

Ambitions for Sustainable Nutrition in the Private Sector

Unpacking Incentives, Limitations and Potentials

Mia Bonnevier Ydholm and Laura Heiduk

Master Thesis Series in Environmental Studies and Sustainability Science,
No 2021:033

A thesis submitted in partial fulfillment of the requirements of Lund University
International Master's Programme in Environmental Studies and Sustainability Science
(30hp/credits)



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Submitted May 11, 2021

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Abstract

The food system accounts for a significant portion of environmental degradation, while it is at the same time to a large extent producing food that is deteriorating to human health. The private sector plays an essential role in contributing to the sustainability of the system. Based on a systematic literature review, we conceptualise the notion of sustainable nutrition (SN), which highlights the importance of integrating sustainability and health dimensions. To understand the challenges and opportunities to operationalise SN in the private sector, we conducted semi-structured interviews with employees at a global food company. While opportunities include improving production and shifting consumer demand, the main challenges encompass the complexity of globalised supply chains and profitability. Applying systems thinking, we argue that SN cannot be fully achieved within the current profit-driven business paradigm. Further transdisciplinary research with the private sector is needed to help close knowledge gaps and enhance structural shifts.

Keywords: sustainable nutrition; human health; environment; food business; systems thinking; food system

Word count: 11 816

Acknowledgements

First and foremost, we are sincerely grateful that throughout this process, we had each other. Thank you, Laura, and thank you, Mia. We would also like to express our deepest gratitude to our supervisor, Maryam Nastar. It is very much a cliché, but it is also very much true in this case: we could not have done this without you. Or at least, the outcome would have been very different.

We would also like to acknowledge and thank our wonderful mentor from the collaborating company. Your positive encouragement and constructive feedback have been invaluable throughout this process. Furthermore, thank you to all of those who participated in interviews with us.

Thank you to the thesis fairy that we were praying to every Friday.

Last but not least, thank you, Billie (picture 1) for your moral support and endless love.



Picture 1. Billie

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List of abbreviations

FAO	Food and Agriculture Organisation
GHGe	Greenhouse gas emissions
LCAs	Life cycle assessments
SDGs	Sustainable development goals
SN	Sustainable nutrition
WBCSD	World Business Council for Sustainable Development

1 Introduction

1.1 The combined environmental and health crisis

Global dietary patterns and food production have changed dramatically over the past half-century, with intensified production contributing to positive advancements such as reduced hunger in certain parts of the world and increased life expectancy. However, such advancements have at the same time come with several severe costs both to humans and the environment (Willett et al., 2019). Globally, health benefits have been offset by a transition from a relatively low-energy-dense diet (Margetts, 2007) to unhealthy diets, characterised by a high intake of calorie-dense, heavily processed, and animal-based foods. Inevitably, the burden of non-communicable diseases, obesity, and micronutrient deficiencies has increased. Over 820 million people remain undernourished globally, while at the same time 2.1 billion adults are overweight or obese (Clark et al., 2019; Willett et al., 2019).

Simultaneously, the environment has become increasingly degraded by intensified food production practices (Willett et al., 2019), including mono-culture and overapplication of pesticides. The current food system is a key driver of environmental degradation, biodiversity depletion, and unsustainable use of resources (Allen et al., 2014; Fresán et al., 2020; Nelson et al., 2016; Willett et al., 2019). It is responsible for around 25% of the total greenhouse gas emissions (GHGe) from human activities, as well as a key contributor to land and water use/change, acidification, and eutrophication (Fresán et al., 2020; Nelson et al., 2016). It is becoming increasingly clear that the degradation and depletion caused by unsustainable food production practices, in turn, affect the food system itself (Allen et al., 2014), and if it continues to operate in the way that is currently the case, irreversible effects are expected on ecosystems (Johnston et al., 2014). Current global food production threatens local ecosystems (Willett et al., 2019), and environmental resources “will be strained and may be lost to future generations if energy, water, and land are not managed and conserved responsibly” (Nelson et al., 2016, p. 1006). We are facing an escalating challenge with on the one hand feeding a growing population with food that meets nutritional needs, while on the other hand ensuring the sustainability of the production of such foods.

1.2 Sustainable Nutrition and the private sector

The evidence demonstrates that a global transformation to healthy diets¹ from a sustainable food system is required in order to improve the well-being of humans and the planet. In order to

¹ The understanding of ‘healthy diets’ is elaborated upon in section 2.1 and in the interpretation of SN in 2.3.

recommend diets that are healthier both for people and the environment, the concept of sustainable nutrition (SN) was developed some 40 years ago (Fanzo, 2019; Hachem et al., 2020; Jones et al., 2016; Dernini et al., 2013; Springmann et al., 2018b). It points to the importance of a holistic approach to the combined health/nutrition and environmental crisis. The concept is further elaborated upon in section 2.

In this context, the private food sector plays a critical role and carries a great deal of responsibility, as it accounts for almost all of the food produced globally (WBCSD, 2020). Many global food companies currently exploit the physical environment by producing energy-dense and cheap food for countries that are already oversupplied, and where food is abundant (Margetts, 2007). While consumers are driving the demand, food companies play an increasingly important role in shaping the food environments which in turn influence consumer choices (Clark et al., 2020; Frison & Clément, 2020). Governmental regulations, such as subsidies, also have a lot of power in shaping the food environment and need to change to facilitate the transition towards sustainable food systems (Laverack, 2018). Yet, companies have considerable agency over the production mode of the food that they are supplying consumers with (Johnston et al., 2014; Stoll-Kleemann & O'Riordan, 2015; Willett et al., 2019). This suggests a great commitment to SN by the private sector if the concept is to be achieved (Johnston et al., 2014).

1.3 Aim and Research questions

This thesis focuses on the role of food companies and aims to increase knowledge and understanding about the concept of SN. Moreover, the goal is to identify barriers to and opportunities for adopting the concept by the private sector. To achieve this, we address the following research questions (RQ):

1. How is the concept of SN framed (a) in the literature and (b) by a food company?
2. What are the challenges and opportunities for operationalisation of the concept from a food company perspective?
3. How should the concept be approached and operationalised from a sustainability science perspective?

1.4 Outline of thesis

Section 2 introduces the concept of SN and points to related challenges. It furthermore provides our own reflections of the concept. Section 3 outlines the theoretical and analytical frameworks that are applied in the discussion section of this thesis. Following this, section 4 outlines the research strategy and design as well as the data collection and analysis process. Section 5 provides the results, while

section 6 discusses these in relation to the theoretical and analytical frameworks. Lastly, concluding remarks with implications for further research are outlined.

2 Sustainable nutrition: What is it?

This section deals with the current literature on the concept of SN (RQ 1a). After presenting definitions of the concept and the different dimensions it entails, the challenges in framing are described. Finally, our interpretation of SN is presented, on which this thesis builds.

2.1 Various framings of the concept

The term SN originates in the 1980s and was developed to recommend healthier diets for both consumers and the environment (Dernini et al., 2013; Hachem et al., 2020; Johnston et al., 2014; Jones et al., 2016; Springmann et al., 2018a). According to Fanzo (2019), the term has only recently been revived in the context of sustainable development. The definition most often referred to internationally is proposed by the Food and Agriculture Organisation (FAO) (Aleksandrowicz et al., 2016; Auestad & Fulgoni III, 2015; Johnston et al., 2014; Macdiarmid et al., 2012). Yet, this does not directly define SN, but ‘sustainable diets’. There is no official definition for SN and the two terms are used parallelly and interchangeably in the current academic literature. This is why the FAO definition of sustainable diets is used as a starting point in this thesis, in order to explicitly be able to put forth an interpretation of SN specifically. Similarly to the use of the terms in the literature, we are using both in this thesis, and understand SN as being part of sustainable diets. The FAO definition of sustainable diets is as follows:

Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy, while optimising natural and human resources (Burlingame, 2012, p.7).

In the current literature, there are various integrative approaches to the concept of SN, combining the five dimensions of environment, economy, society, culture, and health (Figure 1). For instance, Willett et al. (2019) understand sustainable diets as those that are healthy and come from sustainable food systems. The author puts emphasis on plant-based diets, while von Koerber et al. (2017) discuss

‘wholesome nutrition’ as a key sustainable diet, which is mainly plant-based and minimally processed. In the following paragraphs, the dimensions of SN are presented.

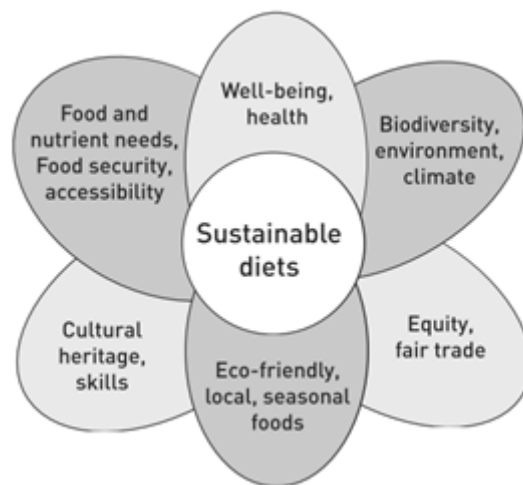


Figure 1. Schematic illustration of sustainable diets. The figure specifies important areas that the concept of sustainable diets, as understood by the FAO, touches upon. Adopted from Lairon (2012, p. 34).

In the literature discussing SN and sustainable diets, the *environmental dimension* refers to the production of food and its impact on biodiversity, environmental resources, and climate (Allen et al., 2014; Fresán et al., 2020; Nelson et al., 2016; Willett et al., 2019). The food system is characterised by several feedback mechanisms. For instance, the food system and climate change have a reciprocal relationship since emissions from food system operations lead to climate change, while climate change affects the food system through its impacts on yields of crops and livestock products through extreme weather events (Jarmul et al., 2020). It is widely known that especially the production of ruminant meat contributes considerably to GHGe (Clark et al., 2020).

In terms of the *economic aspects*, the concept of SN regards the affordability of a healthy and sustainable diet. The literature is somewhat divided – some scholars argue that a sustainable diet can be achieved without necessarily upping costs for consumers (Nelson et al., 2016; Nemecek et al., 2016), while some report higher prices related to such diets (Fresán et al., 2020; Gazan et al., 2018; Hachem et al., 2020; Perignon et al., 2017). Moreover, Willett et al. (2019) stress the importance of reflecting the ‘true costs’ of food in the actual price of it (i.e. having prices fully reflect environmental and human health costs of the production and consumption). As this means that food prices might increase, the authors suggest that in order to protect vulnerable groups, safety nets or social protection should be established. von Koerber et al. (2017) support this idea by presenting the higher prices of sustainable products and the lack of willingness to pay more as the major challenges concerning sustainable behaviour while linking this to the hidden true costs of non-sustainable production.

As food has strong socio-cultural meanings (Johnston et al., 2014), *socio-cultural aspects* of SN on the consumer side of the food system concern the cultural and social acceptance as well as the appropriateness of food and diets and related transitions (Gustafson et al., 2016; Kim et al., 2020; Steenson & Buttriss, 2020). Regarding the production side, socio-cultural aspects concern food security issues and the impact of a diet on the livelihoods of producers across the whole supply chain (Meybeck & Gitz, 2017; Rööös et al., 2017). Several scholars highlight the need to take socio-cultural factors on the local level into account to a greater extent (González-García et al., 2018; Jarmul et al., 2020; Nemecek et al., 2016).

