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HOW NORDIC PRODUCERS OF PLANT-BASED DAIRY ALTERNATIVES CONTRIBUTE TO THE SUSTAINABLE DEVELOPMENT GOALS

A company perspective

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International Business
Bachelor's Thesis
Supervisor: Pasi Rikkonen
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ABSTRACT OF
BACHELOR'S THESIS

Author: Rainer Kravets

Title of thesis: How Nordic Producers of Plant-Based Dairy Alternatives Contribute to the Sustainable Development Goals

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Degree: Bachelor of Science in Economics and Business Administration

Supervisor: Pasi Rikkonen

Objectives

The main objectives of this study were (1) to identify what are the key drivers from companies' perspective that enable changes in the food system towards wider consumption of plant-based dairy alternatives, and (2) to identify different aspects of how Nordic plant-based dairy alternatives producers are contributing to the Sustainable Development Goals (SDGs).

Summary

A shift towards plant-based food system is necessary to achieve the SDGs. Producers of plant-based dairy alternatives are contributing to the shift by developing products that replace animal-based dairy with plant-based alternatives. To study their impact on the SDGs and to identify the key drivers, interviews with Nordic plant-based dairy alternatives producers were conducted.

Conclusions

Taste, price, capacity and availability, and knowledge and habits were identified to be the key drivers that enable changes in the food system towards wider consumption of plant-based dairy alternatives. Production and consumption of plant-based dairy alternatives was associated with the following SDGs: 2 (Zero Hunger), 3 (Good Health and Well-Being), 6 (Clean Water and Sanitation), 13 (Climate Action), 14 (Life Below Water), and 15 (Life on Land). SDG 13 was identified most often, which suggests that positive impact is the biggest for climate.

Key words: sustainable development, plant-based dairy alternatives, oat milk, plant milk, Sustainable Development Goals, food systems

Language: English

Grade:

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

Current global food production and consumption system is not sustainable. Agriculture takes up 50 percent of habitable land. 77 percent of agricultural land is used for livestock, but it provides only 18 percent of global calorie supply (Ritchie & Roser, 2020). A transition towards a significantly more efficient plant-based food system is necessary to feed the growing population of our planet and reduce negative impact on the environment. Poore and Nemecek (2018) have estimated that changing the current diet to a diet that excludes animal products can reduce food's global land use by 76 percent.

Food production is responsible for about 26 percent of global greenhouse gas emissions of which animal agriculture is responsible for most emissions (Poore & Nemecek, 2018). Therefore, tackling food sustainability is crucial in achieving the Paris Agreement goal of limiting global warming to 1,5 degrees Celsius, compared to pre-industrial levels. Implementation of the Paris Agreement is important for achieving the United Nations Sustainable Development Goals (SDGs).

Production of dairy products is significantly more taxing on the environment than production of the same amount of plant-based foods (Ritchie & Roser, 2020). People in the Nordics are among the top dairy consumers in the world (Ritchie & Roser, 2017). However, companies in the Nordics and elsewhere are developing and introducing plant-based dairy alternatives to the market and more and more consumers are switching to these more environmentally friendly products.

This thesis will explore what is the role of Nordic plant-based dairy alternatives producers in transition towards a plant-based food system and how do they contribute towards the SDGs. Current literature will be reviewed to understand interconnections in the food system and sustainability and a conceptual framework will be developed that will be a basis for interview questions. Empirical evidence will be gathered through interviews with Nordic plant-based dairy alternatives producers. The results will be analyzed and compared with relevant literature.

1.2 Research Problem

Consumption of plant-based dairy alternatives is rising across the world. New companies are entering the fast-growing market and even dairy producers are developing their plant-based product lines. However, the drivers behind the growing market and enablers for future growth have not been studied extensively.

There is a significant number of studies available about the importance of adoption of plant-based diets in tackling global climate, environmental, and health problems. However, the role of plant-based dairy alternatives in solving global sustainability problems has not been studied extensively, especially their impact on the Sustainable Development Goals.

1.3 Research Questions

The purpose of this research is to answer the following questions:

- From companies' perspective, what are the key drivers that enable changes in the food system towards wider consumption of plant-based dairy alternatives?
- On which SDGs do Nordic plant-based dairy alternatives producers have the most impact on?
- What is Nordic plant-based dairy alternatives producers' contribution to the SDGs?

1.4 Research Objectives

The objectives for this research are the following:

- To identify what are the key drivers from companies' perspective that enable changes in the food system towards wider consumption of plant-based dairy alternatives.
- To identify different aspects of how Nordic plant-based dairy alternatives producers are contributing to the SDGs.

1.5 Definitions

Sustainable Development Goals - The 17 Sustainable Development Goals (SDGs) with 169 sub-targets are at the focus of the 2030 Agenda for Sustainable Development, which was adopted by all United Nations Member States at the UN Sustainable Development Summit in September 2015 (United Nations, n.d., a).

Plant-based dairy alternatives - Plant-based dairy alternatives are food products that substitute dairy products such as milk, yoghurt, cooking creme, ice cream, cheese etc. Plant-based dairy alternatives are made from plants without using animals in the production process.

Nordic countries - Nordic countries are Finland, Sweden, Norway, Denmark, and Iceland (Mapes, 2020).

Food systems - Food systems consist of various actors that perform value-adding activities in the production, aggregation, processing, distribution, consumption, and disposal of food products. A food system is composed of different sub-systems such as farming system, waste management system etc. (FAO, 2018).

2. LITERATURE REVIEW

The purpose of this literature review is to obtain a revised understanding of the topic through synthesis to create a foundation for the research and construct a conceptual framework by which the phenomenon is studied. The literature review identifies the main environmental and health impacts of animal agriculture and introduces ways how a shift towards plant-based food system can mitigate those negative impacts. The nutritional and health aspects of consumption of cow's milk is evaluated and compared with different types of plant-based alternatives. To get an overview of the size of plant-based dairy alternatives market, it is compared with a global dairy market. The connections of Sustainable Development Goals to food system are examined and the main challenges for Nordic countries are identified. Most of the sources used in this literature review are published within the last 5 – 10 years, which is especially important for plant-based dairy alternatives as the market is in constant development and growing at a very rapid pace.

2.1 Climate Impact of Animal Agriculture

In the last two decades several studies have tried to estimate what percentage of total anthropogenic greenhouse gases (GHGs) is produced by animal agriculture and the results have varied significantly (Figure 1). According to the United Nations Food and Agriculture Organization's (FAO) report entitled 'Livestock's Long Shadow' (2006), animal agriculture is responsible for 18 percent of all anthropogenic GHG emissions and about 80 percent of agriculture sector emissions measured in CO2 equivalent. However, in 2009 Goodland and Anhang disagreed with the estimate of 18 percent because it did not consider emissions from livestock respiration, changes in land use and its ability to store carbon, and it omitted emissions related to fish farming. Additionally, FAO used a 100-year timeframe instead of a more appropriate 20-year timeframe for calculating global warming potential (GWP) of methane. This resulted in a GWP drop from 72 to 25, leading to a significant underestimation of the heat trapping capacity of methane. The analysis done by Goodland and Anhang (2009) concluded that livestock and its byproducts account for at least 51 percent of annual worldwide GHG emissions.

Goodland and Anhang were not the only ones who disagreed with FAO's GHG emissions estimation. After Livestock's Long Shadow report meat industries both in the EU and the U.S. launched lobbying efforts, but their objective was to lower the amount of estimated GHG emissions from animal agriculture (Hannah, 2020). Hannah (2020) compares animal agriculture lobbyists' strategy to the 20th century tobacco and oil lobby as they followed a similar pattern: becoming a privileged partner in discussion and forcing in their own interests in order to prevent change. In 2012 meat lobbies UECBV and CLITRAVI succeeded in becoming leading stakeholders in partnership with FAO in assessing the best way to estimate the environmental impact of the EU animal agriculture industry (Hannah, 2020). Consequently, in 2013 FAO released a new report, which instead of taking into account errors in the previous report, decreased the percentage of GHG emissions from animal agriculture to 14.5 percent.

In 2019 Rao conducted a Global Sensitivity Analysis using the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) and other peer-reviewed scientific sources. The analysis concluded that animal agriculture is responsible for at least 87 percent of GHG emissions annually, being the leading cause of climate change. Rao (2019) agreed with Goodland and Anhang that a shorter timeframe for calculating the GWP of methane should be used, thus a 10-year timeframe with GWP of 130 was used for that purpose. While FAO did not include Carbon Opportunity Cost (COC) in their GHG emission estimation, Goodland and Anhang did include it, but according to Rao (2019) undercounted COC because they did not include CO2 stored in the soil. Therefore, when CO2 storing capacity both above ground vegetation and in soil are included in the COC calculations, true lifecycle emissions of animal agriculture should be at least 87 percent of the total (Rao, 2019). The comparison of the main aspects included in the calculation of GHG emissions from animal agriculture in different studies is presented in Table 1.

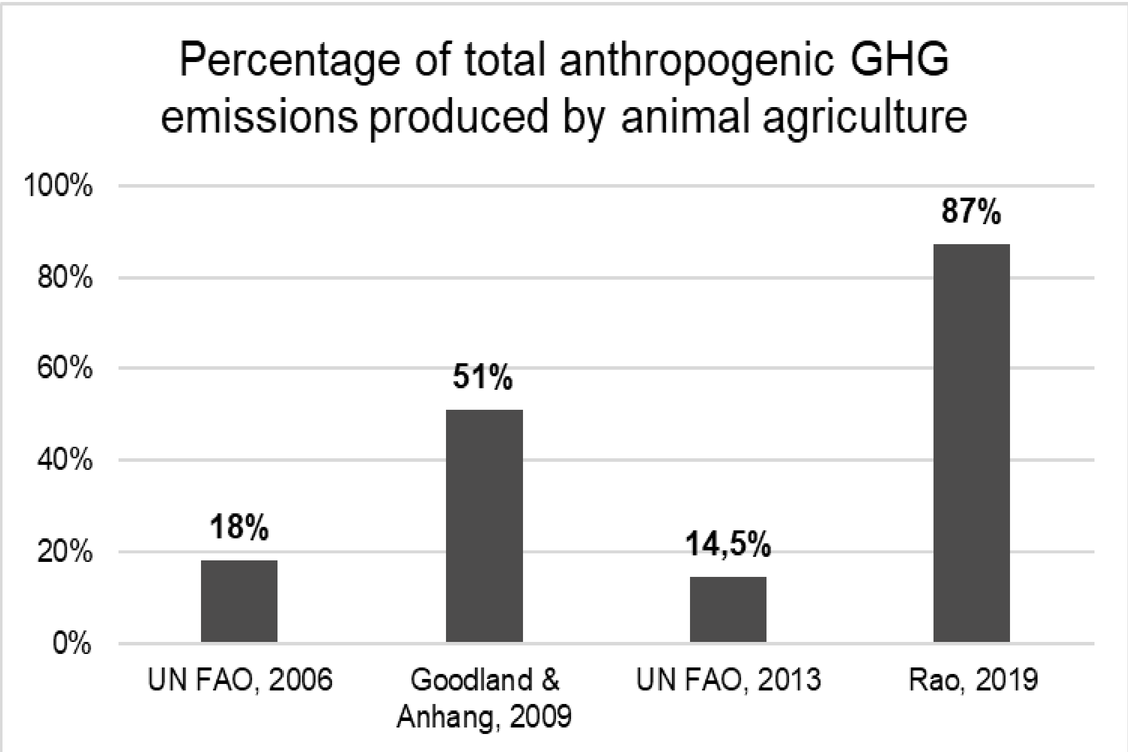

Figure 1: Percentage of total anthropogenic GHG emissions produced by animal agriculture

Table 1: Main similarities and differences of methodologies of calculating GHG emissions by different authors

	UN FAO, 2006	Goodland & Anhang, 2009	UN FAO, 2013	Rao, 2019
Feed production and processing (including deforestation)	X	X	X	X
Enteric fermentation by ruminants	X	X	X	X
Manure storage and processing	X	X	X	X
Processing and transportation	X	X	X	X
Livestock respiration		X		X
Carbon opportunity cost		X (undercounted according to Rao (2009))		X
GWP timeframe in years	100	20	100	10

While Goodland and Anhang (2009) and Rao (2019) emphasized the importance of transition to a mostly plant-based food system to mitigate the emissions from animal agriculture, FAO (2006, 2013) only proposed mitigation through increasing efficiency and new technologies. The potential bias in the data and reluctance to shift towards plant-based food system might be because FAO is publicly partnered with animal agriculture industry promotion organizations like International Meat Secretariat, International Dairy Federation and the International Egg Producers Association (Rao, 2019). Despite the differences in the results, it can be concluded that animal agriculture has an enormous impact on the climate and should be a priority area in tackling climate change. In addition, animal agriculture has a negative impact not only on climate but also environment and other aspects that will be discussed further below.

2.2 Sustainable Development Goals

The 17 Sustainable Development Goals (SDGs) cover all dimensions of sustainable development: economic, social and environmental. The main action areas include ending poverty and hunger (SDGs 1 & 2); providing quality education (SDG 4); ensuring equal and healthy environment for all people (SDGs 3, 5 & 10); protecting the planet from degradation through responsible consumption and production (SDG 12), climate action (SDG 13), and sustainable management of natural resources (SDGs 6, 14 & 15); creating access to affordable and clean energy (SDG 7); promoting sustainable economic growth (SDG 8); building resilient infrastructure (SDGs 9 & 11); fostering peaceful, just and inclusive societies (SDG 16); and building global partnerships (SDG 17) to achieve all the goals together (UN, n.d., b).

2.2.1 SDGs and Food System

According to the UN Food and Agriculture Organization (FAO) (2018) food and agriculture are at the very heart of the Agenda 2030 and are linked to each of the 17 goals. This means that improvements in food systems benefit achieving all the SDGs. However, because of the multidimensional nature of the SDGs, trade-offs and synergies vary between them (Pradhan et al., 2017). Therefore, progress in one target may potentially hamper the progress for another target. Pradhan et al. (2017) analyzed correlation between SDG indicators of all countries and found that SDGs 8 (Decent work and economic growth), 9 (Industry, innovation, and infrastructure), 12 (Responsible consumption and production), and 15 (Life on land) have negative correlation with most other SDGs. Most often, higher human development and socioeconomic standards are in conflict with environmental protection goals. On a positive side, positive correlations among the SDGs largely outweighed the negative ones for most countries, and within each SDG synergies largely exceeded trade-offs. Kroll et al. (2019) analyzed further the relations between projected SDG trends until

2030 and reached a concerning conclusion that there are still a significant portion of trade-offs. Thus, while the synergies between and within the SDGs keep outweighing the trade-offs, the latter ones still require urgent attention and solutions in order to achieve the Agenda 2030.

FAO highlighted several concerning developments regarding world nutrition in its 2018 report. As of 2017, the number of undernourished people was estimated to have increased to 821 million, while more than 672 million adults were obese. About 151 million children under five were affected by stunting and at the same time over 38 million children under five were overweight. The challenges in food systems are influenced by not only countries' socioeconomic status but also climate change, which is disrupting food security, especially in countries with agricultural systems that are highly sensitive to rainfall and temperature variability and severe drought, and where the livelihood of a high proportion of the population depends on agriculture (FAO, 2018). Therefore, reducing the negative impact on climate across the globe contributes to better global food security.

