact of each mode.

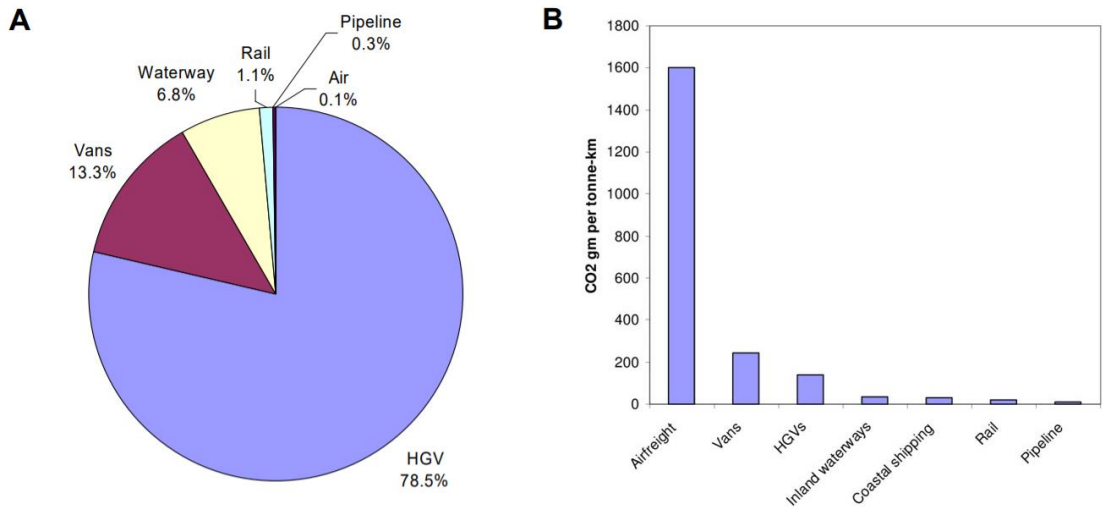


Figure 21. Modal shares of CO2 Emissions and CO2 per tonne-km values for UK Domestic Freight Transport (McKinnon 2007).

Alan McKinnon (2007) from the Logistics Research Centre at Heriot-Watt University in Edinburgh, shows the high contribution of heavy goods vehicles to CO2 emissions from freight transport in the UK as well as the overwhelming impact of airfreight. McKinnon and colleagues (2015, 163) outline the reasons behind the desire to increasingly move away from road haulage to freight being moved by rail and waterways for the longer legs of the distance. Food often travels long distances, and as so, it is believed that transportation is the biggest contributor to overall emissions and energy consumption of a particular good. In fact, in the mid-1990s, the term of 'food miles' was coined to describe the impacts of transporting food over long distances (McKinnon et al. 2015, 358). The initial idea was that further is worse and local is better. While this holds true to a degree, distance is not an indicator of overall impact. In addition, McKinnon and colleagues (2015, 359) examine the idea of a life-cycle assessment approach to evaluate impact of food supply chains. Transport in only one element of what is usually, a very complex supply chain. As a clear example of this, McKinnon and colleagues (2015) point out the findings drawn by Garnett (2003) regarding GHG emissions from food transport, which account for only 3.5% of the total GHG emissions.

3.3.6 Improving the environmental performance of food supply chains

Garnett (2003) suggests a list of elements that are usually part of low-carbon food systems:

- Seasonal and indigenous produce grown during its natural season and adapted to the conditions of the location
- Efficient manufacturing and processing
- Minimal use of temperature-controlled storage without compromising safety or quality
- Local clustering of suppliers in a way that raw material is readily available on demand (Well-established JIT system)
- Journey distance between points of supply, production, retail and consumption
- Logistical efficiency through the right mode of transport and its fuel efficiency plus efficient loading and unloading is also

(as cited in McKinnon et al. 2015, 359)

The ISO standard 14040 defines the LCA as ”a compilation and evaluation of the inputs, outputs and the potential environemtnal impacts of a product system throughout its life cycle” ("ISO 14040:2006" 2016). Through an LCA approach, Weber and Matthews (2008) found that in the US, GHG emissions associated with food are dominated by the production phase which contributes to 83% of the yearly carbon footprint of the average household. Transportation as a whole contributed to only 11% of the life-cycle GHG emissions in a country where the average life-cycle supply chain for food products is 6760 km. Distance and transportation are important factors to consider in the logistics of food supply chains, but the procurement and production phase have by far the largest impact. So whilst buying local is preferable, it is by no means the fundamental criteria to assess a good’s total impact.

Another major area of concern in the life cycle of food products is waste. Food waste has been one of the major issues in the food industry since the age of industrialization. Between the end of the 19th century and the beginning of the 20th century, social and economic change drastically transformed the food system as it shifted from an agrarian to an industrial society. For consumers this meant easier access to food products at lower prices, which was accompanied by a series of challenges for manufacturers and communities. One challenge that still prevails is food waste. The re-organisation of the economy to accommodate manufacturing led to an immeasurable amount of food waste in just over a century. According to the Food and Agriculture Organization of the United Nations (Gustavsson, Cederberg, Sonesson, van Otterdijk, & Meybeck 2011), an estimated one third of all food produced globally is either lost or wasted. This FAO 2011 assessment of food wastage volumes and emissions taken from LCA studies, places carbon footprint of global food wastage at 4.4 $GtCO_2$, which would be the third largest emitter only behind the US and China. This in a context where over a billion people experience hunger and millions more live in abject poverty and have limited access to food.

