FOOD WELLBEING & SUFFERING INDEX FOR SUSTAINABLE FOOD CONSUMPTION

RŪTA JUMĪTE

Master's thesis for Master of Arts (Art & Design)
Master's programme in Creative Sustainability
School of Art, Design & Architecture
Aalto University, 2020

Supervisor: Mikko Jalas
Advisors: Tatu Marttila
and Sonja M. Amadae

Aalto University
School of Arts, Design
and Architecture

Aalto University, P.O. BOX 11000, 00076 AALTO
www.aalto.fi

Master of Arts thesis abstract

Author Rūta Jumīte

Title of thesis Food Wellbeing and Suffering Index for Sustainable Food Consumption

Department Department of Design

Degree programme Master's Programme in Creative Sustainability

Year 2022 **Number of pages** 75 **Language** English

Abstract

The current food system is contributing to the climate crisis, biodiversity loss, and connects with unsustainable water, land, and resource use. The 1.5-degree Lifestyles strategy in Finland includes targets for a more sustainable food industry. The needed change is drastic and requires widespread dietary change and reduction of animal-based products. Food sustainability communication tools have been often used to facilitate dietary change by rising consumer awareness. However, these tools often face shortcomings due to the dietary resistance, attitude-behaviour gap, as well as tool development without considering the context and practicalities of its use.

First, the thesis investigates what complementary strategies could support food sustainability communication tools to empower consumer-citizens to make more sustainable food choices. Therefore, the thesis studies reasons for dietary resistance and attitude-behaviour gap to propose complementary strategies for food sustainability communication tools. Second, the thesis uses the constructive design research approach to define the strategic targets of a food sustainability index, and to apply it to a real-life context of lunch cafeterias in Finland.

The thesis findings suggest several complementary strategies for food sustainability communication tools to more effectively facilitate dietary change: a) knowledge accessibility to raise awareness about the scale of different food product sustainability, as well as awareness about the scale of needed dietary change; b) consideration of the context of the tool application and interventions to link the tools to affordable, accessible, attractive and socially acceptable food alternatives; c) parallel and supportive campaigns and activities that allow experimentation and consumer-involvement; and d) supportive governmental strategies, such as relevant policy and taxation change.

The study of the possible strategic targets for a food sustainability index and the index application in a real-life context, have identified several findings. To respond to the agriculture field and consumer-citizen sensitivity about dietary change, data and strategies relevant to Finnish context were prioritised for the food sustainability index application. Furthermore, the three-threshold levels of the index were defined as rather suggestions and not strict limits to promote progress vs regress thinking about sustainability. Ultimately, to limit the resource-intensive data needs, food products were categorised and included in an online data depository for simpler future applications.

Keywords food sustainability communication, sustainable food consumption, constructive design research, dietary change

ACKNOWLEDGEMENTS

I would like to thank to the ATARCA research group, ATARCA Food Futures team for providing to be part of the ATARCA Food Futures experiment and development of the Food Wellbeing and Suffering index. I would like to thank my supervisor Mikko Jalas for providing clear guidance and constructive criticism throughout the thesis writing process. Furthermore, I would like to thank my advisor Tatu Marttila for guiding the thesis process in an encouraging, critical, and analytical way. I want to thank my other adviser and supervisor within the ATARCA Food Futures research project Sonja Amadae for giving this opportunity, inspiration, and critical feedback throughout the research process.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964678.

TABLE OF CONTENTS

1. INTRODUCTION

1.1. Food system challenge

Today, food systems account for nearly one-third of global GHG emissions causing climate crisis, as well as consume large amount of natural resources, generate air, soil, and water pollution, cause biodiversity loss, and negative health impact for human population (European Commission, 2020; Gorst & Forslund, 2021). Currently, the food industry is unsustainable and is expected to transition towards more nature-neutral food systems, that also ensures healthy nutrition for growing populations (Gerten et al., 2020; Rockström et al., 2009), by decoupling its negative environmental impact (Lukas et al., 2016). Additionally, it is suggested that the food system transition is co-created by different stakeholder groups, such as governmental organisations, civil society organisations, enterprises and consumer-citizens; and responsibility to make change is not put only on the shoulders of one stakeholder group (Chater & Loewenstein, 2022).