2.2.2 Performance of Nordic Countries Against the SDGs

In the most recent Europe Sustainable Development Report European countries were graded and ranked based on their performance in achieving the SDGs (SDSN & IEEP, 2020). Nordic countries were placed at the top of the list: Finland, Sweden, and Denmark in top three, Norway 5th and Iceland 11th out of 31 countries. This indicates that Nordic countries are in a better position in achieving the SDGs than other European countries.

Despite the high ranking, Nordic countries still have major and significant challenges in achieving several SDGs (SDSN & IEEP, 2020). Table 2 shows that SDGs 2 (Zero hunger), 12 (Responsible consumption and production), and 13 (Climate action) are the most challenging for Nordic countries as these three SDGs are included in all countries' major or significant challenges.

Table 2: SDGs that have major or significant challenges in Nordic countries (SDSN & IEEP, 2020)

Country	Major Challenges	Significant Challenges
Finland	2, 12, 13	15
Sweden	14, 15	2, 12, 13
Denmark	12, 13	2, 14
Norway	12, 14, 15	2, 6, 13
Iceland	12, 13, 14, 15	2, 4, 6, 11, 17

SDG 2: Zero hunger

The two worst performing indicators under the SDG 2 are Prevalence of obesity, which measures the percentage of the adult population that has a body mass index (BMI) of 30 or higher and Human Trophic Level, which measures the energy intensity of diet composition, thus indicating the proportion of plants eaten compared to animals (SDSN & IEEP, 2020). Obesity is a significant challenge in all Nordic countries and the trend suggests that the situation is getting worse in all of the countries. Trophic Level is a major challenge in all Nordic countries and the trend points towards worsening or stagnating direction.

SDG 12: Responsible consumption and production

Under the SDG 12, most of the indicators are a major or a significant challenge for the Nordic countries. This can be explained by trade-offs discussed above, which indicate that SDG 12 has negative correlation with most other SDGs (Pradhan et al., 2017). The worst performing indicators for SDG 12 are the following:

- Production-based SO_2 emissions - measures SO_2 emissions associated with the production of goods and services;
- Imported SO_2 emissions - measures emissions of SO_2 embodied in imported goods and services;

- Nitrogen production footprint - measures reactive nitrogen (ammonia, nitrogen oxides and nitrous oxide) emitted during the production of commodities;
- Net imported emissions of reactive nitrogen - measures net imports of reactive nitrogen emitted during the production of commodities.

Due to lack of data, the trends were not provided for most of the indicators. In addition, it should be noted that most of the data for SDG 12 dates back to 2010-2012, which makes it plausible that the current situation is somewhat different.

SDG 13: Climate Action

Two indicators out of three are having major challenges in the Nordic countries under the SDG 13. The two indicators are CO_2 emissions embodied in imports (goods and services) and GHG emissions per capita, which include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and the F-gases. The trend is stagnating in all countries for CO_2 emissions embodied in imports and the same is true for GHG emissions per capita, except for Finland and Iceland where the trend is indicating a worsening direction.

2.3 Shift Towards Plant-Based Food System

Various studies estimate that the climate impact of the global food system is growing in the future. Tilman and Clark (2014) studied changes in income and diets and concluded that if global diets keep changing in the same income-dependent way as was identified in the research, the average global per capita dietary GHG emissions from crop and livestock production would increase 32 percent from 2009 to 2050. Furthermore, when the income dependent GHG emissions increase is combined with the estimated population increase of 36 percent between 2009 and 2050, the total increase of global GHG emissions from food production is estimated at 80 percent. Bajželj et al. (2014) support the trend as according to their study, under the business-as-usual scenario the agriculture-related emissions alone reach the 2°C target emissions allowance in 2050. The 2°C target was set at the United Nations Framework Convention on Climate Change conference in Cancun in 2010, the current target 1,5°C was set in Paris in 2015. Therefore, changes in the food system must happen to reduce the negative impact on the environment.

Technological advancements is one potential source to decrease environmental impact of food production. Bryngelsson et al. (2016) state that under optimistic assumptions technological advancements in agricultural productivity and specific mitigation technologies can cut CH4 and N2O emissions by nearly 50 percent in 2050. This would result in 600–900 kg CO2-eq emissions per capita per year. For example, adoption of improved manure management systems, feed supplementation, and energy saving equipment can reduce GHG emissions by 14 to 17 percent in OECD countries' dairy mixed systems (Gerber et al. 2013). However, only technological advancements are not sufficient because emissions need to be reduced to about 500 kg CO2-eq per capita per year, or less, to meet the climate targets (Bryngelsson et al., 2016). Moreover, some of these potential technological advancements are not yet created. Bryngelsson et al. (2016) study was mainly based on conditions in Sweden but authors state that the findings are likely to be true for the EU as a whole because of similar consumption patterns and technology.

In addition to technological advancements that build on existing technologies, new technologies for food production have been developed. Vertical farming allows to grow leafy vegetables, berries, and herbs indoors all year round while using significantly less land, water, and fertilizers than traditional farming (Tuomisto, 2019). Cultured meat is produced by cultivating animal cells in a bioreactor, making the production also potentially much more resource efficient than animal farming. However, Tuomisto (2019) believes that because of the early stages in the development, these technologies cannot help with the current urgent problems.

Poore and Nemecek (2018) suggest that differences in environmental impact between animal and vegetable proteins will remain in the future unless major technological changes disproportionately target animal products. Five main biophysical reasons that were identified are:

1. Emissions from feed production generally exceed emissions of vegetable protein farming because feed–to–edible protein conversion ratios are greater than 2 for most animals, high usage of low-impact by-products is typically offset by low digestibility and growth; and because additional transport is required to take feed to livestock;

2. Deforestation in agriculture is mainly caused by feed production, which result in losses of above- and belowground carbon. Improved pasture management can only reduce life-cycle ruminant emissions by a maximum of 22 percent, but greater sequestration requires even more land;
3. Additional emissions are created by animals from enteric fermentation, manure, and aquaculture ponds;
4. Additionally, emissions from processing, particularly emissions from slaughterhouse effluent, add a further 0,3 to 1,1 kg of CO2eq per kg of product. This is greater than processing emissions for most other products.
5. Fresh animal products are prone to spoilage, which creates higher wastage.

It is necessary to reduce the consumption of animal foods to reach global climate targets. Tukker et al. (2011) studied the environmental impact of changes towards healthier diets in Europe and found that simply changing to healthier diets will result only in minor impact reductions and that significant reduction in meat and dairy intake in Europe is necessary. Poore and Nemecek (2018) state that dietary change can deliver environmental benefits that producers cannot achieve. Based on a 2010 base year, changing the current diet to a diet that excludes animal products can reduce food's land use by 76 percent, food's GHG emissions by 49 percent, acidification by 50 percent, eutrophication by 49 percent, and scarcity-weighted freshwater withdrawals by 19 percent. Additionally, the land that would no longer be used for food production could remove about 8.1 billion tons of CO2 from the atmosphere each year over 100 years as natural vegetation reestablishes, and soil carbon re-accumulates. Rao (2019) reports that a global transition to a plant-based economy has the potential to sequester over 2000 billion tons of CO2 in regenerating soils and vegetation. This pattern is also supported by Bryngelsson et al. (2016) as their research showed that with vegan diets if spare agricultural land were allowed to revert to forest or other natural vegetation, the resulting carbon sequestration in vegetation stocks could cancel out 300 years of all food related recurrent GHG emissions. In a scenario where all ruminant products were replaced with poultry meat and dairy products with soy milk and vegetable oils, the result was 100 years (Bryngelsson et al., 2016). Theurl et al. (2020) also studied different dietary scenarios and similarly to other studies found that GHG emissions are lowest for vegan diets and highest for scenarios including high meat demand, especially ruminant meat and milk.

Food waste is also a significant problem in the food system. According to FAO (2011) globally about 1,3 billion tons of food, which is about one third of all food produced for human consumption, is lost or wasted. However, according to Bryngelsson et al. (2016) halving current avoidable food waste lowers emissions only by 1 to 3 percent. In the light of achieving climate targets, dietary changes and technological advancements should be a priority in front of tackling food waste. Moreover, as Poore and Nemecek (2018) stated above, fresh animal products are prone to spoilage. Therefore, dietary shift away from animal products also decreases food waste.

2.3.1 Health Aspects of Shifting Towards Plant-Based Food System

People's choices regarding their diets impact both environmental sustainability and their health. Tilman and Clark (2014) who identified in the previous section the income-dependent ways how GHG emissions from diets are increasing also researched the link to human health. The findings showed that trajectories by which diets are changing are remarkably increasing global incidences of type II diabetes, cancer, and coronary heart disease. However, predominantly plant-based diets that follow current evidence on healthy eating improve nutrient levels and reduce diet-related premature mortality, while reducing environmental impacts (Springmann et al., 2018). Chen et al. (2016) studied association between dairy fat and incident of cardiovascular disease in US adults and found that the replacement of animal fats with vegetable sources of fats and polyunsaturated fatty acids may reduce risk of cardiovascular disease.

Results from a 22-year long cohort study in Sweden showed that high milk intake for both men and women is associated with higher mortality and fracture rates and with higher levels of oxidative stress and inflammatory markers (Michaëlsson et al., 2014). Women who consumed three or more glasses of milk a day had a 93 percent higher risk of total mortality, 16 percent higher risk for any fracture, and 60 percent higher risk for hip fracture compared to those who consumed less than one glass a day. For men, higher consumption of milk was also associated with a higher rate of death, but the risk was lower than for women and was mainly associated with cardiovascular death (Michaëlsson et al., 2014).

Feskanich et al. (2014) found that each additional glass of milk per day during teenage years was associated with a 6 percent higher risk of hip fracture in men in the U.S. However, milk consumption during teenage years was not associated with hip fractures in women. Therefore, the study concluded that "greater milk consumption during teenage years was not associated with a lower risk of hip fracture in older adults" (Feskanich et al., 2014).

The position of the American Dietetic Association (2009) about vegetarian and vegan diets is following: "Appropriately planned vegetarian diets, including total vegetarian or vegan diets, are healthful, nutritionally adequate, and may provide health benefits in the prevention and treatment of certain diseases. Well-planned vegetarian diets are appropriate for individuals during all stages of the lifecycle, including pregnancy, lactation, infancy, childhood, and adolescence, and for athletes." This position from an organization that represents over 100 000 food and nutrition professionals assures the healthfulness of plant-based diets.

In addition to health risks related to direct consumption of animal-based foods, farming of animals poses a significant threat to human health by increasing the risk of zoonotic diseases. Livestock products are more susceptible to pathogens than other food products as they are able to transmit diseases from animals (FAO, 2006). Rising consumption of meat, eggs, and dairy has resulted in closer contacts between humans and animals by keeping them in very confined spaces and invading their natural habitats. About 75 percent of newly emerging infectious diseases are zoonoses and 60 percent of infectious diseases in humans are spread from animals. SARS, Ebola, swine flu, and avian flu are all zoonotic diseases as well as COVID-19, which is assumed to have originated from wild animals (ProVeg, 2020). High usage of antibiotics in animal agriculture is mainly responsible for antimicrobial resistance, which is expected to kill 10 million annually by 2050, leading a way towards post-antibiotic era. Based on the developments in the global food system, future outbreaks of zoonotic diseases are expected to be more frequent and more dangerous (ProVeg, 2020).

2.3.2 Ethics of Animal-Based Food Consumption

One of the main ethical arguments against consumption of animal products is that humans do not need to kill animals in order to survive or even thrive. Therefore, humans need to find moral justification for that choice (Henning, 2011). Hölker et al. (2019) show that the proportion of people in the population who are interested in animal welfare is bigger than the proportion of people who are willing to give up meat consumption. This demonstrates cognitive dissonance that is prevalent in our societies. Hölker et al. (2019) identified that animal-ethical value 'rejection of relationism', which means equality of companion and farm animals, plays a key role in adoption of sustainable diets. In combination with animal rights, which intends to give animals various rights, abolitionism, which rejects the use of animals altogether, and new contractarian approach, which allows the usage of animals but intends to enable them good life to the greatest extent possible, rejection of relationism leads to significantly higher rates of flexitarian, vegetarian, and vegan diets (Hölker et al., 2019).

Almiron and Tafalla (2019) argue that speciesist anthropocentrism is preventing humanity from reacting to the main human-caused drivers of global warming. Instead of focusing on the principle of equal consideration and sentience, humans focus on prioritizing their interests within society and the whole biosphere. Almiron and Tafalla (2019) believe that because animal suffering can trigger inherent compassion in humans, it would be a significantly better strategy to protect the environment and human life than strategies based on environmental facts and logic. This is somewhat supported by a study conducted by Janssen et al. (2016), which consisted of interviews with 329 vegans in vegan supermarkets in Germany to identify motivations for adopting a vegan diet. The study found that 46,8 percent of respondents were motivated by environment-related reasons, 69,3 percent by personal well-being and/or health, and as much as 89,4 percent were motivated by animal-related reasons.

2.3.3 Current Food Consumption Patterns in the Nordics

Even though Nordic countries have made strong commitments to adhere to the 2030 UN SDGs, current diets in the Nordic countries are neither healthy nor environmentally sustainable (Meltzer et al., 2019). Meltzer et al. (2019) highlight that transformation of Nordic food production and changes in diets are necessary to reach the goals. Table 3 presents the consumption levels of animal products in Nordic countries. Meat consumption per capita is highest in Iceland (91,01 kg), but other countries also show very high consumption, reaching almost double of the world average, which was 43 kg in 2013. However, the world average has increased significantly over the past decades as it was 23,08 kg in 1961. Milk consumption in the Nordics is 2,8 - 5,1 times higher than world average, with highest consumption in Finland (457,7 kg). Compared to meat and milk consumption, egg consumption in the Nordics is closest to the world average. Finnish per capita consumption is even lower than world average.

Table 3: Meat, milk, and egg consumption per capita in Nordic countries (Ritchie & Roser, 2017)

Country	Meat consumption per capita in 2017 (kg)	Milk consumption per capita in 2017 (kg)	Egg consumption per capita in 2017 (kg)
World (2013)	43,22	90,00	9,19
Finland	76,69	457,7	8,74
Sweden	77,06	304,12	13,5
Norway	67,46	252,82	11,58
Denmark	70,82	307,03	15,79
Iceland	91,01	255,76	10,93

Figures 2 and 3 show the changes in per capita meat and milk consumption in the Nordic countries between 1990 and 2017. Meat consumption was increasing in the first part of the period and has been relatively stable in the second for all countries except for Denmark. High fluctuations in Denmark's data suggest high uncertainty of the estimations, compared to other countries. Throughout the same period world average meat consumption has been about half of the Nordic consumption but has been steadily increasing.