Food waste is a very general term that covers a broad range of subcategories or types of waste. Food waste can by classified according to the stage of the supply chain where a material is disposed without further utilization. Food waste can occur at any of the following 5 stages:

- Agriculture
- Postharvest
- Processing
- Distribution
- Consumption

The composition of food waste per stage varies depending on geographical location. By grouping the stages from production to retailing, we are left with two categories of food waste: consumer and production to retailing.

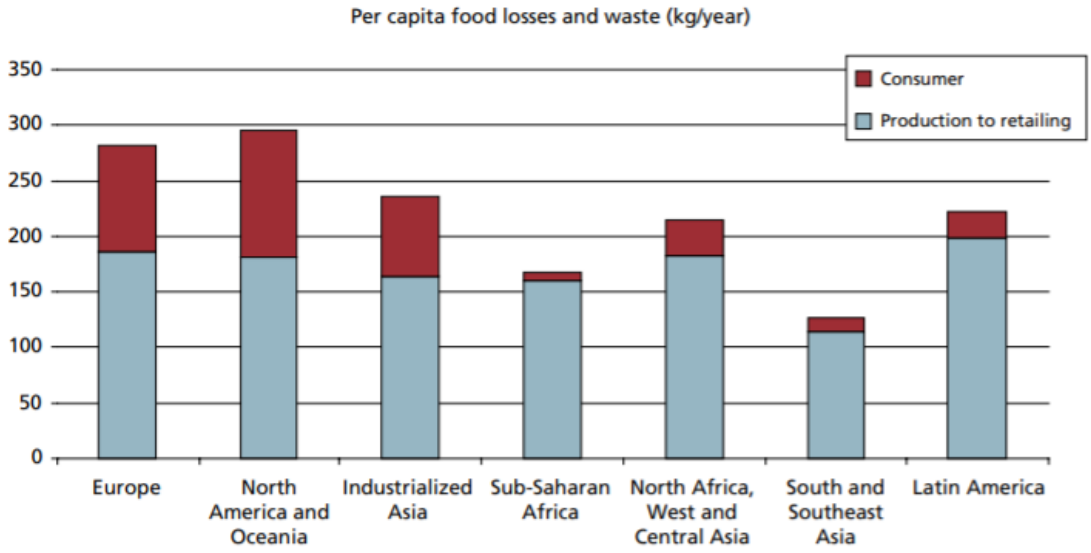


Figure 22. Food loss and waste per capita (Gustavsson et al. 2011)

From the figure above, the largest amount of food waste happens in the production to retailing phase, but the proportion is greater in developing countries. Developing countries see the biggest food losses before the products even reach the consumers due to deficient infrastructure (roads, ports, warehouses, distribution centres), poor planning and/or lack of resources. Through mitigation actions and risk assessment, food waste could be greatly diminished in the production to retailing phase.

Traceability has been increasingly mentioned as a solution to supply chain inefficiencies. Traceability is the ability to follow the movement of a food through specified stages of production, processing and distribution (Dani 2015, 153). The need for traceability will increase in the future and one of its current manifestations is the implementation of blockchain technology in food supply chains. According to Spencer (2019), many brands have activated blockchain technology to target the need for product and supply chain transparency that communicate safety and quality. This gives organizations the opportunity to track their products and optimize their supply chain networks, but it also gives consumers the possibility to have access to information about sustainability and quality in the products they purchase.

4 Implementation of the Project

4.1 Phenomenological study

4.1.1 The Phenomenon

According to the 2018 report on market developments and policy for the plant protein sector in the EU (European Commission 2018), some of the main economic drivers behind the rise of the plant-based product market segment are:

1. Changing consumer habits through a rise in flexitarian diets
2. Availability and stability of supply
3. Quality of the grains
4. EU origin or local sourcing
5. Image of the products (sustainable, healthy etc.)

The rapidly rising popularity of plant-based products creates new business opportunities for entrepreneurs and existing businesses alike. Kesko (2019) reports that 8% of the population eat mainly vegetarian food and 37% of the population eats vegetarian food occasionally by replacing animal protein for plant protein. Collectively, these small changes have a large positive impact on water, energy, land and emissions. Kempas (2018) reports on the rising popularity of non-dairy products in the Finnish market. In 2017, the K group reported on a growth of 47% in non-dairy milk compared to the previous year and growth in every single other plant-based product type. While debates over food choices used to be focused on health effects, the discussion now includes environmental, ethical and other issues. This phenomenon has encouraged companies to enter the plant-based market and to focus on traceability in their supply chains. To analyze the phenomenon, companies that offer plant-based food products in Finland, were contacted. The sample population was made up of eight companies, five of which were interviewed. The companies were predominantly Finnish apart from two that were Swedish.

4.1.2 Overview of the companies in the study

i.