The *nutrition and health aspects* of SN deal with the fact that human health is affected by the food system in various ways (Frison & Clément, 2020). Nutritionally adequate diets² are essential for development and play an important role in lowering disease risk, including both communicable and noncommunicable diseases (Auestad & Fulgoni III, 2015). On the one hand, human health can be affected as a direct result of dietary patterns. As Springmann et al. (2018b) report, “diets low in fruits, vegetables, nuts, and whole grains and high in red and processed meat are responsible for the greatest health burden worldwide” (p. 452). On the other hand, health can be affected by production practices. This concerns e.g. hazards at the occupational level by water, air, and soil contamination from production and processing but also impacts on consumers due to unsafe, contaminated, or altered foods (Frison & Clément, 2020).

In conclusion, Macdiarmid et al. (2012) stress that there is no single global sustainable diet but rather examples of optimised diets. Still, it is widely agreed that there is a link between SN, sustainable diets, and the increased consumption of plant-based foods, while the intake of foods of animal origin needs to be reduced (Fresán et al., 2020; González-García et al., 2018; Nelson et al., 2016; Willett et al., 2019). Scholars furthermore argue for the importance of a nutritionally high-quality, minimally processed plant-based diet, that is furthermore low in sugar and saturated fats, and rich in complex carbohydrates and dietary fibre (including e.g. whole grains, legumes, and vegetables) to achieve health benefits (Macdiarmid et al., 2012; von Koerber et al., 2017; Willett et al., 2019). However, it is emphasised that SN and sustainable diets must be defined within their local and cultural contexts (Hachem et al., 2020).

² Nutritionally adequate diets are understood as those that contribute to the achievement or maintenance of good health, i.e. bodily processes and functions working at their best (Gustafson et al., 2016).

2.2 Challenges to framing the concept

Current research on SN aims at putting nutrition and health at the core of sustainable development (Allen et al., 2014). According to Dernini et al. (2017), who discuss sustainable diets with a large emphasis on nutrition, "there are still many challenges in understanding the full complexity of sustainable diets, their assessments and determinants" (p. 1323). Important to note is that metrics and assessments chosen by researchers and decision-makers "reflect underlying values and priorities and ultimately drive policy processes" (Jones et al., 2016, p. 642). Moreover, there are several methodological challenges as there is a need to combine a nutrition perspective and broader sustainability perspective with all its dimensions. Meybeck and Gitz (2017) describe the challenge of assessments as "get[ting] lost in scopes, scales and data" (p. 6). In this context, Jones et al. (2016) emphasise that the questions of which components should be included and who decides for whom, and with what benefits must be considered. Especially in the light of the fact that the concepts of sustainability and sustainable development are already contested in the sense of disagreements on what is to be sustained (Faran, 2010).

Another challenge concerns the globalised nature of food systems themselves. They have become more complex with multiple actors involved (Fanzo, 2019), making successful cooperation towards greater sustainability more difficult to achieve. There is still no clear understanding of interactions between food systems, production activities and outputs, ecological processes, and human nutrition, which leads to the lack of evidence of benefits of alternative systems, like agrobiodiversity on nutritional outcomes from food systems, and prevents these to become a key consideration in food and nutrition policies (Allen et al., 2014). On that behalf, Johnston et al. (2014) stress the complex interplays between industry, food systems, public health, environment, and consumer behaviour. In addition, there are competing interests among different stakeholders, such as governments, the private sector, and civil society, that challenge efforts towards greater sustainability.

Moreover, many studies and business implementations rely on life cycle assessments (LCAs), which have enhanced many sustainability efforts and currently serve as a base for sustainability assessments. At the same time and in the context of SN, critics stress the limitations and uncertainties of LCAs, as well as their sometimes narrow focus on GHGe. This leads to the neglecting of other ecosystem impacts (Heller et al., 2013; Jarmul et al., 2020; Jones et al., 2016; Macdiarmid et al., 2012). In footprint studies, post-farmgate activities (processing, transportation, retail, consumption) are usually not considered. This is justified by the fact that the majority of GHGe originate from production, but still there are some that can be attributed to later stages (Kim et al., 2020). Nemecek et al. (2016) emphasise the importance of considering these as well when these later

stages also contribute to the overall impact of food and lead to differences between specific food groups being compared. For instance, during consumption, there might be significant food losses which are not accounted for in studies (González-García et al., 2018).

On an aggregate level, research shows that there is no dilemma between sustainable and healthy diets. Springmann (2019) reports that healthy diets generally have a lower environmental impact, and diets with lower environmental impacts are generally healthy. While not all animal-based foods have a negative impact on health when consumed in moderation, they still contribute significantly more to environmental impacts when compared to plant-based food. Furthermore, the latter provide more positive health benefits (Springmann, 2019). Having said this, cross-dimensional aspects, e.g. trade-offs between health and environment, can be easily overlooked. Clark et al. (2020) refer to these possible trade-offs as 'win-lose' (beneficial to health but with high environmental impacts) or 'lose-win' (detrimental to health but with low environmental impacts), referring to fish as an example of a possible 'win-lose', as it is associated with improved health but relatively high environmental impacts, depending on how it is produced. This trade-off narrative is discussed by Wood et al. (2019) and Aleksandrowicz et al. (2016) too, who recognise that a food might be beneficial from one environmental aspect while having a negative impact on other sustainability aspects.

2.3 A multifaceted understanding

The integrated perspective across all five dimensions makes the concept of SN extremely complex and difficult to operationalise (Johnston et al., 2014; Jones et al., 2016), yet necessary for tackling current sustainability challenges of the food system. It requires a shift in thinking about diets from a perspective that looks solely at nutrient adequacy and health dimensions to a conceptualisation that incorporates environmental sustainability, affordability as well as cultural acceptability (Johnston et al., 2014).

Gustafson (2017) discusses SN security to ensure a "satisfactory nutritional status for the world's peoples over the long term" (pp. 45-46). SN security can be understood as a merging of food and nutrition security, i.e. ensuring the availability, accessibility, and cultural acceptability of nutritionally adequate food, while also taking environmental sustainability into account (Gustafson, 2017). He and colleagues further provide a novel methodology to assess SN security and include many important indicators that are sometimes lacking in other methodologies (see Figure 2) (Gustafson et al., 2016). The methodology is directed towards SN *security* specifically, yet, we identify it as helpful when trying to interpret the concept of SN, due to its comprehensive nature. In the background research for this thesis, we found that the socio-cultural dimension is often missing from the SN debate, while it is

repeatedly recognised as an important factor to take into account in order to achieve SN. Therefore, Gustafson et al.'s (2016) methodology, which includes this perspective, is all the more appropriate.

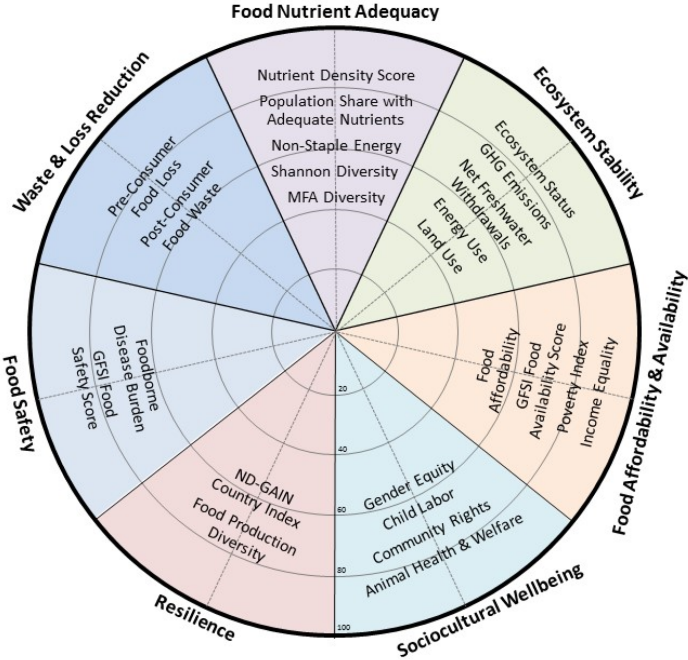


Figure 2. The food system metrics. In this figure, the food system metrics are displayed outside the circle, while their component indicators are displayed within it. A full description of the indicators can be found in Appendix C. Adopted from Gustafson et al. (2016).

As illustrated in figure 2, the methodology includes seven food system metrics. The ‘food nutrient adequacy’ metric refers to the availability of nutritious³ food to consumers as well as the overconsumption of certain food nutrients. The ‘ecosystem stability’ metric is concerned with the impacts of food systems on the environment and thus, covers the environmental sustainability of nutrition, whereas the third metric, namely ‘food affordability and availability’, deals with the socioeconomic dimensions that influence the capacity of consumers to make food choices in the first place. The next metric is ‘sociocultural wellbeing’. As an essential criterion for sustainable development, its indicators cover important societal issues across supply chains. The fifth metric ‘resilience’ deals with the capacities of communities to adapt and recover from disasters resulting from climate change, such as droughts and floods, that impact food supply as well as global food prices. Another metric called ‘food safety’ stresses the issue of contaminated foods to human health. Lastly, ‘waste and loss reduction’ refers to pre- and post-consumer waste (i.e. from production or consumption) (Gustafson et al., 2016).

³ ‘Nutritious’ and ‘healthy’ are used interchangeably in this thesis

Hallström (2015) describes SN as a reflection of sustainable diets and with an additional emphasis on health effects and the nutritional quality of diets and food. Similar to this interpretation, we define the concept as reflecting sustainable diets as defined by the FAO, but with an additional emphasis on human health effects of the production and consumption, as well as a larger emphasis on the importance of local and socio-cultural context considerations, recognising that there is no one global solution to the sustainability of food systems due to the location-dependent ecological and socio-cultural impacts. Thus, we interpret SN as mainly high-quality⁴ plant-based and minimally processed, while meeting nutritional needs⁵. SN can only be achieved if available and affordable for the global population, and deriving from sustainable food systems that conserve ecosystems and respect local, social, and cultural considerations to a vast extent.

3 Systems thinking

This section gives an overview of the theoretical and analytical frameworks and concepts used in this thesis. First, systems thinking and related concepts with their relevance to SN are introduced. Then, the food system, based on the Environmental Nutrition Model (ENM), is described.

3.1 Stocks, flows, and feedback loops

Systems thinking allows for a broad understanding of complex challenges with their many inherent interdependencies and interconnections. With its interdisciplinary and non-linear nature, systems thinking provides a possibility to identify the root causes and effects of complex issues, and explore opportunities (Haraldsson, 2000; Meadows, 2008b). While SN is very much linked to the food system as it relates to the sustainability of food production and consumption, systems thinking enhances the understanding of SN itself as it makes visible the interconnections within the components of the system and helps identify leverage points for action to enable the achievement of SN.

In systems thinking, any set of things that are interconnected and “produce their own pattern of behavior over time” can be understood as a system (Meadows, 2008b, p. 2). External forces might affect the system, but responses to such forces are characteristic of the system itself. Within a system, the stock (an accumulation, store, quantity of information or material) is considered the foundational element, and such stocks change over time due to in- and outflows into them (e.g. failures and successes or deaths and births) (Meadows, 2008a). When changes in a stock affect the flows that go

⁴ High-quality refers to on the one hand a high level of nutrient richness and diversity in the diet, and on the other hand the alignment to the nutritional dietary guidelines (Gustafson et al., 2016; González-García et al., 2018; Heller et al., 2013).