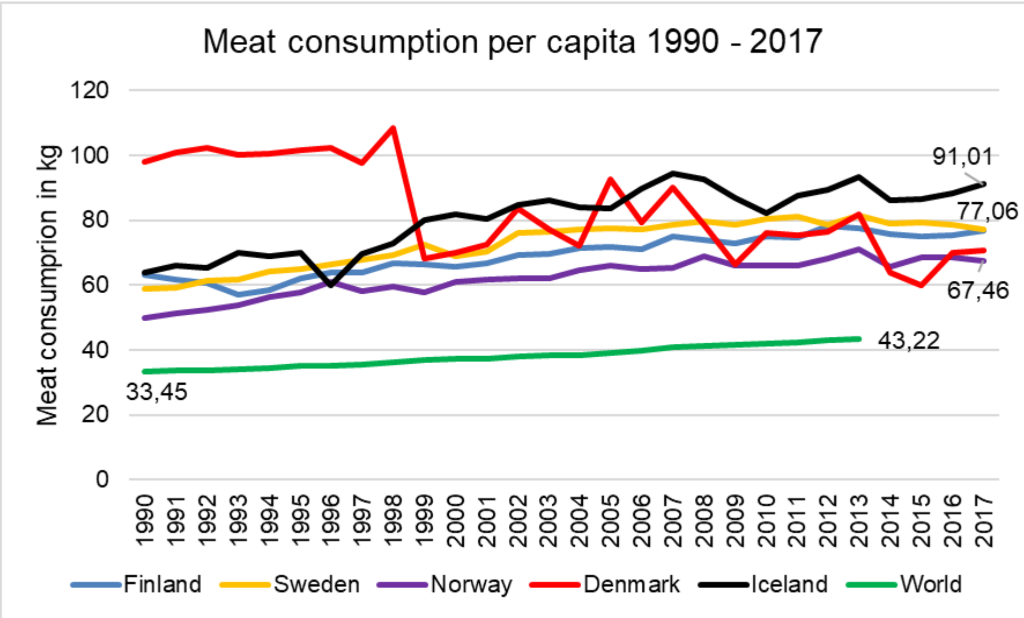

Figure 2: Meat consumption per capita in the Nordics 1990 – 2017 (Ritchie & Roser, 2017)

Compared to meat consumption, milk consumption has been more stable throughout the period (Figure 3). Denmark and especially Finland demonstrated growth in consumption in the last years of the period, while Norway and Iceland remained on the same level and consumption in Sweden declined. Similarly to meat consumption, milk consumption has been increasing in the world but at a slower pace.

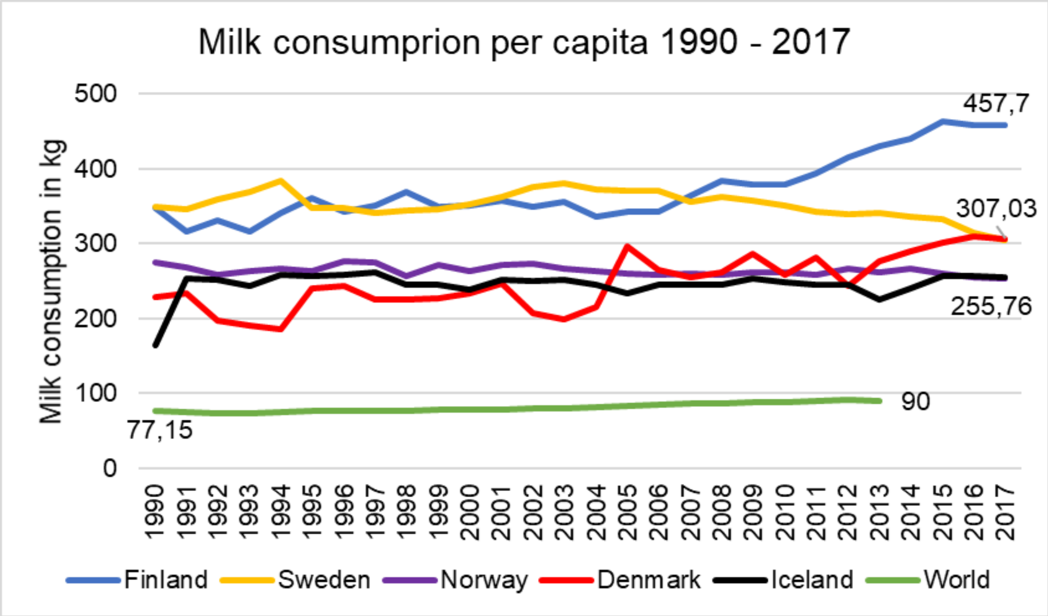

Figure 3: Milk consumption per capita in the Nordics 1990 – 2017 (Ritchie & Roser, 2017)

Wood et al. (2019) compared Nordic food consumption to EAT-Lancet dietary targets and identified several gaps. All Nordic countries should increase intake of vegetables and legumes and reduce added sugars. Red meat consumption should drop nine times to meet the recommended range. Finland and Sweden should reduce the proportion of tubers or starchy vegetables in their diet. Consumption of fruits, fish, and chicken and other poultry are within recommended range, but intake of dairy foods and eggs are close to upper limit. Grains intake is in recommended range but should be replaced with whole grains (Wood et al., 2019).

2.3.4 Role of Policies in Dietary Transition

Policies can influence dietary transition on different levels. Legislations define legal boundaries and norms, guidelines and recommendations influence consumers by providing information, and fiscal measures such as taxes and subsidies create economic incentives.

Bajželj et al. (2014) observed that as of 2014, compared with the attention given to the energy supply and end-use sectors, global food and land use scenarios had received little attention in climate change mitigation policies. Goodland and Anhang (2009) agree that in climate change discussions fossil fuels are usually on top of the list and that GHGs of domesticated animals raised for food have been vastly underestimated. Even though replacing animal products with plant-based products would be the best strategy for reversing climate change (Goodland & Anhang, 2009), the EU is in many cases hindering the transition towards a plant-based food system. European Commission (EC) launched European Green Deal in 2019, which set a target for Europe to become climate neutral by 2050 (EC, n.d., a). However, in the same year European Commission supported the Proud of European Beef campaign with 3,6 million euros to make consumers feel identified and supported in their choice regarding eating red meat, despite the fact that the World Health Organization (WHO) has classified red meat as Group 2A carcinogenic (EC, n.d., b) (WHO, 2015). The reason for starting this campaign was that the consumption of fresh meat had been decreasing in the last decade, which in fact is one target of the Farm to Fork strategy. The Farm to Fork action plan is part of the Green Deal and its aim is to promote plant-based diet and make healthy and sustainable choices easy by adding food labels that cover the environmental and social aspects of food products (EC, n.d., c). Conversely, in 2020 the European Parliament voted in favor of banning dairy-related terms for plant-based alternatives, using similar packaging, and referencing dairy in any way, for example showing comparison of climate impact. However, currently the amendment is not adopted into a law yet and Oatly, the Swedish oat milk producer, Upfield, the global producer of plant-based spreads, and ProVeg, the international food awareness organisation have partnered and created a campaign and a petition to reverse the amendment (Southey, 2021).

Poore and Nemecek (2018) suggest that average product impacts should be communicated to consumers because this enables dietary change. Oatly is already showing the climate footprint of its products on the packaging (Kateman, 2020). A multinational consumer goods company Unilever has set a target to show on each of the company's 70 000 products the amount of GHGs emitted in manufacturing and shipping of these goods (Rathi, 2020). The more companies start showing the climate footprint of their products, the more consumers can compare products based on their impact. Pieper et al. (2020) take a step further and suggest that external climate costs should be included in product pricing as the polluter-pays principle is more fair. According to their research in Germany, internalizing external GHG costs would increase the price of conventional and organic animal-based products by

2,41€/kg (146 percent and 71 percent surcharge on producer price level), the price of conventional dairy products by 0,24€/kg (91 percent surcharge), and the price of organic plant-based products only by 0,02€/kg (6 percent surcharge). This shows how ineffective the current pricing system is and that by incorporating external costs into prices, there would be an incentive for consumers to purchase more environmentally friendly products. In addition, according to FAO (2006), livestock is contributing to global hunger by raising overall demand and prices for crops and agricultural inputs.

Sabaté and Soret (2014) discuss that implementing agricultural and nutritional policies that lead to the adoption of plant-based diets is politically challenging but also the most rational and scientific way of acting, considering the future of our planet. This would tackle several issues simultaneously: optimizing the food supply, health, environmental, and social justice outcomes for the world's population (Sabaté & Soret, 2014). From a food supply perspective, a structural shift in production from dairy to vegetable food would significantly increase global supply of edible protein (Bryngelsson et al., 2016). This is because livestock detract more from total food supply than they provide by consuming more human edible protein than is produced (FAO, 2006). However, Tukker et al. (2011) emphasise that in Europe the production of food items like beef will not drop together with decline in domestic consumption, as meat producers will most likely compensate losses by higher exports. Another aspect that policymakers should take into account is that the animal agriculture industry is providing 190 million tons of food for humans and 140 million tons of other raw materials such as bones, skin, and blood, which means that the industry would continue producing the other materials even when consumption of animals for food would drop (Rao, 2019). To reduce the impact on the environment, the goal should be to adopt a vegan lifestyle that excludes any use of animal products (Rao, 2019). Therefore, policies should target both consumers to shift towards vegan lifestyle and producers to shift production from animal products to plant products.

2.4 Plant-Based Dairy Alternatives

Plant-based dairy alternatives are produced from several different plants. In 2019, the global market size of dairy alternatives made from soy was the biggest - 7,4 billion U.S. dollars, followed by products made from almonds and coconut (Figure 4).

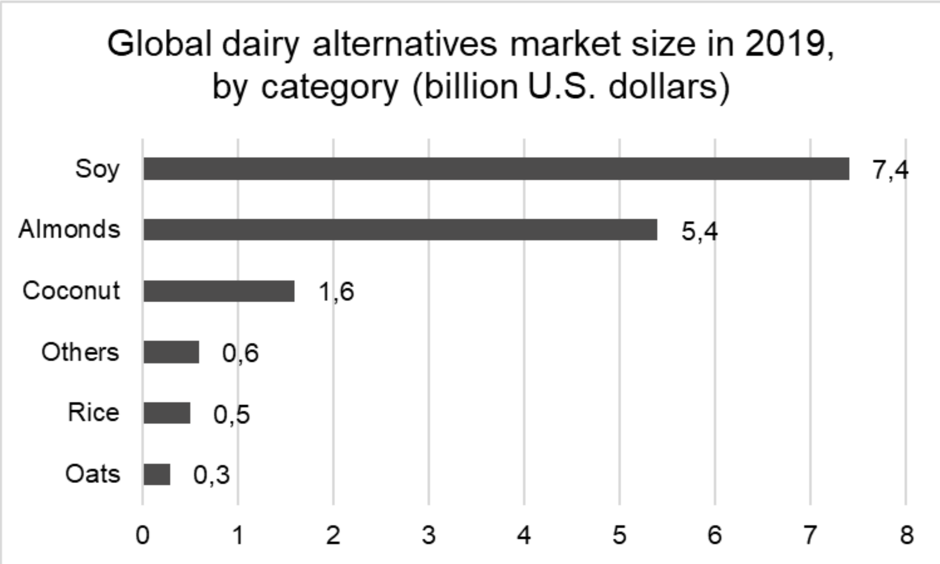

Figure 4: Global dairy alternatives market size in 2019, by category (Statista, 2019)

Plant-based dairy alternatives include several product categories. In 2019 in the United States by far the biggest category based on sales was milk alternatives - 2 billion USD (Figure 5). Other categories like ice cream, creamer, yogurt, butter, and cheese had more even sales ranging from 189 million to 336 million U.S. dollars.

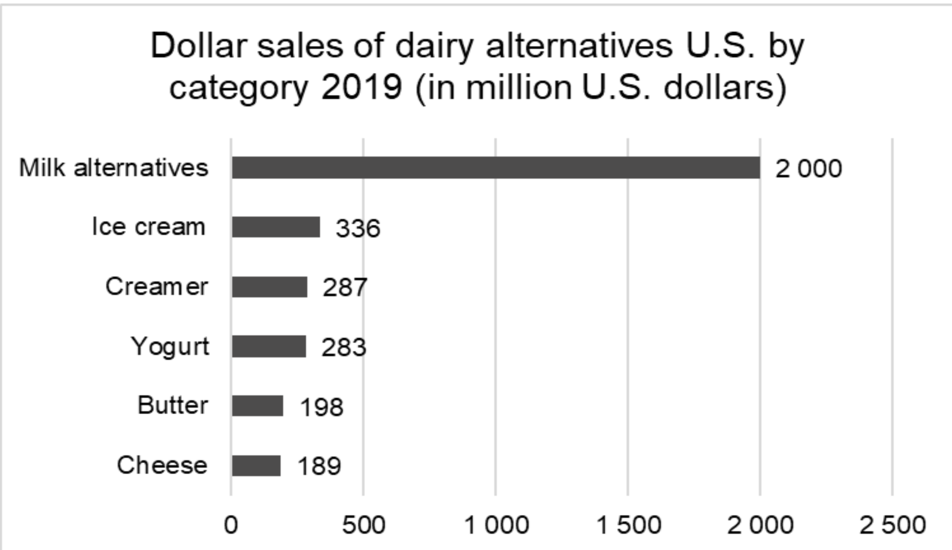

Figure 5: Dollar sales of dairy alternatives U.S. by category 2019 (PBFA, 2020)

Plant-based milk alternatives are produced by breaking down plant materials and mixing them with water where the particles are in a size range between 5–20 lm (Sethi et al., 2016). In an article entitled “Plant-based milk alternatives an emerging segment of functional beverages: a review.” Sethi et al. (2016) categorized plant milks into following categories:

1. Cereal based: Oat milk, Rice milk, Corn milk, Spelt milk
2. Legume based: Soy milk, Peanut milk, Lupin milk, Cowpea milk
3. Nut based: Almond milk, Coconut milk, Hazelnut milk, Pistachio milk, Walnut milk
4. Seed based: Sesame milk, Flax milk, Hemp milk, Sunflower milk
5. Pseudo-cereal based: Quinoa milk, Teff milk, Amaranth milk

Soy milk

Soy milk is known to be consumed in China already 2000 years ago. It is good for cardiovascular health because of its content of isoflavones and essential monounsaturated and polyunsaturated fatty acids. Isoflavones also have protective effects against cancer and osteoporosis. Phytochemicals such as phytosterols in soy foods have cholesterol lowering properties (Sethi et al., 2016).

Almond milk

Almond milk is naturally a good source of vitamins and other nutrients such as calcium, magnesium, selenium, potassium, zinc, phosphorus, and copper. Vitamin E in almond milk contains alpha-tocopherol, which is a powerful antioxidant. It also possesses potential prebiotic properties (Sethi et al., 2016).

Coconut milk

Coconut milk is a significant source of antioxidants, vitamin C and E, and minerals such as iron, calcium, potassium, magnesium, and zinc. It is associated with anti-carcinogenic, anti-microbial, anti-bacterial, and anti-viral properties. Consumption of coconut milk boosts the immune system and can help maintain the elasticity of the blood vessels. However, coconut milk contains saturated fats, which limits its consumption (Sethi et al., 2016).