Table 6. Planti overview

Kavli Oy	Planti	**Main raw materials** **Oats, soy** **Sourcing of raw materials** Oats (Finland), traceable non-GMO soy (US, CA, AT)
Brand launched	2015	**Product range** Oat drink, oat cream, oat yoghurt-type
Headquarters	Espoo, FI	**Production plant** Turku, FI
Enterprise category	Small enterprise (<50) (Kavli Maidoton tehdas)	**Processing and warehousing** Turku, FI

ii.

Table 7. Oatly overview

Oatly AB	THE ORIGINAL OATLY!	**Main raw materials** **Oats, rapeseeds** **Sourcing of raw materials** Different locations in Sweden
Brand launched	1995	**Product range** Oat drink, oat cream, oat yoghurt-type
Headquarters	Malmö, SE	**Production plant** Landskrona, SE
Enterprise category	Large enterprise (>250)	**Processing and warehousing** Landskrona, Sweden Northern Germany

iii.

Table 8. Mö Kaurameijari overview

Mö Foods Oy		**Main raw materials** **Oats**
		Sourcing of raw materials 100% sourced Finnish oats
Brand launched	2017	**Product range** Oat yoghurt-type
Headquarters	Lohtaja, FI	**Production plant** Lohtaja, FI
Enterprise category	Micro enterprise (<10)	**Processing and warehousing** Lohtaja, FI

iv.

Table 9. Sproud overview

WMake Brands AB	Sproud™	**Main raw materials** **Pea protein, agave**
		Sourcing of raw materials Different locations in Sweden
Brand launched	2018	**Product range** Pea drink, pea protein
Headquarters	Malmö, SE	**Production plant** Malmö, SE
Enterprise category	Micro enterprise (<10)	**Processing and warehousing** Malmö, SE

v.

Table 10. Beanit overview

Verso Food Oy	beanit®	**Main raw materials** **Fava bean, pea protein, rapeseed**
		Sourcing of raw materials Kauhava and proximities
Brand launched	2019	**Product range** Spiced fava bean shreds and mince
Headquarters	Vantaa, FI	**Production plant** Kauhava, FI
Enterprise category	Small enterprise (<50)	**Processing and warehousing** Kauhava, FI

Table 11. Role of the interviewee in the organization

COMPANY	ROLE IN ORGANIZATION
KAVLI OY	Board member
OATLY OY	Sustainability specialist
MÖ FOODS OY	CEO and product developer
WMAKE BRANDS AB	Head of export and commercial operations
VERSO FOOD OY	Board member

The interviewees held different positions in their respective companies, and most of them had seen their company grow since its early days. Their names are omitted here. In order to obtain relevant information, the subjects were asked to tell about their subjective experiences as members of the organization in a relatively new market. The subjects were asked to tell about the main challenges that they had faced in organizing their logistics operations. After the interview, the subjects were asked to complete a survey. Three more companies responded to the survey but were unable to participate in the interview.

The companies in the sample were divided into two groups: Companies with only one brand and companies with more than one brand. Most of the companies in the sample have a single brand, so that in most cases, the introduction of the brand in the market came shortly after the company was established. The scatter chart below shows the distribution of the age of the companies. Most of the companies or their brands have existed less than five years since the launch date. Most developments in the industry have started within the last five years.

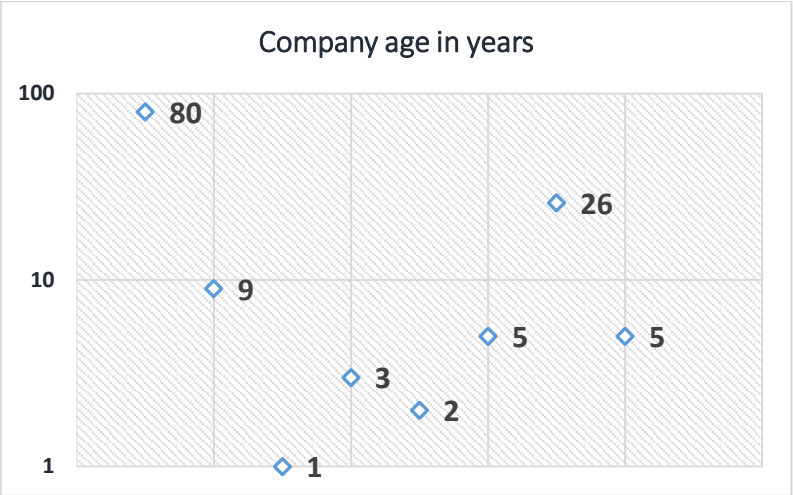


Figure 23. Age of the companies in the sample

All the companies in the sample engage primarily in food processing, but three quarters also have a specialized unit on food technology research and development. Retail and wholesale are generally handled by third-party providers and no company in the sample handles their own.