The Finnish Innovation Fund Sitra has suggested the '1.5-degree lifestyles' strategy to facilitate transition towards the 1.5-target proposed by the Intergovernmental Panel on Climate Change (IPCC, 2018; Lettenmeier et al., 2019). Furthermore, the strategy targets consumer-citizen lifestyles and food consumption, as dietary change is seen as one of the most influential leverages to promote sustainability of the agriculture field (Jungbluth et al., 2012). Although, there are many initiatives of food sustainability labelling, indexing and calculations to inform consumer decisions, scholars have been sceptical about the effectiveness of these communication strategies (Salo et al., 2019). It is widely recognised that dietary change is slow and challenging transition. Although, the awareness about food system impact is rising, there is a considerable consumers' attitude-behaviour gap (Caruana et al., 2016). The dietary change faces many barriers, such as individual taste preferences, accessibility of alternative options, cultural traditions, social norms, and alienation from the individual food consumption impact (Camilleri et al., 2019; Røpke, 2009; Sabaté & Soret, 2014). Actionable sustainability communication, as introduced by Turunen and Halme (2021), is simple yet comprehensive communication of sustainability of products. The thesis explores the means for effective and actionable design approach to promote more sustainable food consumption that considers the dietary resistance and related challenges.

1.2. ATARCA Food Futures project: Exploration of alternative and more sustainable economies

1.2.1. CONTEXT AND OBJECTIVES

ATARCA is a research consortium within Aalto University, between the School of Electrical Engineering, the School of Business, and the School of Art, Design and Architecture. The ATARCA focuses on exploring *anti-rival* digital goods to construct alternative economies enabling more sustainable consumption patterns. Within the research, anti-rival stands as an alternative for the classical rival market goods that are subtractable and linked to the lack of management of collective resources. Firstly, ATARCA within the Food Futures project is exploring blockchain technology and cryptocurrencies as means of anti-rival goods to develop the alternative economic models. Particularly, in this project, unique Foodprint tokens are issued and distributed to consumers for their more sustainable food choices. Secondly, the Food Futures project addresses the food system's negative externalities and tragedy of commons. Hence, the research and project-led experiment aims to explore opportunities to empower more sustainable resource management within communities. As a part of the research, an experimental ecosystem has been created to engage and empower consumer-citizens in three ways:

- By fighting the alienation of food system impact and providing a holistic overview of the environmental impact of food system;
- By providing actionable and contextualised communication of the food system impact to enable more sustainable food choices that are accessible and desirable;
- To record, measure and recognise positive impact of consumer-citizens and consumer-communities with anti-rival sNFT tokens.

The first Food Futures experiment was carried out with a mobile app that allows users to view the UniCafe lunch menu and its environmental impact that is communicated by the Food Wellbeing and Suffering Index

(FWSI). The users can make an informed decision, choose, and validate the chosen meal choice, as a part of their daily lunch routine. Whenever consumers choose the more sustainable food options, crypto tokens are issued to record, measure, and recognise these choices. Furthermore, the users could redeem these tokens to access donated surplus goods that do not increase overall consumption, such as leftover food. However, the token redeeming functionality is yet in a speculative phase. Ultimately, the Food Futures experiment investigates if such an ecosystem has potential to empower consumers to make more sustainable food choices and if the anti-rival economy can have a long-lasting impact and is attractive for consumers.

I have been working as a researcher within the ATARCA Food Futures project since May 2021, and my role has been to contribute to creation and development of the Food Futures concept and the Food Wellbeing and Suffering Index (FWSI), as a project researcher, service designer, as well as UX/UI designer. The MA thesis research contributes to the development and application of FWSI. Particularly, to define its strategic targets and to facilitate its application within lunch cafeteria context in Finland.

