Swedish food habits for higher nutritional value and lower climate impact

- food retail portfolio management

Rebecca Johansson

Linn Torstensson

Degree project • 30 hp
Swedish University of Agricultural Sciences, SLU
Department of Molecular Sciences
Molecular Sciences, 2020:30
Sustainable Food Systems
Uppsala, 2021

Swedish food habits for higher nutritional value and lower climate impact -food retail portfolio management

Svenska matvanor för högre näringsvärde och lägre klimatpåverkan - portföljförvaltning inom livsmedelsindustrin

Rebecca Johansson
Linn Torstensson

Supervisor:	Cecilia Mark-Herbert, SLU, Department of Forest Economics
Examiner:	Fredrik Fernqvist, SLU, Department of People and Society
Credits:	30 hp
Level:	Advanced level, A2E
Course title:	Master thesis in Food Science
Course coordinating department:	Department of Molecular Science
Course code:	EX0875
Programme/education:	Sustainable Food System Program
Place of publication:	Uppsala
Year of publication:	2021
Title of series	Molecular Sciences
Part number:	2020:30
Online publication:	https://stud.epsilon.slu.se

Keywords: Greenhouse Gas Emissions, Private Label Brand, Sustainable Diets, Sustainable Food Consumption, Sustainable Nutrition.

Swedish University of Agricultural Sciences
Faculty of Natural Resources and Agricultural Sciences
Department of Molecular Sciences

Publishing and archiving

Approved students' theses at SLU are published electronically. As a student, you have the copyright to your own work and need to approve the electronic publishing. If you check the box for **YES**, the full text (pdf file) and metadata will be visible and searchable online. If you check the box for **NO**, only the metadata and the abstract will be visible and searchable online. Nevertheless, when the document is uploaded it will still be archived as a digital file.

If you are more than one author you all need to agree on a decision. Read about SLU's publishing agreement here: https://www.slu.se/en/subweb/library/publish-and-analyse/register-and-publish/agreement-for-publishing/.

☒ YES, I/we hereby give permission to publish the present thesis in accordance with the SLU agreement regarding the transfer of the right to publish a work.

NO, I/we do not give permission to publish the present work. The work will still be archived and its metadata and abstract will be visible and searchable.

Acknowledgements

We would like to express our gratitude and give special thanks to several people who walked alongside with us and guided us through this adventure.

The project would never have been possible without our supervisor Cecilia Mark-Herbert who gave us the greatest support and enlightened us with her valuable insights and opinions. Thank you for always cheering us on and all the effort you put into this project, from start to finish.

We thank Axfoundation for their incredible knowledge and guidance in helping us create this study and apply the results in the context of a corporate environment. We are truly grateful that they made this project happen.

Last but not least, we would like to thank our external supervisors Lovisa Boëthius and Emma Töpel Hanson at Garant for welcoming us with open arms. No matter the challenge, you were always very keen to help and connect us with other valuable contacts within the organization. Thank you for letting us be a part of Garant and through transparency allowing us to collaborate for a sustainable future.

Summary

In order to tackle climate change and the increased prevalence of non-communicable diseases, a transformation of human diets is urgently needed. The food retailers can play an important role if integrating sustainability related aspects in their corporate portfolio decisions in order to influence the consumer to make more sustainable food choices.

This master thesis focuses on dietary habits in the light of portfolio management with guidance from a decision-making tool (Cynefin). If focus on principles to identify food alternatives with lower climate impact and higher nutritional value of dishes that are frequently prepared in a home setting. Their understandings are integrated in portfolio management strategies for sustainable development. It was conducted as a commission from Axfood's private label brand Garant, which also serves as the case study. The empirical data consists of sales statistics, nutritional guidelines, nutritional content and calculated carbon dioxide equivalents.

The results show that commonly consumed dishes exceed goals for climate boundaries and they are nutritionally inadequate. In order to reach targets related to nutritional guidelines and climate impact goals, the content of animal-based products needs to be reduced. Furthermore, vegetables and whole grains need to be increased. The findings of the study provide opportunities to integrate climate and health aspects further in the portfolio management of Garant.

Changing dietary habits and integrating sustainability in portfolio management is not a clear and simple road. Rather, it needs to be shaped in accordance to the context of the specific corporation. The results show that integration of sustainability alters the retailer owned brand portfolio management decisions.

Sammanfattning

För att hantera klimatförändringen och den ökade förekomsten av icke-smittsamma sjukdomar, behöver vi förändra våra matvanor. Dagligvaruhandels aktörer, i synnerhet livsmedelsbutikers handlare kan spela en stor roll om de interagerar hållbarhetsrelaterade frågor i deras företagsverksamhet för att influera kunden till mer hållbara val.

Den här masteruppsatsen fokuserar på matvanor i ljuset av portföljförvaltning med guidning av ett beslutsfattande verktyg (Cynefin). Fokus ligger på principer för att identifiera livsmedelsalternativ med lägre klimatpåverkan och högre näringsvärde i maträtter som ofta tillagas i en hemmiljö, och hur dessa kan integreras i portföljhanteringsstrategier. Studien genomfördes på uppdrag av företrädare för Axfoods egna märkesvara Garant, vilket också representerar fallet i studien. Den empiriska datan bygger på säljstatistik, nutritionella riktlinjer, näringsinnehåll och koldioxidekvivalenter.

Resultatet visar att maträtter ofta tillagade i en hemmiljö överskrider klimatpåverkansmål och är näringsmässigt inadekvata. För att nå mål i nutritionella riktlinjer och klimatpåverkan, behöver innehållet av animalie-baserade produkter minskas. Vidare behöver andelen grönsaker och fullkorn öka. Resultaten av studien erbjuder vidare möjligheter att integrera klimat- och hälsoaspekter i Garants portföljförvaltning.

Att ändra matvanor och integrera hållbarhet i portföljförvaltning är inte enkelt. Istället behöver det anpassas efter den specifika företagskontexten. Resultaten indikerar att integrering av hållbarhet påverkar besluten som görs inom livsmedelshandelns varumärkesportföljer.

Popular-scientific summary

Food habits in the food retailer industry

- for a healthier planet and people

Our planet is facing fast evolving climate changes presenting major threats to our ecosystems, different species, food safety and living environments. Additionally, the prevalence of heart diseases, cancer, diabetes type 2 and stroke is increasingly causing premature deaths and major economic pressure on our society around the globe. To turn this situation around, dietary habits need to change urgently. Identification of dishes commonly prepared in Swedish households offers possibilities for marketing, improving or innovating products of a private label brand to influence consumer behavior.

Changing consumer behavior is a challenge as it is highly affected by personal and societal habits. Therefore, we identified ten dishes that customers commonly prepare at home, and how these can be used to guide the consumer to more sustainable food choices in the case of a private label brand. In this study, the sustainability focus was on health aspects and climate impact. As a part of the master thesis, the dishes were altered to be in line with the Nordic Nutrition Recommendations and climate impact boundaries set by the WWF.

Our study showed that commonly made dishes exceeded goals for climate impact and they were also nutrient poor, which challenges the health of both the planet and people. From a nutritional perspective, the total content of fat and saturated fat was too high. They were also poor in fiber, whole grains, fruit and vegetables. Diets rich in vegetables, fruits, fiber, whole grain contribute to lower risk of heart diseases, different varieties of cancer, diabetes type 2, overweight and obesity. By replacing some of the saturated fat found in for e.g. pastries, animal-based products, ice cream with unsaturated fat from e.g. olive oil, rapeseed oil, nuts and seeds, the risk of developing heart disease decreases. In order to reduce climate impact and improve nutritional qualities in the dishes, animal-based products were reduced or to some extent exchanged to plant-based alternatives. Vegetables and whole grains were also added to increase the nutrient content.

To identify the commonly made dishes, we used sales statistics from Axfood's stores Hemköp and Willys, based on consumer purchases during the year 2019. With sales statistics we could define what the customers bought and, through association purchases, see what kind of dishes they were most likely to prepare in their home settings. The results provided valuable information on customer purchase behavior. Knowledge about what meals customers most likely cook based on their purchases, gives possibilities to influence them to make more sustainable food choices. This through increasing the assortment of more sustainable food products either by giving existing products bigger market shares or innovating new sustainable and healthy products. Another way would be to strengthen marketing of those kinds of products. The findings of the study showed upon possibilities to use Garant to guide towards healthier food choices with lower climate impact. The transformation to a sustainable diet presents challenges, but with gradual transformation and further consideration of health and climate impact in the food retail industry, it is possible.

Abbreviations

ACIT	Axfood's Customer Insight Tool	24
CO_2e	Carbon Dioxide Equivalents	3
E%	Energy Percent	13
EDA	Enterprise Data Analysis	24
FAO	Food and Agriculture Organization of the United Nations	1
FCDB	Food Composition Database	24
GHG	Greenhouse Gas	1
LCA	Life Cycle Assessment	24
NNR	Nordic Nutrition Recommendations	26
PLB	Private Label Brand	9
PAL	Physical Activity Level	13
RISE	Research Institutes of Sweden	24
UN	United Nations	1
WHO	World Health Organization	1
WWF	World Wildlife Fund, Världsnaturfonden	1

Table of Contents

List of Figures

List of Tables

1 Introduction

This first chapter presents the context of the research problems as well as the aim, research questions, objectives and delimitations.

1.1 Problem background

The largest cause of global environmental change is food production (Willett *et al.* 2019), responsible for up to 30 percent of global greenhouse-gas (**GHG**) emissions alone (Garnett 2014, p 5). Significant global GHG emission reductions are required throughout all industrial sectors, but it is clear that emissions from food systems need to be addressed (Garnett 2014). Increasing incomes, rapid urbanization and inadequate accessibility to nutritious food are all factors in what has driven the global shift towards diets that are heavily processed, animal based and high in calories (Global Panel on Agriculture and Food Systems for Nutrition 2017). Animal based food takes up almost 80 percent of agricultural land through production of feed and grazing fields (Food and Agriculture Organization of the United Nations, FAO 2020a). With animal products requiring more resources, they lead to a significantly greater environmental impact (Röös 2017). These dietary transitions are not only responsible for contributing to environmental degradation (Springmann *et al*. 2016), they are also increasing the incidence of lower global life expectancy and non-communicable diseases (Tilman & Clark 2014).

A healthy diet should include energy balance, fruits, vegetables and other dietary fiber such as whole grains, with limited intake of sugar, salt and saturated fats (World Health Organization WHO, 2018a). It poses a greater risk to morbidity and mortality to have an unhealthy dietary pattern than the combined risks of alcohol, drugs, tobacco use and unsafe sex (Willett *et al*. 2019). Due to the fact that the majority of saturated fat comes mainly from animal sources, such as meat and dairy products (AHA 2020), reducing the animal-based foods in our diet would benefit both the environment and public health (Godfray *et al*. 2010). According to "Riksmaten", a survey conducted by the Swedish Food Agency, a majority of the Swedish population is not eating enough whole grains, fibers, fruits and vegetables. Instead consumption patterns point to an abundance in intake of sugar, salt, saturated fats and unhealthy snacks such as candy, soft drinks and pastry (Amcoff *et al*. 2012).

Sustainability issues related to the food system have received a lot of attention, especially in the latest years (Nemeck *et al.* 2016). To avoid future negative environmental impacts and worsened public health, actions need to be taken. According to the World Wildlife Fund Sweden (**WWF**, Världsnaturfonden) the climate changes are evolving fast, leading to devastating effects including global melting glaciers, elevated sea levels, increased frequency of storms, forest fires and floods (WWF 2020a). These catastrophic effects are major threats to different species, food safety, living environments and our ecosystems. The urgency to change established food systems is so critical that it is integrated in the Sustainable Development Goals (**SDG**) (United Nations, UN 2020a). The SDGs entails seventeen goals communicated as "[...]

urgent call for action by all countries" (*Ibid.*). Together, the goals aim to end poverty and reduce inequality while improving health and education, spur economic growth, conserve nature and fight climate change. Goal three entails to "ensure healthy lives and promote well-being for all ages", including intentions to reduce mortality from non-communicable diseases (UN 2020b). The aim to decrease GHG is included in goal thirteen as a means to "take urgent action to combat climate change and its impacts" (UN 2020c). The urgency to act has also affected the business world, with multimillion sponsoring projects related to food, health and sustainable development (Gripenberg 2016). Overall, the importance of a sustainable diet is of high interest within governments, civil society organizations, international organizations, academia and the private sector (FAO 2019). According to Intergovernmental Panel for Climate Change, "consumption of healthy and sustainable diets presents major opportunities for reducing GHG emissions from food systems and improving health outcomes" (Shukla *et al.* 2019 p.58).

Technological mitigation options in the agriculture sector is one way of dealing with GHG emissions, but they have not shown to be as effective as changing dietary patterns (Popp, Lotze-Campen & Bodirsky 2010). Today, grocery stores and supermarkets are the primary source to obtain food (Cohen & Babey 2012). Although retailers respond to consumer demand (Dawson 2013), they can also shape food choices by generating demand for certain products (Ekelund *et al.* 2014). One way of doing this is by increasing the number of new products, specifically in retailer branded ranges (Dawson 2013). Working with the products within the assortment of an organization, is a part of portfolio management (Project Management Institute 2013). Due to the fact that 69 percent of the 100 largest economies in the world today are represented by multinational corporations, they have considerable responsibility towards society (Global Justice Now 2018). How much responsibility businesses take and what role they play in our society is an ongoing debate that has caused an increased awareness of corporate social responsibilities (Löhman & Steinholz 2003). Businesses today experience intense scrutiny where lack of awareness or transparency in issues regarding sustainability might damage the brand (Mark-Herbert & von Schantz 2007).

1.2 Problem

Consumer food choices are complex and affected by several aspects including ideals, lifestyle, values, habitual patterns, personal needs and preferences, available resources and knowledge, social factors as well as the physical environment (Furst *et al*. 1996). The World Business Council for Sustainable Development (2008) argues that these reasons hinder the consumer to implement more sustainable behavior, even though there is a growing concern for the environment among consumers. In consideration to the environmental impact of today's food systems, "[...] there is an urgent need to promote diets that are healthy and have low environmental impacts" (FAO 2019 p.5). The Swedish diet exceeds planetary GHGs boundaries (Moberg, Karlsson Potter, Wood, Hansson & Röös 2020). In order to change diets, they need to be accepted from a socio-cultural perspective (FAO 2019). It is also well known that it is very difficult to change dietary habits in practice (Hallström, Davis, Woodhouse & Sonesson 2018).

According to Ekelund *et al*. (2014) there is not enough guidance and communication towards the consumer on how to make food choices with lower climate impact. Therefore, Ekelund *et al*. (2014) reason that the retailers need to increase their communication and support towards the consumer to enhance food choices with lower climate impact. Research also shows that the consumer experience it challenging to identify and implement healthy food choices (Bisogni *et al*. 2012; Neuman *et al*. 2014). This is also confirmed by the media (Gripenberg 2016) that reports there is a need to combine the research fields of health and the environment, to guide the consumer to more sustainable food choices. Furthermore, the food retailers need to increase their efforts in order to improve public health (Food Navigator 2020). More research is needed to understand what a sustainable diet is and how to implement it in society (Hallström *et al.* 2018).

1.3 A commission, aim and research questions

This study is conducted on a commission on the behalf of the food retailer corporate Garant. The brand Garant is developed to guide their customers to food alternatives with lower climate impact and higher nutritional value based on their own assortment. Therefore, they requested a scientific basis to use as support and a means within their portfolio management.

The aim of the study is to identify food alternatives with lower climate impact and higher nutritional value of dishes that are frequently prepared in a home setting, and how these can be integrated in portfolio management strategies.

To fulfill the aim, the following questions, all related to product portfolio management, are of particular interest:

- Which ten protein sources were the highest sellers in Axfood's grocery stores Hemköp and Willys during 2019?
- What did their customers buy together with the protein sources to create food dishes?
- What is the nutritional content and climate impact of the food dishes?
- How can the food dishes be alternated to dishes with higher nutritional value and lower climate impact in line with the product assortment of Garant?

1.4 Delimitations

According to the Food and Agriculture Organization of the United Nations (**FAO**), sustainable food systems integrate economic, social and environmental sustainability (Nguyen 2018). This study focuses on carbon dioxide equivalents (**CO_2e**) and nutritional value with the aim to consume more healthy dishes with lower climate impact. Hence, only two fractions of sustainable food will be taken into consideration due to limitation of data. Optimally, all dimensions and related subcategories should be combined in sustainable healthy diets to prevent unintended consequences (FAO 2019).

CO_2e is difficult to calculate and should not be seen as definitive numbers (Röös 2012). Therefore, CO_2e should rather be used as guidelines to understand the relationships between different food products. Besides this, the database with information on CO_2e only entails information on specific foods, excluding affecting factors after processing such the packaging, cooking and transportation within Sweden (Florén, Sund, Krewer, & Angervall 2015). On imported foods, general CO_2e assumptions on transports are included. The uncertainty of the numbers will also provide some uncertainties within the study regarding how data is interpreted.

From a nutritional point of view, one dish does not represent whole dietary patterns, but rather a fraction of dietary consumption which needs to be taken into consideration. Furthermore, not all nutritional aspects will be accounted for. The nutritional aspects included were content of energy, protein, fat (including the amount of saturated fat), fruit and vegetables, whole grain and dietary fiber. Moreover, micronutrients, sodium and added sugars were not included.

Economical aspects of food and food products were not taken into consideration in this study.

1.5 Outline

The outline of the thesis is illustrated in *Figure 1*.

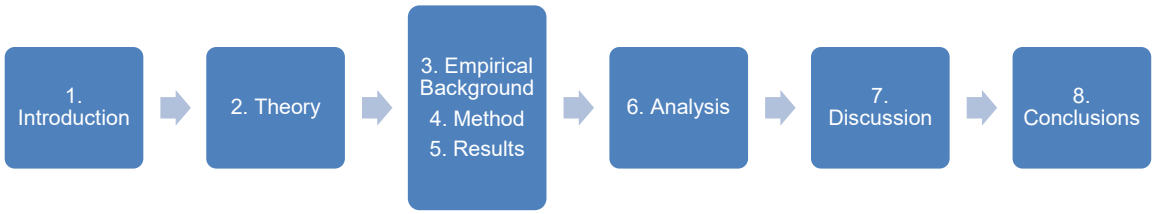

Figure 1. Illustration of the outline of the study.

In the first chapter (*Chapter 1*) the research problem is framed together with a description of how it aims to be addressed. *Chapter 2* presents the framework that shapes the process of the thesis. Further on, *Chapter 3*, describes the research area and its complexity, including recent conducted research in the field. *Chapter 4* entails the methodology and the strategic decisions made throughout the whole process to address quality assurance and ethical considerations. The empirical results are presented in *Chapter 5* and then analysed in relation to the theoretical framework in *Chapter 6*. Furthermore, the results are discussed and compared to recent research in *Chapter 7*. In the last Chapter (*Chapter 8*) the research results are concluded with suggestions on further research.

2 Theory

This chapter presents the theoretical framework of the study. It starts with the presentation of the Cynefin framework, followed by a description of healthier eating patterns with lower climate impact. Finally, the term portfolio management is handled. In this study the theoretical framework will provide a lens to better understand the research area and its complexity.

2.1 The Cynefin Framework

Management of sustainable development includes handling dynamic change processes (Kusters *et al*. 2017). Normally, the change processes are difficult to foresee. Therefore, it is necessary to understand its complexity and how to respond strategically (*Ibid.*).

Kurtz & Snowden (2003, p. 468) developed the Cynefin framework illustrated in *Figure 2*. The Cynefin framework provides a tool for decision-making and is used for consultancy and within research including e.g. branding, product development and management strategy (Kurtz & Snowden 2003). It is a sense-making framework that should not be used to simply categorize. Instead it provides a tool to understand (make sense) of uncertain situations in order to make appropriate decisions. In the latest years, it has been used within further areas such as e.g. health promotion strategies (Van Beurden *et al.* 2013), medicine (Gray 2017) and engineering (Vollmar *et al.* 2017). The framework entails how to handle management challenges in complex systems and is divided in four types of contexts: simple, complex, complicated and chaotic (Kurtz & Snowden 2003, p 468, Snowden & Boone 2007, p 2). The degree of complexity is defined by cause- and effect relationships. Furthermore, the situations need to be handled differently depending on the situation and the relationship within it (*Ibid.*).

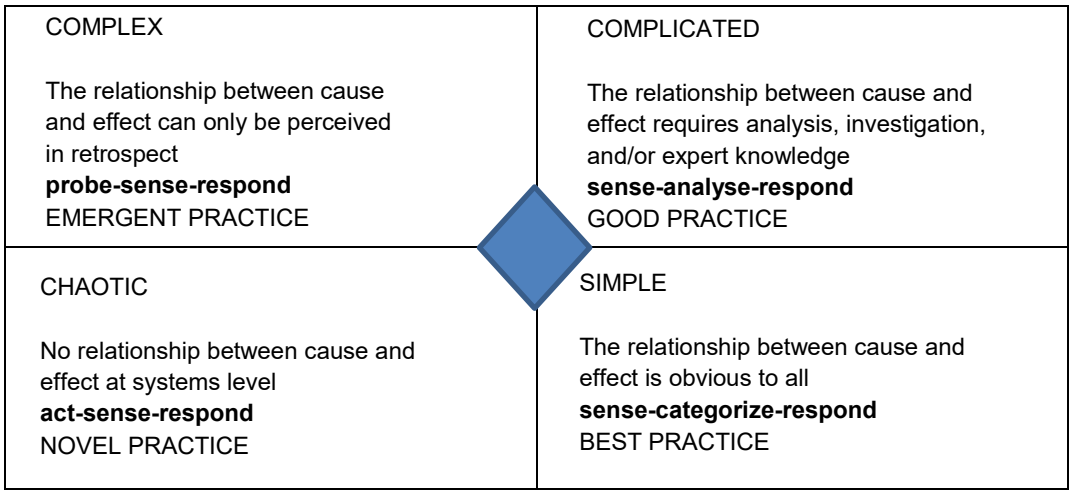

Figure 2 The Cynefin Framework. Own version according to Kurtz & Snowden (2003), 468, further developed by Snowden & Boone (2007), 2.