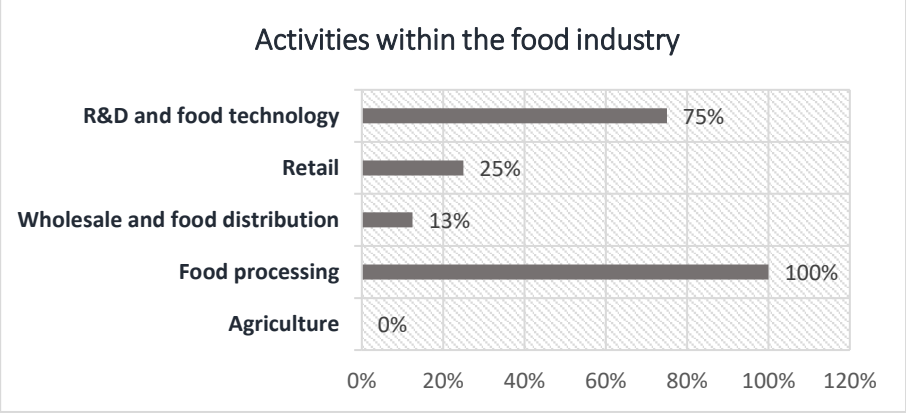


Figure 24. Activities each company handles in their business model

The companies vary in size depending on the year the brand was established and whether merges or acquisitions have occurred during the company's history. Enterprise size is based on the European Commission's classification in the annual structural business statistics (Eurostat) considering the number of employees and revenue. Staff headcount of less than 10 means a micro enterprise, less than 50 a small enterprise, less the 250 a medium enterprise and over 250 a large enterprise.

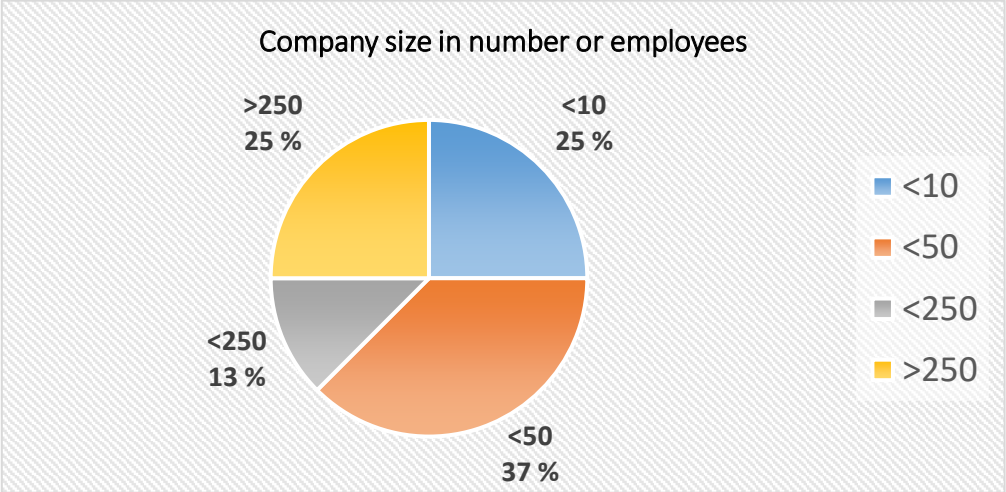


Figure 25. Size of the enterprise according to the Europeans Comission classification

4.1.3 Results

As expected, most brands established in the past five years are micro to small-sized enterprises while others with more time in the market have grown to small to medium-sized enterprises. After analyzing the structural qualities of the companies, their position was assessed regarding different subjects. For this, a spectrum format was used in which the representative of the company could express the company's position according to a spectrum of levels of agreement or disagreement. The majority of the sample strongly agreed that there had been a surge in demand for sustainably sourced food products.

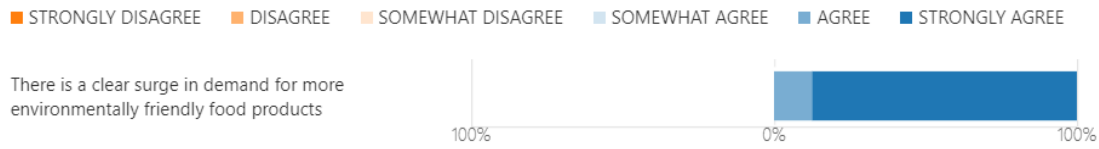


Figure 26. Spectrum #1: Demand for sustainably sourced food products

This was reaffirmed by the interviewees who stated that they entered the market because of high demand and few options to supply that demand. All respondents agreed to different degrees that customer feedback was important for new entrants in the plant-based industry, or in any other industry for that matter, as it provides valuable information on customer experience, likes and dislikes.

Figure 27. Spectrum #2: Customer feedback

The respondents also unanimously agreed that the plant-based market was becoming more competitive due to a series of factors that concur with those previously studied in the literature review. Enterprises of all sizes have had to adapt to the growing competition. Competition was viewed positively among the interviewees as it puts pressure on the company to improve continuously. On the downside, the large number of competitors and threat of substitutes make it harder to lock down customers.

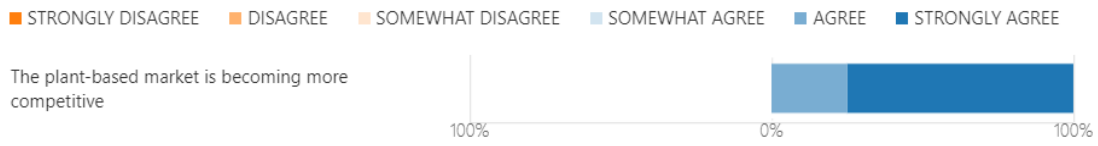


Figure 28. Spectrum #3: Competitiveness

According to the survey, the companies experienced their forecasting in different ways. Companies that were more consolidated or that had experience acquisitions, had struggled less with forecasting systems. Additionally, forecasting had been easier

for companies that had no plant-based brands in the market as the previous forecasting experience had worked as a model to predict future trends.