⁵ In this thesis, we refer to ‘meeting nutritional needs’ on a general level, while recognising that on an individual level, such needs vary.

in or out of that same stock, a feedback loop is created. Such feedback loops are considered the “basic operating unit of a system” (Meadows, 2008b, p. 5) and are either balancing or reinforcing. Balancing feedback loops stabilise or balance the stock level while reinforcing loops amplify and reinforce it. It is the feedback loop concept that “opens up the idea that a system can cause its own behavior” (Meadows, 2008a, p. 34).

Systems thinking sheds light on the important interdependencies that are present in the food system across supply chains. In the food system’s subsystems (e.g. consumption practices or farm practices), any changes that occur in one sub-system affect and create feedback loops in other subsystems in a way that either constrains or enables the desired or needed change (Darnhofer, 2014). Such feedback is often delayed or presented at a different spatial scale, which means that the possible effects on ecosystems and human health might only present themselves at a later or different point, when essential functions of a system might already be impeded (Eakin et al., 2017; Meadows, 2008a).

3.2 The (sustainable) food system

The concept of SN includes both food production and consumption and is being discussed as a critical part of the food system (Donini et al., 2016). Our interpretation of the food system is based on the Environmental Nutrition Model (ENM) by Sabaté (2019), as it includes the physical and social dimensions of the food system and its consequences on the biosphere while integrating human health interactions (see Figure 3). We utilise the model as a conceptual framework to identify sustainable and healthy foods, as well as to identify indicators that are needed to transit to new norms (Sabaté et al., 2016).

The ENM puts emphasis on four domains, namely (1) resource inputs, (2) drivers of demand, (3) food outputs and, (4) waste emissions, that are interacting with each other in the physical (natural) and social (human societies) world, while recognising the need to integrate food demand with its production as well as other elements, such as human health (Sabaté et al., 2016). Characteristics of inputs, drivers, outputs, and waste emissions are influenced by prevailing political, economic, and cultural governing structures (Sabaté, 2019; Sabaté et al., 2016). This thesis focuses on one actor in the private sector and its agency in the operationalisation of SN. For the scope of this thesis, the political structures are less considered.

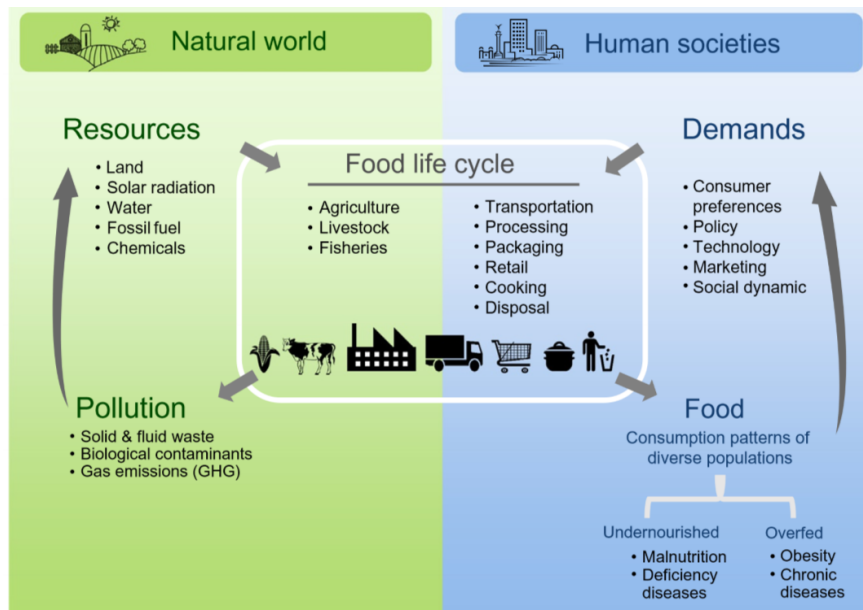


Figure 3. The Environmental Nutrition Model. This model provides an overview of interactions within the food system, the environment, and human health. For example, consumer preferences (demand) feed into the food life cycle (e.g. putting pressure on livestock production), which contributes to pollution, which impacts resources such as water and land. In turn, those resources feed into the food life cycle, and affect e.g. conditions for livestock production, which in turn has an effect on the consumption patterns of populations. Adapted from Sabaté (2019, p.46).

The interrelationships and interactions within the food system encompass the effects of food production on nutrient content as well as the physiological effects on food consumption. Moreover, the quantity and quality of food consumed in turn have impacts on the environment through the demand for resources. In addition, the use of resources and the environmental impact of the agrifood system impact human (and environmental) health (Hallström, 2015). This illustrates an example of a feedback loop within the food system: GHGe in the food system contribute to climate change, which negatively affects yields and nutritional content and thus impacts food production. Due to the aforementioned interrelationships, an integrated and comprehensive analysis of the food system integrating food production, consumption, and other relevant aspects is indispensable (Sabaté et al., 2016).

As we see it, SN should not only be viewed as a critical part of the food system – it must be part of a *sustainable* food system. For such, Eakin et al. (2017) provide a relevant definition:

[A] sustainable food system [is] one that achieves and maintains food security under uncertain and dynamic social-ecological conditions, through respecting and supporting the context-specific cultural values and decision-processes that give food social meaning, and the integrity of the social-ecological processes necessary for food provisioning today and for future generations (p. 759).

This definition points to the importance of context-specific socio-cultural values, as well as the important and intrinsic relationship between the social and ecological processes within, and that emerges from the food system. These aspects are furthermore highlighted in our interpretation of SN, which is why the definition of Eakin et al. (2017) was chosen. The definition of a sustainable food system furthermore emphasises the long-term perspective, which is essential to sustainability at large. To make the definition of food systems more fit to the context of this thesis, we understand SN as being part of the 'food security' aspect in the quote by Eakin et al. (2017).

4 Methodology

Section 4 provides an overview of the research strategy used in this thesis with information on the data collection process, including a systematic literature review and semi-structured interviews. This is followed by a description of the data analysis procedure and ends with ethical considerations regarding the collaboration with a third party.

4.1 Research strategy and design

This thesis builds on an inductive approach in which qualitative research has been carried out. We use a transdisciplinary research approach, collaborating with a multinational company in the food sector, which offers food and beverage products for consumers around the world. The collaboration has opened opportunities to gain comprehensive insights from the private sector's incentives, practices, and challenges in operationalising SN. Transdisciplinary research can involve collaborative efforts among scientists and businesses to address sustainability problems and develop solution options. These can increase the legitimacy, ownership, and accountability of the problem (Lang et al., 2012). This thesis strives to create solution-oriented knowledge that can be of use for the company in future strategy developments as well as for academia.

According to Lang et al. (2012) transdisciplinary research includes three phases. It should start with collaboratively framing the problem, then co-producing solution-oriented and transferable knowledge, and ending with integrating the knowledge into scientific as well as societal practice. After collaboratively framing the problem with the company, we engaged with both primary and secondary data by conducting a systematic literature review and semi-structured interviews with employees. Thus, knowledge was co-produced through the interviews, which were later on analysed with a thematic content analysis. Lastly, an analysis of the results was conducted with the theoretical and analytical entry points described in section 3. In the third phase, following the submission of the

thesis, a presentation of the thesis and its results will be carried out to the employees in the company to ensure the integration of the findings into practice.

4.2 Data collection

The data collection process includes a systematic literature review and semi-structured interviews with employees at the company.

4.2.1 Systematic literature review

A systematic literature review was conducted in order to scan the academic landscape on SN. The aim was to primarily answer the first research question by mapping the concept based on the most recent and relevant science for the background section (section 2). Parts of the systematic literature review were furthermore incorporated into the discussion. The procedure is described in the following paragraph, using Xiao and Watson's (2019) paper on conducting a systematic literature review as a guide. Figure 4 provides an illustration of the process.

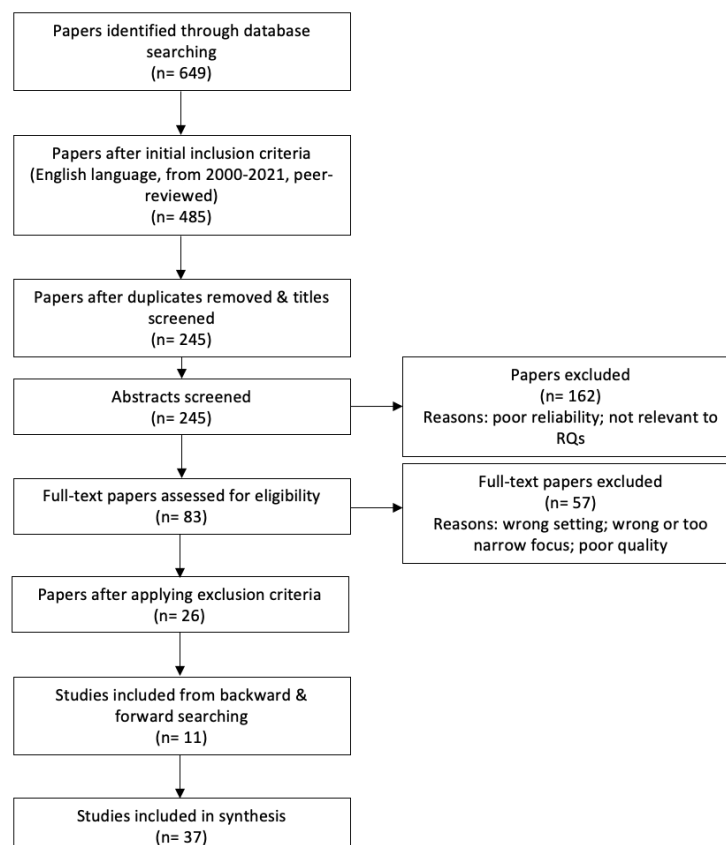


Figure 4. Literature search. This figure illustrates the screening process for the systematic literature review, including inclusion and exclusion criteria. By the end of the process, 37 papers were included for review. Own creation (2021).

The two scientific databases EBSCOhost (EBSCO) and Web of Science (WoS) were used for the review. The search string used in both of the databases was: (“sustainab* nutrition” OR “sustain* food” OR “sustainab* diet*”) AND (“health* diet*”). Our initial search resulted in 274 and 375 hits on WoS and EBSCO respectively, i.e. 649 hits in total. After several screening processes and duplicates removal, 37 papers were included for the review. However, in the final version of the thesis, not all 37 papers were included due to the iterative process of adjusting the content. While we are aware that context plays an important role in what a sustainable diet looks like, since we wanted to understand the SN concept as broadly as possible, studies with a too narrow focus were excluded (for example, studies that focused on single food groups or specific countries). During the screening process, we regularly switched who read which article in order to reduce bias.