Oat milk

Oat milk contains several components that are associated with several health benefits: dietary fibers such as b-glucan, functional protein with good amino acid balance, lipid and starch components, and phytochemicals. Oat fibers are a good source of antioxidants and polyphenols and they reduce total and LDL cholesterol. B-glucan has nutraceutical properties (Sethi et al., 2016).

2.4.1 Market Development

There are many different estimations about current size of the global dairy market and its growth estimations for the future. According to imarc (2020) the global dairy market reached 718,9 billion U.S. dollars in 2019 and is expected to grow at around CAGR of 8 percent to 1032,7 billion U.S. dollars by 2024. However, Meticulous Market Research (2019) estimates that the global dairy market will only grow from around 476 billion in 2019 to 645.8 billion U.S. dollars in 2025 with a CAGR of 5,2 percent. These estimations differ both in current market size and the expectations for growth rate. The demand growth for dairy products is supported by rising population and urbanization but will likely be hampered by growing demand for dairy alternatives and the incidence of lactose intolerance (Meticulous Market Research, 2019). Global dairy alternatives market size was 16,13 billion U.S. dollars in 2019 and it is expected to grow at a CAGR of 16,7% to 41,06 billion U.S. dollars in 2025 (Grand View Research, 2019). The differences in dairy market estimations illustrate well the uncertainty even in the current market size. Nevertheless, it is clear that the global dairy market is significantly bigger than the dairy alternatives market. On the other hand, the bigger growth rate of the dairy alternatives market is steadily minimizing the differences. According to a study conducted by Tilman and Clark (2014) if global diets keep changing in the same income-dependent way as they had changed in the past then the global-average per capita income-dependent diet in 2050 will have 58 percent more dairy and egg, compared to 2009. This creates growth opportunities both for dairy and its alternatives markets, but also poses significant threats to the environment.

Many stakeholders such as supermarkets, coffee shop chains, and branded processors have had an important role in normalizing plant-based milks and making them consistently available. Global branded processors like Danone, Nestlé, and Coca-Cola have acquired plant-based milk producers in order to include them in their product portfolios (Mylan et al., 2019). In the Nordics, the biggest dairy producer in Finland Valio introduced its plant-based dairy alternatives category to consumers in 2018 (Valio, 2017). In a year, Valio's oat milk was made available in McDonald's restaurants across Finland (Valio, 2019). Arla, the biggest dairy producer in Denmark, followed in 2020 when they also launched a plant-based dairy alternative product portfolio to meet consumer demand and develop the category further (Arla, 2020). Examples of Arla and Valio illustrate the importance of these stakeholders in developing the dairy alternatives market.

So far in the transition from dairy milk to plant-based milk consumption changes in cultural significance have been a crucial driver. Increasing criticism from NGOs that challenged positive associations that have long stabilized dairy-milk and public debates have created opportunity for the diffusion and societal embedding of plant-based milks (Mylan et al., 2019). Animal rights organizations such as People for the Ethical Treatment of Animals (PETA), Mercy For Animals, Viva!, and many others have had an important role in educating consumers about cruel standard practices used in dairy farms through undercover videos, articles, and street activism.

Dietary guidelines from public health officials have followed cultural changes and shifting consumption patterns as opposed to leading them (Mylan et al., 2019). For example, according to the Plant Milk Report from ProVeg e.V. (2019), most countries still do not mention plant milk in dietary guidelines. In Europe only Sweden, Finland, UK, and Albania recommend plant milk as an alternative to cow's milk. Some other big countries that also have this recommendation are U.S., Canada, India, Australia, and South Africa (ProVeg e.V., 2019). Including plant milks in dietary guidelines gives consumers more confidence to consume these products.

Mylan et al. (2019) states that policymakers have in many cases hindered the diffusion of plant-based milk consumption, because they are mostly aligned with dairy-milk incumbents. Examples range from product labelling to agricultural support (Mylan et al., 2019). In the EU it is not permitted to use the word "milk" in the labelling of plant-based dairy alternative products (ProVeg e.V., 2019). In October 2020 European Parliament voted on whether plant-based meat products were allowed to be called “burgers” or “sausages” or several other words related to meat products. The proposal to ban these words did not pass. However, the proposal to ban words such as “yogurt-style” or “cream imitation” for plant-based dairy alternatives did pass, making the labelling of these products more confusing, if the law will get adopted (Kwai, 2020). In addition to restrictive labelling the consumption of plant based dairy alternatives in Europe is also hampered by national fiscal regulations. In some countries like Finland and Denmark value-added tax for dairy and its alternative products is equal but in other countries such as Spain, Germany, and Italy the difference in tax rate is more than two-fold, favoring dairy products (ProVeg e.V., 2019). This creates unequal conditions on the market by worsening already unequal conditions as the price of cow’s milk does not reflect its external environmental costs (Pieper et al., 2020). Pieper et al. (2020) calculated that in Germany the external GHG costs for dairy products are 0,24€/kg (91 percent surcharge on producer price level), while on average it was only 0,02€/kg (6 percent surcharge) for plant foods.

2.4.2 Positioning of Plant-Based Dairy Products

Clay et al. (2020) observed that plant-based milk brands that are owned by dairy producers focus on health aspects when promoting their products. Since most of their consumers are not vegan, they do not mention animals and animal welfare in their marketing. The authors state that flexitarian consumers prefer affirmative connections with ideals such as cleanliness, power, and wellness. These brands do not want to be associated with animal suffering, even though they do not use any animals in their production (Clay et al., 2020). Haas et al. (2019) surveyed a thousand people in Austria and found that cow milk’s product image is significantly more positive for most consumers compared with plant-based alternatives. Based on the motivational structure of plant milk consumers, the authors suggest that plant milk companies could emphasize different aspects in their communication about their products such as indulgence and wellness associated with the consumption of plant milks, health by providing information about different diets, and environmental impact compared with cow’s milk. In addition, Haas et al. (2019) find that communicating animal welfare aspects would support the consumption of plant milks.

Swedish oat milk producer Oatly is using various vegan messages in its marketing such as ‘Wow No Cow’, ‘The Post-Milk generation’, and ‘It’s like milk but made for humans’ but at the same time being careful to include non-vegan customers (Fuentes & Fuentes, 2017). Another distinguishing point for Oatly is commitment to producing and marketing sustainable products. Some sustainability issues that Oatly focuses on are genetically modified food, food waste, sustainable farming practices, and global warming (Fuentes & Fuentes, 2017). Oatly’s advertising is often playfully criticizing the milk industry and their posters are large, simple, and clear (Ledin & Machin, 2020). Ledin and Machin (2020) believe that Oatly’s success lies in getting customers to internalize the values which it sells and with that shopping for plant milk becomes a way to make moral choices and take action on political issues.

2.5 Effects of Replacing Cow’s Milk with Plant Milk

2.5.1 Environmental Impact of Plant Milk vs Cow’s Milk

Poore and Nemecek (2018) conducted a meta-analysis that included 38 700 commercially viable farms in 119 countries and 1 600 processors to identify environmental impact of food production. The mean impact of cow’s milk and soy milk under five different aspects is presented in Table 4. Even though the impact of a specific product can vary largely under different production methods, soy milk caused significantly less negative environmental impact in every measured aspect. The biggest difference was for freshwater withdrawals, where production of 1L of soy milk used only 4,5 percent of the water used by production of 1L of cow’s milk. Difference was the smallest for GHG emissions, where production of soy milk required 31 percent of the water required by the production of the same amount of cow’s milk.

Table 4: Environmental impact of cow's milk and soy milk production (Poore & Nemecek, 2018)

	Cow's milk (1L)	Soy milk (1L)
GHG emissions (kg CO2 eq)	3,2	1,0
Land use (m2year)	8,9	0,7
Terrestrial Acidification (g SO2eq)	20,0	2,6
Eutrophying Emissions (G PO4-3eq)	10,7	1,1
Freshwater Withdrawals (L)	628	28

Röös et al. (2016) conducted a study that contained explorative scenarios in which dairy production on a fictional Swedish dairy farm with 100 dairy cows was replaced by oat drink production. Environmental impacts were calculated using life cycle perspective. The impacts were compared with a farm where dairy production was replaced by cultivation of oats and oilseed rape for production of the same amount of oat drink. Since oat drink contains less protein than cow's milk, then three additional scenarios were introduced where additional cereals and legumes were produced to achieve the same total production of protein. The results showed that it is possible to provide the same amount of oat drink (instead of cow's milk) and plant protein (instead of animal protein) with considerably lower climate impact. In an analysis where all animals were removed from the farm, the direct emissions decreased by 61 percent compared with the initial dairy farm scenario. Furthermore, the authors hypothesized that if the substitution effect of replacing diesel with biogas was valid and soil carbon changes were also included then the climate impact of a farm could have been as much as 80 – 90 percent lower (Röös et al., 2016). Although the study was funded by Swedish oat milk producer Oatly, the authors acknowledged that study was set up and performed totally independently by the researchers and that they were given total freedom in the interpretation and publication of results (Röös et al., 2016).

2.5.2 Nutritional Value of Plant Milk vs Cow's Milk

According to Scholz-Ahrens et al. (2020), plant drinks should not be considered nutritional substitutes for cow's milk because of their nutritional differences. Röös et al. (2016), on the other hand, argue that whether milk can be replaced by plant milks is highly context specific as it depends on what rest of the diet is composed of. Because of higher content of most indispensable amino acids and their higher bioavailability, milk is considered higher in protein quality (Scholz-Ahrens et al., 2020). However, since protein consumption is high in the developed world then a large part of the population could replace cow's milk with plant-based milks that are fortified with critical nutrients without any negative health implications (Röös et al., 2016).

Scholz-Ahrens et al. (2020) analyzed the main ingredients of 14 different types of plant milks and compared them with two types of cow's milk: 1,5 percent fat and 3,5 percent fat. Summary is shown in Table 5. Since only one product was chosen for every plant milk type then it is probable that the results vary between different producers to some extent. In terms of calories, 11 plant milks out of 14 contained less calories than 3,5 percent cow's milk with cashew being the lowest - 23 kcal. Coconut milk contained by far the highest amount of kcal per 100g - 178. Fat content was also very similar to cow's milk and the outlier was again coconut milk with 18,5g. Most plant milks contain less protein than cow's milk with only exception being soy milk that contains more protein than cow's milk - 3,7g vs 3,4g. Lastly, the content of carbohydrates varied to great extent and the closest to 4,7g in cow's milk was hazelnut milk with 3,1g.

Table 5: Main ingredients of plant milks compared to cow's milk, 100g (Scholz-Ahrens et al., 2020)

	Cow's milk (1,5%)	Cow's milk (3,5%)	Closest plant milk	Min plant milk	Max plant milk
Energy (kcal)	48	66	Rice (60)	Cashew (23)	Coconut (178)
Fat (g)	1,6	3,6	10/14 close or in this range	Rice (0,9)	Coconut (18,5)
Prot. (g)	3,4	3,3	Soy (3,7)	Macadamia & Rice (0,3)	Soy (3,7)
Carbo. (g)	4,8	4,7	Hazelnut (3,1)	Almond (0,2)	Spelt (15)

Cow's milk is usually considered to be an important source of calcium, with generally better bioavailability than in plant foods, with some exceptions. Therefore, some plant milks are fortified with calcium. In addition, plant milks are often fortified with vitamins A, B12, B2 and D, but their content and nutritional value might be different than that of cow's milk (Scholz-Ahrens et al., 2020). However, the fact that cow's milk contains some nutrients more than plant milks does not mean that humans have to consume cow's milk. Even Scholz-Ahrens et al. (2020) state that "the composition of milk and the concentration of its nutrients is such to satisfy completely and ideally the energy and metabolic needs of the offspring of the respective species during early postnatal life". Humans are not offspring of cows and in postnatal life humans receive breast milk from their own mothers. In fact, humans are the only mammals that consume milk of other species and past their infancy (Kanchwala, 2019). In addition, most of the world population is lactose intolerant as only approximately 30 percent of the population has continued lactase activity beyond weaning and into adulthood (Savaiano & Levitt, 1987). Therefore, it is unnatural and unnecessary for humans to consume milk at all.

There are two additional substances that cow's milk contains that plant milks do not - pus and hormones. According to Jouan et al. (2006), milk products contain several hormonal substances that originate from the cow's blood flow or are synthesized in the mammary gland. Grosvenor et al. (1992) showed that cow's milk contains over 35 different hormones and 11 growth factors. While these hormones are beneficial for newborn calves, the effect on humans was not clear. Because of high stress levels, diseases, and infections in modern animal farming, cow's milk can get contaminated with pus. Cow's body reacts to infections by increasing somatic cells in the affected area and together with cellular debris and necrotic tissue these particles form pus that can be found in milk (Viva!Health, 2014). In the EU, milk for human consumption is legally allowed to contain up to 400 000 somatic cells per one ml of milk (EC, n.d., d).

2.6 Conceptual Framework

The basis for the conceptual framework (Figure 6) is taken for Tilman and Clark (2014) who identified aspects that influence dietary choices and that must be considered in dietary transition. These aspects are culture, taste, availability, convenience, nutritional knowledge, and price. Producers of plant-based dairy alternatives can affect all these aspects. Through advertising plant-based brands can educate consumers about plant-based nutrition as well as influence the culture of milk consumption, as Oatly has done (section 2.4.2). By developing efficient production techniques, taste of plant-based dairy alternatives can be improved, and production price can be reduced. Expanding production and using efficient packaging enhances availability and convenience.

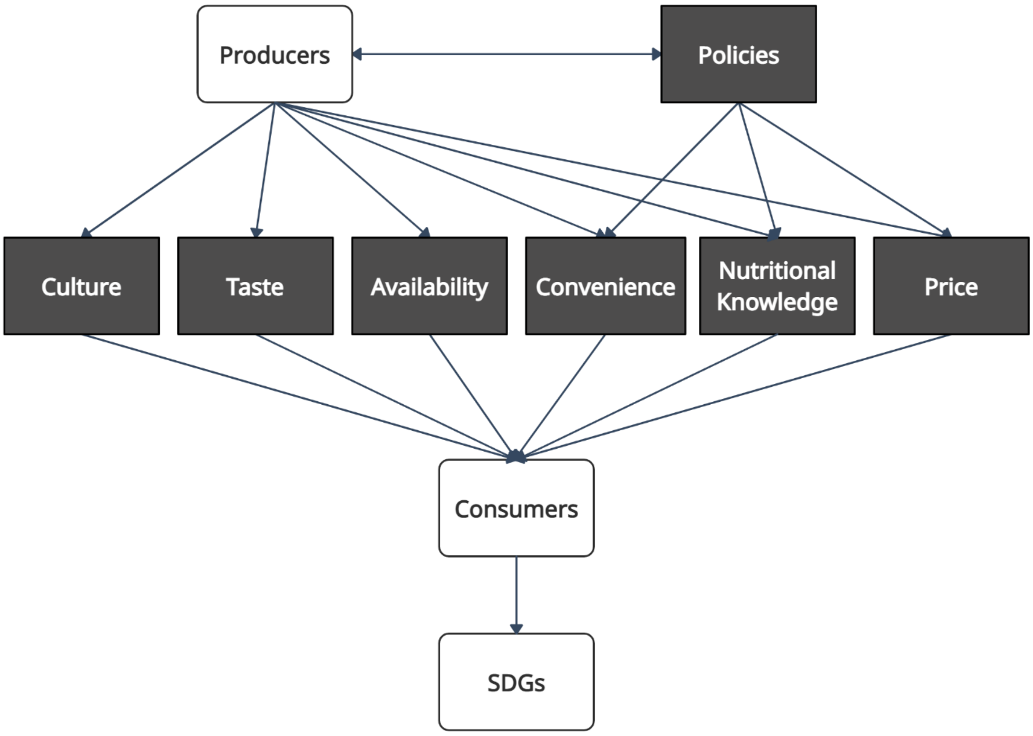

Figure 6: Conceptual framework

Policies influence price, nutritional knowledge, and convenience. In several countries VAT rates are currently discriminating plant-based dairy alternatives (section 2.4.1). National nutritional guidelines also affect nutritional knowledge of consumers and as stated in section 2.4.1, some countries already include plant milks in their guidelines, which can encourage their consumption. EU will be deciding about banning the use of dairy-related terms in plant-based alternatives, which poses a threat to the convenience of shopping for plant-based dairy alternatives (section 2.4.1).