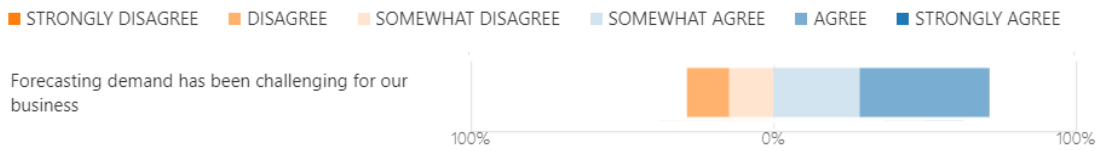


Figure 29. Spectrum #4: Forecasting demand

In general, the companies paid close attention to their forecasting systems and described them as challenging, but at the same time, all companies concurred that lack of experience had not created dire situations with overstock. Another point of parity between the companies was the importance of innovation and capital investment in R&D in order to stay in business. All interviewees agree that R&D was at the core of their business and their companies pursued innovation at any stage of their supply chain.

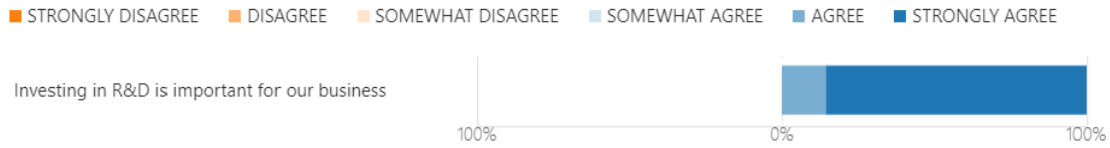


Figure 30. Spectrum #5: Investing in R&D

Participants were also asked to voice their opinion about consumers in two aspects: nutrition and environment. Respondents were divided about consumer knowledge on nutrition and on the environmental impact of foods. Respondents argue that the sector of the population interested in plant-based products is already aware of nutrition and environmental impact to begin with. However, they make up only a small part of customers. On the other hand, the average customer has limited knowledge about nutrition or environmental awareness. One interviewee pointed out that the average customer has no environmental incentive, but instead prefers trendy brands and their perceived image as a more healthful alternative. The main objective of all companies is to offer sustainable products that are also appealing.

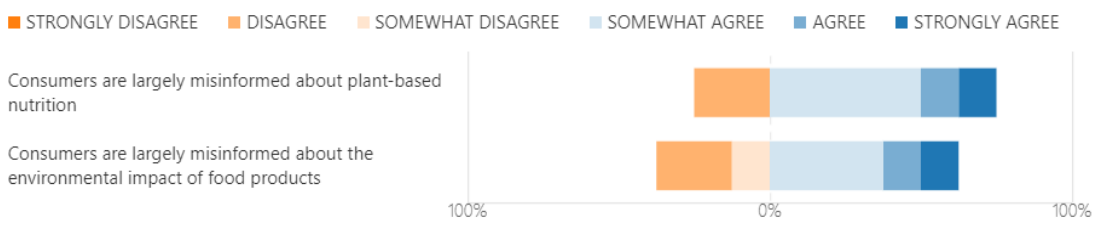


Figure 31. Spectrum #6 and #7: Nutrition and environment

Expanding to foreign markets is a goal of many companies in the industry and it is already a reality for 63% of respondents, with the remaining 37% expressing interest to sell their products in foreign markets within five to ten years.

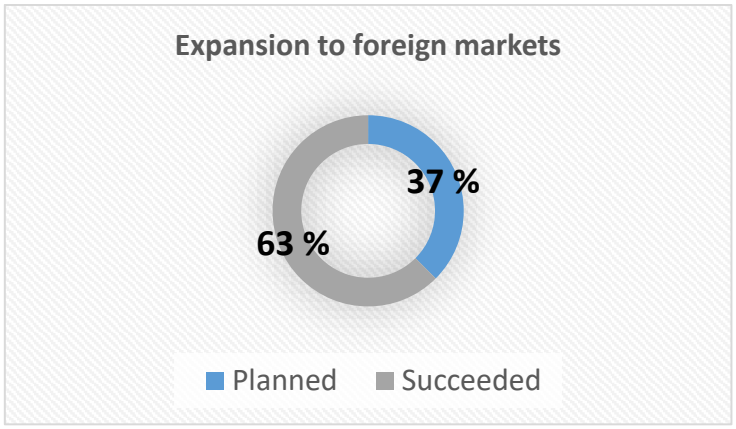


Figure 32. Expansion to foreign markets

Respondents graded their performance with an average score of 85%. While most of the brands, especially the new ones, are extremely satisfied with their results so far, they aknowledge that there is still much to improve and already have plenty of ideas to develop the business.