The four divisions in *Figure 2* represent each type of context within the Cynefin framework; simple, complicated, complex and chaotic, including an explanation of the relationships between cause-and-effect as well as a short description in bold on how to act (Kurtz & Snowden 2003, p.468, Snowden & Boone 2007, p. 2). The grey area in the middle represents disorder. Situations which we do not know how to categorize falls into the disorder domain (*Ibid.*).

In a simple context, there is a clear and predictable relationship between cause- and-effect (Kurtz & Snowden 2003, Snowden & Boone 2007). In this situation, the leaders need to estimate (sense) the facts of it in order to categorize and finally, respond to it. The response should follow the routines and standards in accordance to best practice (*Ibid.*).

Within a complex context, it is impossible to foresee the relationships between cause-and-effect, although it might be possible to identify it afterwards (Kurtz & Snowden 2003, Snowden & Boone 2007). In a complex context, the leaders need to probe, sense and respond to it. Since it is not clear how to act from the start, emergent practice is needed (*Ibid.*).

The relationships between cause-and-effect in a complicated context is clear, but not possible for everyone to see (Kurtz & Snowden 2003, Snowden & Boone 2007). In this situation, there might be several right answers to the issues involved and the leaders need to sense, then analyze and finally respond to it. The analysis can be conducted through support from experts. Practices which are considered viable and dependable are recommended as a response, so called best practices (*Ibid.*).

In the last context, the chaotic one, the relationships between cause-and-effect changes constantly which makes them impossible to establish (Kurtz & Snowden 2003, Snowden & Boone 2007). Firstly, the leaders need to bring order to the situation, then to sense and respond. The aim of the response is to transform the situation to a complex or, if possible, to a simple context. Due to the turbulence and unexpectancy of a chaotic situation, novel practices need to be applied (*Ibid.*).

2.1.1 Criticism to the Cynefin Framework

Van Beurden *et al.* (2013) investigated the use of the Cynefin framework within a social process. The authors used the framework in the context of health promotion and experienced that the sense-making tool was not able to reach its full potential due to its dynamic. Instead, the authors identified a risk that the framework would be understood as a simple categorization matrix. Therefore, the authors believe it is important to work with the framework continuously in the chosen context to truly understand and make use of its benefits (*Ibid.*). Other challenges mentioned by researchers are difficulties in categorizing certain problems in the framework (Grey 2017) and how to handle problems that do not fit (Alexander *et al.* 2018).

2.2 Healthier Eating Patterns with Lower Climate Impact

The area of research regarding the relationship between nutrition and the environment have been expanding during the last decade (Garnett 2014). The scientific consensus today is that consumption patterns with a combination of low GHG emissions, land use and good nutrition consist of minimal animal products with focus on a varied range of minimally processed legumes, fruits, vegetables, whole grains and tubers. However, these general principles could come with certain trade-offs and may not be relevant for all (Vanham, Hoekstra & Bidoglio 2013; Stehfest *et al*. 2009). The problem when excluding animal-based food such as meat, fish and dairy due to high environmental impacts is that these products also tend to be high in essential micronutrients (Garnett 2014). To provide the body with essential nutrients it will be important to substitute the animal products with a larger quantity and more diverse whole plant-based options (WWF 2011). *Figure 3,* based on Garnett (2014, p. 8), marks out the general principles of a healthier diet that is also low in GHG emissions and land use.

Figure 3. Characteristics of healthier and less greenhouse gas emissions and land-intensive eating patterns (own version according to Garnett 2014, p. 8)

The figure illustrated represents ten different general principles of a healthier eating pattern with less GHG emissions. Even though different population groups vary in their nutritional needs, these general principles represent an improvement in what most people generally eat on average, in both developed and developing countries (Garnett 2014).

2.3 Portfolio Management

A portfolio is a tool to work towards the objectives and strategies of an organization and entails a cluster of projects, operations or programs (Project Management Institute 2013). In this study and context, the portfolio refers to Garant's collection of food products. Portfolio management is when one or more portfolios are coordinated to reach the set objectives and strategies within the organization (*Ibid.*) and is the key to build true business value (Kahn 2012). This entails the development and maintenance of a corporate collection of investments, although portfolio management does not only concern buying or selling current holdings (Hiriyapp 2008). It also entails processes within the organization that evaluate, prioritize, allocate and select its internal resources in accordance with its mission, vision and values (Project Management Institute 2013). When the organization environment is competitive and rapidly changes, portfolio management helps leverage the project selection, support a profitable and strong organization and execute the projects successfully (*Ibid.*).

Products within a portfolio are both the foundation and reflection of the corporation (Avlonitis & Papastathopoulou 2006). The total composition of products a corporate offer is referred to as a product mix. A successful product mix needs to include a balance between risk and return, short- and long-term gains (Levin & Wyzalek 2015), vary across different markets, product categories, product types etc. (Kahn 2012). To ensure a successful portfolio, three important aspects need to be taken into consideration: the availability of resources in the corporation, business objectives and technical viability (Levin & Wyzalek 2015). Since all products within the portfolio compete with each other for resources, it is important to compare and evaluate products continuously (Kahn 2012).

Products can be positioned in two different ways, both vertical and horizontal (Choi, Kim & Jung 2018). Vertical positioning of a private label product is about its quality compared to the quality of a similar product from a national brand. Horizontal positioning regards product design such as packaging, shape, color and size. The characteristics of existing products and brands affect brand and corporate performance (Kirca *et al.* 2019). Hence, it is important that the products within the portfolio are in line with the corporate goals (Riesener *et al.* 2019). The composition of the portfolio as well as their level of interdependence of each other can affect the risk of monetary loss. Therefore, it is necessary to apply a holistic approach to portfolio management and the products within it (*Ibid.*).

2.3.1 Portfolio Management Strategies

Strategies are patterns of choices a corporation makes in order to fulfill its purposes, objectives or goals (Johnson *et al.* 2013). One strategy that retailers have been introducing to maximize profit over the past two decades is the private label brand (**PLB**) itself (Choi, Kim & Jung 2018). Retailers have an exclusive advantage to promote, price, position and decide on shelf placement through private label brands. Scott-Morton & Zettelmeyer (2004) argue that retailers strongly value this due to their control over product positioning that national brands will be unable to provide.
Private labels generally have one out of four consumer propositions with different strategies (displayed in *Table 1*), that may vary over time (Kumar & Steenkamp 2007).

Table 1. Different types of private label brands with their respective strategies and empirical examples

Proposition	**Strategy**	**Empirical example**
Generic Private Label	Cheapest - undifferentiated	No name black-and-white packages marked with generic product names such as “soap” or “shampoo”
Copycat Brands	Me too - at a cheaper price	Zara
Premium Store Brands	Value added	Body Shop
Value Innovators	Best performance-price ratio	IKEA, H&M

These four propositions include generic private labels, copycat brands, premium store brands and value innovators (Kumar & Steenkamp 2007). The strategy for the generic private label is to provide the cheapest option in a product category with the objective to expand customer base. Hard discounters such as Lidl put pressure on mainstream retailers, forcing them to develop low price private labels if they want to have a chance to compete for their customers. Copycat brands offer the same quality as national brands but offer the products at a cheaper price, with the objectives to increase retailer share of category profits and to increase negotiating power against the manufacturer. Zara is a copycat fashion brand that makes high fashion accessible universally. The strategy for premium store brands is to provide added value products with the objectives to increase category sales, differentiate stores and enhance margins. Body Shop is recognized for its ethical viewpoint, hence the added value. The strategy for value innovators is to provide the best performance to price ratio with the objectives to build customer loyalty to store, generate word of mouth and provide the best value. IKEA and H&M both start at low prices and are always striving to push down the costs. The first two propositions are traditional approaches while the last two are relatively new (*Ibid.*).

Most retailers have portfolios that integrate multiple types of store brands (Kumar & Steenkamp 2007). Brands are seen as reputational assets (Bakker, Raabe & Siebenhüner 2015). Multiple store brands give the retailer accessibility to different market segments at the same time. According to Kumar & Steenkamp (2007) there are three known portfolio segmentation strategies; price-based, category-based and benefit-based. For example, price-based portfolio

strategy requires the retailer having at least two store brands in their portfolio, in order for them to appeal to different segments. When retailers combine different types of store brands (generic, copycat and premium) together with the various portfolio segmentation strategies, they create multiplex private brand portfolios (*Ibid.*).

A PLB provides a possibility for the retailers to differentiate from their competitors and is a part of brand strategy (Bakker, Raabe & Siebenhüner 2015, Sudhir & Talukdar 2004). Furthermore, the image of PLB was considered the most important factor for customer purchase decisions according to De & Singh (2017).

Strategic decisions related to sustainability are called green product portfolio decisions (Wever, Books & Bakker 2008). Firstly, Wever, Boks & Bakker (2008) states that the company's products need to be in line with the company's sustainability goals to integrate sustainability into product portfolio management. Within product portfolio management, several decisions related to sustainability can be made through examination of the existing products in the portfolio, redesigns and/or development of new products. The existing products can for example be discontinued if they have a bad sustainability profile, but if they have a sustainable (or green) profile they can be given an increased share of the product portfolio, reducing shares of non-sustainable products. An existing product with a green profile can also be promoted to an increase in market shares as a competitor to other brand products, otherwise known as green marketing. Through green marketing a company improves their image and gains a competitive advantage by increasing the added value of their own products (Moravcikova, Krizanova, Kliestikova & Rypakova 2017). They are also more prepared to handle pressure from stakeholders regarding environmental concerns (*Ibid.*).

The redesigns can be applied to existing products in having them lower their climate impact substantially or incrementally over a longer period of time in the product design process (Wever, Boks & Bakker 2008). New products can be developed for eco-conscious niche markets or as radical innovations that might offer a new product or service leading to a more sustainable lifestyle (*Ibid.*).

Arla, a Swedish food corporate, provides an empirical example on portfolio management in line with sustainable development. Recently, Arla created an umbrella brand with only plant-based products as a response to meet consumer demand (Nutria Ingredient 2020). The Swedes are increasing their consumption of plant-based alternatives to milk (SVT 2017), which means it is in line with consumer demand. Additionally, animal-based alternatives have higher climate impact (Röös 2017). Therefore, it is also in line with sustainability as a means to decrease environmental impact by foods.

3 Background for the empirical study

The following chapter gives a brief introduction to the scientific background this study is based on. This includes recommended energy intake, guidelines for a healthy diet, reference values for public meals recommendations and carbon dioxide equivalents dietary habits.

3.1 Recent Research in the Field

The research area of healthy food and diets is a well-established field (Nordic Council of Ministers 2014). It is well known which components to include in a healthy diet. Moreover, the interest in food and nutrition is continuously rising, contributing further to the research field. There is also an increased awareness of how food production and consumption have effects on the environment (Hallström *et al*. 2018). As a result of the growing interest of both areas and how they interact, a new research field is emerging fast with urgent needs to fill the gaps (*Ibid.*). *Table 2* provides an overview of recent research conducted in the area.

Table 2. Recent research conducted in the field, including the researchers, the choices of analysis and the context

Researchers	**Choice of analysis**	**Context**
Hallström, Carlsson-Kanyama & Börjesson (2015)	Climate impact and land requirement of different diets	Scenario analysis on how dietary changes can contribute to more sustainable food consumption
Hallström, Davis, Woodhouse & Sonesson (2018)	Dietary quality scores combined with data on environmental impact	Integration of nutritional aspects with environmental impact to provide a healthy diet scenario within climate impact boundaries
Willet *et al.* (2019)	Definition of a healthy diet within the planetary boundaries	Scenario analysis of a healthy diet that is environmentally sustainable on a global level
Moberg *et al.* (2020)	Environmental impact of the Swedish average diet compared to the planetary boundaries set by Willet *et al* (2019)	Examine how sustainable the Swedish diet is and if global indicators can be applied and used to grasp local environmental issues
Brook & Pagnanelli (2014)	A 5-step framework on how to integrate sustainability aspects (social, environmental and economic) in innovation product management	Applied on the product portfolio management of the automotive industry
Tufinio, Mooi, Ravestijn, Bakker and Boorsma (2013)	Current application of sustainability (social, environmental and economic) in project management	Corporations operating in different industries; energy, construction infrastructure and high-tech semiconductor

In 2015, Hallström, Carlsson-Kanyama & Börjesson summarized 14 articles to address the climate impact and land use requirements of different diets. According to the authors, climate impact by diets can be reduced by up to 50 percent through diet transition. The type of meat included, as well as the amount provided the highest possibility for reduction. Hallström *et al.* (2018) combined health and environmental sustainability in a systematic review. In the article, they investigated different dietary quality scores and combined them with data on environmental impact. The results showed that the choice of method and how it is integrated with environmental assessments might affect the outcome, and thereby which food alternatives that are displayed as more sustainable. Furthermore, the scientists noticed that the articles included in the review usually focus on the nutritional value of a certain food product. Although, food items are rarely consumed individually but as a part of a meal. The researchers therefore argued that food items in the combination of composed meals needs further investigation (*Ibid.*).

Willet *et al.* (2019) gathered 37 leading scientists within different disciplines such as political sciences, human health, agriculture and environmental sustainability. Together they wrote a scientific report on how to compose a diet that is both healthy and sustainable. In this report, the planetary boundaries were used as a framework including climate change, the use of freshwater, biodiversity loss, land-system change and the flow of nitrogen and phosphorus. Their suggested diet was composed of mostly vegetables, whole grains, fruits, nuts, legumes, unsaturated oils with a low intake of seafood and poultry. Furthermore, there was very limited or no red meat, added sugar, processed meat, refined grains and starchy vegetables.

Moberg *et al.* (2020) based their study on the planetary boundaries defined by Willet *et al.* (2019) to examine if the boundaries could be applied in local contexts. In this case, the Swedish diet was benchmarked to the boundaries. The authors of the study concluded that the Swedish diet exceeded planetary boundaries in several aspects, including climate impact. According to the authors, the average Swedish diet was more than 2-3 times beyond the planetary boundaries of GHGs (*Ibid.)*.

Limited research is conducted on how to integrate sustainability in portfolio decision management (Brook & Pagnanelli 2014; Wever, Boks & Bakker 2008), although the interest within the area is increasing (Dobrovolskienė & Tamošiūnienė 2015). Additionally, it provides a valuable possibility to differentiate and create competitive advantage (Belz & Peattie 2012). It is important sustainability is integrated in portfolio management as a means to reach the corporate objectives (Sánchez 2015) and the SDGs, in particular goal 12 on sustainable consumption and production (UN 2020d). Therefore, there is a need for knowledge on how to integrate sustainability in portfolio management (Brook & Pagnanelli 2014). Some researchers have developed frameworks on the issue. Brook & Pagnanelli (2014) developed a 5-step framework on how to integrate sustainability in product development. The framework aims to be applied on portfolio management within platform projects, breakthrough projects, and derivative projects and is developed from the perspective of the automotive industry. Tufinio, Mooi, Ravestijn, Bakker & Boorsma (2013) looked into the current integration of sustainability in project management and portfolio management. According to the authors, definitions of

sustainability differ leading to different ways of implementing sustainability in the organization strategy, project management and operations. Furthermore, sustainability must be incorporated in three levels of the organization; strategic, project and operational level in order to gain competitive advantage. The strategic level involves mission, vision and strategic planning related to finances, products, marketing, supplier and stakeholder relationships. On a project level, sustainability needs to be included in both medium- and short-term planning. Operational level entails daily activities such as production, accounting, human resources, sales, promotions, advertisements, supply and sales. The researchers state that "the road to sustainability is not a single, straight, one-way road described in a map" (Tufinio *et al.* 2013 p.99). The factors to consider are common, but the way to sustainability differs between organizations (*Ibid.*).

3.2 The Swedish Food Agency and the Nordic Nutrition Recommendations

For adults to stay healthy and avoid negative health consequences, energy expenditure and long-term energy intake should be at a balance (Nordic Council of Ministers 2014). Active lifestyles give higher physical activity levels (**PAL**), which ultimately leads to a need for higher energy intake. A more sedentary lifestyle leads to a lower need for energy intake. There is also a difference between men and women, where men have a higher need for energy than women do. *Table 3* below presents the reference values for energy intake based on the Nordic Nutrition Recommendations (Swedish Food Agency 2020a).

Table 3. Reference values for energy intake (kcal/day) rounded to the closest hundred (Swedish Food Agency 2020a)

WOMEN	**PAL: Low**	**PAL: Medium**	**PAL: High**
18-30 years	2000 kcal	2300 kcal	2500 kcal
31-60 years	1800 kcal	2100 kcal	2400 kcal
61-74 years	1700 kcal	1900 kcal	2200 kcal
MEN	**PAL: Low**	**PAL: Medium**	**PAL: High**
18-30 years	2500 kcal	2800 kcal	3200 kcal
31-60 years	2300 kcal	2600 kcal	3000 kcal
61-74 years	2000 kcal	2300 kcal	2600 kcal
MEAN VALUES	2100 kcal	2300 kcal	2700 kcal

The reference energy intake values span from 1700 kcal to 3200 kcal per day, depending on gender, age and physical activity level. The energy can then be divided into different percental energy proportions between the macronutrient's protein, carbohydrates and fat (Nordic Council of Ministers 2014). This is called energy percent (**E%**). Energy percentages are often used to assess the nutritional quality of a certain dish or the entire diet (Swedish Food Agency 2020a).

The recommended amount of whole grain, dietary fiber, fruits and vegetables is the suggested intake during one whole day; hence it does not apply for just one meal. One way of deciding the proper intake for one meal is to look at public meal planning for schools. A report from the Swedish Food Agency concerning assessments and documentation of nutritional school lunches suggests that one meal on average should meet the corresponding reference values which equals approximately 30 percent of the recommended daily intake (Quetel 2013).

Table 4 presents the recommended intake for the overall diet and for a specific meal.

Table 4. Dietary guidelines for a healthy diet, gathered from the Swedish Food Agency (2020a; 2020b) and the Nordic Council of Ministers (2014), with reference values for energy and nutrient content in an average school lunch, corresponding to 30 percent of the recommended daily intake (Quetel 2013, p 11)

Component	Recommended intake per day (100%)	Recommended intake per meal (30%)
Energy (kcal)	1700-3200 kcal	735 kcal (510-960)
Protein	10-20 E%*	18-37 g
Fat	25-40 E%*	20-33 g
Saturated fatty acids	< 10 E%*	< 9 g
Whole grain	70-90 g**	21-27 g
Dietary fiber	25-35 g *	7.5-10.5 g
Fruits & Vegetables	500 g*	150 g

**Nordic Council of Ministers (2014).*

***Swedish Food Agency (2020a; 2020b).*

The table above shows the dietary guidelines for a healthy diet with a focus on the energy intake, protein, fat, saturated fatty acids, whole grain, dietary fiber, fruits and vegetables, where the last column shows the recommended intake per meal. In summary, the reference energy intake value is based on reference values for energy intake, for both men and women, all adult age categories and all PAL values (*Table 3*). These are applied together with other components to create healthy dietary patterns, which lead to clear guidelines on how to compose more healthy meals as seen in the third column of *Table 4.*

3.2.1 Protein Sources, Nutrition & Health

Chicken is a source high in protein and other nutrients, and relatively low in fat (Swedish Food Agency 2020c). Red meat, such as beef, pork, lamb and game, includes a high content of protein along with vitamins and minerals. However, red meat has been shown to increase the risk of developing certain types of cancer, cardiovascular diseases, all-cause mortality and type 2 diabetes (Battaglia Richi *et al*. 2015), which is why the Swedish Food Agency recommends not eating more than 500 grams per week (Swedish Food Agency 2020c). Processed meat are

meats that have been smoked, treated with nitrite or preserved in any way. Sausages and bacon are types of processed meat. Processed meat has an even stronger correlation with certain types of cancer than red meat does. Hence, it should only make up a smaller part of the maximum 500 gram red and processed meat recommendation per week. Fish has a high content of protein, omega-3 fatty acids, vitamins and minerals. Legumes do not only provide a source of protein, vitamins and minerals, they also add a lot of fibers to the diet. Other protein sources could also be paste, rice, potatoes, bulgur, grains, bread, eggs and dairy (*Ibid.*).

3.3 Carbon Dioxide Equivalents

Energy in dietary intake is often translated to environmental effects in terms of greenhouse gases (**GHG**). GHG includes gases such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) (FCRN 2020a). They all have different global warming potentials (**GWP**), meaning that one unit of each gas impacts global warming differently (EPA 2017). Carbon dioxide is used as a reference gas (GWP 1), where methane is around 30 times more potent, and nitrous oxide is roughly 300 times more potent than the reference gas. Instead of referring to various gases with different GWP, they can be compiled into emissions by mass; CO_2e (*Ibid.*).

Food systems contribute with up to 30 percent of the global GHG emissions (Vermeulen, Campbell & Ingram 2012, p 195; Garnett 2014, p 5; Willett *et al.* 2019, p 5). The emissions can further be divided into different stages of production (FCRN 2020b). The major impacts, contributing with approximately 15-25 percent of global GHG emissions, are land-use change and inputs such as fertilizers, pesticides and manure (Vermeulen, Campbell & Ingram 2012). The transport, packaging, processing, sales, cooking and waste disposal accounts for a smaller impact, about 5-10 percent of global GHG emissions (FCRN 2020b). However, these impacts from the later stages in the food system might be smaller but are likely set to grow in the future. This is due to developing countries moving to more developed countries where the GHG emissions from agriculture and fertilizer manufacturing are lower and transport, packaging, processing, retail, domestic food management and waste management are higher (Vermeulen, Campbell & Ingram 2012).