Policies influence plant-based dairy alternative producers as they need to operate within legal boundaries. Producers can also influence policies. Oatly's campaign with ProVeg and Upfield in response to the EU's amendment illustrates how producers can have an impact on policies (section 2.3.4).

Last part of the conceptual framework includes consumers and SDGs. When consumers decide to switch from dairy to plant-based dairy alternatives they support plant-based producers and contribute to achieving the SDGs.

The conceptual framework serves as a basis for questions for interviews with Nordic plant-based dairy alternative producers in the empirical research part of this thesis.

3. METHODOLOGY

3.1 Research Design and Method

A qualitative research method was chosen for this study as it allows to analyze nonnumerical data to explore the phenomenon studied. Since Nordic producers of plant-based dairy alternatives have not been studied before in their impact on the SDGs then an interview method was chosen to gather the data from managers working in the companies. Interviewees were chosen so that their position would be relevant both for sustainability and plant-based dairy alternatives product category.

Interviews can be divided into three categories: unstructured, semi-structured, and structured. Unstructured interviews do not have any specific predetermined questions. Semi-structured interviews usually start with some specific questions and then follow individual’s tangents of thought. Structured interview is based on predetermined questions with a specific order (Cooper & Schindler, 2014). Compared to a structured interview, semi-structured method gives more opportunities to explore the topic because interviewees can express opinions and ideas in their own words. Due to the unplanned nature of unstructured interviews, answers from different interviewees are not well comparable (Esterberg, 2002). Therefore, to be able to compare the answers as well as explore the topic, a semi-structured interview method was chosen for this study. After conducting interviews, they were transcribed, coded, and analyzed.

3.2 Sample Companies

To get an overview of plant-based dairy alternatives producers in the Nordics, companies were chosen across the countries. In terms of headquarters, all Nordic companies are represented, except for Iceland. Summary of companies and interviewees is presented in Table 6. Sampled companies can be divided into three categories:

1. First category includes producers that focus only on plant-based dairy alternatives, these are Dryk and Oatly.

2. Second category is traditional dairy producers Arla and Valio who have added dairy alternatives into their product portfolios.

3. Third category is larger groups that own several different food brands and produce other types of foods in addition to dairy and its alternatives. Kavli and Fazer are part of this category.

Table 6: Sample companies and interviewees

Company	Plant-based brands	Headquarters	Interviewee	Job title	Data gathering method
Arla Foods	JÖRÐ	Denmark	Kristian Eriknauer	Vice President for Corporate Responsibility	interview
Kavli	Planti	Norway	Victoria Voss	Head of Sustainability	interview
Dryk	Dryk	Denmark	Christian Christensen	CEO	interview
Fazer	Yosa, Aito	Finland	Sanna-Maria Hongisto	Senior manager, nutrition & sustainability	questionnaire
Valio	Oddlygood	Finland	Reetta Tikanmäki	Category Manager	interview
Oatly	Oatly	Sweden	-	-	2019 Sustainability report

Fazer was established in Finland in 1891. Nowadays, Fazer's main businesses are Fazer Confectionery, Fazer Bakery, and Fazer Lifestyle Foods. The latter category focuses on plant-based meals, non-dairy products, on-the-go snacking and smoothies, and breakfast foods. Fazer sells their dairy alternatives products such as plant milks, yogurt alternatives, whipping and cooking creams under the brands Yosa and Aito. Fazer acquired the brand Aito from Finnish food company Kaslink in 2019 together with their other brands (Fazer Group, n.d.).

Kavli is a Norwegian food group founded in 1893. The group consists of several companies producing and selling various types of foods: caviar and spreadable cheeses, dairy products, including goat milk products. In 2013, Kavli acquired Finnish company Planti, which produces plant-based milks, yogurt alternatives, oat smoothies, whipping and cooking creams from oats and soya (Kavli, 2019).

Oatly is a solely plant-based business that was founded in Sweden in 1990 when the company patented an enzyme technology that turns fiber rich oats into oat milk (Oatly, 2020). They produce plant-based milks, yogurt alternatives, on the go drinks, spreads, ice cream, whipping and cooking creams.

Dryk is also a solely plant-based business that was founded in Denmark in 2020. They currently offer oat and pea milks and are in the process of developing hemp milk (Dryk, n.d.).

Arla Foods is the fifth largest dairy producer in the world and is owned by more than 9 400 farmers across seven European countries. Arla Foods was founded in 2000 when Danish dairy cooperative MD Foods merged with Swedish Arla (Arla, n.d.). In 2020, Arla launched three oat milks under its new plant-based brand JÖRÐ (Arla, 2020).

Valio is the biggest dairy producer in Finland and was founded in 1905. Similarly to Arla, Valio is owned by dairy farmers. Valio launched its non-dairy product range in 2018. Under the brand Oddlygood they produce and sell plant-based milks, yogurt and cheese alternatives made from oats (Valio, 2017).

3.3 Data Gathering Process and Analysis

All of the sample companies were invited for an interview, which included four sections and 16 predetermined questions. The main interview questions can be found in Appendix 1. The first section asked for reasons and motivations why companies started their dairy alternatives product lines, the second section explored connections between dairy alternatives product lines and the SDGs, the third section looked at companies' marketing principles and the last section asked for opinion on the global plant-based dairy alternatives market and its role in transforming food systems. The interviews were conducted in English through an online voice call in February and March 2021 and lasted from 30 to 60 minutes, depending on the depth of interviewees' answers. The interviews were recorded, transcribed, and coded.

Not all companies were able to participate in an interview. Fazer preferred to present their answers in writing. This resulted in less data from Fazer as semi-structured interviews with other companies allowed to ask additional questions and explore their views more deeply. Oatly is another exception as they were not able to participate in an interview. However, their 2019 Sustainability report included important information for this thesis. Therefore, Oatly's sustainability report was used instead of an interview, which provided sufficient information for sections one and two from the interview questions, but less information for section three and four as questions in those sections included more personal opinion or information outside of the scope of a sustainability report.

4. FINDINGS

4.1. Reasons for Starting the Dairy Alternatives Product Line

For Arla, moving into plant-based products is an expansion that is led by a trend in consumption. According to Eriknauer, since Arla's farmers can also produce oats on their farms then moving into oat-based products was a natural step for them. Kavli also saw an opportunity in the fast-growing market and made the strategic decision to diversify their dairy and meat heavy brands with plant-based products that are healthy for both people and planet. Valio saw that the assortment of plant-based dairy alternatives was low and that consumers were looking for more variation. Therefore, they focused on offering new products with good taste and nutritional value.

Christensen from Dryk and Hongisto from Fazer state that meat and dairy production poses significant challenges to the environment. For Fazer, introducing more plant-based products is one of the four main goals of their sustainability work. Christensen was motivated to start Dryk to change the world through new products that would make it easy for the consumer to switch from animal based to plant-based products.

He knew that the United Nations was encouraging countries all over the world to reevaluate their food production. Another aspect came from the corporate world from a big retailer in Denmark where he saw no improvements in the unsustainable production of food. Consumer acceptance of plant-based products together with inspiration from Oatly encouraged Christensen to enter the plant-based foods. Today, Dryk is the only brand that produces plant milks from both oat and pea and that has a global strategy, according to Christensen.

If other companies started or acquired their plant-based dairy alternatives product lines relatively recently and were mainly driven by environmental, health, and consumer demand aspects, then Oatly is the opposite of them. In the late 1980’s scientists in Sweden were trying to develop a plant-based drink that could replace cow’s milk for people with lactose intolerance. After succeeding in 1990, they founded Oatly.

4.2 Sustainable Development Goals

4.2.1 Impact of Companies’ Strategies

In this section are presented SDGs that companies contribute to but are not directly related to plant-based product categories but rather connected to companies’ other business categories and supporting business activities. In the analysis below are presented SDGs that Oatly, Kavli, Dryk, and Arla identified during the interviews (Figure 7). Fazer has mapped almost all of the SDGs on a group level, but they have not prioritized analysis on them. Valio also did not name any SDGs during the interview but according to their 2019 Sustainability Report, on a company level they have identified the following SDGs: 2, 3, 8, 10, 12, 13, 14, 15 (Valio, 2020).

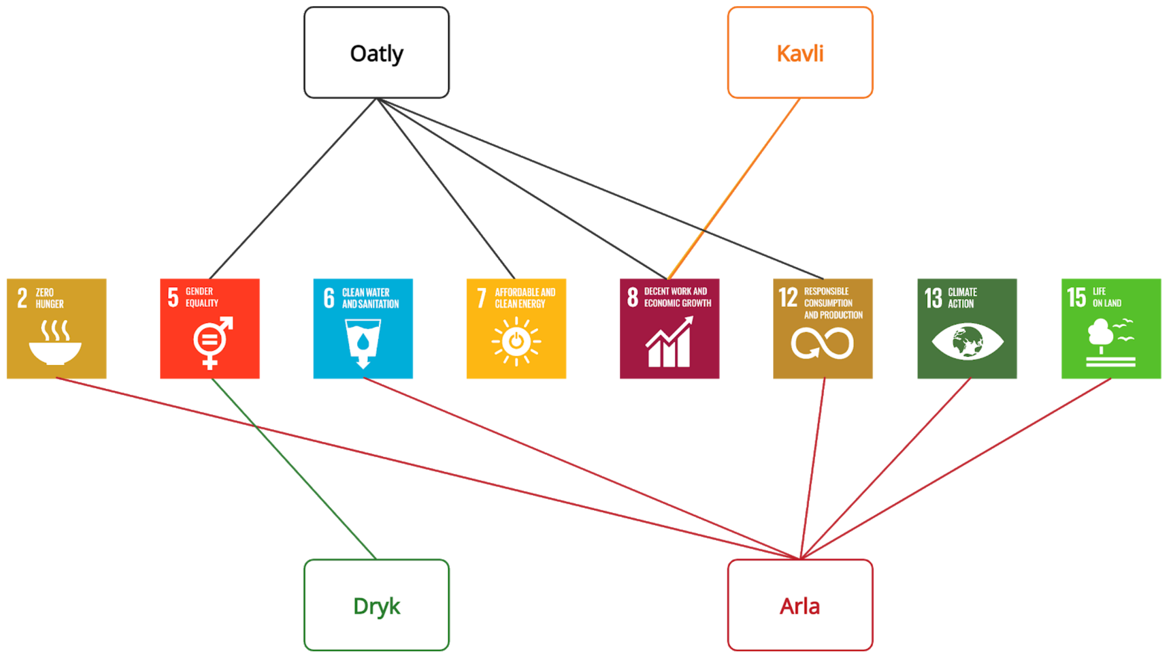

Figure 7: Companies’ strategies and SDGs (based on interviews and Oatly’s Sustainability report, Valio’s Sustainability Report excluded)

According to Voss, Kavli is planning to analyze their impact on the SDGs more thoroughly in a methodologically proper way in the near future. Recent creation of the Head of Sustainability position at Kavli dedicates more resources into that work. However, Voss sees that as a company, Kavli has an impact on SDG 8. Since Kavli is owned by Kavli Foundation, which is a not-for-profit organization, then all of their profits go to charity and projects that address a wide range of problems from hunger and poverty to mental health. Through the foundation Kavli covers most of the SDGs.

As a dairy producer, Arla has a potentially negative impact on several SDGs. Cows’ emissions of methane along with other GHGs have an impact on climate (SDG 13), but according to Arla, their farmers produce milk with less than half the average of emissions per kilogram of milk compared to global dairy productions. Nitrogen and phosphor from manure can pollute water (SDG 6). Farming affects land use and biodiversity (SDG 15). However, Eriknauer states that there is a positive impact on elimination of malnutrition (SDG 2) through nutritionally dense dairy products and also on responsible consumption and production (SDG 12) through reducing food waste. According to Arla, their farmers produce milk with less than half the average of emissions per kilo compared to global dairy productions.

Oatly has identified SDGs that are relevant for their business activities on a sub-goal level. In 2019 the share of energy from renewable sources was 63 percent, decreasing from 87 percent the year before due to new production facilities that run on fossil fuels. There is a trade-off between rapid expansion and more environmentally friendly facilities, but the company plans to increase the use of renewable energy (SDG 7.2 & 7.3). Offering decent working conditions with equal pay is also an action area that Oatly has identified to be important in their operations (SDG 8.5 & 8.8). As a company, Oatly is advocating for climate footprint declarations for food to increase transparency and they have launched campaigns to raise the awareness of the impact of eating habits (SDG 12.8).

Because of rapid growth, Oatly needs to constantly hire more employees and focusing on equality in the recruitment process is necessary (SDG 5.1 & 5.5). Christensen also emphasizes the importance of equal opportunities for women as he sees that this problem is still not solved in Scandinavia. Therefore, at Dryk they decided early in the process that they would ensure that there was equal opportunity and equal pay for equal work.

4.2.2 Contribution of Plant-Based Dairy Alternatives Product Lines

The companies identified in total six SDGs relevant to their plant-based product lines (Figure 8). Climate impact (SDG 13) was mentioned by all of the companies. Impact on nutrition (SDG 2), health (SDG 3), and biodiversity (SDG 15) were identified by three companies. Valio was excluded from this analysis as they have not identified any SDGs relevant specifically for their plant-based product line.