4.2 Organizational case study: The effectiveness of a LCA to improve the performance of primary activities

In the mid 90's, researchers from Lund University patented a process of enzyme technology that turned oats into liquid while maintaining many of its nutrituinal properties. This technology was used to develop oat drink, an alternative to milk for lactose intolerant people which was marketed as Oatly. Lactose, a sugar that constitutes milk and other dairy products, is not properly digested by 18% of the population in Finland and 6% of the population in Sweden. These two countries have some of the lowest incidence of lactose intolerance in the world, where up to 65% of the total human population are lactose intolerant (Vuorisalo, Arjamaa, Vasemägi, Taavitsainen, Tourunen, & Saloniemi 2012). In 2012 Toni Petersson became the new CEO of Oatly and he brought a radical new vision for the brand. The company's mission became to make it easy for people to enjoy dairy-like products without the negative effects associated with them. In addition, Oatly became a sustainability company instead of food manufacturer. In order to estimate the per unit impact, the company commissioned an environmental impact study to estimate the carbon footprint of their final product through a life cycle assessment.

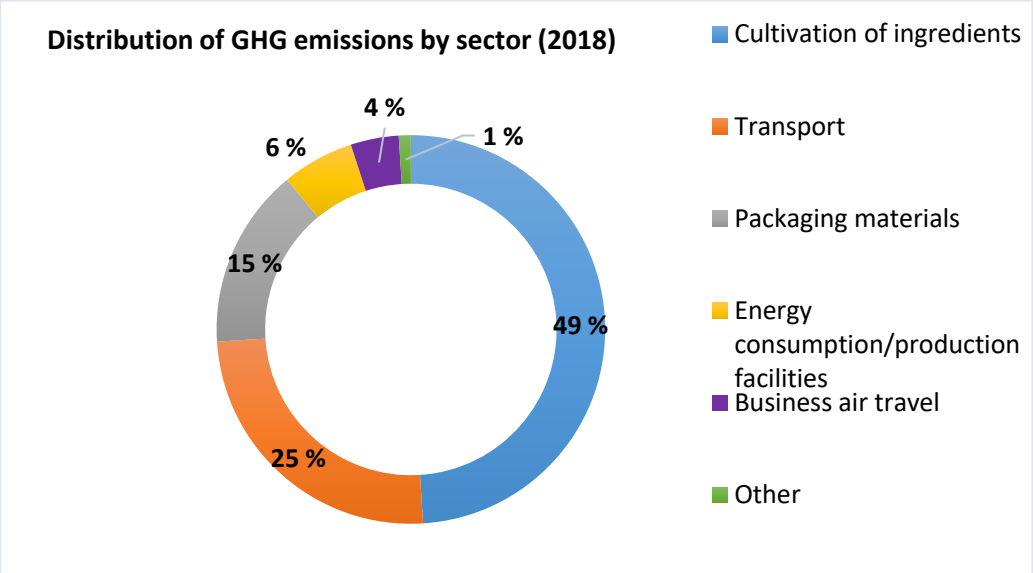
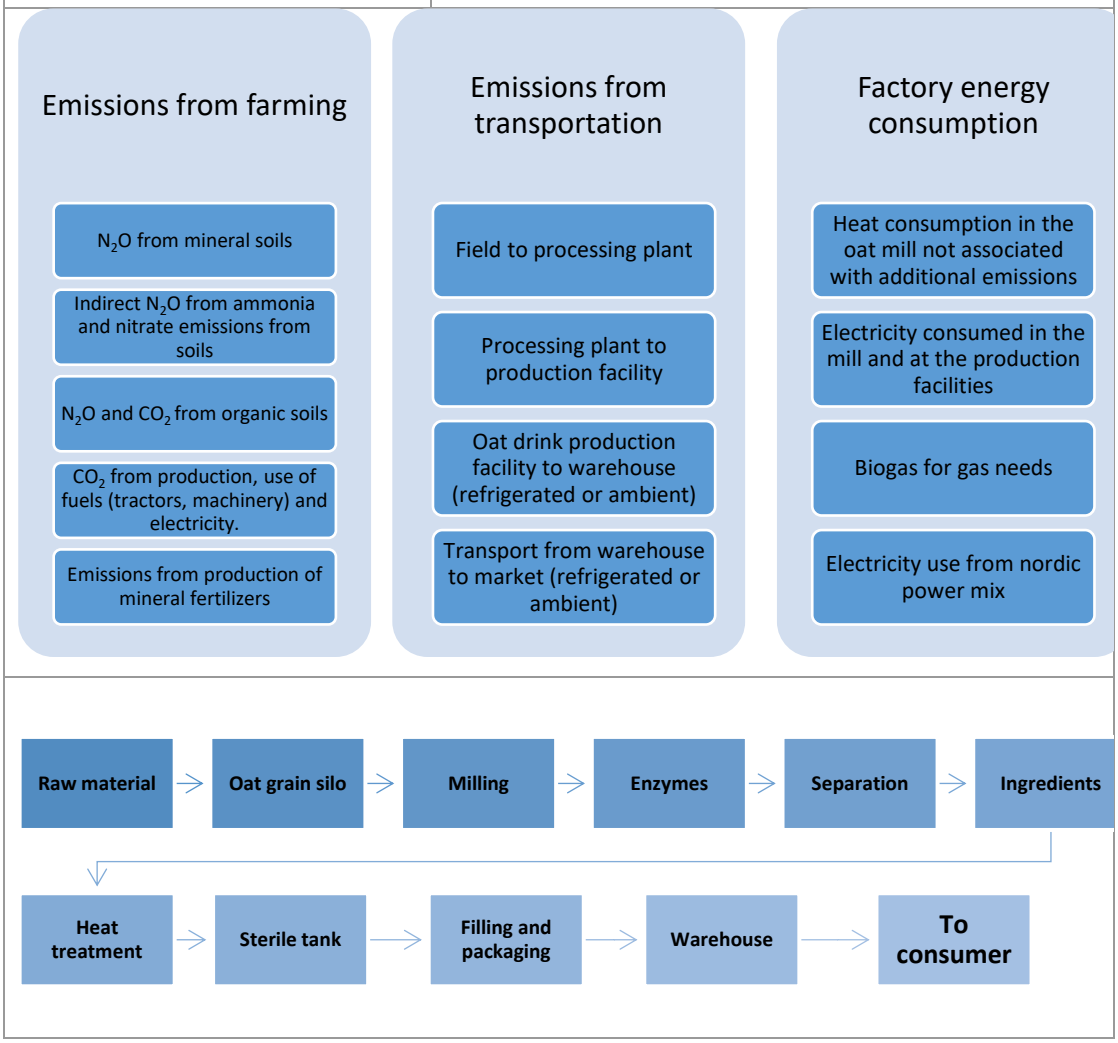