Consumption-based GHG emissions in Sweden (such as food, transports, living, investments and others) have been relatively stable at around 9 tons per capita per year during the last years (Swedish Environmental Protection Agency 2020). The required total carbon footprint needs to be lower than 2 ton CO_2e per capita per year to reach the least ambitious 2-degree United Nations (**UN**) target by the year 2050 (Sjörs *et al.* 2017). Swedish food habits are currently as high as the goal for total consumption based GHG emissions, which calls for urgent changes. A scenario to reach the 1,5-degree UN target has been estimated by WWF, based on the total usage of CO_2e per capita and how much that remains to be consumed by 2050 (WWF 2018). This time frame based on the Swedish population would amount to an allowance of 1.1 ton CO_2e per capita per year. WWF concluded that 50 percent of per capita emissions could come from food, based on the allowance of 1.1 tons CO_2e per capita per year and other sectors becoming climate neutral through efficiency and carbon mitigation. This accounts for 11 kg

CO_2e per week, 1.6 kg CO_2e per day or 0.5 kg CO_2e per lunch or dinner. Altogether, the climate impact of food must be reduced by 75 percent (WWF 2020b).

Another suggestion on climate smart dietary patterns comes from a collaboration between the Swedish Board of Agriculture, the Swedish Environmental Protection Agency and the Swedish Food Agency together with the Institute for Food and Biotechnology (**SIK**) and their climate database (Hjerpe *et al.* 2013). The guidelines for both WWFs One Planet Plate and the collaboration between Swedish Board of Agriculture, the Swedish Environmental Protection Agency, the Swedish Food Agency and SIK are presented in *Table 5*.

Table 5. Reference values for CO_2e recommendation per meal, corresponding to 30 percent of the recommended daily intake (WWF 2018, p. 3; Hjerpe et al. 2013, p. 30)

Organization	CO_2e recommendation per week	CO_2e recommendation per day	CO_2e recommendation per meal (30%)
WWF	11 kg	1.6 kg	0.5 kg
Swedish Board of Agriculture, Swedish Environmental Protection Agency, Swedish Food Agency & SIK	18-25 kg	2.6-3.6	0.8-1.1 kg

Their climate impact allowance is in the range of 18-25 kg of CO_2e per week per capita, making it more flexible (Hjerpe *et al.* 2013). However, they do not have a clear guide for how much CO_2e is allowed per meal, though according to Quetel (2013), one meal equals approximately 30 percent of the recommended daily intake, which is also in line with the CO_2e allowance per meal from One Planet Plate (WWF 2018).

3.3.1 Protein Sources and Carbon Dioxide Equivalents

Red meat is the protein source with the largest environmental impact (Swedish Food Agency 2020c). Beef and dairy cattle contribute the most to global GHG emissions, due to enteric fermentation found in the digestive system of ruminants (FCRN 2020a). Enteric fermentation causes the more potent GHG methane to be released (FCRN 2020a; EPA 2017). Pork is also considered red meat, but pigs are non-ruminants and as such emits less methane (FCRN 2020a). Their feed conversion is also more efficient. This also applies to chickens. Due to this, both pork and chicken causes lower GHG emissions than production of ruminants, even though they are being produced in extremely large quantities (FCRN 2020a; Swedish Food Agency 2020c). However, chicken has lower climate impact than pork per kg of bone free product (Röös 2012). Fish also has a lower climate impact than red meat, about the same as chicken. Legumes have lower climate impact than all of the above-mentioned protein sources (*Ibid.*).

3.4 Dietary Habits

On a global level, dietary habits have altered fast in the latest decades due to globalization, increased wealth and urbanization (HLPE 2017). Overall, people are increasing their food consumption, especially animal-sourced products (FCRN 2020c). Additionally, there is a decrease in consumption of pulses, cereals, roots and tubers. The characteristics of dietary shifts is framed by the term *nutrition transition*. It refers most often to the consumption changes in developing countries, from diets high in fiber and cereals to energy-dense diets high in saturated fat, sugars and animal-based foods. The nutrition transition is a major reason for the increased prevalence of obesity. In Sweden, the meat consumption is decreasing (Swedish Board of Agriculture 2020) while the consumption of vegetarian foods is increasing (Axfood 2018a, Food & Friends 2019).

According to Riksmaten, (Amcoff *et al*. 2012), Swedish residents do not consume enough fruit, vegetables, whole grain and fibers. Furthermore, the consumption of foods high in added sugars, saturated fat and sodium needs to decrease. Compared to earlier versions of Riksmaten, conducted in 1989 and 1997-98, food patterns have improved from a nutritional point of view. In the latest version, Swedish residents consumed more fruit, vegetables, fish and shellfish. Furthermore, more consumers use margarine or oils in cooking although the consumption of butter has also increased. Still, the dietary habits need to improve further to improve public health (*Ibid.*).

From a long-term perspective, there is a clear trend that meals away from home is increasing (SCB 2016). Consumers in the United states increased their food expenditure on food away from home substantially during the twentieth century (FAO 2018). In total, it increased from 10 to 50 percent of total food expenditure. In Sweden between 2007 and 2015, sales within the restaurant industry increased five times more than within the food industry including price change considerations. Additionally, it is expected that food away from home will increase further due to e.g. urbanization and increased incomes (FAO 2018).

3.5 Sustainability Work in the Swedish Food Retailers

The main challenge within today's food retailer industry is to ensure food for growing populations in a way which provides social-, economic- and environmental sustainability (Livsmedelsföretagen, The Swedish Food Federation 2019a). However, Sweden has a great potential to be a world leader in climate- and environmentally friendly food high in nutrition and quality. Possible solutions to the sustainability challenges are to be found in the food chain, all the way from the primary production, the food retailer and consumption (The Swedish Food Federation 2019b). Thereby, the food industry contributes to the fulfillment of the goals in the Paris agreement as well as the goals developed by the United Nations and the environmental plan executed by the European Union (The Swedish Food Federation 2019a). To tackle the challenges, the Swedish Food Federation communicates that they take responsibility and action. In 2019, the Swedish Food Federation shaped suggestions on preferable investments and actions that could enhance and improve Swedish food research. The same year, they wrote

their own manifest on sustainability, including five commitments for a sustainable food production within the Swedish Food Industry (The Swedish Food Federation 2019b). The five commitments entailed an industry free of fossil fuels, bisect food waste, only recycle-friendly packages, good terms in the supply chain and efficient water use (*Ibid.*). A multi-stakeholder initiative named Sustainable Food Chain has also evolved as a strategy to implement environmental- and social sustainability within the food chain (Sustainable Food Chain 2020). The initiative works actively to ensure a sustainable food chain from a long-term perspective with concrete solutions on sustainable product assortment and actions to reduce food waste throughout the whole chain. In total, the initiative includes fifteen leading food corporations in the Swedish food industry and WWF (*Ibid.*).

In regard to public health, the Swedish grocery trade (2015), has developed a five-step program. According to the program, the Swedish grocery trade shall consider health aspects in product assortment and development, guide and inspire the consumer to healthy alternatives, recruit coworkers with health knowledge and engage in research related to health impacts by food (*Ibid.*).

4 Method

This chapter presents the research approach, including the research design, literature review procedure, data collection and quality control of the research process as a whole.

4.1 Literature Review

The literature review is of key importance in research and is pursued for multiple purposes (Creswell & Creswell 2018). It provides a larger context of the chosen field as well as a possibility to compare results with earlier conducted research. In this study, data from several fields and sources has been gathered to understand the complexity of food systems in relation to the environment, health and food retailers. Therefore, several databases have been included; Scopus, Google Scholar, ResearchGate ScienceDirect, Primo and PubMed (presented in *Table 6*).

Table 6. List of databases used in the literature search, including chosen search terms

Database	Search terms
Scopus	Food, Nutrition, Dietary Quality, Environmental Impact, Consumption, Mitigation, Food Patterns, Food Habits, Food Choices, Food Retailer, Communication, Diet, Dietary Risk
Google Scholar	Sustainability, Retail Brand, Private Label Brand, Promotion
ResearchGate	Climate Change, Greenhouse Gas Emissions, Nutrient Intake, Food Security, CSR, Marketing, Brand Management, Communication, Environmental Impacts, Food Consumption, Food System, Food Challenge, Nutrition, Sustainability, Life Cycle Assessment, Diet, Sustainable Diets, Dietary Change, Dietary Recommendations, Health Analysis, Global Risks, Private Label, Product Positioning, Private Brands, Grocery Retail, Case Studies, Reliability, Validity, Qualitative Techniques
ScienceDirect	Climate, Food, Nutrition, Health, Sustainable Food, Consumption, Swedish Food Retailing, Health Effects, Dietary Risks, Healthy Eating, Food Choice, Dietary Quality, Environmental Impacts, Greenhouse Gas Emissions, Mitigation, Food Consumption, Sustainable Consumption, Sustainable Food Systems, Healthy Diets, CSR, Corporate Social Responsibility
Primo	Portfolio, Portfolio Management, Portfolio Strategies, Product Portfolio, Private Label Brand, Brand Management, Brand Performance
PubMed	Public Health, Obesity, Eating Behaviors, Dietary Choices, Climate Change, Dietary Recommendations, Nutrient Intake, Greenhouse Gas Emissions

All in all, several reports, scientific articles, websites and books have been used. The broad set of databases and other resources has provided relevant literature within the areas dietary recommendations, food systems, the environment, portfolio brand management and climate mitigation. The literature has been gathered throughout the whole research process. It has been used to frame the research problem, understand it from a larger perspective, identification of relevant terms and models, and to compare it with the study results. The search hits related to nutrition were broad and many, as well as the hits on environmental impact by food systems. Research on climate impact was the most commonly studied area in regard to environmental

impact by food systems. On the contrary, the hits were much more limited when nutrition and environmental impacts were combined. When nutrition and environmental impacts were combined, the main focus was on climate impact by different foods and diets. It was challenging to find climate impact references on specific meals in a diet. The most difficult challenge was to find research in which sustainability was integrated in portfolio management. Research conducted on sustainability and corporate management mostly focused on energy-efficiency and resource allocation within the supply chain and its different units.

4.2 Research Approach

A research approach defines the procedures of the research, including broad assumptions, methodological choices, analysis and interpretation of data (Creswell & Creswell 2018). This study uses a qualitative method, in an inductive approach. An inductive approach is appropriate for the kind of research that aims to cover a complex phenomenon from a multi-level perspective (Robson & McCartan 2016). Due to the complexity in this project and combination of multiple data collection techniques, it was handled with a flexible design study. In a flexible design the research questions, purpose, structure and choice of method has not been decided in forehand which allows for continuous adjustment in the work process (Robson & McCartan 2016). In this study, multiple data have been combined to tackle a complex issue and it was difficult to foresee how to handle all the data in the best way. Therefore, it is valuable that a flexible design allows the researcher to adapt the approach throughout the research process. This type of design requires a flexible researcher that has an open mind and is willing to adjust earlier plans or procedures. It also requires that the researcher is able to interpret and grasp the phenomenon during the study (*Ibid.*).

4.2.1 Case Study

When conducting research, it is important to decide the type of research design, meaning the type of inquiry (Creswell & Creswell 2018). In this study, the design was a case study which is one of three approaches to flexible design according to Robson and McCartan (2016). A case study focuses on a limited unit of analysis as a means to investigate a phenomenon in depth (Robson & McCartan 2016). The definition of a case can be interpreted in several ways e.g. a group, an individual, a process, an organization or a situation. Usually, a case study involves techniques using both quantitative and qualitative data (*Ibid.*).

When designing a case study, the case can vary and be about essentially anything (Robson & McCartan 2016). Case studies regarding organizations and institutions can have many possible focal points, for example best practice, organizational cultures and processes of change and adaptation. A case study method is optimal when you need to answer questions like “how” or “why” (Yin 2009). In our case we knew “why” a transition to healthy diets with low environmental impacts needed to happen, but we wanted to explore “how” which is why a case study was appropriate for this study. Conducting case studies as a research method comes with both advantages and disadvantages, where a comprehensive analysis of a specific phenomenon is a clear advantage (Lindvall 2007). Examples regarding disadvantages in conducting a case

study is that they provide hardly any scientific generalization from the results of one single case (Flyvbjerg 2006), and that cases are subject to selection bias that could influence the directions of the findings and conclusion (Yin 2009).

4.3 Choice of Unit of Analysis

Swedish food retail is regarded as a relatively concentrated market, with a few major actors dominating the market (further presented in *Appendix 1)*. Axfood is the second largest food retail corporation in Sweden (DLF 2019). To conduct this study, both Axfood and Axfoods own private label Garant is used as a unit of analysis.

Axfood was chosen for several reasons. The most important criterion for choosing Axfood as a unit of analysis is that they work actively with sustainable development. For example, they are a part of the Sustainable Food Chain (presented in *Chapter 3.5*). Another criterion is that Axfood's head of sustainability works actively to integrate sustainability in product portfolio management (Aktuell Hållbarhet 2010), by questioning products that are not in line with sustainable development and changes in product assortment (My news desk 2012; My news desk 2014; The Haga Initiative 2020). Besides this, their head of sustainability communicates that they want to increase the consumption of sustainable food choices by promoting sustainable alternatives (Aktuell Hållbarhet 2010). Earlier incentives, such as the Sustainable Food Chain, also shows that Axfood is willing to share information to improve sustainability within the food industry. The willingness to share information is an important criterion for choosing Axfood as a unit of analysis. Axfood are also of interest considering they are the leaders in private brands in the industry, with Garant as their largest private brand found in most product categories (SRB Butikservice 2020).

4.3.1 Product Portfolio

Private brands could be trailblazers in creating a responsible selection of products and providing information of high quality to their consumers (Carrero & Valor 2012). A strong PLB also enables a possibility to gain large market power (Hakan Altıntaş *et al.* 2010). With market power, comes the opportunity to further affect sustainability related issues (Biely *et al.* 2018).

Garant is one of Axfood's four house brands (Axfood 2020a). The three other house brands; Eldorado, Minstingen and Premier integrate sustainability within their supply chain but do not have sustainability as their focus. Eldorado's offers attractive food products with low prices. Minstingen's main focus is baby products with an attractive design, high quality and price worthiness. Finally, Premier offers soft drinks with high quality. Garant on the other hand, aims to be in the forefront of sustainable and healthy foods which is the main criteria for being selected as a unit of analysis. The product portfolio of Garant was chosen since they work actively with integration of sustainability in their product management through better packaging solutions, changes in ingredients and product innovation (Axfood 2020b, Garant 2020a, My News Desk 2018).

4.3.2 Case Description Axfood

In 2000, the family owned corporation Axel Johnson AB founded Axfood with the aim to create the best food corporation in Sweden (Axfood 2020c). As a food corporation in the Swedish food industry, they are a part of the sustainability work within the Swedish Food Federation. The corporation's goal is to "[...] become the best in the business on sustainability" (Axfood 2020d) and they communicate that "[...] they will always be one step ahead and push for the right conditions of the business" (Axfood 2020e). Axfood's mission is to "enable a better day where everyone can enjoy affordable, good and sustainable food" (Axfood 2018b p.14). This is followed by their vision to "[...] be the leader in good and sustainable food" (Axfood 2018b p.14). All in all, the corporation owns over 300 food stores, e-commerce and about 900 co-stores. Every week, Axfood reaches more than four million customers (2018a p.2).

Sustainability is one of the key elements in Axfood's corporate strategy (Axfood 2018c). It is integrated in the corporate strategy through a sustainability program that is applied within all parts and brands of the organization. Axfood has several sustainability goals connected to food climate mitigation as a means to fulfill goal 12 of the Sustainable Development Goals; sustainable production and consumption. The goals are also a part of the Swedish environmental goals on limited climate impact. The goals connected to food climate mitigation that are included in their sustainability program can be found in *Appendix 2*.

Axfood does not have specific goals related to public health in their sustainability program. The corporation aims to contribute to improved public health through inspiring healthy alternatives in their marketing (Axfood 2020f). Health aspects such as low sugar and salt content are also taken into consideration in their product portfolio management when developing their products and assortment. If a product is close to reaching the criteria for the Swedish keyhole, they work to fulfill the criteria. For a food product to be labelled with the Swedish keyhole it needs to contain lower salt and sugar, more fiber and whole grain as well as a healthier fat content (Swedish Food Agency 2019a).

4.3.3 Case Description Garant

Garant, one of Axfood's PLBs, was founded in 2009 and their products are sold in all stores and e-commerce owned by Axfood (Hemköp, Willys, Tempo, mat.se, Urban Deli, Snabbgross, Handlarn and Middagsfrid) (Axfood 2020g). Their product portfolio consists of seventeen different categories (Garant 2020b). These categories include prepared meals, breads & cookies, frozen products, coffee & tea, cold beverages, vegetables & organic fruits, chocolate & snacks, Swedish meat & poultry, cured meats, fish & shellfish, dairy, eggs, cheese, pantry, flavoring, TexMex and plant-based alternatives (*Ibid.*). Their selection of healthy and sustainable alternatives in their product portfolio is continuously increasing (Axfood 2020a). Garant encourages their customers through their webpage to follow the Swedish food recommendations from the Swedish Food Agency, including increased consumption of fruit, vegetables, fish, shellfish, whole grain, low-fat dairy, healthy fats and less salt, sugar and meat (Garant 2020a).

Garant is communicated as a price worthy high-quality brand that constantly strives to become better at making more sustainable choices by evaluating suppliers and making demands in order to make a difference in environmental and social issues (Axfood 2020a). It was created to be a brand responsive to their customers (Axfood 2020g). Therefore, the customers' opinions have always been the key point of the brand and an important part of product development. It started off with about 50 products (Axfood 2020g), but now it has grown to be Axfood's largest PLB (Axfood SRB, Butikservice 2020). With their slogan "Guaranteed good selection" (Garant 2020c), they aim to guarantee their customers a good and tasty selection of foods.

4.4 Choice of Nutritional Boundaries

According to Afshin *et al*. (2019) the major dietary risks for deaths and disability-adjusted life-years on a global level are a low intake of whole grains and fruits in combination with high intake of sodium. Riksmaten (Amcoff *et al*. 2012) reports that the Swedish residents consume too little vegetables, fruit, fish, fiber and whole grains. Additionally, Swedish consumers eat too much saturated fats, added sugar and sodium. Another major issue is the growing prevalence of obesity, a risk factor for non-communicable diseases (WHO 2018b). On a global level, the prevalence of obesity has nearly tripled since 1975 due to imbalanced energy intake in relation to energy needs (WHO 2018b). Prevalence of obesity is also increasing rapidly in Sweden (Public Health Agency of Sweden 2019). Therefore, the nutritional aspects included are content of energy, protein, fat (including amount of saturated fat), fruit and vegetables, whole grain and dietary fiber (*Table 4, chapter 3.2*). Carbohydrates such as fruit, vegetables and whole grains are important sources of fiber, vitamins, minerals, antioxidants and other bioactive components. Therefore, carbohydrates were not included as a macronutrient, but rather in the form of whole grain, fiber, fruit and vegetables. The boundaries of the nutritional guidelines for one meal was based on 30 percent of the recommended daily intake (Quetel 2013, p 11). However, no upper boundaries were set on whole grain, fiber, fruit and vegetables due to remarkably low intake in the majority of swedes (Amcoff *et al*. 2012).

Sodium was excluded due to the difficulty of estimating the portion sizes. Micronutrients and added sugar were not included. Since foods high in micronutrients were accounted for such as whole grains, fruits and vegetables, no specific calculation of micronutrients is included. The main sources of added sugar among Swedish consumers are soft drinks, pastries, candy and chocolate (Amcoff *et al*. 2012). Since the study will focus on main meals, added sugar was not included.

4.5 Choice of CO_2e Boundaries

The clearest number of how to meet the Paris Agreement's 1.5-degree target was a climate budget concerning food that does not exceed 0.5 kg CO_2e per meal (WWF 2018). Furthermore, the food chain with the most market shares on the Swedish market already offers a bag of groceries with recipes that, on average, contain 0.5 kg CO_2e per serving (ICA 2020b). According to the Swedish Environmental Protection Agency (2020) the food-based greenhouse

gas emissions per person and year were 1410 kg CO_2e in 2017, which makes 0.5 kg CO_2e per serving an ambitious goal. If representatives of Axfood, and particularly Garant, wants to be at the forefront with their climate aware work and communication, the aspiration to stay within this climate budget and benchmark with other food chains is of major importance. That is why the maximum 0.5 kg CO_2e per meal was chosen as a CO_2e boundary in this study.

4.6 Data Collection

In an empirically driven research approach collection of data helps in the development of the framework and boundaries of the research (Creswell & Creswell 2018). In order to guide the researcher through the research problem and its research questions, purposefully selected data is needed in an iterative process (*Ibid.)*.

In this study, data has been collected from several sources. The main sources used within this research are Axfood's publicly published strategic documents, Axfood's sales statistics Enterprise Data Analytics (**EDA**) (Axfood 2020h), Axfood's customer insight tool (**ACIT**) (Axfood 2020i), Mat.se Climate Database (Mat.se 2020) and the Swedish Food Composition Database (**FCDB**) (Swedish Food Agency 2019b) through Dietist Net (Dryselius 2012). Furthermore, data was collected through a continuous literature review throughout the duration of the project (see *Chapter 3.1*).

The initial orientation started in publicly available documents from and about Axfood. It continued with searches in EDA (Axfood 2020h) among all major protein sources based on the fact that protein sources have the highest climate impact (Röös 2012). The most sold protein sources were chosen. Thereupon, searches within ACIT (Axfood 2020i) were conducted to investigate how consumer behavior was centered around the final protein sources. Data from ACIT is based on food purchase receipts made by members of Hemköp and Willys. This was to define which different components consumers most commonly used to create an entire meal, to define the most applicable dishes for this study. Data from both EDA and ACIT were collected by employees of Axfood and reviewed by the researchers, due to its content of corporate secrecy.

The third major source of data, Mat.se Climate Database, consists of Lifecycle-based Environmental Data (**LCA**) developed in collaboration with Research Institutes of Sweden (**RISE)** (2019). In the collaboration, RISE (2019) has produced the climate data. Furthermore, data extracted from RISE Climate Database has been collected through an ISO-standardized and a quality assured method (RISE 2020). The database includes numbers in kilogram CO_2e per kilogram of food product. To execute this study, the researchers were provided with climate data from a list compiled by Mat.se containing CO_2e on 3000 frequently consumed food products in Sweden.