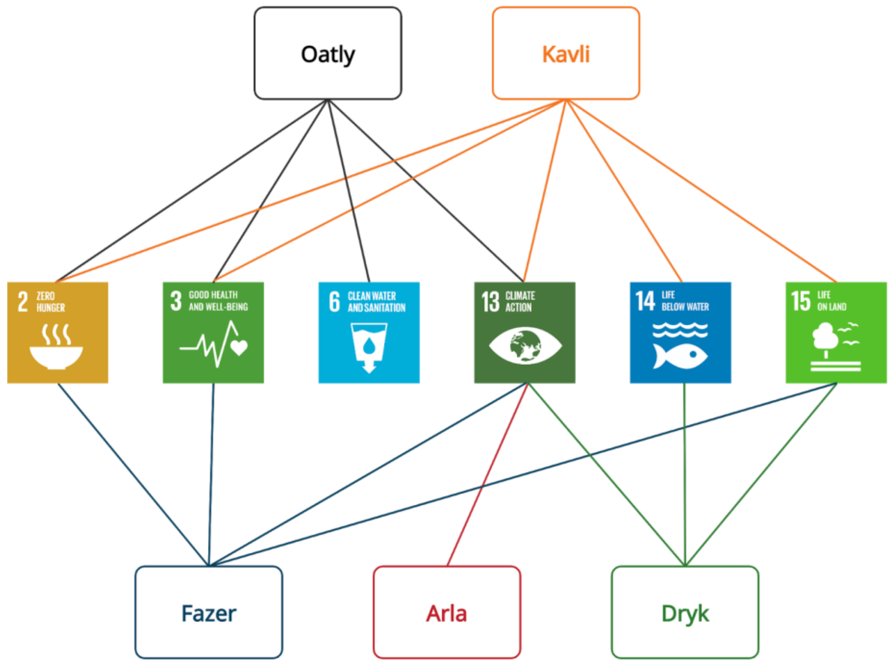

Figure 8: SDGs that plant-based dairy alternatives contribute to

SDG 2: Zero Hunger and SDG 3: Good Health and Well-Being

SDG 2 and SDG 3 were identified by the same companies. Oatly has more specifically identified sub-goals 2.4 and 3.4. Voss from Kavli sees that there is a strong overconsumption of animal-based products in our part of the world, which has negative health consequences. According to Oatly, diet is the biggest cause of chronic lifestyle diseases such as cancer, type 2 diabetes, and cardiovascular disease. Both Kavli and Oatly agree that consumption of plant-based products helps to avoid the intake of saturated fats. Voss explained that people in Sweden consume about 50 percent too much dairy and should consume 10 times more legumes in terms of health and plant-based dairy alternatives made from legumes address both of those issues.

Fazer contributes to these two goals by providing healthy products that improve nutrition. Oatly promotes consumption of plant-based foods by providing information and training to nutritionists, dietitians, and healthcare professionals in Sweden and the UK. The sub-goal 2.4 focuses on sustainable food production and resilient farming practices. Oatly contributes to it through increasing product availability and production as compared to animal products, plant-based production requires less resources.

SDG 6: Clean Water and Sanitation

Oatly has more specifically identified sub-goals 6.3 and 6.4. Good water quality is essential for Oatly's operations and they have reduced water usage on their sites per litre of product from 5.3 liters to 4.3 liters in 2019.

SDG 13: Climate Action

Climate action is the only SDG where Eriknauer sees Arla's contribution as the CO2 footprint per kg of product is lower for plant-based alternatives than for dairy products. According to Christensen, by producing plant milk instead of animal-based milk they reduce emissions of greenhouse gases by up to 70 percent. Oatly is contributing more specifically to sub-goal 13.3 by encouraging consumers to shift to more plant-based diets. In addition, they calculated the climate footprint of their products and put them on product packaging in 2019.

SDG 14: Life Below Water and SDG 15: Life on Land

Christensen states that it is significantly more effective to produce plant-based instead of animal-based milk as on the same amount of land that is required to produce 1 liter of animal-based milk, there can be produced 11 liters of plant-based product. By using the land more efficiently, land can be released for nature and other productions. In Denmark 85 percent of farmland is used to produce cattle and feed for pigs and Christensen sees a potential to reduce that inefficient land use. Positive impact for oceans comes from not using fertilizers in the production of raw materials for Dryk's products. Therefore, they minimize the amount of nutrients that are being washed out from fields into oceans.

Voss agrees with Christensen that there is a need to rethink the way land is used. Currently 80 percent of farmed land is used for animal production, which produces only 20 percent of calories. Crop production for human consumption takes up only 20 percent of farmed land but provides 80 percent of calories. Production of plant-based alternatives also contributes to animal well-being as no animals are harmed in the process, according to Voss.

Additionally, Voss highlights the impact of using legumes such as soy in the production of plant-based dairy alternatives. Legumes naturally bind nitrogen from the atmosphere, which reduces the need for fertilizers that can cause several environmental problems, including eutrophication and soil erosion. Therefore, Kavli is motivated to further increase the usage of legumes in their products.

4.2.3 Potential Negative Spillovers of Plant-Based Products

Eriknauer sees that there is a tradeoff between nutritional content and climate impact of dairy and its alternatives products. He states that milk provides good nutrition, but plant-based alternatives are lower in nutrient content and are less complex. Christensen, on the other hand, does not see that Dryk would contribute to any of the SDGs in a negative way.

Voss believes that as a business they have a positive impact across the SDGs. She summarized her view on the changes in society regarding the changes in production the following way:

> I think that the traditional dairy industry does feel threatened to some extent by the increase in plant-based, but that is always the case when you have big shifts in society and maybe in the short term there might be a certain level of threat for certain industries when it comes to job security and everything that entails but in the long term, this also means big opportunities to explore a new booming market in different ways and that also entails job opportunities. So, I would say that as a net impact the imprint will be generally positive across the board, across all the SDGs (Voss, 2021).

4.2.4 Summary of the Impacts on the SDGs

The impact of production and consumption of plant-based dairy alternatives can be divided into two categories: human health and natural environment. Figure 9 summarizes both positive and negative impacts of production and consumption of plant-based dairy alternatives that were mentioned in the interviews.

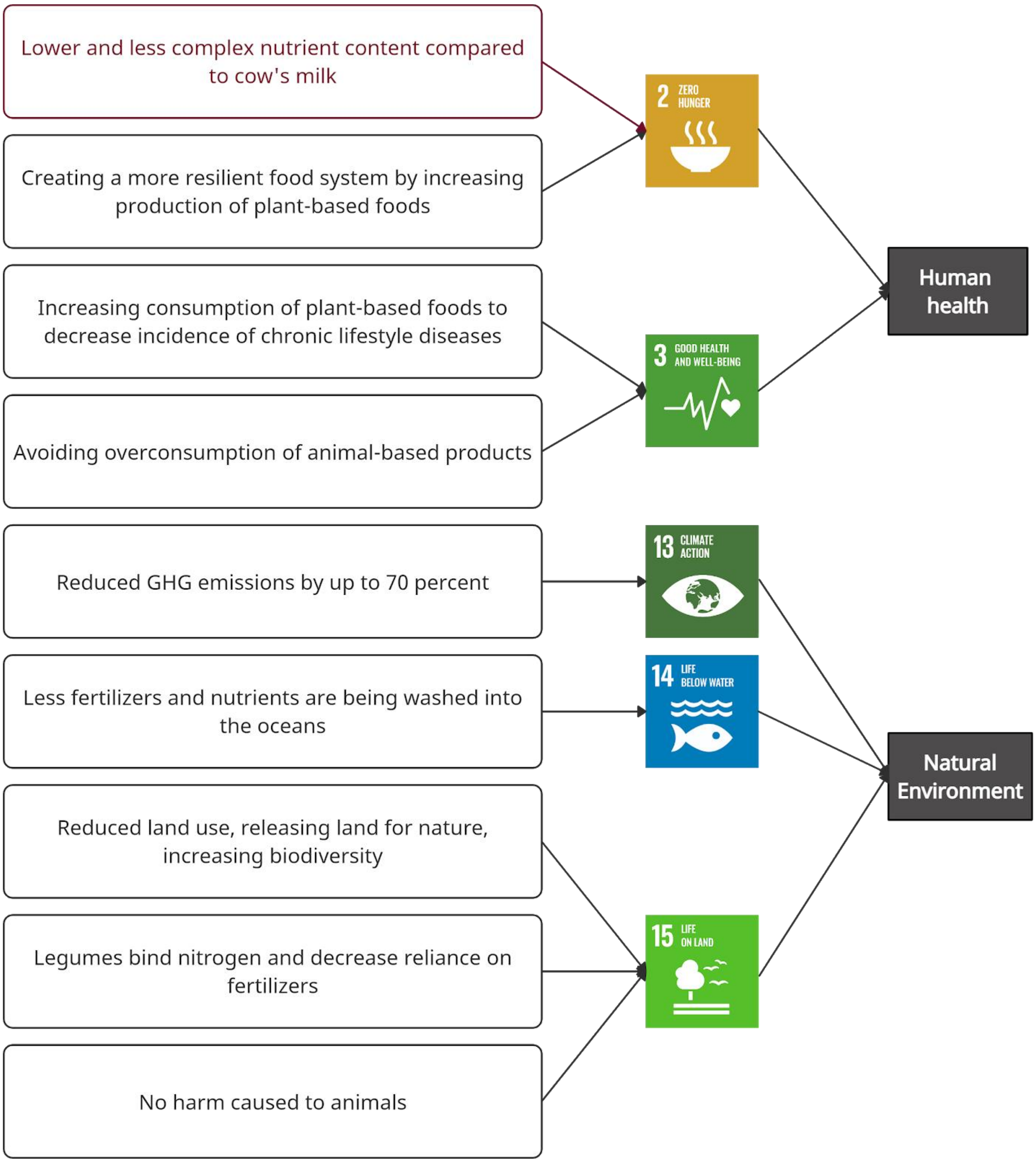

Figure 9: Impact of production and consumption of plant-based alternatives on human health and natural environment

4.3 Marketing of Plant-Based Dairy Alternatives

4.3.1 Target Customers and Markets

Both Valio and Fazer target their products to a wider audience as this helps to invite more customers to the plant-based category and have more impact on dietary habits, according to Hongisto. Dryk also aims to target everyone, and they have identified three customer groups:

1. Health warrior - people to whom healthy living is important.
2. Everyday heroes - women with children who need their everyday life to function and want to contribute for a better world for their children.
3. Idealist - usually young people who want to change the world for the better.

Arla sees young people who are more easily influenced regarding dietary habits as their target customer segment. Kavli also identified younger customers as the main one and added that they are more educated and engaged in sustainability issues and health. Also, they are willing to pay a small price premium for a more sustainable product. Voss sees that their customers want to do good and vote with their wallets. However, they want to broaden their target group to inspire more people to eat plant-based, as Fazer does. For Kavli it is important that Planti brand reflects the values of their customers.

Christensen highlighted that there is a customer group that does not purchase plant-based products from dairy companies because these companies started plant-based product lines to make profit instead of changing the world. According to Christensen, one dairy company that started its plant-based product line has said that they will use profits from plant-based business to raise payments for dairy farmers and many Dryk's customers do not want to contribute to that. Instead, the customers want to support smaller companies with a more holistic approach with a philosophy and strategy to change the world.

Nordic plant-based dairy alternatives producers are mainly selling their products in their home markets in the Nordics. Sweden and Finland are the most popular target markets. However, some companies have expanded outside of that region, Valio to Baltics and Russia, and Arla to the UK. Fazer and Kavli are planning their expansion to new markets. Dryk is currently marketing their product in 19 different countries, China being the main market. Oatly has also a more global approach as their products are being sold across Europe, in North America, and in Asia.

4.3.2 Key Messages

The key communication messages for analyzed companies are presented in Figure 10. So far, Kavli has focused on taste in their communication about plant-based products. Voss believes that taste is an enabler for other qualities of the product such as sustainability and health because even if a product performs exceptionally well under the latter aspects, if the taste is bad then there will not be a market for the product. However, in the future Kavli will communicate more aggressively about environmental sustainability and health benefits, which are shown with a densely dashed line in Figure 10.

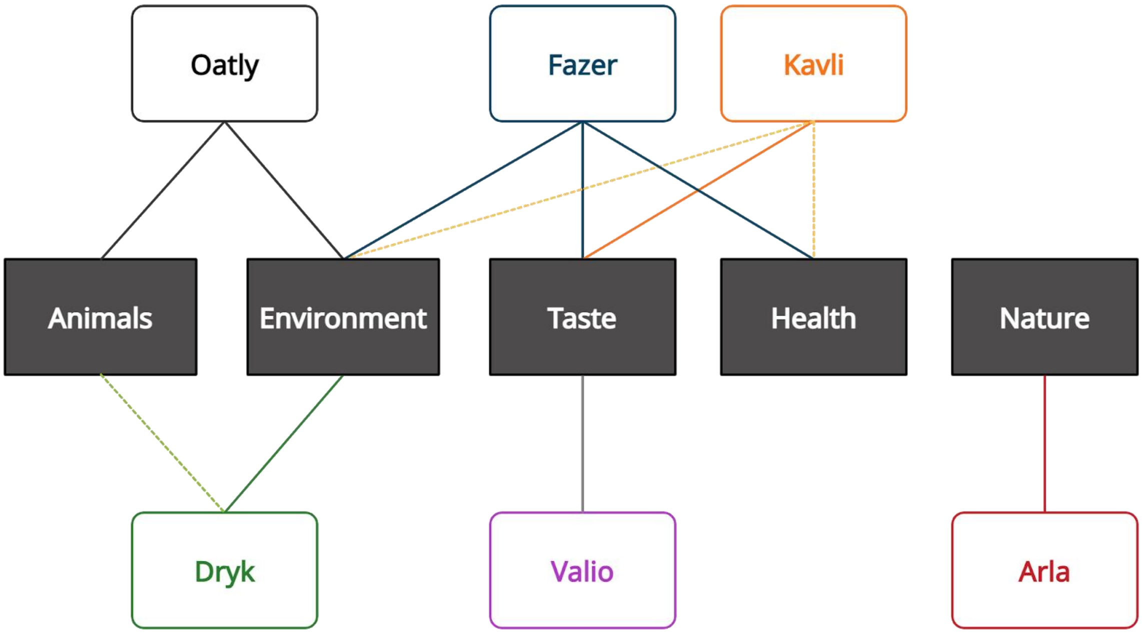

Figure 10: Key message categories (lighter densely dashed lines illustrate future plans)

Fazer is inspiring consumers to try their plant-based products through health, environmental, and taste reasons. They are promoting shifting towards a healthier and more sustainable lifestyle by making small changes.

Dryk is experimenting with different messages but their focus has been on the reduction of GHG emissions. In the near future they are planning to use more messages focused on animals and biodiversity and to raise awareness about how shifting from animal-based products to plant-based products have an impact on the world. However, according to Christensen, the main reason why consumers are purchasing Dryk's products is taste:

> I have never given it to anyone that said “well, I don't like this.” It just tastes better. That is one of the big reasons why the adoption from the consumer is happening at such a steep rate. Because these products are very tasty (Christensen, 2021).

Similarly to Dryk, Oatly has also mainly focused on messages about environment and climate. For example, “Hey Food Industry! Show us your numbers.” campaign requested the whole food industry to start showing the climate impact of their products on packaging. “Ditch milk. Switch to oat drink and save 75% in CO2e.” is another example that emphasizes the low climate impact of their plant-based products. Additionally, Oatly has also mentioned animals in their advertisements: “Wow no cow!”.