Figure 33. Distribution of corporate GHG emissions by sector. (Oatly 2018, 26)

Table 12. Evaluation of the study. Adapted from CarbonCloud (2019).

LCA commissioned to	**CarbonCloud AB**
Attributional Approach	• ISO 14067 • GHG Protocol
Functional Unit	One kg of packaged food product delivered to the store.
Parameters	• Oat Yield: 3,99 tonne DM/ha/yr • Rape seed yield: 3,25 tonne DM/ha/yr
Goal and scope	Estimation of climate footprint of Enriched Oat Drink Ambient in 1L package in a defined market



By optimizing processes in each sector of the organization, Oatly was able to reduce emissions associated to their operations and this translated into a lower impact per

unit. CarbonCloud evaluated their operations and calculated the carbon emissions for one single product in a specific market.

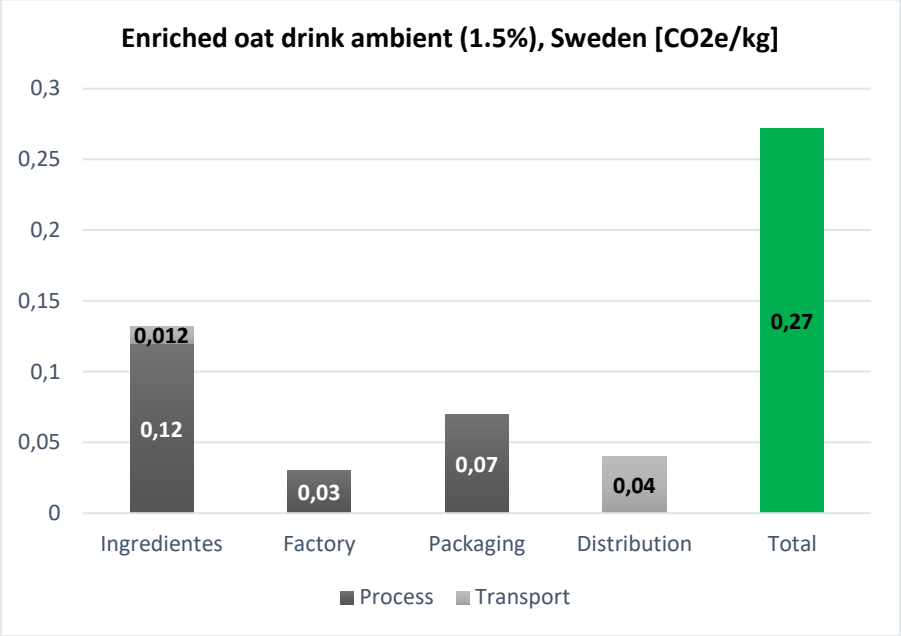


Figure 34. Findings on the study for climate footprint of enriched oat drink ambient in Sweden (CarbonCloud 2019)

CO_2eq values were added to the packaging of their products. The company now sells their products in over 20 countries and the estimated value varies according to geographical location. This is due to the transport requirements but also different production conditions. For instance, after immediate success in the United States, the company invested in a factory in America to remove the major leg of transportation and reduce the size of the supply chain. The new factory now produces locally with a different final CO_2eq value. But do these values mean anything to consumers? Part of the company's marketing campaign focused on challenging other brands label their products in the same way. This would allow consumers to make more concious decisions when purchasing goods. While this kind of developments seem unlikely, the company hopes that en a near future environmental labeling will become a standard in the same way nutritional labeling is a standard today. Nutritional labeling was not required until the passage of the nutrition labeling and education acto in the 1990's ("*History of Nutrition Labeling*", 2010). The regulation of nutrional labeling would happen even later for Europe and other areas around the world.

5 Discussion

After identifying the drivers behind the growth of the plant-based food consumption and compiling information provided by the companies in the sample group, there is a better understanding of the current situation of SMEs in the industry.