Finally, data on the nutritional value of each of the chosen dishes was collected from the Swedish FCDB (Swedish Food Agency 2019b), through the use of the nutritional calculation program Dietist Net (Dryselius 2012). The Swedish FCDB's quality assurance systems include

participation in external quality assurance schemes and a certified ISO-standard concerning "General requirements for the competence of testing and calibration laboratories" (Swedish Food Agency 2020d). It includes almost 2100 foods and composed dishes, including over 50 nutrients for each food (Swedish Food Agency 2019b). The FCDB provides a part of the data foundation of Dietist Net (Kost & Näringsdata 2020).

4.7 Data Analysis

Table 7 presents the process of the data analysis. Protein sources can have a major contribution to climate impact (Röös 2012), and therefore provided the baseline of the dishes. In total, 10 dishes were selected and altered to fulfill the choice of nutritional and CO_2e boundaries (stated in *chapter 4.4 and 4.5*).

Table 7. The course of action in the data analysis.

Step	Further Explanation of Each Step
1. Compiled list of main protein food sources	Excluded protein sources commonly used as spreads, starters, snacks or protein rich foods not frequently consumed or not commonly used as main protein sources in a dish.
2. Definition of most Sold Food Protein Sources (by weight)	Information collected through sales statistics including sales from Willys and Hemköp*
3. Definition of most sold protein food products (by weight)	The largest food protein sources were divided further in order to identify the most sold protein food products.
4. Food products associations	Associations were made on commonly bought products with the most sold protein food products**
5. 10 selected food dishes	Dishes compiled based on the associations. Ingredients defined by the use of generic recipes. Nutritional content*** and climate impact**** were calculated per portion of each dish.
6. Alteration of the Selected Food Dishes	The selected food dishes were altered to adhere to nutritional and CO_2e boundaries.

* Calculated by EDA (Axfood 2020h)
** Calculated by ACIT (Axfood 2020i)
*** Calculated by Dietist Net (Dryselius 2012)
**** Calculated with Mat.se climate database (Mat.se 2020)

Initially, food protein sources that can be used as main protein sources in a dish were listed by the researchers. Foods that are commonly used as spreads, starters, or snacks, e.g. caviar, sliced ham and cheese were excluded. Eggs are commonly used in all types of dishes, including breakfast, dinner and desserts which would make it difficult to find strong purchase associations on it in ACIT further in the process. Therefore, eggs were excluded. Lobsters is one example of rarely consumed foods and therefore also excluded. In the second step, sales statistics were observed to identify the most sold protein sources by weight. In a third step, the

most sold protein sources were divided further to identify the most sold type of product within each protein category. Finally, the most sold food protein sources were compiled for further investigation in ACIT. In ACIT, associations were made on what the customers bought together with the protein sources. To see the associations, the researchers looked at the three most sold product articles for each protein source in Hemköp and Willys respectively, followed by the ten most associated products for each article. Products that were associated with all articles were included and provided a baseline for the dishes. Through the associations, dishes were compiled. Generic recipes available online from major recipe databases such as ICA (ICA 2020a), Santa Maria (Santa Maria 2020), Köket (Köket 2020) and Arla (Arla 2020), were used to compile the dishes.

Portion sizes were gathered for every ingredient in the dishes through Dietist Net. The dishes were then nutritionally calculated by their content of energy, protein, fat, saturated fat, whole grain, fruit, vegetables and dietary fiber per portion. These were then compared and altered to be in line with the dietary guidelines set by the researchers based on the Swedish Food Agency (Brungård Konde *et al*. 2015) and the Nordic Nutrition Recommendations (**NNR**) (Nordic Council of Ministers 2014). Furthermore, CO_2e for every complete dish per portion was calculated through Mat.se (2020) climate database, compared and altered to the CO_2e boundaries set by the researchers in accordance to WWF (2018).

4.8 Quality Assurance

When conducting research, it is important to ensure validity and reliability of the study (Creswell & Creswell 2018). The scientific value of qualitative research has historically been questioned (Silverman 2014). Therefore, it is especially important to identify and address possible threats to validity and reliability in qualitative studies. To address these issues, Riege (2003) compiled comprehensive literature on techniques to ensure validity and reliability in case studies (presented in *Table 8*).

Table 8. Techniques for establishing validity and reliability in case studies (own version accorded to Riege 2003 p. 78-79)

Case study design test	Examples of applicable techniques	Applied to this study
Construct validity	Use multiple sources of evidence when collecting data	Triangulation through the use of different data sources
	Third party audit during the project process by key informants	Drafts of the report continuously sent to Garant, ACIT and supervisor
	Continuously establishment of a chain of evidence when collecting data	Detailed information on course of action during data collection written down in a separate document
Internal validity	Explaining of process through the use of illustrations and diagrams in the data analysis	Theoretical frameworks and graphic models to assist understanding in the data analysis
External validity	Definition of scope and boundaries in the research design	Analytical generalizations described in chapter 4.3, 4.3.1, 4.4, 4.5
	Comparison of evidence with existing literature during the data analysis	Analysis built and compared with theoretical as well as established framework within the field
Reliability	Give full account of theories and ideas for each research phase	Done throughout the research design and data analysis
	Assurance of accordance between the research problem and the characteristics of the research design	Presented throughout the method chapter 3
	Ensuring meaningful parallelism of findings across multiple data sources	The same logic applied throughout all parts of the data collection
	Use peer review/examination	Continuously reviewed by supervisor and a peer. Finally, an opposition for the seminar draft

In order to achieve validity and reliability in this project, multiple sources of evidence were used when collecting data. The most common food dishes were decided through triangulation between the sales statistics and consumer behavior, while drafts of the report were continuously sent to the representatives of Garant, ACIT and the supervisor to validate the Swedish process. CO_2e and nutritional value of the dishes were then calculated using the Mat.se Climate Database and Dietist Net that in turn uses data from the Swedish FCDB. Throughout this process, detailed information on the course of action during data collection was written down in a separate document to establish a chain of evidence. Detailed data from the consumer behavior tool ACIT and EDA entailed corporate secrecy on sales amounts was presented to the researchers, but could not be presented in the paper, which presented a minor threat to transparency. To ensure reliability in the research, the paper was continuously reviewed by supervisor and a peer, while the same logic was applied throughout all parts of the data collection.

4.8.1 Ethical Considerations

When conducting research, it is important to consider ethical guidelines to assure the research is pursued in a way that protects the participants while still providing value to the participants involved and the society at large (Silverman 2014). No primary consumer data were collected in the study, instead already existing data were used. Furthermore, the data that were used have already been collected in regard to ethical considerations.

Other ethical aspects to consider is the effect of the research results. While more people develop obesity and non-communicable diseases, and food systems continue to contribute largely to global greenhouse gas emissions, food retail that sells and exposes society to food products have a responsibility to tackle these issues. The results conducted in this study therefore might affect the portfolio management of the PLB Garant at Axfood. Given the growing importance of retailer owned brands, it might affect the customers of Garant and the brand from a broad perspective.

5 Results

In this chapter, the empirical findings of the study are presented. The empirical findings are based on sales statistics, consumer behavior, climate and nutrition data. Initially, the process of defining the ten food dishes by sales statistics and consumer purchase behavior is shown. Then, focus shifts to the nutritional content and CO_2e of the dishes. Finally, the altered dishes are presented followed by their nutritional content and CO_2e per dish in comparison to the chosen reference values (previously stated in Chapter 4.4 and 4.5).

5.1 Sales Statistics Protein Sources

The searches in Axfood's sales statistics EDA was conducted among all major protein sources, and their respective sub-categories (*Appendix 3*, *Table 19).* In order to identify the most sold food product protein sources, they were divided further (*Appendix 3, Table 20*). The top ten protein sources were then compiled by sold product in weight from Hemköp and Willys during 2019 (*Figure 4*).

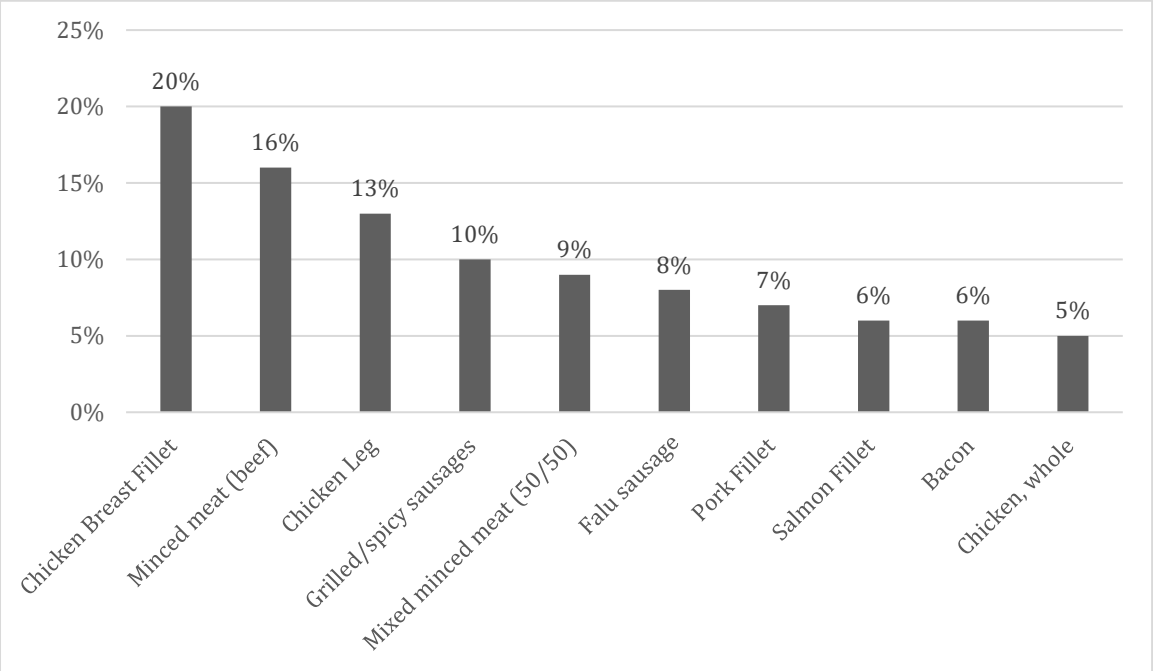

Figure 4. The ten most sold protein sources at all Hemköp and Willys stores during 2019, and their percentual distribution amongst each other, gathered from Axfood's sales statistics EDA (Axfood 2020h).

The ten most sold protein sources were in falling order; chicken breast fillet, minced meat (beef), chicken leg, grilled or spicy sausage, minced meat (mixed pork and beef 50/50), Falu sausage, pork fillet, salmon fillet, bacon and whole chicken. Chicken was in the largest percentual category, and present in three different categories. In total, chicken represented 38 percent of the top ten sales. Red and processed meat together made up 56 percent, i.e. the majority. Fish only took up 6 percent of the top ten protein sources sales. Due to corporate

secrecy, the actual weight of each product could not be displayed, hence the presentation is in percentual shares between the top ten protein sources.

5.1.1 Association data in ACIT

In ACIT, associations were made on what Axfood's customers most commonly bought with each of the top ten protein sources respectively (*Table 9*).

Table 9. The ten most sold protein sources and their respective purchase associations in ACIT

Protein Food Source	**Associated Food Products***
Chicken Breast Fillet	Tikka masala (spice mix and sauce), wok spice mix, pre-cooked vegetables mix (water chestnut, broccoli, corn, carrot and bamboo shoots), rice, noodles.
Minced meat (beef)	Taco spice mix, tortilla, tortilla chips, taco sauce, tomato sauce, crushed tomatoes and lasagna.
Chicken Leg	Rice, different pre-cooked vegetables, curry, potato fries, potato, chicken stock, cabbage, potato salad.
Grilled/spicy sausages	Sausage buns, cucumber mayonnaise, ketchup, roasted onions, shrimp salad, mashed potatoes.
Mixed minced meat (50/50 pork & beef)	Lasagna, tortilla, taco spice mix, taco salsa.
Falu sausage	Stroganoff spice mix, macaroni, rice.
Pork Fillet	Marinades with different flavors, pre-cooked potato (fries, croquette, gratin), bearnaise, mushroom (chanterelle, champignon), pickled onions, cream.
Salmon Fillet	Dairy-based sauces (flavored with lemon, dill, shrimps, cold dairy-based sauce (e.g. hollandaise or flavored with caviar), fish stock, fresh herbs, fish taco spice mix, cod.
Bacon	Potato dumplings, meat balls, Falu sausage, blood pudding, minced meat, carbonara sauce (cream, bacon, salt, cheese powder, parsley).
Chicken, whole	Fresh herbs, chicken stock, feta cheese, spicy sausages.

**The associated food products listed in falling order of association.*

In the left column the ten most sold protein source products are presented, followed by their respective associations in the right column. Some associations indicated several dishes being made with the same protein food source. For example, chicken breast fillet entailed high associations with both tikka masala spice mix and wok spice mix indicating that two dishes were likely common.

5.1.2 The Food Dishes

Based on the associations (*Table 9*), food dishes were compiled (*Table 10*). Composition of dishes were made based on the associated food products and generic food recipes. The

ingredients of each dish are presented in *Appendix 4 Table 21.* Food products with the highest associations were prioritized to use as a baseline for the dishes.

Table 10. The ten food dishes based on consumer purchase associations from ACIT

Protein Food Source	**Food dish**
Chicken Breast Fillet	Tikka Masala with rice, Chicken wok with noodles
Minced meat (beef)	Taco, Spaghetti Bolognese
Chicken Leg	Chicken leg with curry sauce and rice
Grilled/spicy sausages	Grill sausage with sausage buns and cucumber mayonnaise
Mixed minced meat (50 % pig meat, 50 % beef meat)	Lasagna
Falu sausage	Sausage stroganoff
Pork Fillet	Marinated pork fillet with pre-cooked potato wedges and bearnaise
Salmon Fillet	Salmon and shrimp with lemon- and dill sauce and boiled potatoes

The left column includes the protein food source while the right column presents the food dishes. Two dishes were made of chicken breast fillet and minced meat (beef) respectively, since there were indications on several dishes based on those protein sources. Chicken breast fillet and minced meat (beef) were also the most sold protein food sources (*Figure 4*), providing an incentive for creating two dishes of each. In this process, dishes of bacon and whole chicken fell out. Partly because the aim was to compile ten common dishes and partly because it was difficult to define common food dishes based on associations with whole chicken and bacon. Additionally, chicken as a protein source was already included in three dishes, and whole chicken would not contribute any further. Moreover, bacon and whole chicken were the least commonly sold protein food sources in comparison to the other eight (*Figure 4*).

5.2 Nutritional Content and Climate Impact of Selected Dishes

In the next step, the nutritional content and CO_2e were calculated for each dish and compared to reference values.

5.2.1 Nutritional Content

Table 11 presents the nutritional content of each food dish.

*Table 11. The ten dishes and their nutritional content of energy, protein, carbohydrates, fat, saturated fat, whole grain, dietary fiber, fruits and vegetables in comparison to the recommended daily intake per meal**

Dishes	**Energy (kcal)**	**Protein (gram)**	**Fat (gram)**	**Saturated fatty acids (gram)**	**Whole grain (gram)**	**Dietary fiber (gram)**	**Fruits & Vegetables (gram)**
Chicken Tikka Masala	584	36	26	12	0	1	0
Chicken Wok	612	45	18	2	0	8	100
Tacos	913	35	49	22	0	7	140
Spaghetti Bolognese	622	37	22	7	0	7	200
Curry Chicken Leg	674	32	38	17	0	0	0
Grilled Sausage	608	19	42	12	0	4	10
Lasagna	1041	45	52	29	0	5	128
Sausage Stroganoff	960	23	71	36	0	1	0
Pork Fillet	881	31	57	7	0	4	1
Salmon with Lemon- And Dill Sauce	910	40	66	33	0	5	30
Recommended intake per meal (30 E%)	735 (510-960)	18-37	20-33	<9	>21	>7.5	>150

*Calculated with the data program Dietist Net (Dryselius 2012).

Each food dish is presented in the left column, followed by its nutritional content of energy, protein, total fat, saturated fatty acids, whole grain, fiber, fruit and vegetables. In the final row, the recommended intake values per meal are shown within each category. The nutritional content of energy, protein, fat (including saturated fatty acids), whole grain, dietary fiber, fruits and vegetables varied greatly between the selected dishes but neither fulfilled the requirements. None of the dishes included whole grain and only the chicken wok reached the recommended intake per meal of dietary fiber. Spaghetti Bolognese was the only dish in line with recommended intake of fruit and vegetables with crushed tomatoes as the main source. The fat content exceeded in all dishes besides chicken tikka masala, chicken wok and spaghetti Bolognese although the content of saturated fat was too high in the chicken tikka masala. Furthermore, only the spaghetti Bolognese, chicken wok and the pork fillet stayed within the recommended levels of saturated fatty acids. Most dishes stayed within the recommended frame of protein content, except for the chicken wok, lasagna and salmon dish. Finally, only the lasagna exceeded the content of energy.

5.2.2 Climate Impact

Table 12 presents the CO_2e of each food dish.

*Table 12. The ten dishes and their climate impact (kilogram CO_2e per dish and portion) in comparison to the recommendation per meal**

Dish	**Climate impact (kilogram CO_2e per dish)**
Chicken Tikka Masala with rice	0.7
Chicken wok with noodles	0.7
Tacos (minced beef)	3.3
Spaghetti Bolognese	3.7
Curry Chicken Leg	0.7
Grilled Sausage	0.8
Lasagna	3.0
Sausage Stroganoff	1.5
Pork Fillet	1.0
Salmon with Lemon and Dill Sauce	1.4
Maximum CO_2e recommendation per meal (30%)	0.5

**Calculated using the Mat.se (2020) climate database.*

The climate impact of each dish per portion is presented in the right column in kilograms of CO_2e. In the final row, the maximum CO_2e recommendation per meal is stated as a reference value. The climate impact for every ingredient in the dish was calculated according to its weight, and then added up for the full climate impact of the entire dish *(see Appendix 5 Table 23)*. Tacos, spaghetti Bolognese and lasagna had the highest climate impact while chicken tikka masala, chicken wok, chicken leg and grilled sausage had the lowest. Pork fillet, the salmon dish and grilled sausage had lower climate impact than the beef dishes but higher than the ones containing chicken. All the dishes had higher climate impact than the maximum recommended CO_2e per meal. Hence, all dishes had to be altered.

5.3 Altered Food Dishes

The main food dishes were used as a template when creating the new dishes. Ingredients were altered to similar ingredients as much as possible to create comparable dishes that were compliant with both the climate budget (WWF 2018) and the nutritional guidelines (*Table 4*).

5.3.1 Alteration of the Food Dishes

In order to transform the original dishes to alternatives in line with WWF (2018) climate budget and the nutritional guidelines (*Table 4*), several differences were made (presented in *Table 13*).

Table 13. The ten original and altered dishes, including the main difference between them

Original dish	Altered dish	Main difference in the altered dish compared to the original
Chicken Tikka Masala with rice	Tempeh Tikka Masala with whole grain couscous	Tempeh instead of chicken Creme fraiche (15 % fat) instead of creme fraiche (34 % fat) Whole grain couscous instead of rice Added vegetables
Chicken wok with noodles	Wok with soybeans & whole grain noodles	Soybeans instead of chicken Whole grain noodles
Tacos (minced beef)	Tacos (veg mince)	Veg mince instead of minced beef Creme fraiche (5 % fat) instead of creme fraiche (34 % fat) Whole grain taco tortillas
Spaghetti Bolognese	Spaghetti Bolognese (veg mince)	Soy mince instead of minced beef Whole grain spaghetti Added vegetables
Curry Chicken Leg	Tempeh with Curry	Tempeh instead of chicken leg Oat base (13 % fat) instead of cream (40 % fat) Whole grain couscous instead of rice Added vegetables
Grilled Sausage	Grilled Veg Sausage	Veg sausage instead of pork sausage Mashed potatoes instead of sausage bread Added whole grain rye bread Added vegetables
Lasagna	Lasagna (veg mince)	Veg soy mince instead of minced pork and beef Bechamel based on oat base and oat beverage instead of milk and cheese Whole grain lasagna plates Added vegetables
Sausage Stroganoff	Veg Sausage Stroganoff	Veg sausage instead of Falu sausage Oat base (13 % fat) instead of cream (40 % fat) Whole grain couscous instead of rice Added vegetables
Pork Fillet	Veg mince beef	Veg fillet instead of pork fillet Tzatziki instead of bearnaise Added whole grain rye bread Mixed tubers instead of potato wedges
Salmon with Lemon and Dill Sauce	Mussels with Lemon and Dill Sauce	Blue clams instead of salmon and shrimps Oat base (13 % fat) instead of cream (40 % fat) Creme fraiche (15 % fat) instead of creme fraiche (35 % fat) Added whole grain rye bread Added vegetables

The original dishes are presented in the left column, followed by its respective altered dish and the main changes between them. In all dishes, apart from the salmon dish, animal-based protein sources were traded with plant-based or mostly plant-based alternatives to reduce climate impact. The trade was also made to improve fat quality in the dishes containing minced meat

and pork fillet. Fat content and fat quality was also improved by trading high fat dairy products with low fat dairy products. In some cases, both climate impact and fat quality were improved by replacing animal fats with oat-based alternatives. In most dishes, refined grain was replaced with whole grain products. If not replaced, whole grain was added through rye bread as a complement to the dish. Furthermore, vegetables were added in most cases to reach the recommended amount of fruit, vegetables and fiber. Food products of Garant were used when possible in the altered dishes, see further in *Appendix 4 Table 21.* Ingredients and nutritional values of specific food products from Garant, such as e.g. veg sausage and veg mince used in the altered dishes are presented in *Appendix 4 Table 22.*

5.3.2 Nutritional Content

Table 14 presents the alternated ten dishes and their nutritional content in comparison to the recommended daily intake per meal.