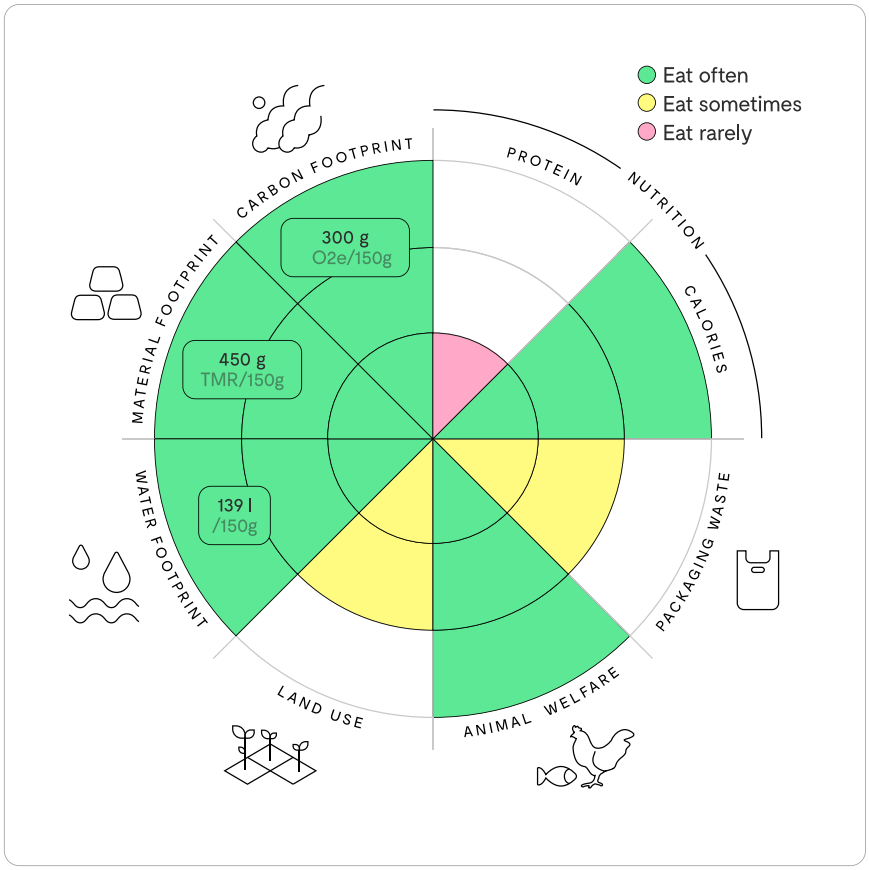
1.2.2. FOOD SYSTEM TRANSPARENCY AND THE FOOD WELLBEING AND SUFFERING INDEX

An integral part of the ATARCA Food Futures experimental ecosystem is the Food Wellbeing and Suffering Index (FWSI). The aim of the index is to inform consumers about environmental impact of different food options to inform food-related decision-making. Additionally, the index aims to avoid the carbon-impact tunnel vision; therefore, it is omnilabel and communicate several the most-significant environmental aspects of food system impact. Generally, the food system impact is wide and have complicated impact on environmental, social, and economic sustainability; however, the FWSI combines only the most significant impact metrics in its initial stage, such as Carbon Footprint, Material Footprint, Land Use, Water Footprint, Animal Welfare and Packaging Waste (See: Figure 1). The chosen metrics and the index visual design are informed and inspired by the Planetary Boundaries framework (Rockström et al., 2009), Nutritional footprint framework (Lukas et al., 2016) and work by Wallbaum and Kummer (2006).

The Food Wellbeing and Suffering Index (FWSI) aims to inform daily consumer-citizen food decisions, as well as incentivise the more sustainable food choices with the Foodprint tokens. Ultimately, the

index aims to become a tool embedded into consumer-citizen daily lunch habits. FWSI has been designed to provide actionable communication that is relevant to the context of its use, and to inform consumer decisions. It is recognised that effective food sustainability labelling and indexing requires clear and strategic targets, and relevant functional units for items to be compared on equal basis, such as different types of products within the same product group. Therefore, FWSI and its three-threshold levels initially are defined within the protein product group that is also responsible for the highest environmental impact. However, the social sustainability dimension, such as labour conditions, impact on livelihoods have not been included in the initial phase of the framework development due to the lack of available data and trackability of this information.