4.2.2 Semi-structured interviews

In order to gain insights from the company and to better understand their perspective on SN, interviews were carried out with nine employees at the food company. The interviews served as the basis for answering RQ 1 and RQ 2. Based on input from our approach person at the company, the interviewee selection was made to ensure that the employees represented different areas and levels of the business. Emails that introduced the thesis topic and asked for interview participation were sent out a couple of weeks prior to the suggested dates. The majority of the employees that agreed to take part in interviews worked directly with health and sustainability. 30-60 minutes long semi-structured interviews were conducted between February 2021 and March 2021. The semi-structured design was chosen because of its flexibility and focus on interviewees' own perspectives (Bryman, 2012) which are relevant to our research questions. The interview guides varied between the different interviewees, depending on their position and field of expertise, and they were furthermore developed iteratively based on prior interviews. For example, the first interview spurred inspiration for questions for the subsequent interview that would lead us closer to answering the research questions. We took turns in conducting the interviews, meaning that when one of us conducted an interview, the other was in charge of recording and note-taking. However, the person not conducting the interview was free to complement the questions and take part in any discussions that arose. An example of a full interview guide can be found in Appendix A. All interviews were recorded with the aim of transcription, coding, and thematic content analysis.

4.3 Thematic content analysis

The interviews were transcribed using an online software, then double-checked for spelling mistakes. In order to search underlying themes, transcripts were uploaded to the software NVivo, which allows

for organisation and analysis of data. In order to explore challenges and opportunities for operationalisation of SN from a private sector perspective (RQ 2), the interviews were coded accordingly. While going through the transcripts of the first interviews, certain challenges and opportunities were explicitly and implicitly raised, which served as inspiration for the codes that were most useful to answer RQ 1 and 2. The selection of codes and the coding process itself were iterative. The applied codes can be found in Table 1.

Table 1. Interview codes (Own creation, 2021).

Codes	Description	Files	References
Challenges:			
Knowledge gaps	refers to lack of knowledge on SN, also includes internal disagreements	9	53
Meeting customer demand	refers to challenges of setting and meeting certain goal while simultaneously meeting customer demand	9	37
Powerlessness	refers to the feeling of powerlessness in changing towards greater sustainability	8	24
Profit-driven business	refers to leadership, dominant values, profit-orientation, fear to change	9	61
Scale complexity	refers to supply chain issues, including global and local scale interlinkages	9	66
Sustainability contradictions	refers to challenges in working with sustainability topics in regards to trade-offs	9	61
Opportunities:			
Brand capital	refers to the power of brands	7	22
Improving production	-	8	37
Shifting consumer demand	-	8	30
Strong partnerships	refers to partnerships across the supply chain, like producers, redistributors as well as certification schemes	8	36
Technology	refers to the trust in innovative technologies	3	4
Transparency	refers to transparency and visibility through the supply chain	6	13

Note. Self-explanatory codes are not described. ‘Files’ refers to the number of interviews in which the code was applied, while ‘References’ indicates the total number of times the code was used.

When analysing the results, the codes were combined into larger themes, with challenges divided into knowledge gaps, the food supply chain, profitability, and opportunities to improve the supply chain and changing consumer demand.

4.4 Ethical considerations

The collaboration agreement with the food company included full confidentiality for the company, and therefore the thesis is presented in a way that will not compromise either them or the participating interviewees. Compliance to the collaboration agreement was verified by the company prior to submission of the thesis.

Regarding the interviews, consent forms were sent to the interviewees prior to the interviews, and can be found in Appendix B. These were either signed digitally or orally agreed upon at the beginning of the interviews. All interviewees as well as their answers were treated anonymously throughout the process in order to ensure confidentiality. In regards to the collaboration with the food company, this did not affect the outcome of the research in terms of either independence or creativity.

5 Challenges and opportunities: A private sector perspective

This section reports the findings on RQ 2, what are the challenges and opportunities for operationalising the concept from the company's perspective, based on the semi-structured interviews conducted. It begins with a description of the challenges and finishes with the opportunities.

5.1 Challenges

5.1.1 Knowledge gaps

One of the major challenges raised by interviewees regarding the operationalisation of SN for food companies relates to knowledge gaps. These broadly involve both internal and external dissonance about what SN, or aspects of sustainability in the food system, means. It also refers to what interviewees identified as misconceptions and lack of knowledge in society at large about nutrition and sustainability. It was mentioned that the complexity and breadth of the concept of SN, as well as the lack of global consensus on a definition and elements to include, exacerbate difficulties in operationalisation.

The lack of integrated knowledge on health and sustainability was identified as problematic by several interviewees, given the importance of such integrated understanding, which they felt can lead to a narrowed view of sustainability or health issues (e.g. focusing only on GHGe or nutritional values). It was emphasised that there is no sustainability without nutrition; both components need to be treated as equal, even though this is often not the case currently. In addition, the complexity of measuring and assessing certain aspects of SN was reported, referring to the challenge of then having a positive impact.

Some interviewees also emphasised the overall societal misconception that eating more sustainably is automatically healthy. It was mentioned that understanding the difference between nutritious and sustainable food needs to increase to allow for an understanding of what the two mean together. In addition, sustainability was described as being better understood in comparison to nutrition in the

company. It was also expressed that setting goals related to the nutritional content of food is relatively uncomplicated, compared to setting sustainability goals related to the global food system in which food companies operate.

Interviewees emphasised the need for internal commitment to SN to enable companies to meet their sustainability and health goals, while all employees "need to have a good understanding of sustainable nutrition, and what it takes to deliver on that within the business". Another challenge that emerged involved leaders with only business backgrounds. While acknowledging that not everyone in a company can be an expert on everything and emphasising that this is not necessary, some respondents saw an advantage in having more business people with advanced knowledge in sustainability as well as having more sustainability experts in the business sector generally. It was seen as a challenge to have discussions with managers who lack a profound understanding of components of SN, recognising that it is difficult for them to mediate between sustainability and costs.

5.1.2 Food supply chain

A major challenge in implementing SN was reported to be the complex and non-transparent nature of the supply chain. Global food companies struggle with the many intermediaries in the supply chain and the distance to the actual producers, which was presented by interviewees as challenging the ability to actively influence and make changes at the farm level. For example, global food companies cannot certainly know if benefits along the supply chain are distributed equitably. In addition, companies with a wide product range naturally need to work with a high number of suppliers, which stands in the way of relationships at a deeper and more familiar level.

As a direct result of the complex food supply chain and the actual distance to the production side, it was found that it is very challenging to consider local environmental impacts such as on water, land, and biodiversity as a global company. Additionally, the structural and contextual environmental and social issues at the production level lead to further challenges as there is no single global solution to each individual problem. In this context, the predominance of activities on GHGe in food was explained by the availability of assessment tools and advanced knowledge in this area. In other words, other environmental aspects such as land or water use cannot be fully considered because there is not as advanced knowledge and tools available for these to the same extent in the global arena yet. In terms of environmental trade-offs, companies need to set priorities based on existing knowledge and impact potential.

The powerlessness of individual stakeholders to create change was another identified challenge in implementing SN. Having high ambitions but relatively low leverage due to lower volume compared to larger actors limits the possibilities to create change in the food supply chain.

5.1.3 Profitability

Several interviewees raised strong customer focus as a challenge in operationalising SN for food businesses. Customers have certain expectations and desires that sometimes challenge changes towards SN operationalisation. In addition, interviewees argued that removing certain (unsustainable and/or unhealthy) products⁶ from the range would hurt both people and the business, as no customers mean no more business. The perceived powerlessness is also reflected in the statements that refusing meat eaters by not offering meat products would not solve the problem, but would only make customers get their desired meat elsewhere. One employee spoke of the fear that loyal customers would feel rejected if they did not find what they were looking for, and the challenge that customers might not be interested in sustainability or health issues when consuming or buying the company's food. It was overall agreed that it is not the role of companies to decide for customers what they should eat. A company should offer a responsible range of products for people to choose from.

Interviewees pointed to the fact that efficiency is usually a dominant driver for product development as well as strategic decisions in food companies. Companies typically aim to save money and achieve efficiencies while at the same time addressing environmental and social issues. One interviewee pointed to the "fear of losing money" when being asked why unsustainable and unhealthy products are not removed from the range. The potential for global food companies to work more with small producers was described as challenging, as their businesses largely depend on the reliability of their producers to deliver large quantities of consistent and high quality, which small producers often cannot do.

5.2 Opportunities

5.2.1 Improving supply chains

Interviewees noted that working with SN provides opportunities for food businesses to improve the production of their products and the food system in general. Several interviewees talked about the importance and essentiality of improving agriculture to be regenerative or restorative so that production becomes climate positive. When discussing responsible agriculture, another interviewee

⁶ In this context, this means products that would not fit within the SN interpretation.

spoke about the opportunities that exist from an overall perspective – the use of a wide variety of crops and the importance of local considerations. Several interviewees expressed that if customers were to choose a product with meat in it, “they should have the best possible meat”, referring to the sustainability of production as well as nutritional adequacy. In addition, some interviewees portrayed future technological tools as very promising. It was reported that companies have the opportunity to make such technology cheaper so that it can be mainstreamed across the supply chain.

Strong partnerships with local stakeholders were described as relevant opportunities to improve sustainability across the supply chain. Deep relationships with suppliers were described as a good fit for business improvement. There was also an emphasis on trust and strong partnerships to build efficiencies together to reduce economic, social, and environmental costs. Finding local partners was cited as key to being closer to production. Several interviewees saw the potential to create social benefits by working with smaller companies that are not typically in the supply chain, as they have advanced knowledge and experience of local contexts. In that regard, one interviewee pointed to the large amount of untapped local knowledge held by farmers and indigenous people that could improve the sustainability of the supply chain.

Working with certification schemes was also presented as a good way to address social and environmental issues throughout the supply chain. Through public consultation as well as roundtable discussions, existing certification schemes could be jointly improved and new ones developed. The majority of interviewees indicated that improved visibility and traceability in the supply chain is an important step in being able to make changes.

An opportunity for well-known global brands is to drive sustainability improvements regardless of purchasing volumes as the brand in itself can be something that many suppliers and partner organisations want to be associated with. From the other perspective, sustainability projects within the supply chain can also provide brand-building opportunities.

Finally, internal collaboration within a company was also highly rated as an opportunity. A global company usually has many experts with different competencies. Cross-functional collaboration on different tasks was described as a good process to improve the work in operationalising SN aspects.

5.2.2 Shifting consumer demand

Several interviewees pointed to the opportunities for food companies in providing more sustainable and healthy alternatives to meat products (usually referred to as plant-based alternatives), in order to shift customer demand. In terms of making sure that such alternatives appeal to the broad range of

customers, the commerciality, good taste, and affordability of such products were emphasised as an important vehicle for a demand shift. Food companies have the opportunity to create a demand shift quite naturally, without customers thinking too much about it, as was argued by some interviewees. Working more with local ingredients for the healthier and more sustainable products was also mentioned by a few interviewees as an opportunity in relation to the shifting-customer-demand discussion. Within the same discussion, several other interviewees rather saw an opportunity in working with a globalised supply chain due to its efficiency gains through optimal sourcing possibilities which could enhance not only the economic sustainability of the supply chain but also the ecological.

Food companies do not necessarily have to meet customer demand in all regards, and “going against the stream” in certain regards was identified by several as an important opportunity. For instance, many interviewees saw an opportunity in going against the growing meat demand in certain regions of the world, by simply not accommodating such demand. Pricing more sustainable and healthier offers lower than their alternatives was also identified as a way of shifting demand and could mean that customers would naturally choose the better products, at a lower price. Furthermore, soft mechanisms, such as nudging and encouraging people to convert to more healthy and sustainable food options were seen as an important and inclusive way of shifting customers’ demand, rather than going too extreme by e.g. removing certain products.