*Table 14. The alternated ten dishes and their nutritional content of energy, protein, carbohydrates, fat, saturated fat, whole grain, dietary fiber, fruits and vegetables in comparison to the recommended daily intake per meal**

Dishes	**Energy (kcal)**	**Protein (gram)**	**Fat (gram)**	**Saturated fatty acids (gram)**	**Whole grain (gram)**	**Dietary fiber (gram)**	**Fruits & Vegetables (gram)**
Tempeh Tikka Masala with rice	733	25	32	7	66	17	150
Wok with soybeans & whole grain noodles	863	36	27	3	59	21	285
Tacos (veg mince)	721	36	25	4	50	10	180
Spaghetti Bolognese (veg mince)	701	35	27	3	39	20	277
Tempeh with Curry	704	24	29	3	66	16	150
Grilled Veg Sausage	641	26	31	5	22	19	150
Lasagna (veg mince)	824	35	33	6	39	20	150
Veg Sausage Stroganoff	715	36	33	4	66	21	230
Veg mince beef	596	28	33	7	22	16	240
Mussels with Lemon and Dill Sauce	698	36	26	9	22	14	155
Recommended intake per meal (30 E%)	735 (510-960)	18-37	20-33	<9	>21	>7.5	>150

*Calculated with the data program Dietist Net (Dryselius 2012).

All the selected dishes were altered to reach recommended levels of intake per meal. The left column presents the new dishes followed by content of energy, protein, fat (including saturated fatty acids), whole grain, dietary fiber, fruit and vegetables. After the alteration, all the dishes were in line with the recommended levels within each area.

5.3.3 Climate Impact

Table 15 shows the total kilogram CO_2e of each food dish.

Table 15. The ten altered dishes and their climate impact (kilogram CO_2e per dish and portion) in comparison to the recommendation per meal, including percentual reduction in climate impact of the altered dishes*

Altered Dish	**Climate impact (kilogram CO_2e per dish)**	**Reduction in climate impact (%)**
Tempeh Tikka Masala with whole grain couscous	0.4	43
Wok with soybeans & whole grain noodles	0.3	57
Tacos (veg mince)	0.5	85
Spaghetti Bolognese (veg mince)	0.4	89
Tempeh with Curry	0.3	57
Grilled Veg Sausage	0.3	63
Lasagna (veg mince)	0.5	83
Veg Sausage Stroganoff	0.5	67
Veg mince beef	0.4	60
Mussels with Lemon and Dill Sauce	0.5	64
Maximum CO_2e recommendation per meal (30%)	0.5	

**Calculated using the Mat.se (2020) climate database.*

The altered dishes are displayed in the left column followed by their climate impact per portion and dish in the column in the middle. The column to the right presents the percentual reduction in climate impact in each dish respectively. In the bottom of the table, the maximum CO_2e recommendation value per meal is presented. All altered dishes were under the maximum recommendation, differentiating between 0.3-0.5-kilogram CO_2e.

6 Analysis

In this chapter, the empirical findings are analyzed to answer the research questions stated in Chapter 1. The analysis is founded on the theoretical framework described in Chapter 2. First, the Cynefin Framework (Figure 2) is examined as a means to understand the challenge to lead and create possibilities to change behavior. In the next section, ways to eat healthier food with lower climate impact (Figure 3) is discussed in relevance to the altered food dishes. The altered dishes are then seen from a business perspective on how to integrate health- and climate aspects in portfolio management.

6.1 How to Handle Dynamic Changing Processes

Sustainable development is challenging as it involves several dynamic change processes which can be difficult to foresee (Kusters *et al*. 2017). To handle its complexity, it needs to be considered from a systematic perspective. The decision-making tool developed by Kurtz and Snowden (2003) provides a means for leaders to handle the dynamic change process of complex contexts. The tool can also help leaders discover new ways to understand and handle difficult problems, and to identify opportunities. It can be applied to Garant as a leader who aims to create possibilities to alter today's food consumption behavior into more sustainable alternatives. In *Figure 5,* the case of Garant is applied in the Cynefin Framework (Kurtz & Snowden 2003, p. 468, Snowden & Boone 2007, p. 2).

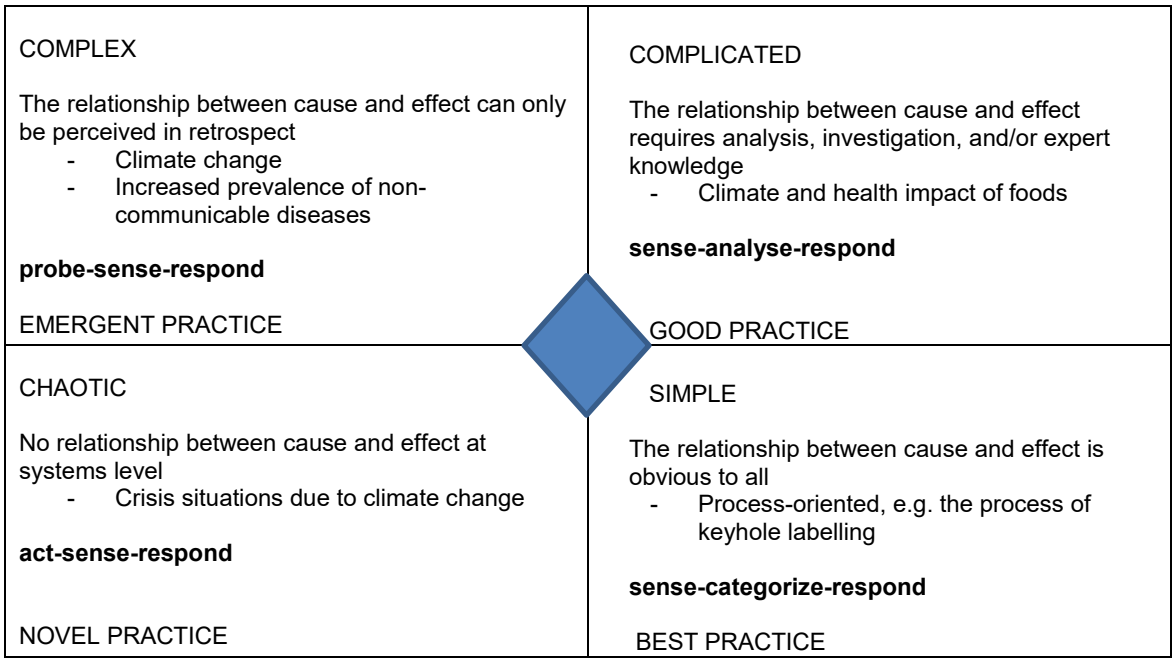

Figure 5. Illustrates four types of situations applied to the context of Garant in accordance with the Cynefin Framework. Customized version based on Kurtz and Snowden (2003), 468 and Snowden & Boone (2007), 2.

In their daily work, representatives of Garant will need to categorize, handle and make decisions in different situations related to climate and health impacts by food. The *simplest situations* will entail cause-and-effect relationships that can be foreseen and handled with best practice. Simple contexts could entail situations related to e.g. the process of labeling products with the Swedish keyhole. If a manufacturing problem would occur in which the Swedish keyhole criteria would not be fulfilled like intended, representatives of Garant would need to sense the situation, categorize it and respond in accordance with best practice. A potential risk by categorizing contexts as simple might be that it does not encourage new ways of acting. This could be unfortunate, since innovation plays an important role to combat climate change and other factors related to sustainable food systems (FAO 2020b). Therefore, it is key to have an open-door policy allowing new ideas with potential to improve current processes (Kusters *et al*. 2017).

A complex situation in the context of Garant in this setting could be climate change. The relationship between food and climate change is difficult to identify and predict with certainty. The solutions to climate change are not clear and known in forehand. Instead, solutions to these issues need to be developed in collaboration with different stakeholders and experts in related fields. Representatives of Garant need to probe the situation in order to sense and respond. For this process, they need to combine expert knowledge from different stakeholders in order to develop emergent practices. Indirectly, representatives of Garant is already doing this as a part of Axfood. As stated earlier in Chapter 4, Axfood is engaged in several networks to improve sustainability in the food chain, including e.g. the Sustainable Food Chain Initiative.

Expert knowledge can also be useful when handling *complicated contexts*, in which the relationship between cause-and-effect might be clear but not for everyone. From the perspective of Garant, this could include climate and health impacts by food. In this context, experts can assist by analyzing climate and health impacts by specific foods to help representatives of Garant respond in an appropriate way in accordance with good practice. The empirical data from this study provides support to respond to these kinds of complex situations.

The final context, *the chaotic one*, could include crises due to climate change. In a crisis, it is not possible to define the relationship between cause-and-effect (Kusters *et al*. 2017). Instead, the situation is turbulent and requires the leader to act to establish order. In the summer of 2018, Sweden experienced a drought caused by the climate changes (Swedish Board of Agriculture 2019, Mann *et al.* 2017) which had devastating effects at the agricultural stage of the food supply chain (Swedish Board of Agriculture 2019). Crisis situations require novel practices and the ability to transform the context to a complex one. A transformation provides a possibility to identify patterns to prevent similar crises to reoccur (Kusters *et al*. 2017).

Contexts which are difficult to categorize are placed in the disorder domain, representing the grey area in the middle of *Figure 5* (Kurtz & Snowden 2003). This might result in a conflict between different leaders, in which each leader argues to categorize it depending on how they want to act (*Ibid.*). This could provide a potential risk that a context related to sustainability is not sensed and responded to with the most appropriate practice.

All in all, the application of Garant on the Cynefin framework (*Kurtz & Snowden 2003, p. 468 and Snowden & Boone 2007, p. 2)* communicates the difficulties to handle and respond to situations connected to sustainability, in this case climate and health impacts by food. Additionally, it shows the need to include experts and other stakeholders in the dialogue in order to increase sustainability in the contexts within the food system.

6.2 Healthier Food Dishes with Lower Climate Impact

Facing the food system due to health and environmental challenges are necessary, where GHG emissions and land use needs to decrease urgently (Garnett 2014). The characteristics of healthier and less GHG- and land-intensive eating patterns as presented by Garnett (2014) are visualized in *Figure 6,* along with how the characteristics were applied in the alternate dishes.

Figure 6. The major characteristics of healthier and less greenhouse gas- and land-intensive eating patterns (own version according to Garnett 2014, p. 8) and how they are applied in this study.

As the figure shows, all alternate dishes were balanced according to the Swedish Food Agency guidelines, and this fulfilled both characteristics of limiting the consumption of foods high in fat, sugar or salt and low in micronutrients along with achieving balance between energy intake and energy needs. The alternated dishes were all given a diverse range in whole grains, vegetables and protein sources that fulfilled the attributes of whole grains, legumes, fruits, vegetables and minimally processed tubers along with the diversity of different foods. Saturated fats were substituted with unsaturated fats, which lead to a beneficial omega 3:6 ratio. Another attribute of the healthier and less GHG-intensive patterns is to limit meat consumption as much as possible, which is why none of the alternated dishes contained meat. Only one dish contained aquatic products, and it was traded for a product with lower climate impact than the original. Salted nuts were traded for unsalted nuts and dairy products were replaced with oat products or low-fat dairy products in moderation. Lastly, many of the alternated dishes were given frozen and locally produced vegetables, as a way to reduce foods that require rapid and energy-intensive transport modes.

This model presenting healthier food choices with lower climate impact has three important factors to consider. These factors are; how much we eat, what we eat and how the food is produced. Balanced achievement and limited consumption of foods high in fat, sugar or salt are two characteristics referring to the "how much we eat" factor. What we eat can be linked to multiple characteristics, such as diversity of foods, moderate intake of dairy products, minimally processed tubers and whole grains, reduced meat consumption and oils with beneficial omega 3:6 ratio. The last factor, how the food is produced, is congregated in one of the characteristics; food less requiring of rapid and energy-intensive transport modes. These three factors along with the different characteristics form a model greatly applicable in any setting or situation where dietary consumption patterns need to change. The more characteristics that are being met, the more rigorous and sustainable the change.

Important to consider is that more detailed targets need to be set for all characteristics, as seen in this study. With e.g. energy balance achieved, nutritional knowledge and target group is of relevance. The target group in this study are healthy adults, both male and female, with different PAL values. The boundaries for energy balance are based on the average of the target group. The characteristics can be seen as guidelines, where boundaries alter in different populations or different climate goals.

6.3 Strategies for Integrating Nutrition and Climate

The product portfolio of a corporation is both a reflection of the organization (Avlonitis & Papastathopoulou 2006) and a tool to reach organizational goals (Project Management Institute 2013). Therefore, the product portfolio provides a possibility to show important stakeholders sustainability is a priority as well as a means to reach goals and implement strategies related to sustainability.

Businesses includes three levels; a strategic, project and operational level (Tufino *et al.* 2013) At a strategic level, sustainability is a part of Axfood's mission and vision to "enable a better

day where everyone can enjoy affordable, good and sustainable food" (Axfood 2018b p.14) and to "[...] be the leader in good and sustainable food" (Axfood 2018b p.14). If the results of this study are appropriately applied in the organizational levels of Axfood and Garant, it can contribute to the mission and vision of Axfood. No earlier incentives combining health and climate impact has yet been seen within the Swedish Food retailer industry, providing a possibility to use the results as a means to be one step ahead with regards to sustainability.

The strategic goals of Axfood (*Appendix 2*) is applied within all parts of its organization, including the brand Garant. One of their goals is to actively work to display sustainable food choices (Axfood 2018c p.3). The empirical data from this study provides valuable information on commonly consumed foods, dishes and products which can be used to contribute to the mentioned goal. The study results also contribute to Axfood's aim to increase sales of frozen foods to decrease climate impact. In the altered dishes in this study, frozen alternatives from Garant were added, including tempeh, soy-based mince and several frozen vegetables.

Axfood intends to inspire healthy alternatives in their marketing as a means to contribute to improved public health (Axfood 2020f). The dishes and the main food products of Garant included in the altered dishes can be used to inspire their customers to healthier food dishes and products. Furthermore, the altered dishes are based on food commonly prepared at home. Thereby, the new dishes have potential to improve public health by offering healthier everyday food dishes.

6.3.1 Product Development in the Assortment of Garant

Product portfolio management provides strategic possibilities to incorporate sustainability in the organization (Wever, Boks & Bakker 2008). One part of product portfolio management is handling PLB which offers the company multiple possibilities to differentiate from their competitors (*Ibid.*).

Axfood's private label Garant communication entails a brand that is both price worthy and of high-quality (Axfood 2020a). There are four general propositions within private labels; generic private label, copycat brands, premium store brands and value innovators (Kumar & Steenkamp 2007). The brand of Garant offers the same quality as national brands but the products are at a cheaper price which implies that it can be propositioned as a copycat brand. The main objectives of being a PLB copycat brand is by having a way to increase retailer share of category profits and to increase negotiating power against the manufacturer so they can maximize overall profit (Kumar & Steenkamp 2007). To further integrate sustainability in the portfolio management of Axfoods private label Garant, green product portfolio decisions could be made. Green product portfolio decisions are strategic decisions connected to sustainability (Wever, Boks & Bakker 2008). Little is known from earlier research on how to integrate sustainability in portfolio management decisions (Brook & Pagnanelli 2014; Wever, Boks & Bakker 2008), but the results from this study could be useful when considering future product portfolio decisions of Garant. For example, food products with lower climate impact and healthier nutritional content could be given increased share in the product mix, reducing shares

of less sustainable products. A product mix refers to all the products in a corporate portfolio, in this case all the products Garant offers to the market (Avlonitis & Papastathopoulou 2006). Increased shares of sustainable products are one possible way to work with portfolio management as a means to reach strategic goals and the SDGs connected to climate and health impact. It also further communicates to stakeholders that the brand Garant offers sustainable products and aims to be in the front line.

During alteration of the dishes, several potential gaps for product development in the assortment of Garant were identified (presented in *Table 16*). Since the food dishes seem to be commonly made by the customers, the gaps present major possibilities for Garant as a brand to increase market share of their products. It also provides a means to work towards sustainable consumption and production as well as improved public health in accordance with the SDGs, goal twelve (United Nations 2020d) and three (United Nations 2020b).

Table 16. Potential gaps for product development in the assortment of Garant

Type of product	**Commonly made dish in which the product can be applied on**	**Potential benefits related to nutrition and climate impact**
Plant based alternative to chicken	Chicken tikka masala, chicken wok, chicken leg with curry sauce and rice	Reduced climate impact*
Whole grain sausage bun	Grilled sausage with sausage bun	Increased intake of whole grain (more fiber, vitamins, minerals, antioxidants and potential to reduce prevalence of non-communicable diseases)**
Increased assortment of whole grain cereals	Chicken tikka masala, chicken leg with curry sauce, Falu sausage stroganoff	Increased intake of whole grain (more fiber, vitamins, minerals, antioxidants and potential to reduce prevalence of non-communicable diseases)**
Sauce or dip with lower fat content	Pork fillet with potato wedges and sauce, grilled sausage with sausage bun topped with cold sauce	Reduced energy intake and thereby potential to contribute to reduction of obesity and non-communicable diseases**

**Röös (2012)*
***Nordic Council of Ministers (2014)*

The column to the left presents the identified type of product in which there is a potential market gap. The dishes in which the product gap was identified by is presented in the middle. Finally, the right column shows the potential benefits from a climate and nutritional perspective.

The most commonly bought protein source was chicken breast fillet (*Figure 4)* but there was no hybrid product in the assortment of Garant with similar sensory qualities. Therefore, tempeh was used instead. The meat consumption is decreasing in Sweden (Swedish Board of Agriculture 2020), while the consumption of vegetarian foods is increasing (Axfood 2018a, Food & Friends 2019). This offers a major market possibility to develop a plant-based product similar to chicken and its area of use. It also provides incentive to increase the share of plant-

based alternatives in the product assortment of Garant. Furthermore, it could be valuable to consider enriching plant-based alternatives to meat with vitamin B12 to ensure a more adequate nutritional content.

During alteration of the food dishes, it was noted that Garant as a brand had few whole grain cereals to choose from resulting in less variation within the dishes. Therefore, one possibility could be to develop more varieties of whole grain cereals. Furthermore, whole grain sausage buns could not be found on the Swedish market although it seems to be a commonly made dish in combination with grilled sausage. If the representatives of Garant were to develop a whole grain sausage bun, they could be the only ones offering it to the market.

The difficulty in finding cold sauces equivalent to bearnaise with lower fat content was also revealed in the process of altering the dishes. Several alternatives on the Swedish food market included healthy fatty acids from rapeseed oil, but still provided too much energy which made it difficult to stay within the nutritional guidelines set for the study. Today, there is an increasing incidence of obesity, due to imbalance in energy intake, leading to increased risk of noncommunicable diseases (Public Health Agency of Sweden 2019). Therefore, it could be worth considering developing a cold sauce with lower energy content. According to Food & Friends (2019), the importance of nutritional aspects is increasing among customers providing further reason to increase the assortment of healthy products.

7 Discussion

In this chapter the empirical results are discussed in relation to earlier conducted research to frame the research within a larger context.

7.1 The Most Sold Protein Sources

Axfood's sales of protein-based foods serves as the starting point for the discussion of alternative protein sources with more beneficial health and climate aspects. The most sold protein sources per kilogram product were in falling order; chicken breast fillet, minced meat (beef), chicken leg, grilled or spicy sausage, minced meat (mixed pork and beef 50/50), Falu sausage, pork fillet, salmon fillet, bacon and whole chicken.

According to Riksmaten, the major protein sources in Sweden are meat and meat dishes (Amcoff *et al*. 2012, p. 134). This confirms our results for the major protein sources. From a health perspective, however, there are great health benefits from eating a variety of vegetables, legumes, fruits and other plant-based foods (Nordic Council of Ministers 2014). Vegetarians are less likely to suffer from diseases caused by consuming increasing amounts of red meat under a longer period of time. However, excluding animal protein from the diet can lead to lower levels of some nutrients compared to an omnivorous diet. Protein quality is the balance of all essential amino acids in a protein source. Animal protein sources all have a high protein quality, where plant-based protein sources such as legumes, nuts, seeds and whole grain cereals have a lower quality. Nonetheless, if a variety of different vegetable proteins are consumed, all essential amino acid requirements are met. Vitamin B12 is exclusively found in animal foods, and if changing to an exclusively plant-based diet, B12 must be added through supplements or fortified foods. Iron is comparatively high in plant-based protein sources but has a different type of iron present in meat that is called heme iron. Heme iron has a higher bioavailability than non-heme iron, which makes it easier for the body to absorb. Iron anemia deficiency is the most common micronutrient deficiency globally, which makes the mineral extra important for consideration. Non-heme iron can however be absorbed more easily through facilitation by vitamin C, so when consuming plant-based sources high in iron such as legumes, it is important to add sufficient amounts of vitamin C to the meal (*Ibid.*).

Animal based protein is problematic from a climate change perspective, but if other sustainability factors are included, both socio-economic and environmental, it complicates making choices for sustainable development (UNEP, 2016). From a climate perspective, animal products have a significantly greater environmental impact than their plant-based counterparts (FAO 2020a; Röös 2017). Chicken might have the lowest climate impact of all types of meat, but it is still high in comparison to vegetable protein sources (Röös 2012). According to Moberg *et al.* (2020), the average Swedish diet contributed to environmental impacts mostly through animal products (about 67 percent). Only 15 percent of the GHG emissions were caused by plant-based foods (Moberg *et al*. 2020). That is why a protein shift could benefit both public health and the environment.

7.2 Associated products to the most sold protein sources and the compiled dishes

The associations made in ACIT (presented in *Table 9*) included mostly convenience products such as industrially made sauces, pre-cooked vegetables, potato mash and spice mixes. This implies that convenience is an important factor when compiling dishes to eat at home. According to Food & Friends (2019), convenience is the ninth most important aspect when deciding what to eat for dinner.

Several of the compiled food dishes in the study were in line with commonly consumed dishes reported by Food & Friends; spaghetti Bolognese, tacos, sausage stroganoff and dishes with salmon/fish, pork fillet, chicken and pasta. According to the report, dishes with chicken and spaghetti Bolognese were the most frequently consumed foods both in the weekdays and during the weekend (*Ibid.*). In this study, chicken was a commonly purchased protein source (*Table 9*). Therefore, this study confirms it is most likely common to cook dishes with chicken in a home setting.