What value proposition do Nordic plant-based food producers offer to consumers in the Finnish market?

Firms and entrepreneurs in the industry look to capitalize from the growth in quantity demanded for sustainably sourced food products. Consumers look for practicality and variety and producers wish to address those needs by supplying a wide range of new products. The trend also points to interest in minimal processing and locally sourced raw material. The value proposition that these companies offer is an alternative to the experience of conventional products such as meat and dairy but with the assurance of being low impact, ethical, minimally processed, supportive of local producers and in most cases, a healthier alternative. The question these companies take as base to set a unique selling proposition is: how to make low-carbon alternatives more convenient and appealing for consumers interested in flexitarian diets? For this, the businesses rely heavily on customer feedback, taste trials and high investments in research and development. In addition, the plant-based sector has been paying more attention to traceability in supply chains.

What are the main strengths and challenges in logistics for Nordic producers of plant-based FMCGs?

Upon review of information from the theoretical framework and connecting it to points expressed by interviewees, short supply chains featuring local clustering of suppliers has been one of the greatest strength for the companies thus far. Locally sourced raw material that is cheap and does not need to be transported over long distances (e.g. air travel), has made it easier to scale the businesses in just a few years. In addition, most supply chains have a minimal need for temperature-controlled storage. Companies in the sample are a good representation of the industry, where most are under 10 years old. Companies have experienced steady

growth and all the representatives were pleased with the financial results since initial release.

When it comes to challenges, getting the average consumer to replace products that are generally seen as “necessity goods” due to their highly inelastic own-price demand is an ongoing challenge. The cultural aspect of food consumption means that, to some extent, this challenge will always be present. Therefore, companies have paid close attention to the target market and how they advertise their product. From the survey, respondents agree that the average consumer is largely misinformed about nutrition and the environmental impact of the supply chain of foodstuff items. Moreover, the plant-based industry is still largely misunderstood as its presence in the market is still relatively new. Lack of forecasting data has made it difficult for newer businesses to estimate the needs for production and inventory levels. Rapid growth in demand, has created competition due to a considerable number of new entrants in the market.

What solutions are being implemented by firms and entrepreneurs in the industry to develop their supply chains?

Interviewees highlighted the importance of constant improvement in the form of research and development investments. Research and development for product and process innovations remains the most effective way to optimize production and minimize waste. Well-established cooperation with suppliers is for logistical planning so firms are mindful to develop their SRM.

Some firms place sustainability at the core of the business strategy to set themselves apart as a sustainability organization instead of merely a food producer. Oatly provided an example of their life-cycle assessment to estimate the unitary environmental footprint. They were able to identify shortcomings in production, packaging and waste management. At the same time, the LCA study provided an addition in the labeling of the package that now displays the carbon emissions of a single product. While this number may seem arbitrary to the average consumer, the company hopes that from the pressure towards climate action, other companies will follow in the footsteps and tell consumers the real impact of each product. During an

interview with the company's sustainability specialist, the interviewee emphasizes on the importance of educating consumers about the impact of food choices. The outcomes of implementing environmental labeling would result in greater transparency and a continuous need to improve the sustainability of logistics.

6 Conclusion

Finnish authorities acknowledge that through the gradual transitions towards low-carbon energy systems, food consumption will account for an increasingly large share of GHG emissions. Therefore, the importance of improving food production systems by introduction of new technologies and innovations is necessary. The plant-based market is surging amid the growing demand for plant-based fast-moving consumer goods. Compelling evidence of the environmental benefits of opting for these products was presented in the study. By following a predominantly plant-based diet, the average consumer in Finland can reduce their carbon footprint by more than half from 1.8 to 0.7 tons CO_2e per year. However, low-carbon alternatives appeal to only a small sector of the population. Nordic plant-based food producers have a clear understanding of their target market and are aware of the limitations due to the cultural and traditional aspect of food consumption. Despite the small market size, businesses know that a greater selection of alternatives will help more people transition to a flexitarian diet.

Through a phenomenological study paired with a case from one of the companies that participated in the study, some connections were drawn between theoretical aspects and the current situation of the SMEs in the industry. Three quarters of the companies in the sample engage in food technology as a primary activity. Investments in research and development are essential to define the unique value proposition. Upon review of the unique value proposition, the value offered to consumers is a wide range of low-impact foodstuff products that features short supply chains, innovative products and local procurement. Minimal processing is also preferred for health promotion. Most of the companies in the sample were established over the past 10 years have had relative success for the short time

period. Younger companies prioritize optimizing their value chain and gaining competitive advantage by way introducing attractive products. In addition, they mostly compete with other plant-based brands. Older companies that have consolidated over the years, aim to develop their supplier relationship management and focus of corporate social responsibility.

The case study evaluated the effectiveness of a life-cycle assessment as a method to obtain a more holistic view of SCM. As a rapidly growing company, the LCA succeeded in estimating inventory valuation and emissions of a single item for multiple production facilities in different countries. The LCA was a recommended method for increased traceability and transparency. The case study also provided insight on improvements needed in processes within oats cultivation and packaging. The rapid expansion of the brand also demands the need to minimize transport and fueling unavoidable shipments with renewable fuels. Future studies should review the progress of companies after the initual start-up period and try to include a larger sample.

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