Lastly, full transparency towards customers was pointed out as an important opportunity to take pressure away from customers, e.g. by working with certifications and other labels on the healthier and more sustainable options.

6 Revisiting sustainable nutrition: Insights from sustainability science

Section 6 discusses the findings from a sustainability science perspective (RQ 3), with an emphasis on the role of systems thinking. By doing so, this section attempts to reframe SN in comparison to the identified framing in the private sector. The second part critically addresses the limits of the dominant economic paradigm and its shortcoming to the achievement of SN.

6.1 Importance of systems thinking

The lack of knowledge and understanding of SN within food companies is a major challenge to operationalise the concept. The missing integrated and comprehensive perspective and knowledge of health and sustainability issues in the private sector makes it difficult to draw connections and

understand food-related sustainability issues in an integrated way, resulting in a narrowed focus on specific dimensions or indicators of food-related sustainability challenges. Currently, the described challenges to the operationalisation of SN are framed in relation to the supply chain and the consumer demand. We believe that this framing neglects the bigger picture, and a systems perspective can improve the process of better understanding system challenges and their root causes.

6.1.1 Harnessing complexity

Thinking in systems allows for a reframing of the health and sustainability challenges, as it makes interconnectedness in the food system visible. For example, a siloed perspective on past agricultural developments might point to the great achievements of increasing food supply globally and reducing hunger by increasing efficiency and intensifying food production. If the goal were to increase food supply at any cost, one could argue that this has been accomplished. However, if one applies a systems perspective, it becomes clear that these developments have led to serious long-term trade-offs that include ecological destructions, such as the loss of many regulating and supporting ecosystem services, which in turn can be linked to human health as the ability of ecosystems to provide essential nutrients for human consumption has declined (Allen et al., 2014). In addition, many significant human health impacts result from current industrial food systems, such as intensive animal agriculture, which uses inappropriate amounts of antibiotics that can spread in food, leading to antibiotic resistance in humans (Landers et al., 2012).

Therefore, new agricultural production practices and systems are needed that aim to conserve resources and reduce their impacts on the environment and humans (Nelson et al., 2016). Improving sustainability in production is usually about optimising the use of water and other resources and avoiding food losses throughout the supply chain. It could be argued that increasing agricultural production per unit of land area and generally improving the efficiency of agricultural systems would result in fewer environmental impacts per unit of land area. For example, more efficient and scaled-up livestock production would reduce pressure on land and achieve an overall relative decrease in GHGe. However, this efficiency approach would lead to significant trade-offs, such as point source pollution and antibiotic overuse (Röös et al., 2017). This again highlights the need for thinking in systems when dealing with sustainability and health challenges.

The complexity of the concept as described in the current literature makes it more difficult for the private sector to integrate it into current business models, operational activities, and decision-making paradigms. While there is a widespread understanding in academia of SN and what it does, more or less, entail, there is a gap between the knowledge that is produced in academia and the strategies

that emerge in businesses or among other actors in society outside academia to deal with it. There is a risk that scientific research and knowledge production takes place in isolation from businesses (and other actors), which in the end are the ones who operate and deal with societal challenges. This makes the scientific knowledge created abstract and intangible to them. In this context, transdisciplinary research offers a comprehensive tool to bridge this identified gap between scientific innovation and problem-solving in the business world (Lang et al., 2012).

Transdisciplinary research produces new knowledge by integrating scientific and extra-scientific insights, and thereby, contributes to societal progress (Jahn et al., 2012). Such collaborations, like this thesis, can help to provide solutions to the complex issues of sustainability, in which health-related challenges are included. To tackle the lack of knowledge on SN in businesses, transdisciplinary research projects can create solution-oriented knowledge (Lang et al., 2012) that is valuable for science as well as the business per se. Complex sustainability challenges that the concept of SN touches upon requires co-produced solution-oriented knowledge that transdisciplinary collaboration can offer. For example, it was mentioned that it is challenging to tap into the unknown knowledge of local and indigenous people, while this serves a perfect opportunity to co-create knowledge, e.g. through participatory action research (Baum et al., 2006). Thus, prioritising and putting more resources into this kind of comprehensive and integrative knowledge production provides a wide range of opportunities for the operationalisation and achievement of SN.

6.1.2 Feedback loops

Food and nutrition-related issues, such as obesity, are driven by the food system itself, whereas various processes in the food system are influenced by several determinants, such as the organisation of companies, supply chains, and infrastructure. Food businesses themselves as important players in the system non-deliberately but inevitably contribute to or create issues such as environmental degradation and obesity through different actions (Hammond & Dubé, 2012; Wells, 2012). For example, a food company offering unhealthy foods and perhaps also promoting the purchase of these through e.g. pricing and marketing is impacting consumer demands, which in turn impacts the supplies. Figure 5, based on Vandebroek et al. (2017), illustrates this feedback loop. When the demand for 'convenience'⁷ food increases, then it is likely that this demand is met by food companies and that customers become increasingly used and attached to such products. And then, the demand continues to go up. Until there are compromises on e.g. price and taste, this loop is likely to continue (Vandebroek et al., 2007). Business actions and strategies can contribute to the mitigation of the aforementioned issues, by drastically improving the food offer so that it goes in line with SN.

⁷ Convenience food is understood as unhealthy and unsustainable food according to our interpretation of SN.

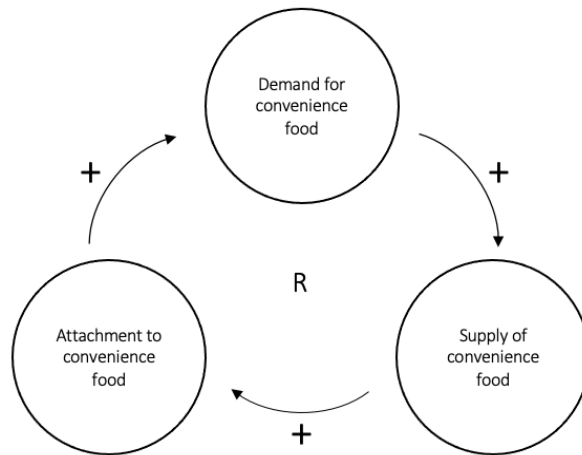


Figure 5. Causal Loop Diagram (CLD) illustrating a reinforcing feedback loop. When the demand for ‘convenience food’ (understood here as unhealthy and unsustainable according to our interpretation of SN), increases, this demand is met by food businesses and thus the supply of convenience food increases (+). This increasing supply reinforces (+) the attachment to the convenience food by consumers, and thus, the demand continues to increase (+). Own illustration (2021).

In the end, environmental and health issues in the food system persist due to the fact that “they are intrinsically systems problems – undesirable behaviors characteristic of the system structures that produce them” (Meadows, 2008b, p. 4). As the actions are highly interdependent on each other, trade-offs and feedback loops are unavoidable. Figure 5 illustrates the feedback loop between the food offered by companies and environmental degradation. In the long-term perspective, the food offer, if not improved in line with SN within a sustainable food system as illustrated in Figure 3, will continue to contribute to environmental degradation and lead to the lack of resources available to produce food, which in turn affects what food will be available for consumption. Efforts to tackle these challenges must take into account these ecosystem dynamics. Food and nutrition security, that are important concerns of SN, are not solely dealing with providing access to adequate food today, but are also about avoiding the loss of access to it in the future (Hammond & Dubé, 2012). However, with the current modes of production, access will decline. Applying this thinking to a food business implies that the business itself will struggle to operate in the future since environmental resources build the base for their operations.

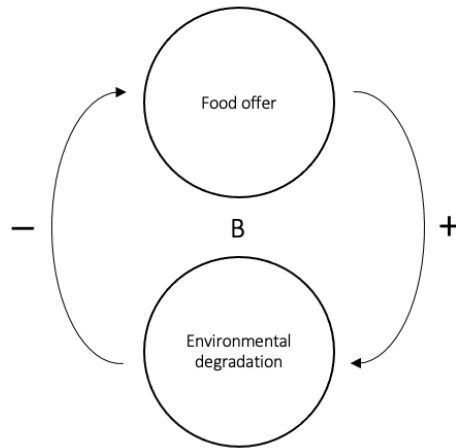


Figure 6. Causal Loop Diagram (CLD) illustrating a balancing feedback loop. If the food offer remains outside the frames of SN, it will lead to increasing (+) environmental degradation and thus less resources available for the food offer. Thus, the more environmental degradation, the less (-) food will be available to offer. Own illustration (2021).

As a response to on the one hand the wide and diverse customer demand for certain products, and on the other to the current health issues as well as environmental impacts related to suboptimal eating habits, food companies are complementing their range with healthier and more sustainable alternatives. However, it is not about replacing the less sustainable and less healthy range, which means that the number of products that are offered increases, as does the complexity of the supply chain. This is already identified as a key challenge for food businesses to be able to operationalise SN, and such increasing complexity can also be expected to create more and more feedback loops whose behaviours are difficult to predict.

The more complex, the less transparency and traceability throughout the supply chains, and especially to the farm and local settings. Research on SN highlights the need to take socio-cultural and environmental factors on the local level into account to a greater extent (González-García et al., 2018; Jarmul et al., 2020; Nemecek et al., 2016). In addition, the problem with globalised food chains is that they extend the link between consumer and producer, making the consumer more distant from social and environmental impacts and thus less aware of subsequent impacts of their actions. The further one is distanced from the consequences of one's actions, the greater the sense of detachment of the problem. Not only consumers, but other actors at the end of the chain, such as food distributors, feel powerless (Greig et al., 2007). By offering a less wide range of products, and ensuring that the range fits within the SN framework, problems related to the complexity of the supply chain can be reduced.

Being a global food company in modern society is inherently complex, and trying to match that with the inherent complexity of SN makes a difficult equation. The fact that there are so many

sub-suppliers involved in the supply chain of global food businesses makes it extremely challenging to put direct pressure on them (sub-suppliers) to improve on sustainability efforts, as well as difficult to assess such efforts. In addition, the diversity of actors in the supply chain is a challenge in the sense that they have different goals and optimisation issues. While there should be a common goal for all stakeholders to deliver food that goes in line with SN, different actors might be preoccupied with different concerns. For example, a farmer might be more concerned with yields and disease resistance, while consumers might be more concerned with the use of chemicals and the impacts on their health (van Boekel, 2017). Thus, as elaborated upon by Eakin et al. (2017), "interventions designed to enhance sustainability may work at one level but fail to improve or even decrease sustainability at other levels or scales" (p. 757). Again, the example of complementing the range with more sustainable and healthy products, instead of replacing it, illustrates how health and sustainability aspects might improve on one level (e.g. increased consumer health from consuming more of the healthy products), while deteriorating it on another (e.g. increased supply chain complexity and thus less impact on sustainability efforts on the local level).