There are some main divergences between the dishes compiled in this study and the dishes in Food & Friends. In the report by Food & Friends, soups, vegetarian dishes, pizza, hamburger and meatballs were included as commonly consumed dishes. These were not identified as commonly made dishes in this study. One possible reason could be that this study includes ten dishes while Food & Friends include 20. If more dishes were included in this study, maybe it would be more in line with Food & Friends. Furthermore, it is not defined whether or not each of the represented dishes in Food & Friends is prepared at home or eaten outside of the home setting. Another potential reason is because of the difficulty to define dishes such as pizza and soups by using ACIT. Firstly, it might not include a main protein source and thereby automatically fall out of this study. Secondly, it is difficult to see clear patterns in ACIT if there is not e.g. one specific soup made substantially more often than others. It also requires the researchers to be able to identify the dish based on associated products. In this study, sliced ham and other similar products were excluded since it was too difficult to define whether or not they were used as main protein source in a lunch or dinner, or as a spread on a sandwich. Therefore, a dish like pizza would most likely not be identified even if it might be commonly made in a home setting. It is also important to mention that the report by Food & Friends is based on self-reporting, while this study is based on food purchases. Furthermore, Food and Friends is based on 1000 participants while the consumer purchase of this study is based on all purchases made in Willys and Hemköp during the whole year of 2019. Hence, the data collected in this study provide a larger underlay without risk of self-reporting bias. It is common to under or overestimate food intake when self-reporting (Amcoff *et al*. 2012).

7.3 The Nutritional Content and Climate Impact of the Selected Food Dishes

After associations were made in ACIT, ten dishes were selected (*Table 10*). The ten dishes differed in their nutritional value and climate impact providing challenges related to public health and environmental impact.

7.3.1 Nutritional Content of the Selected Dishes

In comparison to the recommended values, the food dishes overall were substantially higher in fat, including saturated fatty acids (*Table 11*). Furthermore, they were significantly lower in fiber, whole grain, fruit and vegetables. Energy content varied greatly between the dishes but only the lasagna was outside the reference values of recommended intake. None of the dishes included less protein than recommended per dish and portion, but some included more. The fact that the selected dishes were inadequate to nutritional recommendations is problematic, since healthy food habits can reduce the increased prevalence of non-communicable diseases (Nordic Council of Ministers 2014). Considering the increased prevalence of obesity due to energy imbalance, it was surprising that only one of the dishes exceeded the recommended energy intake (WHO 2018b). At the same time, this study only provides insight on commonly made dishes. It does not foretell the energy intake in people's daily diets.

In *Table 17,* the results and methodological decisions made are compared to Riksmaten (Amcoff *et al.* 2012).

Table 17. Comparison of results and methodological differences between Riksmaten (Amcoff et al. 2012) and this study

Riksmaten (Amcoff *et al.* 2012)	**This study**
Insufficient consumption of fruit, vegetables, whole grain and dietary fiber	Insufficient content of fruit, vegetable, whole grain and dietary fiber.
Recommended amount of fat intake but too much saturated fat	Exceeded content of fat, including saturated fat
Includes sugar, sweets, snacks, sodium, as well as frequency of consumption on fish, margarine and oil	Parameters not included
Based on self-reporting	Based on sales statistics
Based on 2-4 days of reported food consumption	Based on sales statistics during 1 year
Dietary patterns	Composition of commonly made dishes
Data collected in 2010-11	Data collected from sales statistics of 2019

The left column presents results and methodological choices conducted in Riksmaten (Amcoff *et al.* 2012), followed by its counterpart in this study. Similar to Riksmaten, the identified

dishes in this study entailed insufficient content of fruit, vegetables, whole grain and dietary fiber. Both Riksmaten and this study observed too much saturated fat. Parameters on sugar, sweets, snacks, sodium, fish, margarine and oil were not included in this study, therefore could neither oppose nor confirm the results reported by Riksmaten.

In divergence to Riksmaten, the selected dishes in this study exceeded recommendations of total fat content. Compared to this study, Riksmaten includes all foods consumed as a means to define dietary patterns. Potentially, the total fat intake in Riksmaten was balanced by including all meals consumed, instead of only one dish.

Differences were also identified in methodological execution. Riksmaten is based on self-reporting. A common reliability issue of self-reporting is the tendency to over or underestimate food intake. At the same time, sales statistics does not foretell what is actually consumed. Riksmaten is also based on food intake during 2-4 days. Even though a couple of days provides a reflection of food patterns, it is not enough to clearly define it. Although, this study only provides insights on commonly made dishes consumed for dinner or lunch rather than dietary patterns. Finally, the data from Riksmaten was collected ten years ago. Several behavioral changes might have happened during that period of time.

7.3.2 Climate Impact of the Selected Dishes

The climate impact of the selected dishes differed between 0.7-3.7 (*Table 12).* Hence, all of them exceeded the boundaries set for the study on maximum 0.5 CO_2e per dish and portion. Dishes containing beef (tacos, spaghetti Bolognese and lasagna) had the highest climate impact while the ones based on chicken (chicken tikka masala, chicken wok and chicken leg) had the lowest. Furthermore, sausage stroganoff, pork fillet and the salmon dish were in between the dishes based on beef and chicken in regard to climate impact. These results are in line with the climate impact by certain protein sources reported by Röös (2012), in which beef had the highest impact followed by pork and chicken.

Recent conducted research confirms that the Swedish diet exceeds the planetary boundaries (Moberg *et al.* 2020). According to Moberg *et al.* (2020 p. 1407), it is more than 2-3 times higher than the planetary boundaries of GHGs set by Willet *et al*. (2019) based on a yearly basis. It is problematic to compare a food dish with a yearly consumption since it is difficult to define how many meals that entails. Furthermore, it requires that both numbers are calculated equal with the same climate factors included. No earlier research on climate impact per meal could be found to compare with the meals in this study.

7.4 Alteration of Food Dishes

In order to reach the requirements, set in regard to nutritional content and climate impact, all dishes have been altered. Some ingredients were exchanged to alternatives with higher nutritional content and lower climate impact, others were altered in amount. Products of Garant were applied in the altered dishes to the extent possible.

7.4.1 Alterations to Increase Nutritional Value

To fill the nutritional gaps identified in the selected dishes (*Table 11*), several ingredients were exchanged or altered in some way (*Table 13*). Whole grain, fruit and vegetables were added in most dishes to reach the recommended levels and thereby increase nutritional value (*Table 14*). Furthermore, fat content was reduced and to some extent replaced with unsaturated fatty acids. If a dish contained red meat, it was exchanged to a plant-based alternative.

The exchanges made are in line with the Nordic Nutritional Recommendations (Nordic Council of Ministers 2014) to define dishes with potential to improve public health. The need to increase the consumption of fruit, vegetables, whole grain, fiber and decrease intake of saturated fat among the Swedish consumers was also identified and lifted in Riksmaten (Amcoff *et al*. 2012).

7.4.2 Alterations to Decrease Climate Impact

Main change made in the altered dishes to reach the target of 0.5 CO_2e per dish and portion, was to exchange the animal-based protein source to a plant-based alternative (*Table 13 & 15*). In some of the dishes, it was necessary to reduce climate impact further by reducing or exchange animal-based products such as e.g. creme fraiche and cream to meet the objective.

Hallström *et al.* (2015) stated that the amount of meat and animal products provides the most potential to reduce climate impact. Furthermore, Hallström *et al.* (2015) argued the potential depended on the type of meat included. When altering the dishes, it became clear that animal-based products had the highest climate impact. It was not possible to reach the target without exchanging or altering the animal-based ingredients. As mentioned earlier, the dishes containing beef had the highest climate impact which confirms the statement by Hallström *et al.* (2015).

The altered dishes had some similarities to the diet suggested by Willet *et al.* (2019). Willet *et al* (2019) proposed a diet mostly based on vegetables, whole grains, fruits, nuts, legumes and unsaturated oils with small amounts of seafood. Their diet included limited or no red meat, starchy vegetables or refined grains. In divergence to the diet compiled by Willet *et al.* (2019), the dishes in this study did not include any poultry or red meat. The main reason was that each dish was handled individually, as well as the strive to minimize intake of red meat. If the study would have been based on a weekly diet, like the one suggested in the one planet plate (WWF 2020b), it would have been possible to have a broader climate impact range between the different dishes.

It would have been possible to include dishes with higher climate impact than 0.5 CO_2e per portion, provided some of them had less. When handling the dishes separately, the frames became rigid. Additionally, the dishes with lower climate impact were based on selected dishes. This contributed further to rigid frames with the strive for the alternated dishes to be as similar as possible, also in regard to proportions to make potential food exchanges easy to accomplish. It could have been possible to include small amounts of poultry in some of the dishes, but the amount would have needed to be altered significantly. Knowing consumer food choices are

affected by habitual patterns (Furst *et al.* 1996), the researchers strived to compile the dishes for the customer to make easy exchanges without altering the dishes or proportions more than necessary. If the dishes would have been more flexible, new recipes could have been developed with small amounts of meat and poultry. The similarity between the dishes presented in this study and the diet suggested by Willet *et al.* (2019) is especially interesting considering different environmental factors were included. Although this study did not consider the use of freshwater, biodiversity loss, land-system change and the flow of nitrogen and phosphorus, the food components and its proportions were alike.

7.5 Integration of Sustainability in the Swedish Food Retailer Industry

Sustainability within food systems includes the whole value chain, from production, processing, consumption and disposal (Nguyen 2018). The manifest written by the Swedish food industry entails commitments to improve sustainability within the supply chain (The Swedish Food Federation 2019b). Further, the initiative Sustainable Food Chain works actively to ensure a more sustainable production and assortment on the market as well as reduced food waste. The initiative aims to contribute to a more sustainable consumption by offering more sustainable products on the market. Even though technological mitigation provides one way to handle GHG emissions, it is not as effective as changing dietary patterns (Popp, Lotze-Campen & Bodirsky 2010). The need to change current food consumption, especially reduction of animal-based products, to reduce climate impact is stated by several researchers (Hallström *et al.* 2015; Moberg *et al.* 2020; Röös 2017; Willet *et al.* 2019). Further on, food retailers urgently need to do more to tackle the increasing prevalence of obesity (Food Navigator 2020). To be sustainable, the whole food chain needs to be considered (Ngyen 2018). Therefore, the authors of this study believe there is a need to increase focus on consumption and the need to change dietary patterns. Alteration in dietary patterns offers both possibilities to improve public health, as well as decreased climate impact in line with SDGs 3, 12 and 13.

Food retailers have a branding opportunity in the capacity to develop demand for certain products (Ekelund *et al.* 2014). In this study, the main focus has been placed on consumer consumption patterns and how to alternate them. However, the empirical data offers valuable information on purchase behavior and possible products to generate demand for in order to enhance a healthier consumption with lower climate impact. According to Bisogni *et al.* (2012) and Neuman *et al.* (2014), consumers find it difficult to implement healthier food choices. The altered dishes compiled in this study, could potentially provide practical guidance as part of transitions for healthier food habits.

Stated by Tufino *et al.* (2013), the road to sustainability does not entail a clear path. How to implement sustainability in management is not defined and needs to be further developed. Additionally, sustainability needs to be customized for each organization on all levels. If it does, it provides a major possibility to create value to the organization and differentiate from

competitors. To integrate sustainability is a process, in which sustainability needs to be considered all parts of the way (Brook & Pagnanelli 2014). The empirical data produced in this study is customized to the customers of Axfood and Garant and could be used to add value and to differentiate from competitors.

8 Conclusions

This study aims to identify and alternate commonly made dishes to alternatives with lower climate impact and higher nutritional value, in the context of portfolio management. In this final chapter, the key findings to the aim are summarized. Finally, methodological choices are considered followed by suggestions for future research.

8.1 Integration of Nutrition and Climate Impact in Food Habits and Portfolio Management

In order to tackle climate change and the increased prevalence of non-communicable diseases, human diets need to change urgently. Knowing that consumer food choices are challenging to change and highly affected by habitual patterns, there is a need to provide options that consumers are already familiar with to facilitate the transition to healthier food patterns with lower climate impact. In this transition, the food retailers have a responsibility to integrate nutrition and climate impact in their organization to influence the consumer to make more sustainable food choices.

This study shows that many commonly consumed dishes in a home setting is not in line with the nutritional guidelines and exceeds goals for climate boundaries. All in all, the content of fat and saturated fat is too high and the content of fiber, whole grain, fruit and vegetables is too low. From both a nutritional and a climate perspective, animal products such as dairy need to be exchanged for low-fat dairy products or oat-based products. More vegetables and whole grains need to be increased. To reach the targets related to climate impact, it is key to lower the amount of meat and other animal products in the diet.

Throughout the process of altering commonly made dishes to options with lower climate impact and higher nutritional value, several gaps were identified in the product portfolio of the case unit (Garant). The gaps identified offer valuable opportunities for Garant to influence consumer behavior, differentiate from their competitors and a means to reach strategic goals related to the SDGs. Thereby, the study highlights the great possibilities integration of sustainability in portfolio management strategies offers for sustainable development.

8.2 Methodological Reflection

The healthier eating patterns with lower climate impact framework provided a structure before further developing the guidelines based on data from conservation organizations and governmental administrative authorities. The dishes were based on sales statistics and purchase behaviors and altered accordingly to the designated nutritional guidelines and CO_2e boundaries. The Cynefin framework and portfolio management provided valuable structures for deciding how the unit of analysis could apply the altered dishes in practice. There are however some aspects that were not included in the study due to lack of data and previous research, such as certain nutritional and planetary boundaries.

A healthy diet should limit intake of saturated fats, sugar and salt, but sugar and salt were not included in the analysis of the dishes. Salt, or sodium, was excluded due to the difficulty of estimating the portion sizes. Added sugar was excluded considering this study only focused on single meals (lunch or dinner), not on snacks where most sugar presumably is consumed. Another outcome of centralizing the study around single meals is that entire dietary patterns are not considered. Since sales statistics from food retailers only show which products are being bought and possibly consumed in home settings, it is hard to acknowledge the status of consumers' overall dietary patterns. Neither can sales statistics show how much nor which kind of food is being wasted, hence not having a direct impact on consumers' health.

Climate impact is measured by life cycle analysis, and CO_2e should not be seen as exact numbers but approximate measures of the product's climate impact. 0.5 CO_2e per portion is an estimate from WWF that also assumes that other industries change and become climate neutral. Furthermore, climate impact is not the only important aspect of environmental issues. Other environmental aspects are for example biodiversity, biogeochemical flows, freshwater use, ocean acidification and land-system change. These are not included in the study. Neither are other sustainability issues such as animal welfare and fair trade. These are excluded due to the difficulty in combining all these factors without a functioning framework.

Despite the limitations of this project, it has offered an understanding of how Garant as a brand could influence their consumers to shift the ten most consumed dishes to the adjusted versions, it could have a major advantage for improving both public health and lowering diet related climate impact.

8.3 Further research

This study contributes to the research on how to combine nutritional and climate guidelines into more sustainable food choices, including the challenges it presents. Furthermore, it offers suggestions on how it can be implemented in portfolio management. However, the study only includes one case and two perspectives of sustainable food choices. Suggestion for future research would be to examine if the sales statistics, associations and the food dishes are in line with other food retailers. It would also be interesting to study the dishes (or other common dishes) in regard to additional factors related to environmental, social and economic challenges to compare and for further alteration.

Despite the fact that all consumers need food, there is a limited number of studies in the field of food related fast moving consumer goods portfolio management for sustainable development. A possible explanation is seen in the perception that portfolio management is an internal business matter, not something that needs to be researched. This may have been so, in the era of strategic management, but that does not embrace the notion of transparency, corporate responsibility beyond short-term profits and their role in efforts for public health. Clearly, the results from this study show that portfolio management may matter quite a bit,

both as part of influencing consumer behavior and creating grounds for corporate branding. Therefore, more research in the area is needed.

Furthermore, experimental research on how to communicate and guide the consumer to more sustainable consumption patterns from a retailer perspective would add further value to the research field and the transformation to a sustainable food system. In light of strategic efforts in portfolio management at one of the three big food retailer corporations in Sweden, it would be interesting to see what joint efforts among food retailers as a whole in Sweden could accomplish for sustainable development.

Bibliography

Literature and publications

Afshin, A. *et al*. (2019). Health Effects of Dietary Risks in 195 Countries, 1990–2017: a Systematic Analysis for the Global Burden of Disease Study 2017. *The Lancet*, 393(10184), pp. 1958–1972

Amcoff, E., Sverige & Livsmedelsverket (2012). *Riksmaten - vuxna 2010–11 Livsmedels- och näringsintag bland vuxna i Sverige*. Uppsala: Livsmedelsverket. Available: https://www.livsmedelsverket.se/globalassets/publikationsdatabas/rapporter/2011/riksmaten_2010_20111.pdf [2020-01-21]

Alexander, A., Kumar, M. & Walker, H. (2018). A Decision Theory Perspective on Complexity in Performance Measurement and Management. *International Journal of Operations & Production Management,* 38(11), pp. 2214-2244.

Avlonitis, G.J. & Papastathopoulou, P. (2006). *Product and Services Management*. London ; Thousand Oaks, Calif: SAGE.

Axfood (2020h). *Enterprise Data Analytics*. Axfood: Stockholm

Axfood (2020i). *Axfood's Consumer Insight Tool* [internal material]. Axfood: Stockholm

Battaglia Richi, E., Baumer, B., Conrad, B., Darioli, R., Schmid, A. & Keller, U. (2014). Health Risks Associated with Meat Consumption: A Review of Epidemiological Studies. *Int. J. Vitam. Nutr. Res*. 85, (1–2), pp. 70–78.

Bakker, D., Raabe, T. & Siebenhüner, B. (2015). *Vertical Brand Portfolio Management: Strategies for Integrated Brand Management Between Manufacturers and Retailers*. Wiesbaden: Springer Gabler. (Research)

Belz, F-M. & Peattie, K. (2012). *Sustainability Marketing: a Global Perspective*. 2nd ed.

Biely, K., Maes, D. & Van Passel, S. (2018). Market Power Extended: From Foucalt to Meadows. *Sustainability*, 10(8), p.2843

Bisogni, C.A., Jastran, M., Seligson, M. & Thompson, A. (2012). How People Interpret Healthy Eating: Contributions of Qualitative Research. *Journal of Nutrition Education and Behavior*, 44(4), pp. 282–301

Brook, J.W. & Pagnanelli, F. (2014). Integrating Sustainability into Innovation Project Portfolio Management – A Strategic Perspective. *Journal of Engineering and Technology Management*, 34, pp. 46–62

Brungård Konde, Å., Bjerselius, R., Haglund, L., Jansson, A., Pearson, M., Sanner Färnstrand, J. & Johansson, A. K. (2015). *Swedish Dietary Guidelines - Risk and Benefit Management Report.* Uppsala: Livsmedelsverket. Available: https://www.livsmedelsverket.se/globalassets/publikationsdatabas/rapporter/2015/rapp-hanteringsrapport-engelska-omslag--inlaga--bilagor-eng-version.pdf [2020-02-20]

Carrero, I. & Valor, C. (2012). CSR-labelled Products in Retailers' Assortment - A Comparative Study of British and Spanish Retailers. *International Journal of Retail & Distribution Management,* 40(8), pp. 629 - 652

Choi, J.-H., Kim, T. & Jung, S.-U. (2018). Sustainable Decision Making for Store Brand Product. *Sustainability*, 10(11), pp. 1-14

Cohen, D.A. & Babey, S.H. (2012). Contextual Influences on Eating Behaviours: Heuristic Processing and Dietary Choices. *Obesity Reviews*, 13(9), pp. 766–779

Creswell, J.W. & Creswell, J.D. (2018). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. Fifth edition. Los Angeles: SAGE.

Dawson, J. (2013). Retailer Activity in Shaping Food Choice. *Food Quality and Preference*, vol. 28 (1), pp. 339–347

De, D. & Singh, A. (2017). Consumer's Perspective and Retailer's Consideration Towards Purchase of Private Label Brands. *Procedia Computer Science*, 122, pp. 587–594

Dobrovolskienė, N. & Tamošiūnienė, R. (2015). Financial Resource Allocation in a Project Portfolio: Analysing the Necessity to Integrate Sustainability into Resource Allocation. *Annals of the Alexandru Ioan Cuza University - Economics*, 62 (3), pp. 369–382

Dudhir, K. & Talukdar, D. (2004). Does Store Brand Patronage Improve Store Patronage? *Review of Industrial Organization*, 24 (2), pp. 143–160

Dryselius, H. (2012). Dietist Net. Data Program for Nutritional Calculation. Kost & Näringsdata. Available: http://www.kostdata.se/sv [2020-02-03]

Ekelund, L., Hunter, E., Spendrup, S. & Tjärnemo, H. (2014). Communicating GHG mitigating food consumption in-store: An observational study of food retailers in five European countries. *British Food Journal*, 116(10), pp. 1618–1635

FCRN (2020a). *Food Systems and Greenhouse Gas Emissions.* Available: https://www.foodsource.org.uk/chapters/3-food-systems-greenhouse-gas-emissions [2020-02-06]

FCRN (2020b). *What Are the Relationships Among Food Systems and Environmental Change?* Available: https://www.foodsource.org.uk/13-what-are-relationships-among-food-systems-and-environmental-change [2020-02-06]

FCRN (2020c). *How Are Food Systems Diets, and Health Connected?* Available: https://www.foodsource.org.uk/chapters/7-what-connection-between-food-health [2020-02-06]

Florén, B., Sund, V., Krewer, C. & Angervall, T. (2015). *Lätt att välja rätt - Klimatdata för medvetna val av livsmedelsråvaror i storkök.* Borås: SP Technical Research Institute of Sweden. Available: http://www.diva-portal.org/smash/get/diva2:962915/FULLTEXT01.pdf [2020-02-07]

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), pp. 219–245

Food & Friends (2019). *Matrapport 2019.* Food & Friends. Available: https://www.foodfriends.se/wp-content/uploads/2019/06/Matrapporten_2019_web.pdf [2020-03-13]

Furst, T., Connors, M., Bisogni, C.A., Sobal, J. & Falk, L.W. (1996). Food Choice: A Conceptual Model of the Process. *Appetite*, 26(3), pp. 247–266

Garnett, T. (2014). *Changing What We Eat - A Call for Research & Action on Widespread Adoption of Sustainable Healthy Eating*. Oxford: Food Climate Research Network. Available https://www.fcrn.org.uk/sites/default/files/fcrn_wellcome_gfs_changing_consumption_report_final.pdf [2020-01-28]

Godfray, H. C. J. *et al*. (2010). Food Security: The Challenge of Feeding 9 Billion People. *Science*, 327(5967), pp. 812–818

Global Panel on Agriculture and Food Systems for Nutrition (2016). *Food Systems for Nutrition: Food Systems and Diets: Facing the Challenges of the 21st Century*. London: UK. Available: http://www.glopan.org/sites/default/files/ForesightReport.pdf [2020-02-06]

Gripenberg, Pia. (2016). Mångmiljonsatsning på hållbar matproduktion. *Dagens Nyheter,* 17 March.