Arla is using different positioning for its products compared to other producers. They focus on the Nordic origin and nature. They state that their plant-based products are natural and are connected with the strengths of a traditional Nordic culture.

4.3.3 Positioning Compared to Dairy Products

Eriknauer sees plant-based dairy alternatives as supplements for dairy products and he does not see them replacing milk production in the future. However, Arla is planning to increase production capacity of plant-based milks over time.

Voss sees a substitution effect between dairy and its alternatives increasing because companies are developing more types of dairy replacement products such as yogurts and cooking creams. In their communication, Kavli positions Planti’s product line as a “gentle alternative for the average consumer who might be a vegan or vegetarian, but also those who want just eat more flexitarian-based on a daily basis” (Voss, 2021). According to Voss, Oatly is on the other end of the spectrum, positioning themselves more aggressively against the dairy industry. She thinks that the meat and dairy lobby in Brussels is feeling threatened by the fast growth of plant-based alternatives and this is one reason why they are working in favor of a legislation that hinders labeling and packaging of plant-based dairy alternatives.

Christensen also recognized Oatly’s positioning against the dairy industry and commented that Oatly is strong enough to have legal battles with the dairy producer

Arla. Dryk does not position their products related to dairy products as they see that the market is big enough for plant milks to stand alone. With their current monthly growth rates around 40 percent they see no need for controversial messages as dealing with legal questions with the dairy industry would limit their ability to grow.

4.3.4 Educating Consumers

Christensen believes that they have an obligation to educate customers about food sustainability. Their customers are already reaching out for information, are interested in Dryk's values, and want to participate in their products. Due to the pandemic, Dryk has not been able to participate in conferences but they are developing marketing material to raise awareness about biodiversity issues.

Arla dedicates a significant amount of resources to educating the next generation about the health impact of different eating habits. They organize weekly food camps where they teach children how different types of foods affect their health and also environment and climate. Eriknauer says that this is part of their sustainability strategy and they take it very seriously.

Voss sees that as a company Kavli has an important role in educating customers about food sustainability. Last year Planti co-sponsored a book about sustainable and healthy eating that was based on the latest science. However, they want to do more and are developing a strategy for more extensive communication through their social media channels:

> We feel that our consumer base is one that is already interested in these matters so if we can grow that interest further and be a spokesperson, and the voice that speaks for societal change, that is only a bonus (Voss, 2021).

Since Oatly's goal is to enhance a transition toward a more plant-based food system then they are actively trying to influence society through various initiatives. They are creating campaigns to raise awareness about food sustainability. In the Oat Academy that they established more than 1 500 school chefs have received training about climate friendly plant-based cooking. Oatly also founded an association Plant-food Sweden, which aims to increase the consumption and production of plant-based foods. As mentioned in section 4.3.2, Oatly advocates for climate footprint declarations on food products and is engaging in a dialogue with various stakeholders such as politicians, policymakers, healthcare professionals, and NGOs to promote sustainable food systems. Additionally, they engage in research studies about sustainability and nutrition.

Valio does not have specific education initiatives, but rather they want to be transparent in the actions that they are doing.

4.4 Plant-Based Dairy Alternatives Market and Food System

4.4.1 Development of Plant-Based Dairy Alternatives

Interviewees identified various obstacles that plant-based dairy alternatives need to overcome to develop further and also what needs to happen for more broad adoption of these products (Figure 11). Oatly's results should be interpreted carefully as their aspects were adopted from their sustainability report, which means that they could in reality identify more aspects, if given the chance.

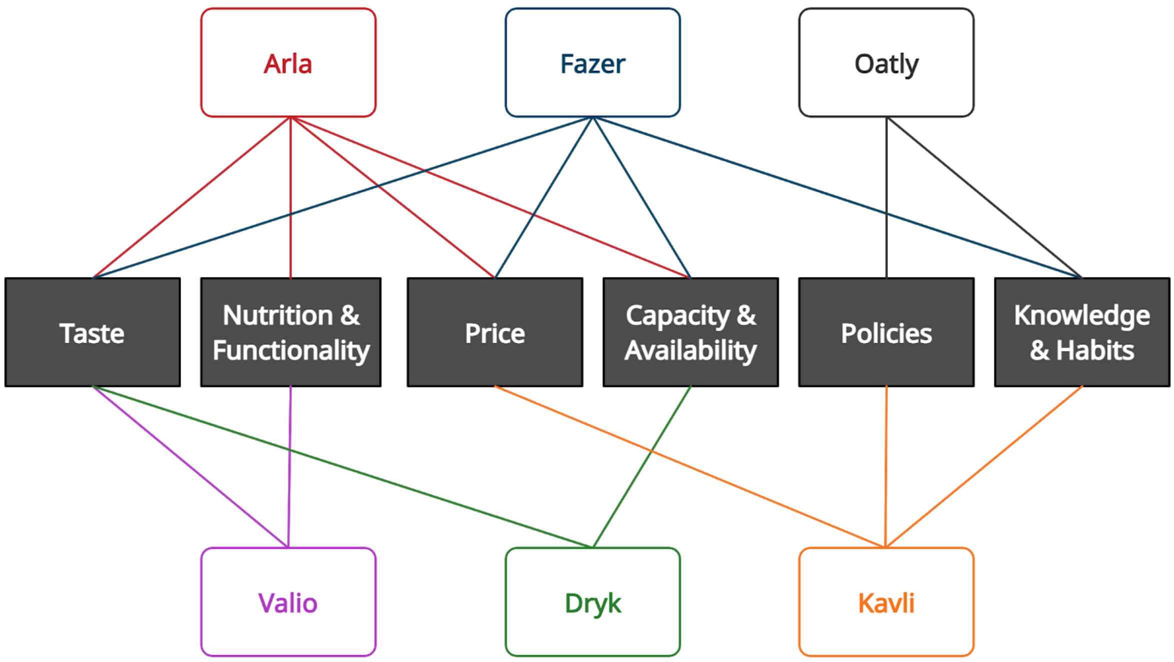

Figure 11: Main aspects that influence the development of plant-based dairy alternatives

Taste, nutrition, and functionality

Eriknauer thinks it is difficult for plant-based products to beat the taste and functionality of dairy products such as butter, cream, and cheese. Tikanmäki has also observed based on different consumer researches that some people are saying that plant-based alternatives do not function the same way. In her opinion it is important to be able to switch from animal-based to plant-based without making any compromises.

Christensen explained that there are different methods for production of oat milk and many products on the market are of poor quality because of cheap production methods. For example, one method includes mixing oat powder with water, salt, sugar, and oil. The real Swedish oat milk is produced in one piece and both Oatly and Dryk are among few producers who use that production method. Christensen is concerned that consumers will give up on plant milks due to poor quality of many products. However, he sees a push towards better quality products on the market.

In Tikanmäki's opinion nutritional questions are important when it comes to plant-based alternatives and in the development of their products they have considered what mineral, vitamin, or protein additions they should make. Eriknauer, on the other hand, thinks that it will not be possible for plant-based alternatives to match the nutritional benefit of milk because of a matrix effect of the nutritional impact in milk.

Price, production capacity and availability

In Christensen's view the main obstacle is production capacity and if that would be higher then significantly more people would consume plant-based alternatives. Eriknauer theorized that when a certain volume will be reached then many people will start changing their habits. Christensen explains connections between capacity and price in a following way:

> Oat milk can be extremely competitive if the production capacity was there. You could probably sell it at less than 50 US cents and still make a profit on it. At the moment the batch sizes are about 20 000 liters. Once you get to 100 000 liters of batch sizes or continuous batches then you will see prices dropping tremendously (Christensen, 2021).

Currently, plant-based products are sold at a premium and most of the milk consuming population is very price sensitive. Therefore, price reduction is necessary for targeting the mass market, according to Eriknauer.

Voss thinks that broader assortment incentivizes consumers to try new plant-based products. She used an example about Oatly's coffee milk, which became very popular and was a gateway for consumers to try plant-based alternatives within other product ranges.

Policies

Both Oatly and Voss criticize EU politics related to sustainable food production and consumption. Oatly sees contradictions between EU's climate goals and school milk subsidy, which makes it more economical for schools to prefer cow's milk in front of plant-based milks. Voss sees a similar contradiction regarding the legislation that aims to ban the use of dairy related descriptive words and packaging for plant-based alternatives.

Voss sees a need for greater subsidization of sustainable and healthy food and taxation of products with larger negative impact. Currently, incentives for increasing consumption of sustainable foods are not existent and price mechanisms are necessary to enhance the transition.

Knowledge and dietary habits

Voss states that dietary habits are strongly attached to culture and entrenched behavior makes it easier to keep existing habits. However, she is optimistic about the younger generation that has the highest proportion of vegans, vegetarians, and flexitarians and which is leading the shift towards more plant-based food habits. Oatly adds that real change requires systemic changes within society, including norms and behaviors. They are addressing those by participating in societal debate about sustainable eating and increasing awareness through campaigns. Oatly's strategy for increasing the knowledge of customers was more thoroughly presented in section 4.3.4.

4.4.2 Future of Plant-Based Dairy Alternatives

Christensen is confident that plant-based dairy alternatives are transforming the food industry. He states that this needs to happen very fast and cannot be left up to every individual. He forecasts a strong push from political side:

> If you read the reports that the United Nations has sent out, there is no doubt we need to do this, and that is the reason why the politicians announced putting tremendous effort into making it more attractive to live green. You see the change to electric cars, change to sustainable power production. And very soon you will see a push for plant-based foods into the public sector to hospitals, and that is something we have already had the first attempts here in Denmark (Christensen, 2021).

All companies interviewed agreed that the plant-based dairy alternatives market will maintain its fast growth rate over the next decade and some project even faster growth. Tikanmäki sees that the trend is connected to wider megatrends related to health and environment. Voss added that incentives for more sustainable products are also coming from the retail industry as retailer Coop in Sweden will be scanning all their products against 10 sustainability criteria and another retailer ICA requires their suppliers to be committed to science-based targets.

Eriknauer sees a lot of money going into development of dairy alternatives and Christensen states that compared to money that has been invested into dairy production over the last 80 years, investments into plant-based dairy alternatives comprise only a small fraction of that. Therefore, Christensen is very optimistic about the future of plant-based alternatives as they are only at the beginning of their life cycle while dairy products are at the end and are already falling:

> There has never been a bigger opportunity in the food industry than there is now in the conversion from animal-based to plant-based because the consumer has already made the decision that they just have not implemented yet (Christensen, 2021).

5. DISCUSSION AND ANALYSIS

In the following section findings are discussed and analyzed by comparing them with relevant literature. When referring to the interviews, it also includes Fazer's questionnaire and Oatlys sustainability report from where data was gathered.

5.1 Reasons for Starting the Dairy Alternatives Product Line

As discussed in the literature review, the dairy alternatives market is predicted to have a significantly faster growth than the dairy market in the coming years (Grand View Research, 2019). Therefore, several interviewees mentioned a trend in consumption as one reason for starting their plant-based product lines. However, in addition to economic motivations there were political and environmental as a stronger push for changes in the global food production from United Nations was expected and interviewees themselves were concerned about environmental damages caused by the current food system.

5.2 Sustainable Development Goals

The interviews demonstrated that the SDGs are a highly interconnected set of goals as the companies identified in total 10 out of 17 SDGs. Eight goals were associated with their business activities, excluding the production of plant-based dairy alternatives, and six goals were directly related to these products. Since this study is focused on the impact of plant-based dairy alternatives then the following analysis is focused only on the SDGs related to plant-based product lines.

SDG 13 (Climate Action) is one of the most challenging SDGs for Nordic countries, as discussed in the literature review (SDSN & IEEP, 2020). Therefore, it is especially positive that contribution to the SDG 13 was most often associated with the production and consumption of plant-based alternatives. This is supported by Poore and Nemecek (2018) who calculated that in the production of soy milk 69 percent less GHGs are emitted than in the production of the same amount of cow's milk. They also quantified the positive impact of globally adopting a plant-based diet to which plant-based dairy alternatives contribute. However, only one company had calculated the climate impact of their products. To increase transparency of the climate impact, other companies should monitor and calculate their climate footprint as well.

SDG 2 (Zero Hunger) was another SDG next to the SDG 13 being one of the worst performers in Nordic countries, especially its indicators related to overconsumption of animals (SDSN & IEEP, 2020). Tilman and Clark (2014) studied that increasing consumption of animal foods is remarkably increasing global incidences of type II diabetes, cancer, and coronary heart disease, which were also identified during this study. Wider consumption of plant-based dairy alternatives helps to decrease the overconsumption of animal-based products.

SDGs 14 and 15 (Life Below Water and Life on land) were identified by several companies. Plant-based dairy alternatives producers reduce negative impact on the natural environment by producing plant-based products instead of animal-based products. Poore and Nemecek (2018) found significantly smaller impact for soy milk compared to cow's milk in all of the following aspects: land use, terrestrial acidification, eutrophying emissions, and freshwater withdrawals. The interviewees identified mainly decreased land use but impact of legumes in binding nitrogen and reducing eutrophication was also presented. Poore and Nemecek (2018) studied that changing the current diet to a diet that excludes animal products can reduce food's land use by 76 percent and they suggested that the land could be used for reestablishing vegetation, which would also remove a significant amount of $CO2$ from the air. Similarly, it was said in the interviews that released land could be given back to nature to reestablish biodiversity, which is crucial for the future life of our and other species.

SDG 3 (Good Health and Well-Being) is important for several companies. According to Wood et al. (2019), Nordic people's consumption of dairy is close to the upper limit and they should increase intake of legumes and reduce added sugars. One interviewee stated that plant-based dairy alternatives produced from legumes help to decrease the consumption of dairy and increase current underconsumption of legumes. Reducing sugar content and increasing the quality of the products was especially important for another interviewee who was dissatisfied with seeing products with as high as 14g of sugar per 100g of product on the market. Most companies interviewed emphasized the importance of nutritional content in their product development.

Pradhan et al. (2017) studied that because of the multidimensional nature of the SDGs, trade-offs and synergies vary between them. One interviewee identified a tradeoff between the climate impact and nutritional content as one negative aspect of plant-based alternatives. However, as Röös et al. (2016) stated, whether there is any significant nutritional impact in replacing cow's milk with plant milk is highly dependent on the rest of the diet. Moreover, plant-based products are usually fortified with vitamins and minerals, which was also confirmed in the interviews.

Overall, there were significantly more positive associations identified between the production and consumption of plant-based dairy alternatives and the SDGs than negative ones. Pradhan et al. (2017) also found that positive correlations among the SDGs largely outweighed the negative ones, and within each SDG synergies largely exceeded trade-offs.

5.3 Marketing of Plant-Based Dairy Alternatives

Nordic plant-based dairy alternatives companies have used different approaches for targeting customers. Most have been targeting a wider audience to invite new consumers to the plant-based product category. Even those companies that have had a narrower focus are planning to broaden their target group in the near future. Similar trend is seen in international expansion as most companies have been mainly selling their products in Nordic countries but are planning expansion outside of that region. The two solely plant-based companies in this study have a significantly more international strategy than other more local producers to whom plant-based business is only one business category among others.