6.2 Limits to change within the business-as-usual model

6.2.1 Prioritising economic aspects: At what cost, to whom?

Within the current neoliberal system, companies pursue to produce "economic value in form of profit, market value or ... stakeholder value" (Dyllick & Muff, 2016, p. 163). The reason for offering unsustainable and unhealthy products according to SN and not excluding these are ultimately linked to the fear of losing customers, and thus profits. While a full commitment to SN would require to not allow any products connected to unsustainable activities across the supply chain, these ambitions are undermined by the prioritisation of profit-making. Companies argue that not offering certain products would not solve the problem, as they would get their desired product somewhere else. In our understanding, what they mean is that this would lead to a competitive disadvantage to the company as they might lose profit. In addition, arguing that customers who demand and buy unsustainable and unhealthy food products from food companies are hindering them to fully operationalise SN neglects the active decisions companies make to offer these unsustainable and unhealthy products in the first place. The reasons for not excluding such from the product offers are once again connected to the risk of losing profit.

Moreover, companies usually want to sell at competitively low prices, while, nowadays, at the same time try to operate environmentally and socially conscious. However, priority is usually put on the first due to competitive advantage and profit-making, while the latter is subordinate, which ultimately

is contradictory for the well-being of society (Málovics et al., 2008). One example considers intensive livestock production, where antibiotics are used to an increasing extent to safeguard and increase volumes (Martin et al., 2015). In the end, however, consumers' health is impeded due to increased antibiotic resistance, which ultimately places an economic burden on society (Frison & Clément, 2020; Rust et al., 2020), and thus, limits the well-being of society as a whole. In addition, considering the fact that, from a health and sustainability perspective, overconsumption is a significant challenge of today's society (Campbell et al., 2017), a responsible company, following that logic, would try to persuade customers to consume less. However, this contradicts the very nature of a profit-oriented company. By narrowing down the volumes of products or aiming at selling less, they "[might] suffer a disadvantage in global competition, e.g. by reduced relative economies of scale and higher prices" (Málovics et al., 2008, p. 916). The business community thus, following the conventional thinking, would interpret sustainable consumption as higher consumption of sustainable products, yet this cannot be in line with SN.

Historically, in the private sector and in many other aspects of global economic and social systems, economic aspects have been the driving forces for decision making and development. However, while affluence is indeed one of many preconditions for human well-being, such well-being will stagnate if further economic growth is not pursued in a more sustainable manner, by addressing issues such as inequalities and poor environmental quality (De Neve & Sachs, 2020). Such issues are furthermore essential to sustainable and human development, on which SN and a sustainable food system rest. The focus on economic aspects has inevitably led to a down-prioritisation of environmental conservation as a key requirement for welfare and human well-being, in particular for future generations. From a human development perspective (see Sen, 2013; Anand & Sen, 2000), such conservation is indispensable as exploitive natural resource activities in the food industry are ultimately taking away the freedoms of future generations to achieve their well-being. This inter- and intragenerational perspective is moreover essential within the sustainable development debate, as well as in the sustainable food system definition provided in section 3.2.

With the realisation of the fact that the concept of SN puts heavy emphasis on the importance of food coming from a sustainable food system that regenerates ecosystems, comes the realisation that the prioritisation of economic aspects cannot provide for the achievement of SN.

6.2.2 Consumers: Rational agents?

Since societal demand and dietary habits are believed to drive food companies' operations, they choose to rely on consumers to make the best choices. It is emphasised that it is not their role to

decide for customers what they should consume. Still, the question arises as to what 'best choices' are. It can be argued that in the context of SN, these ultimately exclude all products that run counter to the various dimensions of SN. If companies want to commit to SN for the product line, but are unwilling to exclude products that do not fit this notion, this ultimately shifts the responsibility towards consumers and their demands to drive the change toward SN.

This implies certain assumptions about consumers. They would be expected to be fully informed about SN as well as aware and committed to sustainability, and then act rationally on this basis. Rationality implies that consumers and producers act in ways that maximise their utility and their own well-being (Sen, 1994). In this narrative, it is assumed that people make their decision after weighing the costs and benefits of purchasing a particular product. However, these quantifications and comparisons "do not automatically dictate a decision" (Faran, 2010, p.21), as there are many more factors that determine and influence decisions. They are derived normatively rather than rationally since there are other value-based and ethical considerations that influence decisions (Faran, 2010; Sen, 1994). For example, social constructs play an important role in shaping decisions and thus rationality is subject to change and based on different social contexts (Hinton, 2021). While this was recognised by some interviewees, most emphasised the idea of customers making responsible choices. Ultimately, relying on consumers to make such choices to guide SN aspirations is a very limited approach to actually achieve it.

Second, there are broader systemic forces that determine what foods are actually available for people to consume (Lynch et al., 2019). The food system and individual decision-making constitute a feedback loop: While indeed decisions taken by individual consumers impact the food system, the food system itself also influences individual decision-making through e.g. food prices, advertisements, and marketing (Hammond & Dubé, 2012). Companies are the actors that provide goods and services to people (Hinton, 2021) and through their product offerings, they significantly influence consumer behavior (Málovics et al., 2008; Willett et al., 2019). Thus, companies play a significant role in shaping these factors and should take the larger responsibility compared to consumers and not rely on the individual responsibilities of people. Focusing on changing the product offerings so that they are consistent with the concept of SN in order to change consumer demand can take the responsibility off customers' shoulders. Ultimately, the reason for companies not to do this may be linked to the fear of losing customers and therefore profit.

6.2.3 Achieving sustainable nutrition: Which ways?

It is widely agreed that current economic activities are destructive for ecosystems that in turn provide the base for society and the economy. This means that business-as-usual will limit the chances of future generations to thrive as they will inherit a less habitable planet (Greig et al., 2007; Málovics et al., 2008; Maye & Duncan, 2017). The actions of profit-oriented businesses on how to achieve sustainable development ambitions are always influenced by overall business strategies. As discussed earlier, ambitions towards sustainability ultimately underlie the economic paradigm of profit orientation and growth (Málovics et al., 2008). To fulfil the requirements of SN, prioritising economic aspects is not sufficient. The conservation of the natural stock must be seen as a central element for the well-being of society at large, and the food business should encourage *less* consumption, not a constant growth in affluence. The implementation of SN must consider all aspects of sustainability and health and apply a long-term perspective, just as the UN Sustainable Development Goals (SDGs) require. Businesses need to go beyond their short-term planning when committing to SN and other sustainability concepts. In the end, SN should be pursued under the objective to increase people's capabilities to ensure long-term human well-being. This is where a strict social commitment is needed by companies in order to truly achieve SN. This should not be confused with deciding for customers what they should eat, as was expressed by some interviewees. Ultimately, it comes down to individual responsibility and choice, but food companies should ensure the opportunity for customers to choose products that are in fact in line with SN if the goal is to achieve it.

While food companies are part of a bigger system, an economic superstructure that rewards prioritising economic rather than environmental and social aspects (Wiedmann et al., 2020), to really achieve SN with its social, environmental, economic, cultural as well as health aspects, these structural and systematic challenges must be addressed (Greig et al., 2007). Similar to Anand and Sen (2000) who argue that the modern world has failed in bringing about the most fundamental capabilities (e.g. the capability to be healthy) for all, Hinton (2021) argues that the way the growth-based economy has failed in delivering its promise to improve lives for all calls for a systemic change towards a system that does not prioritise and favour economic growth. In such reorganisation, businesses play a crucial role. If wanting to implement and achieve SN, moving on towards business models that see the profit as a means to social and environmental sustainability, rather than an end in itself (Hinton, 2021), will be of central importance. If the aim of development is to increase human well-being in the sense of everyone's freedoms to live a fulfilling life, then profit must be used as a means to achieve this "socially-useful end" (Hinton, 2021, p.68). The surplus should serve as a reinvestment to meet everyone's needs, instead of the accumulation of wealth, while

conserving the environment as this is an indispensable element for people's well-being. Ultimately, it is needed to move beyond the business-as-usual model and transform the neoliberal agenda that shapes how business and society operate (Scheyvens et al., 2016).

On a higher level, for issues such as obesity and environmental degradation to be addressed and mitigated, the food system requires a shift towards a *sustainable* system. After all, SN can only come from such a system if it is to be regarded as 'sustainable'. It seems as though food companies are realising that the food system they are operating within consists of and creates its own problems and that the problems are ultimately bad for the business (WBCSD, 2019). The shift towards a sustainable food system is thus explicitly expressed by the private sector as being in their interest. In the end, however, this realisation seems to depart from an understanding that does not take the whole system, and its varying spatial and temporal dimensions into account to the extent needed to achieve SN within a sustainable food system. If not thought of from a systemic perspective, responses might exacerbate rather than mitigate or eradicate these problems. It is furthermore vital for actors to keep feedback loops and delays in mind, and to realise that due to the fact that such delays are difficult to predict, a long-term perspective is essential. As Haraldsson (2000, p. 24) puts it, "the harder we push the system, the harder it pushes back".

7 Concluding remarks

The aim of this thesis was to increase knowledge and understanding about the concept of SN and identify opportunities and barriers in the adoption of the concept in the private sector.

7.1 The (im)possibility of achieving sustainable nutrition

To conclude, SN is a concept that integrates human health and sustainability aspects (RQ 1a: How is the concept of SN framed in the literature), and achieving this concept depends on global, collaborative, and transdisciplinary efforts. Identified opportunities stress the essential role of food companies in shifting both food production and consumption to more sustainable practices (RQ 2: What are the challenges and opportunities for operationalisation of the concept from a food company perspective?), while from the private sector perspective soft nudging methods were favored compared to more radical approaches to achieve SN (RQ 1b: How is the concept of SN framed in a food company?). Currently, private food companies can *contribute* to SN. Yet, the responsibility taken is not sufficient in order to *achieve* it. If business-as-usual continues, this will exacerbate the current environmental and health crisis, taking away capabilities from future generations to live healthy,

fulfilling lives and ultimately harming food companies themselves as they will not be able to run their businesses in the future.

From a sustainability science perspective, identified barriers, namely, knowledge gaps, food supply chain complexity, and profitability refer to the underlying structural challenges that the food system faces. As developed in this thesis, the way the global food system currently operates obviously creates many wicked problems that are highly interconnected and nearly impossible to solve, and that span time, scale, and space. Systems thinking identifies the acute challenges of the food system that need to be addressed in order to achieve SN, which refers to prioritising economic issues in the private sector while subordinating environmental and social concerns.

Generally, targets for healthy diets from sustainable food systems are intertwined with all SDGs (Willet et al., 2019). Achieving SN is heavily linked to the need for a sustainable food system, and businesses, governments and civil society are equally challenged to shape sustainable pathways. One cannot rely on the other. Achieving the SDGs requires all actors from all disciplines within society to work together.

Substantial shifts towards healthy and sustainable dietary patterns, major improvements in food production methods as well as a reorientation of business models are needed to achieve a system change. Stakeholders must ask themselves if the aim should really be to create more and more affluence, or if it should rather be to create the conditions for present and future generations to be free to choose what is of importance to them. Thus far, economic growth has failed to provide justice for all, which is of essential importance to sustainable development at large. It is highly questionable that it will. Ultimately, operationalising SN requires a shift in business models away from prioritising profit and instead towards models that are driven by social and environmental concerns (RQ 3: How should the concept be approached and operationalised from a sustainability science perspective?). This is needed in order to contribute to human well-being and development.

7.2 Implications and reflections

The collaboration with the food company opened up opportunities for insights into their operations. The findings contribute to the literature on SN in general, and in the private sector context. Moreover, they are helpful in identifying barriers and opportunities in the operationalisation of SN.