Gray, B. (2017). The Cynefin Framework: Applying an Understanding of Complexity to Medicine. *Journal of primary health care,* 9(4), pp.258-261

Hjerpe, K., Markensten, T., Pearsson, M., Rundberg, B., Lundström, A., Rydberg, I., Sonesson, U. & Nilsson, K. (2013). *Hur liten kan livsmedelskonsumtionens klimatpåverkan vara år 2050? – ett diskussionsunderlag om vad vi äter i framtiden.* Uppsala: Livsmedelsverket. Available: http://www2.jordbruksverket.se/webdav/files/SJV/trycksaker/Pdf_ovrigt/ovr296_1.pdf

HLPE (2017). *Nutrition and food systems.* A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome

Hakan Altintaş, M., Kilic, S., Senol, G. & Bahar Isin, F. (2010). Strategic Objectives and Competitive Advantages of Private Label Product: Manufacturer's Perspective. *International Journal of Retail & Distribution Management*, 38(10), pp.773-788

Hallström, E., Carlsson-Kanyama, A. & Börjesson, P. (2015). Environmental Impact of Dietary Change: a Systematic Review. *Journal of Cleaner Production*, 91, pp. 1–11

Hallström, E., Davis, J., Woodhouse, A & Sonesson, U. (2018). Using Dietary Quality Scores to Assess Sustainability of Food Products and Human Diets: A Systematic Review. *Ecological Indicators*, 93, pp. 219-230.

Heller, M.C., Keoleian, G.A. & Willett, W.C. (2013). Toward a Life Cycle-Based, Diet-level Framework for Food Environmental Impact and Nutritional Quality Assessment: A Critical Review. *Environmental Science & Technology*, 47(22), pp. 12632–12647

Hiriyappa, B. (2008). Investment Management: Securities and Portfolio Management. New Delhi: New Age International (P) Ltd., Publishers. Available: http://site.ebrary-com/id/10318658 [2020-01-31]

Johnson, W., Parente, D. & Safari. (2013). *Project Strategy and Strategic Portfolio Management*. Business Expert Press

Kahn, K, B. (2012). *The PDMA Handbook of New Product Development.* Chichester: John Wiley & Sons AND Sons LTD

Kirca, A.H., Randhawa, P., Talay, M.B. & Akdeniz, M.B. (2019). The Interactive Effects of Product and Brand Portfolio Strategies on Brand Performance: Longitudinal Evidence from the U.S. Automotive Industry. *International Journal of Research in Marketing*, s. S0167811619300643

Kumar, N. & Steenkamp, J.B. (2007). *Private Label Strategy - How to Meet the Store Brand Challenge.* Harvard Business School Publishing, Boston.

Kurtz, C.F. & Snowden, D.J. (2003). The new dynamics of strategy: Sense-making in a Complex and Complicated World. *IBM Systems Journa*l, 442(3), p. 22

Kusters, C., Batjes, K., Wigboldus, S., Brouwers, J. & Dickson Baguma, S. (2017). Managing for Sustainable Development Impact. Available: https://edepot.wur.nl/420122 [2020-01-27]

Levin, G. & Wyzalek, J (2015). *Portfolio Management: a Strategic Approach*. Boca Raton: CRC Press

Lindvall, J. (2007). Fallstudiestrategier. *Statsvetenskaplig Tidsskrift*, 109(3), pp. 270–278

Löhman, O. & Steinholz, D. (2003). *Det ansvarsfulla företaget*, Ekerlids förlag, Stockholm.

Mann, M.E., Rahmstorf, S., Kornhuber, K., Steinman, B.A., Miller, S.K. & Coumou, D. (2017). Influence of Anthropogenic Climate Change on Planetary Wave Resonance and Extreme Weather Events. *Scientific Reports*, 7(1), pp. 45242

Mark-Herbert, C. & von Schantz, C. (2007). Communicating Corporate Social Responsibility – Brand management. *Electronic Journal of Business Ethics and Organization Studies*, 12(2), pp. 4-11.

Moberg, E., Karlsson Potter, H., Wood, A., Hansson, P.-A. & Röös, E. (2020). Benchmarking the Swedish Diet Relative to Global and National Environmental Targets—Identification of Indicator Limitations and Data Gaps. *Sustainability*, 12 (4), p. 1407

Moravcikova, D., Krizanova, A., Kliestikova, J. & Rypakova, M. (2017). Green Marketing as the Source of the Competitive Advantage of the Business. *Sustainability*, 9(12), p. 2218

Nemecek, T., Jungbluth, N., Calans, L.M. & Schenck, R. (2016). Environmental Impacts of Food Consumption and Nutrition: Where Are We and What is Next? *The International Journal of Life Cycle Assessment*, 21(5), pp.607-620

Neuman, N., Persson Osowski, C., Mattsson Sydner, Y. & Fjellström, C. (2014). Swedish Students' Interpretations of Food Symbols and Their Perceptions of Healthy Eating. An Exploratory Study. *Appetite*, 82, pp. 29–35

Nordic Council of Ministers (2014). *Nordic Nutrition Recommendations 2012 - Integrating Nutrition and Physical Activity.* Copenhagen: Nordic Council of Ministers. Available: http://norden.diva-portal.org/smash/get/diva2:704251/FULLTEXT01.pdf [2020-02-03]

Popp, A., Lotze-Campen, H. & Bodirsky, B. (2010). Food Consumption, Diet Shifts and Associated non-CO2 Greenhouse Gases from Agricultural Production. *Global Environmental Change*, 20(3), pp. 451–462

Project Management Institute (2013). *The Standard for Portfolio Management.* Newtown Square, Pa: Project Management Institute.

Quetel, A. (2013). *Bedömning och dokumentation av näringsriktiga skolluncher - hanteringsrapport.* (Livsmedelsverkets rapportserie nr 2013:2). Uppsala: Livsmedelsverket. Available: https://www.livsmedelsverket.se/globalassets/publikationsdatabas/rapporter/2013/2013_livsmedelsverket_2_bedomning_dokumentation_naringsriktiga_skolluncher_hanteringsrapport.pdf [2020-02-04]

Riesener, M., Dölle, C., Schuh, G., Lauf, H. & Jank, M.-H. (2019). Performance-driven and Company Goal-orientated Design of Product Portfolios: A Methodological Framework. *Procedia CIRP*, 84, pp. 725–730

RISE (2019). RISE Klimat Databas [internal material]. Göteborg: Research Institutes of Sweden

Robson, C. & McCartan, K. (2016). *Real World Research: a Resource for Users of Social Research Methods in Applied Settings.* Fourth Edition. Hoboken: Wiley.

Röös, E. (2017). The Sustainable Farm – Does It Exist? Uppsala: SLU Future Food. Available: https://www.slu.se/globalassets/ew/org/centrb/fu-food/publikationer/2017/the-sustainable-farm---does-it-exist--aug2017_webb.pdf [2020-01-23]

Röös, E. (2012). Mat-klimat-listan. Uppsala: Sveriges Lantbruksuniversitet (Rapport 040). Available: https://pub.epsilon.slu.se/8710/1/roos_e_120413.pdf [2020-01-23]

Sánchez, M.A. (2015). Integrating Sustainability Issues Into Project Management. *Journal of Cleaner Production*, 96, pp. 319–330

Scott-Morton, F. & Zettelmeyer, F. (2004). The Strategic Positioning of Store Brands in Retailer–Manufacturer Negotiations. *Review of Industrial Organization*, 24, pp. 161–194.

Silverman, D. (2014). *Interpreting Qualitative Data: David Silverman*. Fifth edition. London: SAGE.

Sjörs, C., Hedenus, F., Sjölander, A., Tillander, A. & Bälter, K. (2017). Adherence to Dietary Recommendations for Swedish Adults Across Categories of Greenhouse Gas Emissions from Food. *Public Health Nutrition*, 20(18), pp. 3381–3393

Snowden, D. J. & Boone, M. (2007). A Leader's Framework for Decision Making. *Harvard Business Review*, 85(11), pp. 68-76

Shukla, P.R., Skea, J., Slade, R., Diemen, Van, R., Haughey, E., Malley, J., Pathak, M., Portugal Pereira, J. (2019). *Technical Summary. Climate Change and Land: an IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security and Greenhouse Gas Fluxes in Terrestrial Ecosystems.* Available: https://www.ipcc.ch/srccl/chapter/technical-summary/ [2020-02-03]

Springmann, M., Godfray, H.C.J., Rayner, M. & Scarborough, P. (2016). Analysis and Valuation of the Health and Climate Change Cobenefits of Dietary Change. *Proceedings of the National Academy of Sciences*, 113(15), pp. 4146–4151

Stehfest, E. *et al*. (2009) Climate Benefits of Changing Diet. *Climatic Change,* 95, pp. 1–2.

Swedish Grocery Trade (2015). *Maten och Folkhälsan 2015.* Available: https://svenskdagligvaruhandel.se/wp-content/uploads/Matenochfolkhaelsan2015.webb_.pdf [2020-03-13]

Swinburn, B.A., Sacks, G., Hall, K.D., McPherson, K., Finegood, D.T., Moodie, M.L., Gortmaker, S.L., 2011. The Global Obesity Pandemic: Shaped by Global Drivers and Local Environments. *The Lancet,* 378 (9793), pp. 804-814.

Tilman, D. & Clark, M. (2014). Global Diets Link Environmental Sustainability and Human Health. *Nature,* 515(7528), pp. 518–522

Tufinio, S.P., Mooi, H., Ravestijn, W., Bakker, H. & Boorsma, M. (2013). Sustainability in project management: where are we? *International Journal of Engineering*, p. 10

Vanham, D., Hoekstra, A. Y. & Bidoglio, G. (2013). Potential Water Saving Through Changes in European Diets. *Environment International,* 61, pp. 6145–6156

Vermeulen, S.J., Campbell, B.M. and Ingram, J.S.I. (2012). Climate Change and Food Systems. *Annual Review of Environment and Resources*, 37(1), pp. 195-222

Vollmar, J., Gepp, M., Palm, H., Calá, A. (2017). Engineering Framework for the Future: Cynefin for Engineers. *IEEE International Systems Engineering Symposium*, 10. Doi: 10.1109/SysEng.2017.8088286

Wever, R., Boks, C. B. & Bakker, C. A. (2008). *Sustainability Within Product Portfolio Management.* Available: https://repository.tudelft.nl/islandora/object/uuid:563ad303-48d6-4376-9973-6ed358aeccb3?collection=research [2020-03-12]

Willett, W. *et al.* (2019). Food in the Anthropocene: the EAT–Lancet Commission on Healthy Diets from Sustainable Food Systems. *The Lancet*, 393(10170), pp. 447–492D

WWF (2011). *Livewell: a Balance of Healthy and Sustainable Food Choices*, WWF UK, Godalming, UK

Yin, R. K. (2009). *Case study research: Design and methods*. 4th ed. London: SAGE publications.

Internet

Aktuell Hållbarhet. Erfarenhet: *Så fick Åsa Domeij hela Axfood att tänka hållbart.* Available: https://www.aktuellhallbarhet.se/miljo/klimat/erfarenhet-sa-fick-asa-domeij-hela-axfood-att-tanka-hallbart/ [2020-02-18]

AHA (2020). *Saturated Fat.* Available: https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/saturated-fats [2020-01-23]

Arla (2020). *Recept & mat*. Available: https://www.arla.se/recept/ [2020-02-27]

Axfood (2018a). Vegotrenden: 2018: Mer och allt oftare. Available: https://mb.cision.com/Main/1306/2658695/935553.pdf [2020-03-13]

Axfood (2018b). *Delad glädje för bra och hållbar mat - Års och hållbarhetsredovisning 2018*. Linköping: Larsson Offsettryck AB. Available: https://mb.cision.com/Main/1306/2750680/999698.pdf [2020-02-03]

Axfood (2018c). *Hållbarhetsprogram*. Available: https://www.axfood.se/globalassets/startsida/hallbarhet/publikationer-och-rapporter/axfood_hallbarhetsprogram_sv.pdf [2020-02-13]

Axfood (2020a). *Our House Brands*. Available: https://www.axfood.com/about-axfood/private-labels/our-house-brands/ [2020-02-18]

Axfood (2020b). *Garant lanserar mindre salladsförpackning för minskat matsvinn.* Available: https://www.axfood.se/media-och-opinion/nyheter-och-artiklar/garant-lanserar-mindre-salladsforpackning-for-minskat-matsvinn/ [2020-02-17]

Axfood (2020c). *Axfood i korthet*. Available: https://www.axfood.se/om-axfood/axfood-i-korthet/ [2020-02-03]

Axfood (2020d). *Strategi för hållbar utveckling*. Available: https://www.axfood.se/hallbarhet/strategi/ [2020-01-23]

Axfood (2020e). *Intervju med Åsa Domeij, hållbarhetschef*. Available: https://www.axfood.se/hallbarhet/strategi/intervju-med-asa-domeij-hallbarhetschef/ [2020-01-23]

Axfood (2020f). *Inspiration för hälsosam mat.* Available: https://www.axfood.se/hallbarhet/sa-jobbar-vi/halsa/ [2020-02-28]

Axfood (2020g). *Axfoods eget varumärke Garant fyller tio år.* Available: https://www.axfood.se/media-och-opinion/nyheter-och-artiklar/garant-fyller-10-ar/ [2020-02-03]

Axfood (2020j). *The Axfood Family.* Available: https://www.axfood.com/about-axfood/the-axfood-family/ [2020-03-09]

Bergendahls (2020). *Varumärken inom Bergendahls.* Available: https://bergendahls.se/vara-varumarken/ [2020-03-09]

Coop (2020a). *Om Coop.* Available: https://www.coop.se/globala-sidor/om-coop/ [2020-03-09]

Coop (2020b). *Våra varor och varumärken.* Available: https://www.coop.se/butiker-erbjudanden/vara-varor-varumarken/ [2020-03-09]

DLF (2019). *Dagligvarukartan 2019*. Available: https://www.dlf.se/rapporter/dagligvarukartan-2019/ [2020-01-23]

EPA (2017). *Greenhouse Gas Emissions.* Available: https://www.epa.gov/ghgemissions/overview-greenhouse-gases [2020-02-06]

FAO (2018). *Food Data Collection in Household Consumption and Expenditure Surveys*. Available: http://www.fao.org/3/CA1561EN/ca1561en.pdf [2020-02-06]

FAO (2019). *Sustainable Healthy Diets: Guiding Principles.* Available: http://www.fao.org/3/ca6640en/ca6640en.pdf [2020-01-23]

FAO (2020a). Animal Production. Available: http://www.fao.org/animal-production/en/ [2020-01-22]

FAO (2020b). Innovation at FAO. Available: http://www.fao.org/innovation/en/ [2020-03-05]

Food Navigator (2020). *Food Retailers Failing to Tackle Obesity Risk Disinvestment, Report Warns*. Available: https://www.foodnavigator.com/Article/2020/03/04/Food-retailers-failing-to-tackle-obesity-risk-disinvestment-report-

warns?utm_source=newsletter_daily&utm_medium=email&utm_campaign=04-Mar-2020# [2020-03-16]

ICA (2020a). *Hitta ditt recept.* Available: *https://www.ica.se/recept/* [2020-02-27]

ICA (2020b). *En matkasse som gör gott! Och smakar gott.* Available: https://www.ica.se/handla-online/ica-matkassen/om-ica-matkassen/vilken-matkasse-passar-din-vardag/klimat-matkasse/ [2020-03-03]

ICA (2020c). *Våra Egna Varumärken.* Available: https://www.ica.se/icas-egna-varor/varumarken/ [2020-03-09]

ICA Gruppen (2020). *ICA Gruppen in Brief.* Available: https://www.icagruppen.se/globalassets/1.startsida/3.-ica-gruppen-i-korthet/190515_ica_gruppen_in_brief_2018.pdf/ [2020-03-09]

Garant (2020a). *Mat och Hälsa.* Available: https://www.garantskafferiet.se/miljo-och-ansvar/mat-och-halsa/ [2020-02-20]

Garant (2020b). *Våra produkter.* Available: https://www.garantskafferiet.se/vara-produkter/ [2020-02-07]

Garant (2020c). *Garanterat bra urval.* Available: https://www.garantskafferiet.se/om-garant/ [2020-02-03]

Global Justice Now (2018). *69 of the Richest 100 Entities on the Planet are Corporations, not Governments, Figures Show.* Available: https://www.globaljustice.org.uk/news/2018/oct/17/69-richest-100-entities-planet-are-corporations-not-governments-figures-show [2020-01-23]

Kost & Näringsdata (2020). *Dietist Net.* Available: http://www.kostdata.se/se/dietist-net [2020-02-03]

Köket (2020). *Recept, matinspiration, kockar och matprogram*. Available: https://www.koket.se/ [2020-02-27]

Lidl (2020a). Kött & Chark. Available: https://www.lidl.se/vara-varor/kott-chark [2020-03-011]

Lidl (2020b). *Fisk & skaldjur.* Available: https://www.lidl.se/vara-varor/fisk-skaldjur [2020-03-11]

Lidl (2020c). *Kyckling.* Available: https://www.lidl.se/vara-varor/kyckling [2020-03-11]

Lidl (2020d). *Ost & mejeri.* Available: https://www.lidl.se/vara-varor/mejeri-ost [2020-03-11]

Lidl (2020e). *Barnsortiment.* Available: https://www.lidl.se/vara-varor/barnsortiment [2020-03-11]

LIDL (2020f). *Om oss*. Available: https://om.lidl.se/om-oss?_ga=2.161925180.1064206761.1583759396-2063052403.1583759396 [2020-03-09]

Mat.se (2020). *Handla Klimatsmart.* Available: https://www.mat.se/mat-klimat [2020-03-04]

My News Desk (2018). *Butikspremiär: Vegansk burgare för köttälskare.* Available: http://www.mynewsdesk.com/se/axfood_ab/pressreleases/butikspremiaer-vegansk-burgare-foer-koettaelskare-2689340 [2020-02-14]

My News Desk (2014). *Hemköp och Willys: Bara grönlistad fisk 2020*. Available: http://www.mynewsdesk.com/se/axfood_ab/pressreleases/hemkoep-och-willys-bara-groenlistad-fisk-2020-1014145 [2020-01-23]

My News Desk (2012). *Willys och Hemköp först med miljömärkta (MSC) kungsräkor*. Available: http://www.mynewsdesk.com/se/axfood_ab/pressreleases/willys-och-hemkoep-foerst-med-miljoemaerkta-msc-kungsraekor-783610 [2020-01-23]

Naturskyddsföreningen (2020). Frågor och svar om klimatförändringarna. Available: https://www.naturskyddsforeningen.se/svar-pa-tal-om-klimatet [2020-03-05]

Netto (2020). *Våra egna varumärken.* Available: https://netto.se/vaara-varor/egna-varumaerken/ [2020-03-09]

Nguyen, H. (2018). *Sustainable Food Systems: Concept and Framework*. Available: http://www.fao.org/3/ca2079en/CA2079EN.pdf [2020-01-23]

Nutra Ingredient. *Arla Enters Plant-based sector.* Available: https://www.nutraingredients.com/Article/2020/03/05/Arla-enters-plant-based-sector?utm_source=newsletter_daily&utm_medium=email&utm_campaign=06-Mar-2020 [2020-03-13]

Public Health Agency of Sweden. Statistik övervikt och fetma. Available: https://www.folkhalsomyndigheten.se/livsvillkor-levnadsvanor/fysisk-aktivitet-och-matvanor/statistik-overvikt-och-fetma/ [2020-02-04]

RISE (2020). *The foundation for climate-smarter food consumption.* Available: https://www.ri.se/en/our-stories/foundation-climate-smarter-food-consumption [2020-02-03]

Santa Maria (2020). *Alla Recept.* Available: https://www.santamariaworld.com/se/recept/ [2020-02-27]

SCB (2016). *Svenskarna äter ute mer.* Available: https://www.scb.se/hitta-statistik/artiklar/2016/Svenskarna-ater-ute-mer/ [2020-02-06]

SRB Butikservice (2020). *Garant.* Available: https://srbgruppen.se/kundcase/garant/ [2020-01-23]

Sustainable Food Chain (2020). *Vad är en hållbar livsmedelskedja?* Available: https://hallbarlivsmedelskedja.se [2020-02-18]

SVT (2017). *Svenskarna köper allt mer vegetabilisk dryck*. Available: https://www.svt.se/nyheter/inrikes/svenskarna-koper-allt-mer-vegetabilisk-mjolk [2020-03-16]

Swedish Board of Agriculture (2019). *Långsiktiga effekter av torkan 2018.* (Report series 2019:13). Jönköping: Swedish Board of Agriculture https://www2.jordbruksverket.se/download/18.21625ee16a16bf0cc0eed70/1555396324560/ra19_13.pdf