Clay et al. (2020) observed that plant-based milk brands that are owned by dairy producers focus on health aspects when promoting their products. This was not supported by this study as one dairy producer highlighted taste and another nature and Nordic origin as their main aspects in communication. Clay et al. (2020) also stated that plant-based brands owned by dairy companies do not mention animals and animal welfare in their marketing and this was supported by this study as no references to animals related to communication were identified in the interviews with the two dairy producers.

Haas et al. (2019) suggest that plant milk companies could emphasize different aspects in their communication about their products such as indulgence and wellness associated with the consumption of plant milks, health by providing information about different diets, and environmental impact compared with cow's milk. Environmental aspects were included in half of the companies' communication strategies in this study and health aspects for one company. However, health aspects were included in future plans of one other company as well. In addition, Haas et al. (2019) found that communicating animal welfare aspects would support the consumption of plant milks. However, references to animals were found only in one solely plant-based company's advertisement messages.

Even though most companies see plant-based dairy alternatives directly substituting dairy products, they do not position their plant-based products related to dairy products either because they do not want to get into a legal battle with the dairy industry or their customers also consume dairy products. One company, however, was found to have a more aggressive approach towards the dairy industry.

5.4 Development of Plant-Based Dairy Alternatives

The interviewees identified several aspects that influence development of plant-based dairy alternatives products and market. These aspects were found to be highly correlated with the conceptual framework presented in section 2.6. Tilman and Clark (2014) identified that culture, taste, availability, convenience, nutritional knowledge, and price are aspects that influence dietary choices and that must be considered in dietary transition. These aspects were included in the conceptual framework and interviewees covered all of them (Figure 12).

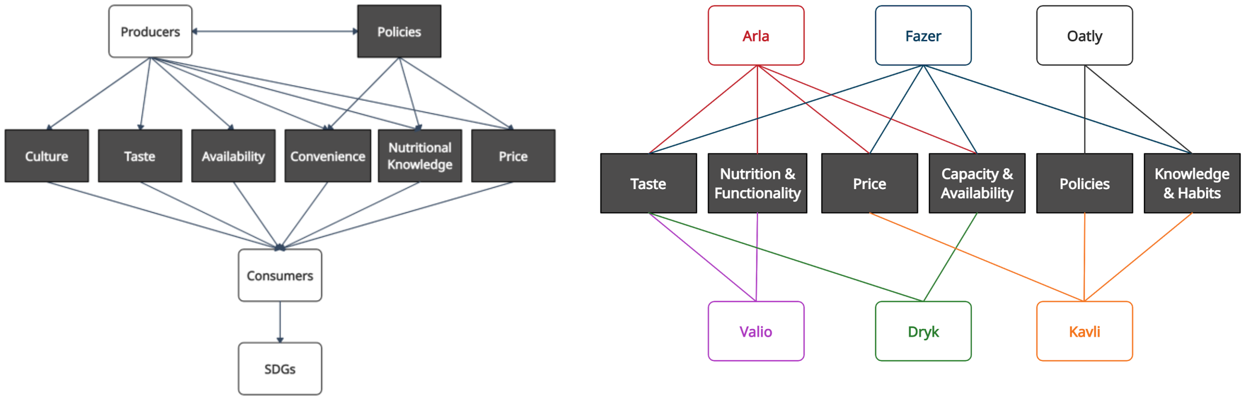

Figure 12: Conceptual framework and aspects identified by the companies

Culture is connected to dietary habits and one interviewee was optimistic about the younger generation that leads the transition towards more plant-based dietary habits. It can be said that all the companies are contributing to normalizing the consumption of plant-based dairy alternatives though advertising their products and making them more widely available.

Taste was mentioned as a strength of plant-based products. However, functionality of dairy products was considered to be difficult to replicate in different types of plant-based alternatives. Also, a concern was expressed about low quality plant-based products on the market. However, interviewees see that product development is bridging the gaps in functionality and for some product types it is already achieved. Also, the quality of products on the market is getting better.

Availability of products has been increasing in the past, especially given that most companies in this study have started or acquired their plant-based dairy alternatives brands in the last four years. The availability is expected to increase in the future as producers develop new products and are expanding to new markets.

Convenience was not mentioned separately in the interviews, but it is related to availability, functionality, and **policies**. By making their products more widely available, plant-based dairy alternatives producers make it more convenient for a wider group of people to consume their products. Better and more similar functionality to dairy products contributes to making it more convenient to replace dairy products with alternatives. Several interviewees mentioned the importance of product development in their businesses. Lastly, the EU's plan to ban the use of dairy-related terms in plant-based alternatives and the use of similar packaging to dairy products was criticized by two companies because if adopted, it would hinder the consumption of more sustainable products.

Nutritional knowledge of customers is an important aspect for several companies and most of them see that they have a role in educating consumers about food sustainability. Although some focus only on plant-based foods while others also include animal products in their education initiatives. One company has taken a step further from educating consumers and has provided training for school chefs about climate-friendly cooking.

In addition to nutritional knowledge, knowledge about the impact on the environment was also considered important by several companies. **Policies** can increase the transparency about the impact of different food products and one company has been active in pushing policymakers for making it mandatory to have climate declarations on products. Poore and Nemecek (2018) support that by suggesting that average product impacts should be communicated to consumers because this enables dietary change.

Price was identified as an important obstacle for plant-based dairy alternatives as they are currently significantly more expensive than dairy products. However, at least one interviewee projects a significant reduction in prices as production capacity increases in the future. **Policies**' role in creating price mechanisms that favor consumption of more sustainable products was also mentioned. Pieper et al. (2020) found that internalizing external GHG costs in Germany would increase the price of conventional dairy products by 0,24€/kg and the price of organic plant-based products only by 0,02€/kg and similar results can be expected from the Nordic countries. Therefore, there is a lot of potential for improvement in price mechanisms and at least one alternatives producer is actively engaging with policymakers to suggest solutions for governance hindrances impacting the consumption of plant-based foods.

Finally, a SWOT analysis was conducted of the aspects affecting plant-based dairy alternatives (Table 7). The main strengths are taste and functionality. However, functionality is also considered to be a weakness because not all types of dairy alternatives have achieved the same functionality of corresponding dairy products. Other weaknesses include price, availability, and capacity, which are interconnected as higher capacity is expected to lower prices. Nutritional content was also considered to be a weakness, but it varies between products as many producers are fortifying their products with minerals and vitamins. Therefore, turning current weaknesses into strengths is a matter of time as both market and product functionality develop.

Knowledge level of consumers about health and environmental impacts can be considered an opportunity as the companies are putting effort into educating public and, therefore, changing their dietary habits. Policies were considered both opportunities and threats as some interviewees are expecting a stronger push towards sustainable food systems, but on the other hand current EU's plan to ban the use of dairy-related terms in plant-based alternatives and the use of similar packaging to dairy products is a significant threat for the industry. However, even there one interviewee saw an opportunity to completely rethink the way plant-based products are described and to come up with innovative packaging.

Table 7: SWOT analysis of the aspects affecting plant-based dairy alternatives

Strengths	Weaknesses
• Taste • Functionality	• Functionality • Price • Availability & Capacity • Nutritional content
Opportunities	**Threats**
• Policies • Knowledge & Habits	• Policies

5.5 Future of Plant-Based Dairy Alternatives

Global dairy alternatives market is expected to grow at a CAGR of 16,7 percent to 41,06 billion U.S. dollars in 2025 (Grand View Research, 2019). All interviewees agreed that the market is going to keep growing at a fast pace. As discussed in the previous section, growing demand from consumers pushes producers to increase production capacity, which in turn lowers average costs. Lower costs make it possible to decrease price, which increases demand and enhances market growth (Figure 13). Given that plant-based dairy alternatives are only at the beginning of their product life cycle, this loop is expected to function for a long time as the market develops and matures.

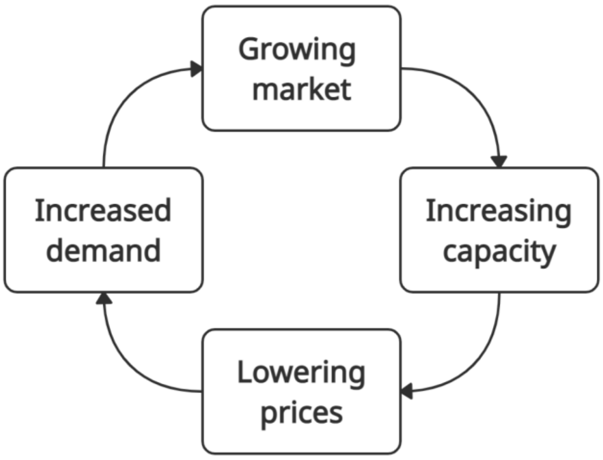

Figure 13. Market growth loop of plant-based dairy alternatives

As discussed in the literature review, global food and land use scenarios have received little attention in climate change mitigation policies, compared with the attention given to the energy supply and end-use sectors (Bajželj et al., 2014). However, some interviewees see food sustainability topics becoming more important as international organizations are emphasizing the importance of dietary shift, which pushes politicians to make it more attractive to consume plant-based foods, and retailers are starting to measure the impact of the products they sell. The shift is politically challenging, but as Sabaté and Soret (2014) discussed, implementing agricultural and nutritional policies that lead to the adoption of plant-based diets is the most rational and scientific way of acting, considering the future of our planet.

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6. CONCLUSION

6.1 Main Findings

The objectives of this research were (1) to identify what are the key drivers from companies' perspective that enable changes in the food system towards wider consumption of plant-based dairy alternatives, and (2) to identify different aspects of how Nordic plant-based dairy alternatives producers are contributing to the SDGs.

Based on the literature review, a conceptual framework was developed with the following key drivers of dietary change: culture, taste, availability, convenience, nutritional knowledge, price, and policies. Interviews with the plant-based dairy alternatives producers confirmed the importance of all these drivers. Additionally, functionality, nutritional content, production capacity, and dietary habits were identified. All these aspects were found to be highly interconnected as they influence one another. Since taste, price, capacity and availability, and knowledge and habits were identified the most then these can be considered the key drivers that enable changes in the food system towards wider consumption of plant-based dairy alternatives. These key drivers were analyzed in a SWOT analysis: taste was identified as strength; price, capacity and availability as weaknesses; and knowledge and habits as opportunities. Turning these weaknesses into strengths and making use of the opportunities presents great outlook for further development of the category.

Nordic plant-based dairy alternatives are contributing to the SDGs in two ways: (1) through their supporting business activities and other product lines, excluding plant-based dairy alternatives product lines, and (2) through the production of plant-based dairy alternatives instead of dairy products. In the first category the following SDGs were identified: 2 (Zero Hunger), 5 (Gender Equality), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 8 (Decent Work and Economic Growth), 12 (Responsible Consumption and Production), 13 (Climate Action), and 15 (Life on Land) of which SDGs 5, 8, and 12 were identified most often.

Production and consumption of plant-based dairy alternatives was associated with the following SDGs: 2 (Zero Hunger) by contributing to sustainable food production; 3

(Good Health and Well-Being) by reducing overconsumption of animals; 6 (Clean Water and Sanitation) by reducing water usage; 13 (Climate Action) by reducing GHG emissions by approximately 70 percent compared to dairy; 14 (Life Below Water) by using less fertilizers that could be washed into oceans; and 15 (Life on Land) by reducing the amount of land used compared to dairy. SDG 13 was identified most often, which suggests that positive impact is the biggest for climate. SDGs 2, 3, and 15 were the next most often identified goals.

6.2 Implications for International Business

Achieving the SDGs is an international task that cannot be done in isolation within one country's borders. As the findings showed, Nordic producers of plant-based dairy alternatives have an important role in solving global problems. Several companies in this study already have a global strategy and presence in markets across the world. Others that have been targeting local Nordic markets, are also planning expansion abroad. The shift from animal-based to plant-based in the food industry was identified to be one of the biggest opportunities in the food industry's history.

6.3 Limitations

One limitation of this study is that it is based on four interviews with managers, one questionnaire, and one sustainability report. Therefore, less data was gathered from the latter two companies. Since all information came from producers then their answers might be influenced by their position. However, most statements from the interviewees related to this study were supported by relevant literature.

Only one company has identified more specifically the SDG sub-goals that they contribute to, which means that there is a significant amount of improvement for other companies. Moreover, most of the companies have not measured the impact of their production on the SDGs, which means that the answers the interviewees provided were mostly based on their personal opinion or external studies about the production of plant-based food. Therefore, there is an inequality between credibility of answers from companies that have analyzed their impact on the SDGs more thoroughly and others whose answers were based on their opinions.

Although the studied companies covered most of the Nordic countries, no producers from Iceland were included in this study. Therefore, the study may not perfectly represent all plant-based dairy alternatives producers in the Nordics. However, the studied companies included different types of companies, ranging from dairy producers to solely plant-based companies.

6.4 Suggestions for Further Research

Since this research was based on companies' perspective of their impact on the SDGs then one suggestion is to study the impact from other stakeholders' perspective such as climate and nutritional scientists, NGOs, retailers, and policymakers, for example.

This research identified the main SDGs that plant-based dairy alternative producers see they have an impact on. Therefore, it is suggested to conduct a quantitative study on the impact of these companies. Since the biggest impact was identified to be on the emissions of GHGs then the companies themselves could calculate their emissions per kg of product to become more transparent in communicating their impact to consumers.

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APPENDICES

Appendix 1: The Interview Structure

The study is being done by Rainer Kravets from Aalto University School of Business as part of his bachelor's thesis. The aim of this study is to identify different aspects how Nordic plant-based dairy alternatives producers contribute to achieving the UN Sustainable Development Goals (SDGs) for 2030. All data collected through this questionnaire will only be used for this study. The respondent has the right to refuse to answer. All questions about this study can be sent to rainer.kravets@aalto.fi.

Respondent's name:

Job title:

Company:

Section 1: Reasons to start the product line

1. What were the grounds/reasons to start your plant-based dairy alternatives product line?

Section 2: Sustainable Development Goals

1. Have you reflected as a company how your strategy contributes to the sustainable development goals (SDGs)?

2. What are the SDGs that your plant-based dairy alternative product line contributes the most to?

3. What is your contribution to these SDGs?

4. Do you see that the production of plant-based dairy alternatives has any negative spillovers to some SDGs?

Section 3: Marketing

1. Who is your target customer?

2. What are the target markets for your plant-based dairy alternatives?

3. What key messages do you use in advertising your plant-based dairy alternative products?

4. How do you position your plant-based dairy alternative products related to dairy products?

5. Do you advocate for replacing dairy with plant-based dairy alternatives? Why?

6. What are the top reasons why consumers are buying your plant-based dairy alternative products?

7. Do you see that you as a company have a role in educating consumers about food sustainability?

Section 4: Plant-based dairy alternatives market and its role in food system

1. What needs to happen for plant-based dairy alternatives to become more widely consumed?

2. What are the main obstacles for plant-based dairy alternative products?

3. Do you see that plant-based dairy alternative products have a role in transforming the food system? Why? If yes, then what role?

4. How do you see the market of plant-based dairy alternatives evolving over the next 10 years (in the Nordics and globally)?