As touched upon previously in this thesis, knowledge produced in academia does not always translate well into the business sphere. We hope that this thesis can contribute to bridging this gap, since we believe that food companies have great opportunities to contribute to SN. However, while

contributions in terms of improving production methods and the product offer can be made, we recognise that the achievement of SN would require huge structural shifts to companies' business models.

The last note that we want to reflect upon considers the collaboration between the two of us (i.e. Laura and Mia). Throughout the thesis process, we believe that it has been invaluable to be two people working towards the same goal. Our different backgrounds have helped us to provide different perspectives and enhanced the quality of the whole thesis. In regards to the interviews, it felt especially beneficial as the person not conducting the interview could complement questions so that they, as well as the answers, become more comprehensive.

7.3 Limitations

It is important to note that since only one company has participated in this thesis collaboration, the findings are limited to the interviewees' own perspectives and experiences. While generalisations are being drawn in this thesis, this is important to recognise. In addition, while we chose the interviewees in a way that would ensure the best representation of employees working with health and sustainability aspects in the company, the sample number is still relatively low. Thus, this research does not represent the opinions and views of all company employees.

Another limitation concerns the iterative process of the development of interview guides. We recognise that since we constantly developed the guides for the different interviewees, the interviews that were carried out at an early stage of the research might have had a different outcome if conducted at a later occasion. Moreover, while semi-structured interviews serve as an appropriate method to understand the perspectives of the stakeholder group, they do not explain causal relationships.

7.4 Future research

Building on the identified challenges of the food supply chain complexity and the profit-oriented nature of a company, further research should explore alternative business models in-depth, e.g. non-for-profit, and their contribution to achieving SN. In addition, more transdisciplinary research is needed to address the identified gap between theoretical knowledge and active execution on SN, particularly in linking sustainable production methods and appropriate nutrition outcomes for consumption. Here, a deeper consideration of the socio-cultural dimension is needed, as it is of very high importance in terms of food as well as human development. While this thesis focuses on the role of the private sector in achieving SN, other stakeholders, such as the government, are recognised as

essential in enabling the environment to achieve SN. Thus, further research on SN should explore the interactions between the various stakeholders, e.g. government and businesses, in the food system, and how they can collaboratively facilitate a transition towards SN by shaping enabling conditions for the private sector to pursue SN.

8 References

- Aleksandrowicz, L., Green, R., Joy, E. J., Smith, P., & Haines, A. (2016). The impacts of dietary change on greenhouse gas emissions, land use, water use, and health: a systematic review. *PLoS one*, 11(11), e0165797.
- Allen, T., Prosperi, P., Cogill, B., & Flichman, G. (2014). Agricultural biodiversity, social–ecological systems and sustainable diets. *Proceedings of the Nutrition Society*, 73(4), 498-508.
- Anand, S., & Sen, A. (2000). Human development and economic sustainability. *World development*, 28(12), 2029-2049.
- Baum, F., MacDougall, C., & Smith, D. (2006). Participatory action research. *Journal of epidemiology and community health*, 60(10), 854.
- Auestad, N., & Fulgoni III, V. L. (2015). What current literature tells us about sustainable diets: emerging research linking dietary patterns, environmental sustainability, and economics. *Advances in Nutrition*, 6(1), 19-36.
- Bryman, A. (2012). Interviewing in qualitative research. In *Social Research Methods* (4 ed., pp. 468-499): Oxford University Press Inc.
- Burlingame, B. (2012). Preface. In B. Burlingame & S. Dernini (Eds.), *Sustainable diets and biodiversity directions and solutions for policy, research and action* (pp. 7-8): FAO Headquarters, Rome.
- Campbell, B. M., Beare, D. J., Bennett, E. M., Hall-Spencer, J. M., Ingram, J. S., Jaramillo, F., ... & Shindell, D. (2017). Agriculture production as a major driver of the Earth system exceeding planetary boundaries. *Ecology and Society*, 22(4).
- Clark, M., Macdiarmid, J., Jones, A. D., Ranganathan, J., Herrero, M., & Fanzo, J. (2020). The role of healthy diets in environmentally sustainable food systems. *Food and Nutrition Bulletin*, 41(2_suppl), 31S-58S.
- Clark, M., Springmann, M., Hill, J., & Tilman, D. (2019). Multiple health and environmental impacts of foods. *Proceedings of the National Academy of Sciences*, 116(46), 23357-23362.
- Darnhofer, I. (2014). Contributing to a transition to sustainability of agri-food systems: Potentials and pitfalls for organic farming. In *Organic farming, prototype for sustainable agricultures* (pp. 439-452). Springer, Dordrecht.
- De Neve, J. E., & Sachs, J. D. (2020). Sustainable development and human well-being. *World happiness report*, 112-127.
- Dernini, S., Berry, E. M., Serra-Majem, L., La Vecchia, C., Capone, R., Medina, F. X., ... & Trichopoulou, A. (2017). Med Diet 4.0: the Mediterranean diet with four sustainable benefits. *Public health nutrition*, 20(7), 1322-1330.

- Dernini, S., Meybeck, A., Burlingame, B., Gitz, V., Lacirignola, C., Debs, P., Capone, R., & El Bilali, H. (2013). Developing a methodological approach for assessing the sustainability of diets: the Mediterranean diet as a case study. *New Medit*, 12(3), 28.
- Donini, L. M., Dernini, S., Lairon, D., Serra-Majem, L., Amiot, M.-J., Del Balzo, V., . . . Maiani, G. (2016). A consensus proposal for nutritional indicators to assess the sustainability of a healthy diet: the Mediterranean diet as a case study. *Frontiers in nutrition*, 3, 37.
- Dyllick, T., & Muff, K. (2016). Clarifying the meaning of sustainable business: Introducing a typology from business-as-usual to true business sustainability. *Organization & Environment*, 29(2), 156-174.
- Eakin, H., Connors, J. P., Wharton, C., Bertmann, F., Xiong, A., & Stoltzfus, J. (2017). Identifying attributes of food system sustainability: emerging themes and consensus. *Agriculture and human values*, 34(3), 757-773.
- Fanzo, J. (2019). Healthy and sustainable diets and food systems: the key to achieving sustainable development goal 2? *Food ethics*, 4(2), 159-174.
- Faran, T. (2010). Sustainable development: A typology of perspectives. Retrieved May 10th, 2021 from <https://lup.lub.lu.se/record/27339a78-efcf-4039-89c4-9567824fbabf>
- Fresán, U., Martínez-González, M. A., Segovia-Siapco, G., Sabaté, J., & Bes-Rastrollo, M. (2020). A three-dimensional dietary index (nutritional quality, environment and price) and reduced mortality: The “Seguimiento Universidad de Navarra” cohort. *Preventive Medicine*, 137, 106124.
- Frison, E., & Clément, C. (2020). The potential of diversified agroecological systems to deliver healthy outcomes: Making the link between agriculture, food systems & health. *Food Policy*, 96, 101851.
- Gazan, R., Brouzes, C. M., Vieux, F., Maillot, M., Lluch, A., & Darmon, N. (2018). Mathematical optimization to explore tomorrow's sustainable diets: a narrative review. *Advances in Nutrition*, 9(5), 602-616.
- González-García, S., Esteve-Llorens, X., Moreira, M. T., & Feijoo, G. (2018). Carbon footprint and nutritional quality of different human dietary choices. *Science of the Total Environment*, 644, 77-94.
- Greig, A., Hulme, D., & Turner, M. (2007). Modernity, Development, and their Discontents. In *Challenging global inequality: Development theory and practice in the 21st century* (pp. 186-217): Palgrave Macmillan.
- Gustafson, D., Gutman, A., Leet, W., Drewnowski, A., Fanzo, J., & Ingram, J. (2016). Seven food system metrics of sustainable nutrition security. *Sustainability*, 8(3), 196.

- Gustafson, D. (2017). Modeling Sustainable Nutrition Security. In H. K. Biesalski, A. Drewnowski, J. T. Dwyer, J. Strain, P. Weber, & M. Eggersdorfer (Eds.), *Sustainable Nutrition in a Changing World* (pp. 43-57): Springer.
- Hachem, F., Vanham, D., & Moreno, L. A. (2020). Territorial and sustainable healthy diets. *Food and Nutrition Bulletin*, 41(2_suppl), 87S-103S.
- Hallström, E. (2015). *Sustainable nutrition: Opportunities, risks and uncertainties from environmental and health perspectives*. (Doctoral Thesis), Lund University. Retrieved May 4, 2021, from <https://lup.lub.lu.se/search/ws/files/5829211/7766343.pdf>
- Haraldsson, H. V. (2000). Introduction to systems and causal loop diagrams. *System Dynamic Course, Lumes, Lund University, Sweden*.
- 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), 12632-12647.
- Hinton, J. (2021). *Relationship-to-Profit. A Theory of Business, Markets, and Profit for Social Ecological Economics*. (Doctoral thesis), Stockholm University & Université Clermont Auvergne. Retrieved April 13, 2021, from <http://su.diva-portal.org/smash/get/diva2:1510169/FULLTEXT03.pdf>
- Jahn, T., Bergmann, M., & Keil, F. (2012). Transdisciplinarity: Between mainstreaming and marginalization. *Ecological Economics*, 79, 1-10.
- Jarmul, S., Dangour, A. D., Green, R., Liew, Z., Haines, A., & Scheelbeek, P. F. (2020). Climate change mitigation through dietary change: a systematic review of empirical and modelling studies on the environmental footprints and health effects of 'sustainable diets'. *Environmental Research Letters*, 15(12), 123014.
- Johnston, J. L., Fanzo, J. C., & Cogill, B. (2014). Understanding sustainable diets: a descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability. *Advances in Nutrition*, 5(4), 418-429.
- Jones, A. D., Hoey, L., Blesh, J., Miller, L., Green, A., & Shapiro, L. F. (2016). A systematic review of the measurement of sustainable diets. *Advances in Nutrition*, 7(4), 641-664.
- Kim, B. F., Santo, R. E., Scatterday, A. P., Fry, J. P., Synk, C. M., Cebren, S. R., . . . Bloem, M. W. (2020). Country-specific dietary shifts to mitigate climate and water crises. *Global Environmental Change*, 62, 101926.
- Landers, T. F., Cohen, B., Wittum, T. E., & Larson, E. L. (2012). A review of antibiotic use in food animals: perspective, policy, and potential. *Public health reports*, 127(1), 4-22.
- Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., . . . Thomas, C. J. (2012). Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustainability science*, 7(1), 25-43.