Swedish Board of Agriculture (2020). Variation i utvecklingen av marknaderna för kött, ägg och mejeriprodukter. Available: http://www.jordbruksverket.se/download/18.7e00f39170a44e92651dcca/1583327079626/Kortrapport%20animaliemarknaden_mars2020.pdf [2020-03-13]

Swedish Environmental Protection Agency (2020). *Konsumtionsbaserade växthusgasutsläpp per person och år.* Available: https://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Vaxthusgaser-konsumtionsbaserade-utslapp-per-person/? [2020-02-06]

Swedish Food Agency (2019a). *Nyckelhålet - enkelt att välja nyttigt.* Available: https://www.livsmedelsverket.se/livsmedel-och-innehall/text-pa-forpackning-markning/nyckelhalet [2019-02-28]

Swedish Food Agency (2019b). *The Food Database*. Available: https://www.livsmedelsverket.se/livsmedel-och-innehall/naringsamne/livsmedelsdatabasen/ [2020-02-03]

Swedish Food Agency (2020a). *Energi, kalorier*. Available: https://www.livsmedelsverket.se/livsmedel-och-innehall/naringsamne/energi-kalorier/ [2020-02-04]

Swedish Food Agency (2020b). *Wholegrain - advice*. Available: https://www.livsmedelsverket.se/en/food-habits-health-and-environment/dietary-guidelines/adults/wholegrain/ [2020-02-03]

Swedish Food Agency (2020c). *Protein - hur mycket är lagom?* (Livsmedelsverkets rapportserie 2016). Uppsala: Livsmedelsverket. Available: https://www.livsmedelsverket.se/globalassets/publikationsdatabas/broschyrer/protein---hur-mycket-ar-lagom.pdf [2020-03-12]

Swedish Food Agency (2020d). *Quality Assurance*. Available: https://www.livsmedelsverket.se/en/production-control-and-trade/eurl-foodborne-viruses/about-us/quality-assurance/ [2020-02-03]

The Haga Initiative. *Åsa Domeij: Är det hållbart att använda palmolja?* Available: https://www.hagainitiativet.se/sv/blogg/Åsa-Domeij-Är-det-hållbart-att-använda-palmolja [2020-02-18]

The Swedish Food Federation (2019a). *Så kan Sverige bli världsledande inom hållbar livsmedelsproduktion - Genom kraftfulla och innovativa organiserade FOI-satsningar*. Available: https://www.regeringen.se/4ae287/contentassets/a0eb9c4e65c04da8ac944fb790142460/livsmedelsforetagen.pdf [2020-02-10]

The Swedish Food Federation (2019b). *Hållbarhetsmanifest.* Available: https://www.livsmedelsforetagen.se/app/uploads/2019/05/livsmedelsforetagens-hallbarhetsmanifest-maj-2019.pdf [2020-02-10]

United Nations (2020a). *Sustainable Development Goals.* Available: https://sustainabledevelopment.un.org/?menu=1300 [2020-01-23]

United Nations (2020b). *Sustainable Development Goal 3.* Available: https://sustainabledevelopment.un.org/sdg3 [2020-01-23]

United Nations (2020c). *Sustainable Development Goal 13.* Available: https://sustainabledevelopment.un.org/sdg13 [2020-01-23]

United Nations (2020d). *Sustainable Development Goal 12.* Available: https://sustainabledevelopment.un.org/sdg12 [2020-03-09]

WHO (2018a). *Healthy diet*. Available: https://www.who.int/en/news-room/fact-sheets/detail/healthy-diet [2020-01-23]

WHO (2018b). *Obesity and Overweight*. Available: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [2020-02-03]

World Business Council for Sustainable Development (2008). *Sustainable Consumption: Facts and Trends: From a Business Perspective*. Available: http://docs.wbcsd.org/2008/11/SustainableConsumptionFactsAndTrends.pdf [2020-01-22]

WWF (2020a). *Klimatförändringarna*. Available: https://www.wwf.se/klimat/klimatforandringar/ [2020-02-03]

WWF (2020b). *One Planet Plate*. Available: https://www.wwf.se/mat-och-jordbruk/one-planet-plate/#klimat-och-biologisk-mangfald [2020-02-06]

WWF (2018). *One Planet Plate 2018 – kriterier och bakgrund.* Available: https://www.wwf.se/dokument/one-planet-plate-2018-kriterier-och-bakgrund/ [2020-02-07]

Appendix 1: Food Retail in Sweden

The Swedish food retailer industry is a concentrated market dominated by a few actors, presented in *Table 18*.

Table 18. The major actors in the Swedish Food retailer industry, including their respective market share, form of ownership and private label brands.

Food retailer	Market Share* (percent)	Form of Ownership	Private Label Brands
ICA	51.9	Incorporated	ICA, ICA I Love Eco, ICA Gott Liv, ICA Skona, ICA Selection, ICA Basic, ICA Garden, ICA Cook & Eat, ICA Home (ICA Gruppen AB 2020)
Axfood	17.8	Incorporated	Garant, Eldorado, Såklart, Minstingen, Fixa, Premier and Gastrino (Axfood 2020a)
Coop	16.9	Consumer Cooperative	Änglamark, Coop, Xtra (Coop 2020b)
Bergendahls	7	Incorporated	City Gross, Glitter, EKO, Granit, Duka, Zanzlöza, Hyllinge Cash, Matöppet (Bergendahls 2020)
LIDL	4.7	Incorporated	Svea Lantkött, Enebacken, Dulano (Lidl 2020a), Ocean Sea, Admiral (Lidl 2020b), Gyllda (Lidl 2020c), Ängens, Milbona (Lidl 2020d), Lupilo (Lidl 2020e)
Netto	2.1	Owned by Coop	Go Eko, La Campagna, Premeiur, Asian Kitchen, Rice Market, Engholm, Goda Bordet, Bygdens, Lovena, Savin, Shine (Netto 2020)

*DLF 2019

In the table, each of the major food retailers in Sweden is displayed including respectively market share, definition of ownership and private label brands. ICA is the leading food retailer in Sweden with 1932 own and retailer-owned stores including pharmacies (ICA Gruppen AB 2020). ICA has several private label brands (ICA 2020c). Axfood is the second largest food retailer that owns more than 300 food stores, e-commerce and additionally 900 co-stores (2018a). The third largest Swedish food retailer is Coop with more than 650 food stores owned by 3.5 million consumers (Coop 2020a). Similar to the other major food retailers of Sweden, they have their own private label brands (Coop 2020b). Additionally, Coop owns Netto which has its own private label brands (Netto 2020). Bergendahls owns a smaller part of the market share and entails eight private label brands (Bergendahls 2020). LIDL owns 189 food stores (Lidl 2020f) as well as multiple private labels brands.

Appendix 2: Food Climate Mitigation Goals in Axfood's Sustainability Program

(Axfood 2018c, p3-5)

- Axfood's food stores shall actively work to raise good sustainability choices
- The customers shall successfully receive improved information on which articles within fruits and greens that are transported by plain, mainly through improved package information
- Axfood's co-store Willys and Axfood's restaurant wholesaler shall work to change the assortment through conducting an overview of articles on fruits and greens transported by plane
- Axfood shall increase sales of frozen foods
- Axfood's restaurant wholesaler shall increase their sales of Swedish meat with 25 percent until 2020 (base year 2018)
- The share of sustainable certified foods (the sum of all certifications that improve environmental and/or social sustainability) shall reach at least 25 percent until 2025 and 30 percent until 2030
- Axfood's co-store Hemköp shall increase their share of sales of ecologically produced meat to 15 percent by 2020

Appendix 3: Categories Protein Sources

Table 19. Categories of protein sources commonly used as main protein sources in food dishes that are sold at Hemköp and Willys

Main category	Subcategory
Meat	Mixed minced meat based on beef and pig (50/50)
	Minced meat (beef)
	Minced meat (pork)
	Minced meat (chicken)
	Beef (top side, stew beef, entrecote, prime rib, fillet, minute steak, stewing steak, loin)
	Miscellaneous beef (chin, marrowbone, breast, oxtail, blood, beef liver, kidney tap)
	Veal (escalope, breast, stew beef, entrecote, minced, fillet, primed rib)
	Pork (cutlet, loin, ribs, shoulder, comb legs, stewing steak schnitzel, salted shoulder)
	Smoked pork and bacon
	Miscellaneous pork (feet, lard, marrowbone, knuckle, marrowbone, lard, chin)
	Wild meat from deer, moose, reindeer, duck, wild boar, pheasant and kangaroo (entrecote, stew beef, steak, fillet, mince, loin, shoulder, steak)
	Lamb (racks, steak, breast, fillet, neck, mince, knuckle, cutlet)
	Ready to cook products based on chicken, beef and pig (breaded schnitzel, ribs, kebab, pulled, buffalo wings, skewer, taco-spiced)
	Organ meats from pig, beef and lamb (tongue, heart, liver, kidney, feet)
Chicken	Breaded chicken (nuggets, fries, schnitzel, sticks, cordon bleu)
	Chicken fillet (breast fillet, inner fillet, stripes, thigh fillet, stewing steak, spiced)
	Chicken, whole (uncooked, warm, cold, whole, half)
	Chicken w/ bones (thighs, legs, wings)
	Chicken mince
	Turkey (mince, fillet, leg)
	Miscellaneous poultry based on duck and chicken (liver, heart, stomach)
Sausage	Grill sausage and spicy sausage based on meat from pig, chicken, lamb, moose, turkey and beef (bratwurst cheese sausage, cabanoss, chorizo, salsiccia)
	Hotdogs and Weiner sausage

	Coarse sausage (Falukorv, isterband, pölsa, pork sausage, meat sausage)
	Prince sausage
Hamburger	Based on meat from beef, chicken and pig
Cured meat	Meatballs and meat patties based on meat from pig, chicken, turkey and beef
	Black pudding
Fish	Salmon (uncooked, cured, seared, burger, pink salmon, rainbow trout, cutlet, fillet, smoked)
	Cod (fillet, cutlet)
	Products of other fishes: Alaska Pollock, Pangasius, Baltic Herring, Flounder, Mackerel, Plaice, Saithe, Hake, Blue Biting, Haddock, Anchovy, Octopus, Perch, Brill, Carp (fillet, smoked, cured, skewer, cutlet)
	Breaded fish based on cod and salmon (fish sticks, nuggets, friable baked)
	Herring (potted, cured, fillet)
Shellfish	Shrimps (peeled, unpeeled)
	Crayfish (peeled, unpeeled, uncooked, cooked)
Vegetarian	Falafel, nuggets, stripes, schnitzel, mince, bacon
	Sausage
	Hamburger, patties and balls based on quorn, soy, hemp and peas
	Tofu and tempeh (flavored, unflavored, fried, smoked, graved)
	Dried beans and lentils (canned, dried)
Cheese	Halloumi

Table 20. Further divided categories of protein sources commonly used as main protein sources in food dishes that are sold at Hemköp and Willys

Main category	**Subcategory**
Pork	Loin
	Cutlet
	Fillet
	Other (ribs, shoulder, comb legs, stewing steak schnitzel, salted shoulder)
Smoked pork & bacon	Smoked pork
	Bacon
Chicken Fillet	Breast (including inner fillet)
	Other (stripes, thigh fillet, stewing steak, spiced)
Chicken w bones	Chicken legs
	Other (thighs, wings)
Chicken, whole	Grilled
	Uncooked
Coarse sausage	Falu sausage
	Other (isterband, pölsa, pork sausage, meat sausage)
Salmon	Salmon Fillet (uncooked)
	Other (Alaska Pollock, Pangasius, Baltic Herring, Flounder, Mackerel, Plaice, Saithe, Hake, Blue Biting, Haddock, Anchovy, Octopus, Perch, Brill, Carp (fillet, smoked, cured, skewer, cutlet)
Beef	Prime rib
	Minute steak
	Entrecote
	Other (top side, stew beef, fillet, minute steak, stewing steak, loin)

Appendix 4: Recipe ingredients and products

Table 21. Ingredients in respectively dish, in the original and altered recipe

Dish (1 portion)	Original recipe	Altered recipe
Chicken Tikka masala with rice	125 g chicken fillet 6,5 g rapeseed oil 6 g Tikka masala spice mix 50 g creme fraiche (34 % fat) 10 g fresh coriander 60 g uncooked rice	125 g Garant tempeh 20 g Garant rapeseed oil 6 g Tikka masala spice mix 50 g Garant creme fraiche (15 % fat) 10 g Garant fresh coriander 80 g Garant uncooked whole grain couscous 65 g Garant frozen spinach
Chicken wok with noodles	150 g chicken fillet 6,5 g rapeseed oil 125 g wok mix vegetables (water chestnut, broccoli, corn, carrot and bamboo shoots) 8,5 g sweet chili sauce 28 g soy sauce 17 g roasted and salted peanuts 10 g fresh coriander 60 g uncooked rice noodles	150 g Garant frozen soybeans 6,5 g Garant rapeseed oil 125 g Garant wok mix 8,5 g Garant sweet chili sauce 28 g soy sauce 17 g unsalted peanuts 10 g Garant fresh coriander 60 g uncooked whole grain noodles
Tacos (minced beef)	100 g minced beef 10 g taco spice mix 3,5 g butter 123 g taco tortillas 58 g taco salsa 30 g iceberg lettuce 50 g tomatoes 50 g creme fraiche (34 %) 60 g avocado	120 g Garant soy mince 7 g Garant taco spice mix 3,5 g Garant rapeseed oil 126 g Garant whole grain taco tortillas 58 g Garant taco salsa 40 g iceberg lettuce 70 g tomatoes 50 g creme fraiche (5%) 50 g Garant corn 20 g red onion
Spaghetti Bolognese (minced beef)	125 g minced beef 6,5 g rapeseed oil 25 g yellow onion 50 g carrots 11,25 g tomato purée 125 g crushed tomatoes 1,25 g meat stock (cube) 8,5 g soy sauce 70 g uncooked spaghetti	125 g Garant soy mince 25 g yellow onion 2,5 g garlic 50 g Garant carrots 11,25 g Garant tomato purée 125 g Garant crushed tomatoes 1,25 g Garant meat stock (cube) 8,5 g soy sauce 70 g Garant uncooked whole grain spaghetti 75 g Garant frozen broccoli
Chicken legs with curry sauce and rice	125 g chicken leg 3,25 g rapeseed oil 3,5 g soy sauce 7 g butter 4 g yellow curry (spice mix) 51,5 g milk (3 % fat) 25 g cream (40 % fat) 1,25 g chicken stock (cube) 60 g uncooked rice	125 g Garant tempeh 15 g Garant rapeseed oil 3,25 g soy sauce 7 g Garant margarine 4 g Garant yellow curry (spice mix) 51,5 g Garant milk (0,5 % fat) 25 g Garant oat cream (13 % fat) 1,25 g Garant chicken stock (cube) 80 g Garant uncooked whole grain couscous 75 g Garant frozen cauliflower
Grilled sausages with	120 g sausage (75 % pork,	120 g Garant vegetarian chorizo sausage

cucumber mayonnaise	potato meal, spices) 54 g hot dog bread 40 g cucumber mayonnaise	35 g Garant mashed potatoes 18 g Garant ketchup 150 g Garant cabbage mix 22 g rye bread 100 % whole grain 10 g margarine 15 vinaigrette
Lasagna 50 % minced pork 50 % minced beef	125 g minced pork and beef 3,2 g rapeseed oil 30 g yellow onion 2,5 g garlic 18 g tomato purée 2 g dried thyme 2 g dried rosemary 125 g crushed tomatoes 1,25 g meat stock (cube) 70 g uncooked lasagna plates 21,4 g butter 13,5 g flour 250 g milk (3 % fat) 21 g parmesan cheese	125 g Garant soy mince 3,2 g Garant rapeseed oil 30 g yellow onion 2,5 g garlic 18 g tomato purée 2 g Garant dried thyme 2 g Garant dried rosemary 125 g crushed tomatoes 1,25 g Garant meat stock (cube) 70 g Garant uncooked whole grain lasagna plates 15 g Garant flour 125 g Garant oat beverage 10 g Garant margarine 37,5 g Garant oat base (13 % fat) 22 g Garant Cabbage Mix (carrot, cabbage) 5 g vinaigrette
Sausage Stroganoff	150 g Falu sausage 7 g butter 30 g yellow onion 11,25 g tomato purée 1,25 g Dijon mustard 75 g cream (40 % fat) 60 g uncooked rice	140 g Garant vegetarian chorizo mild 7 g Garant rapeseed oil 30 g yellow onion 125 g Garant crushed tomatoes 11,25 g Garant tomato purée 1,25 g Dijon mustard 25 g mini fraiche 80 g Garant uncooked whole grain couscous 75 g Garant frozen haricot verts
Marinated pork fillet with pre-cooked potato wedges and bearnaise	125 g pork fillet 10,5 g liquid honey 26 g rapeseed oil 1 g garlic 2,5 g red chili pepper 200 g pre-cooked potato wedges 70 g bearnaise sauce	125 g Garant soy mince 30 g yellow onion 7 g dried spices 200 g Garant tuber mix (carrot, parsnip, red onion, celeriac, Jerusalem artichoke) 7,5 g Garant rapeseed oil 70 g Garant Tzatziki 22 g rye bread 100% whole grain 10 g margarine
Salmon- and shrimps with lemon- and dill sauce and boiled potatoes	125 g salmon fillet 50 g shrimps (peeled) 5 g Dijon mustard 10 g lemon juice 35 g leek 75 g cream (40 % fat) 50 g creme fraiche (34 % fat) 1,25 g fish stock 10 g fresh dill 175 g boiled potatoes	125 g Garant blue clams 5 g Dijon mustard 10 g Garant lemon juice 35 g leek 75 g Garant oat creme 50 g Garant light fraiche (15% fat) 1,25 g fish stock (cube) 10 g Garant fresh dill 120 g Garant frozen peas 175 g Garant potatoes 22 g rye bread 100% whole grain 10 g margarine

Table 22. Ingredients and nutritional content of specific food products by Garant used in the altered recipes

Food product	Ingredients	Nutritional values
Oat base (Matbas havre)	Water, OATS* 9%, rapeseed oil*, palm oil*, emulsifier (rapeseed lecitin*), stabilizer (E415), sea salt. *Organic ingredient.	*(per 100 ml)* Energy 602 kJ/ 146 kcal Fat 13 g saturated fat 2.9 g Carbohydrates 5.8 g sugars 3.6 g Fiber 0.9 g Protein 0.9 g Salt 0.1 g
Ovo vegetarian chorizo hot (Vegetarian chorizo het)	Rehydrated field bean protein 60%, sunflower oil, mushrooms 12%, EGG WHITE PROTEIN, natural aroma, spices (paprika, white pepper, coriander, garlic, cayenne pepper, cumin, nutmeg, ginger, mace, chili pepper), salt, corn meal, acid (citric acid), oat fiber, paprika extract, pea protein.	*(per 100 g)* Energy 854 kJ/ 206 kcal Fat 16 g saturated fat 2 g Carbohydrates 1.2 g sugars 1 g Fiber 0.5 g Protein 14 g Salt 1.6 g
Ovo vegetarian chorizo mild (Vegetarian chorizo mild)	Rehydrated field bean protein 60%, sunflower oil, mushrooms 12%, EGG WHITE PROTEIN, natural aroma, spices (paprika, white pepper, coriander, garlic, cayenne pepper, cumin, nutmeg, ginger, mace, chili pepper), salt, corn meal, acid (citric acid), oat fiber, pea protein, paprika extract.	*(per 100 g)* Energy 882 kJ/ 213 kcal Fat 17 g saturated fat 2.1 g Carbohydrates 1.2 g sugars 1 g Fiber 0.4 g Protein 14 g Salt 1.6 g
Tempeh	Chickpeas (31 %), green peas (31 %), water, starting culture (rhizopus oligosporus), vinegar.	*(per 100 g)* Energy 681 kJ/ 163 kcal Fat 2.3 g saturated fat 0.3 g Carbohydrates 20 g sugars 3.4 g Protein 12 g Salt 0.06 g
Moldable soy mince (Formbar vegofärs)	Water, soy protein 23%, rapeseed oil, stabilizer (E461), salt, onion powder, tomato powder, caramelized sugar, garlic powder, black pepper.	*(per 100 g)* Energy 697 kJ/ 168 kcal Fat 9.9 g saturated fat 1.1 g Carbohydrates 1.2 g sugars less than 0.5 g Fiber 5.1 g Protein 16 g Salt 0.8 g

Appendix 5: Climate data & calculations

The dishes were calculated using limited climate data from RISE acquired through Axfood. Each ingredient was matched with its respective climate number and multiplied with the weight for a meal specific climate number. All ingredients climate numbers were added up and the dish was given the final climate number. *Table 23* presents an example of how the dishes were calculated, in this case Tacos with minced beef.

Table 23. Calculation example of the Tacos (minced beef) dish

Ingredients	**Weight (kg)**	**Climate number (kg CO_2e / kg ingredient)**	**Specific climate number for ingredient in dish**
Minced Beef	0.1	28	0.1 kg * 28 CO_2e / kg = 2.8 CO_2e
Butter	0.0035	8	0.0035 kg * 8 CO_2e / kg = 0.028 CO_2e
Spice Mix	0.01	2.2	0.01 kg * 2.2 CO_2e / kg = 0.022 CO_2e
Tortillas	0.126	0.8	0.126 kg * 0.8 CO_2e / kg = 0.1008 CO_2e
Taco Salsa	0.058	0.8	0.058 kg * 0.8 CO_2e / kg = 0.0464 CO_2e
Shredded Iceberg Lettuce	0.03	0.5	0.03 kg * 0.5 CO_2e / kg = 0.015 CO_2e
Tomatoes	0.05	0.9	0.05 kg * 0.9 CO_2e / kg = 0.045 CO_2e
Crème Fraiche (34%)	0.05	3	0.05 kg * 3 CO_2e / kg = 0.15 CO_2e
Avocado	0.06	0.8	0.06 kg * 0.8 CO_2e / kg = 0.048 CO_2e
SUM			**3.3 CO_2e**