- Lairon, D. (2012). Biodiversity and Sustainable Nutrition with a food-based approach. In B. Burlingame & S. Dernini (Eds.), *Sustainable diets and biodiversity directions and solutions for policy, research and action* (pp. 31-35): FAO Headquarters, Rome.
- Laverack, G. (2018). The Challenge of Addressing Obesity: Moving to the Extremes. *Challenges*, 9(2), 33.
- Lynch, H., Berardy, A., & Wharton, C. (2019). Food production and dietary patterns. In J. Sabaté (Ed.), *Environmental Nutrition* (pp. 101-122): Elsevier.
- Macdiarmid, J. I., Kyle, J., Horgan, G. W., Loe, J., Fyfe, C., Johnstone, A., & McNeill, G. (2012). Sustainable diets for the future: can we contribute to reducing greenhouse gas emissions by eating a healthy diet? *The American journal of clinical nutrition*, 96(3), 632-639.
- Málovics, G., Csigéné, N. N., & Kraus, S. (2008). The role of corporate social responsibility in strong sustainability. *The Journal of Socio-Economics*, 37(3), 907-918.
- Margetts, B. (2007). Priorities. In M. Lawrence & T. Worsley (Eds.), *Public health nutrition: from principles to practice* (1 ed.): McGraw-Hill.
- Martin, M. J., Thottathil, S. E., & Newman, T. B. (2015). Antibiotics overuse in animal agriculture: a call to action for health care providers.
- Maye, D., & Duncan, J. (2017). Understanding sustainable food system transitions: Practice, assessment and governance. *Sociologia Ruralis*, 57(3), 267-273.
- Meadows, D. H. (2008a). The Basics. In *Thinking in systems: A primer* (pp. 11-34): Earthscan.
- Meadows, D. H. (2008b). Introduction: The Systems Lense. In *Thinking in systems: A primer* (pp. 1-7): Earthscan.
- Meybeck, A., & Gitz, V. (2017). Sustainable diets within sustainable food systems. *Proceedings of the Nutrition Society*, 76(1), 1-11.
- Nelson, M. E., Hamm, M. W., Hu, F. B., Abrams, S. A., & Griffin, T. S. (2016). Alignment of healthy dietary patterns and environmental sustainability: a systematic review. *Advances in Nutrition*, 7(6), 1005-1025.
- Nemecek, T., Jungbluth, N., i Canals, 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), 607-620.
- Perignon, M., Vieux, F., Soler, L. G., Masset, G., & Darmon, N. (2017). Improving diet sustainability through evolution of food choices: review of epidemiological studies on the environmental impact of diets. *Nutrition reviews*, 75(1), 2-17.

- Röös, E., Bajželj, B., Smith, P., Patel, M., Little, D., & Garnett, T. (2017). Greedy or needy? Land use and climate impacts of food in 2050 under different livestock futures. *Global Environmental Change*, 47, 1-12.
- Rust, N. A., Ridding, L., Ward, C., Clark, B., Kehoe, L., Dora, M., . . . Reynolds, C. J. (2020). How to transition to reduced-meat diets that benefit people and the planet. *Science of the Total Environment*, 718, 137208.
- Sabaté, J. (2019). The environmental nutrition model. In *Environmental Nutrition* (pp. 41-52): Elsevier.
- Sabaté, J., Harwatt, H., & Soret, S. (2016). Environmental nutrition: A new frontier for public health. *American journal of public health*, 106(5), 815-821.
- Scheyvens, R., Banks, G., & Hughes, E. (2016). The private sector and the SDGs: The need to move beyond 'business as usual'. *Sustainable Development*, 24(6), 371-382.
- Sen, A. (1994). The formulation of rational choice. *The American Economic Review*, 84(2), 385-390.
- Sen, A. (2013). The ends and means of sustainability. *Journal of Human Development and Capabilities*, 14(1), 6-20.
- Springmann, M. (2019). Can diets be both healthy and sustainable? Solving the dilemma between healthy diets versus sustainable diets. In J. Sabaté (Ed.), *Environmental Nutrition* (pp. 197-227): Elsevier.
- Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B. L., Lassaletta, L., . . . Carlson, K. M. (2018a). Options for keeping the food system within environmental limits. *Nature*, 562(7728), 519-525.
- Springmann, M., Wiebe, K., Mason-D'Croz, D., Sulser, T. B., Rayner, M., & Scarborough, P. (2018b). Health and nutritional aspects of sustainable diet strategies and their association with environmental impacts: a global modelling analysis with country-level detail. *The Lancet Planetary Health*, 2(10), e451-e461.
- Steenon, S., & Buttriss, J. (2020). The challenges of defining a healthy and 'sustainable' diet. *Nutrition Bulletin*, 45(2), 206-222.
- Stoll-Kleemann, S., & O'Riordan, T. (2015). The sustainability challenges of our meat and dairy diets. *Environment: Science and Policy for Sustainable Development*, 57(3), 34-48.
- van Boekel, M. (2017). Food chain processes and food quality. In H. K. Biesalski, A. Drewnowski, J. T. Dwyer, J. Strain, P. Weber, & M. Eggersdorfer (Eds.), *Sustainable Nutrition in a Changing World* (pp. 283-288): Springer.
- Vandenbroeck, P., Goossens, J., & Clemens, M. (2007). *Tackling Obesities: Future Choices - Building the Obesity System Map*. Retrieved May 4, 2021 from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/295154/07-1179-obesity-building-system-map.pdf

- von Koerber, K., Bader, N., & Leitzmann, C. (2017). Wholesome nutrition: an example for a sustainable diet. *Proceedings of the Nutrition Society*, 76(1), 34-41.
- WBCSD (2019). *CEO Guide to Food System Transformation*. Retrieved March 20, 2021, from <https://www.wbcsd.org/Programs/Food-and-Nature/Food-Land-Use/Resources/CEO-Guide-to-Food-System-Transformation>
- WBCSD (2020). Food & Agriculture Roadmap – Chapter on Healthy and Sustainable Diets. Retrieved March 20, 2021 from <https://www.wbcsd.org/Programs/Food-and-Nature/Food-Land-Use/FReSH/Resources/Food-Agriculture-Roadmap-Chapter-on-Healthy-and-Sustainable-Diets>
- Wells, J. C. (2012). Obesity as malnutrition: the role of capitalism in the obesity global epidemic. *American Journal of Human Biology*, 24(3), 261-276.
- Wiedmann, T., Lenzen, M., Keyßer, L. T., & Steinberger, J. K. (2020). Scientists' warning on affluence. *Nature communications*, 11(1), 1-10.
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., . . . Wood, A. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447-492.
- Wood, S. L., Alam, M., & Dupras, J. (2019). Multiple pathways to more sustainable diets: Shifts in diet composition, caloric intake and food waste. *Frontiers in Sustainable Food Systems*, 3, 89.
- Xiao, Y., & Watson, M. (2019). Guidance on conducting a systematic literature review. *Journal of Planning Education and Research*, 39(1), 93-112.

9 Appendices

9.1 Appendix A: Example of interview guide

Introduction

1. Briefly: Who are you and what is your position? What are your main areas of interest within your position?

Definition of Sustainable Nutrition

1. How familiar are you with the concept of sustainable nutrition?
 - a. If yes: From your point of view and in general, how would you describe it?
 - b. If no: Sustainable nutrition concerns both sides of the food system; production and consumption. According to FAO, sustainable nutrition includes all three pillars of sustainability (social, economic, environmental) across the supply chain and adds health and cultural aspects to it. A sustainable diet is culturally appropriate, fair and affordable, nutritionally adequate and healthy, while staying within planetary boundaries.
2. What are the reasons for why you want to incorporate the concept into the business?
3. What would you describe as the biggest challenge in applying this concept?
4. Do you believe there are any priorities of the concept for your business? Which ones and why?

Role of business

1. In your view, what role does a food company have in shifting customer's behaviours towards healthy and sustainable food?
 - a. In relation to other stakeholders?
2. What opportunities and challenges can you see in a hypothetical use of a concept such as 'true cost accounting', where environmental and social externalities are reflected in the price set by the business?
3. Do you think that one of the two general aspects of sustainable nutrition (sustainability/nutrition) weighs heavier than the other for a global food company? Why, why not?
4. Should all products "fit" in the frames of sustainable nutrition – i.e. that all foods should be both sustainable and nutritious?
5. What is the role of industrialised livestock farming for a global food company?
 - a. What role does a global food company play in influencing the livestock industry?

Final question

1. How does profit-orientation go along with ambitions towards sustainable nutrition?

9.2 Appendix B: Letter of consent

Consent to take part in interview for the Master's Thesis:
Ambitions for Sustainable Nutrition in the Private Sector:
Unpacking Incentives, Limitations and Potentials

- I _____ voluntarily agree to participate in this interview for Mia Bonnevier Ydholm and Laura Heiduk's Master's Thesis.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I understand the purpose and nature of this study, and I understand that I have the opportunity to at any time ask questions about the study.
- I understand that participation involves only an interview and potentially follow-up questions over email, to which I am not obliged to answer.
- I agree to my interview being audio-recorded.
- I understand that my name and company position will be treated anonymously
- I understand that extracts from my interview may be quoted in the final report and presentation of this research.
- I understand that I have the right to demand that certain confidential information I might share can be blacked out in the final thesis.
- I understand and agree to that the researchers will create a transcript of my interview.
- I am aware that the thesis will be published on Lund University's website and will be accessible to everyone.

Signature of participant

Date

Signatures of thesis students

Date

9.3 Appendix C: Description of indicators in metric

From Gustafson et al., 2016.

Indicator	Description
<i>Food Nutrient Adequacy</i>	
Nutrient Density Score	Measured as ratio of nutrients to calories
Population Share with Adequate Nutrients	Average of population shares across some specific nutrients (e.g. zinc, niacin and vitamin A) with sufficient data availability
Non-Staple Energy	% of kcal available to a consumer from non-staple foods
Shannon Diversity	Measure of food supply diversity
MFA (Modified Functional Attribute Diversity) Diversity	Index to track diversity of nutrients provided by the different food items in the food supply
<i>Ecosystem Stability</i>	
Ecosystem status	Based on Environmental Protection Index which includes following issues: water resources; agriculture; forests; fisheries; biodiversity/habitat
GHG Emissions	Per-capita annual food system GHG emissions (kg CO ₂ e per person/year)
Net Freshwater Withdrawals	Per-capita annual food system net freshwater withdrawals (m ³ freshwater per person/year)
Energy Use	Per-capita annual food system non-renewable energy use (MJ per person/year)
Land Use	Per-capita food system land use (m ² per person/year)
<i>Food Affordability & Availability</i>	
Food Affordability	% of household expenditure on items other than food
GFSI Food Availability Score	Measure of factors that influence the supply of food and the ease of physical access to food
Poverty Index	% of population living below the 'poverty line' (\$1.90/day)
Income Equality	Based on the Gini Coefficient
<i>Sociocultural Wellbeing</i>	
Gender Equity	Based on the Global Gender Gap Index (GGGI) to assess the magnitude of gender disparity (economic participation and opportunity; educational attainment; health and survival; political empowerment are indicators used to derive the overall GGGI)
Child Labor	% of children (age 5-17) in a country that are employed in the food system
Community Rights	Based on the Environmental Democracy Index (EDI) (ranks

	countries according to presence of appropriate legal protections of community rights in the form of national laws)
Animal Health & Welfare	Based on the Animal Protection Index (API) (ranks countries commitment to animal protection)
Resilience	
ND-GAIN Country Index	An overall indicator for vulnerability and readiness (in terms of climate change and other global challenges)
Food Production Diversity	Measure of agricultural production for a country by weight of each food produced in the country
Food Safety	
Foodborne Disease Burden	Incidence of foodborne diseases and related mortality, morbidity and disability-adjusted life years (DALYs)
GFSI Food Safety Score	Measure of (1) if the country has a regulatory agency to ensure food safety, (2) % of population with access to potable water, (3) presence of a formal grocery sector
Waste & Loss Reduction	
Pre-Consumer Food Loss	% of produced food that is not lost
Post-Consumer Food Waste	% of produced food that is not wasted