Figure 1. Food Wellbeing and Suffering Index. (Jumite, 2022)



1.2.3. EXPERIMENT PILOT AT THE UNICAFE LUNCH CAFETERIA CONTEXT

The UniCafe is a student restaurant and catering company owned by the student association of University of Helsinki, with more than twenty outlets within Helsinki, Finland. On daily basis, the cafeterias are serving extensive number of government-subsidised lunches for students, academic personnel, and regular-price lunch for regular

customers. Customers can choose from different protein source options, such as meat, fish, vegetarian or vegan, as well as different kinds of additives. As it is also recognised by the UniCafe management, the protein sources have the most significant environmental impact (Saarinen et al., 2019). Therefore, the UniCafe already have excluded the most environmentally-harming protein source – beef from their lunch menus. Furthermore, the UniCafe management has employed a strategy to transition towards more sustainable food consumption and has an objective to continue popularising plant-based diets and overall awareness of food system impact.

The UniCafe lunch cafeterias context is suitable for the ATARCA Food Futures experiment, because of its existing consumer ecosystem, and easiness and accessibility of sustainable food options within the UniCafe outlets. One of the advantages for the experiment in this context, is that the student audience visits the cafeterias on regular basis throughout several years of their studies; therefore, their interaction with the experimental ecosystem can be analysed in a scope of longer time and not just one time visit. The first pilot experiment was run in one of the UniCafe outlets and applied only to the protein sources of the lunch menu; however, the research findings allow to expand the experiment and test it within all of the UniCafe outlets.

Within the spring period of year 2022, ATARCA Food Futures launched the experiment at the UniCafe Kaivopiha together with students from University of Helsinki who participated in the experiment through an experimental MOOC. The MOOC was set up to start to engage the consumer-citizen audience with the initial prototype, ant to test the ecosystem concept. As the UniCafe outlets usually are located near or within the University of Helsinki faculties and is one of the most popular lunch cafeterias amongst students, the people that applied for the experimental MOOC were already frequent visitors of UniCafe; therefore, the experimental intervention took part within their existing lifestyle and daily habits. The experimental MOOC sessions had several aims: to educate students about the ecosystem concept; to engage students with the digital app and ecosystem; to generate insights of student experiences and opinions about the concept; and to test the UX/UI of the app and the service design of ecosystem.

1.3. Research questions and objectives

The overall objective of the thesis is two-fold. First, the thesis aims to research larger context of the Food Wellbeing and Suffering Index (FWSI) and possible complementary strategies for the food sustainability communication to be effective. Second, the thesis focuses on the real-life application of FWSI in the context of Finnish lunch cafeterias by using the constructive design research approach, as well as defines strategic targets for the index three-threshold levels.

1.3.1. STUDYING THE CONTEXT OF THE FOOD WELLBEING AND SUFFERING INDEX: THE DIETARY RESISTANCE, AND STRATEGIES FOR MORE EFFECTIVE FOOD SUSTAINABILITY COMMUNICATION

RQ1: What complementary strategies could support food sustainability communication tools to empower consumer-citizens to make more sustainable food choices?

The first research question focuses on the context of the FWSI application, to propose the possible strategies that could support FWSI application to effectively to catalyse dietary change. The thesis acknowledges a consumer-citizens as one of the stakeholder groups essential for sustainability transition co-creation, and dietary change as an essential aspect for food industry transition. Although, there are many food sustainability communication schemes, such as food labelling and impact calculators, that aim to promote dietary change, their actual impact often is limited. Therefore, there is a need to recognise reasons for such failures and possible strategies for more effective communication related services. The thesis investigates the context of the food sustainability communication tools, to indicate reasons for dietary resistance, and to furthermore, propose strategies that could support effective application of FWSI.

1.3.2. THE APPLICATION OF THE INDEX AND DEFINITION OF ITS TARGETS AND THRESHOLD LEVELS

RQ2: How to define the strategic targets of a food sustainability index, and how to apply it to a real-life context of lunch cafeterias in Finland?
The second research question focuses on the strategic targets for the Food Wellbeing and Suffering Index (FWSI), and the index application in real-life context at lunch cafeterias, by using the constructive design research approach. One of the research objectives related to this research question is to define strategic targets for food sustainability reduction and dietary change that would be necessary to enable more sustainable food system in Finland. Furthermore, the constructive design research aims to define three-threshold levels and their intervals that were integrated in FWSI. Another, research objective is to apply FWSI within a real-time context of the Unicafe lunch cafeterias and their daily lunch protein sources. The applied research process includes gathering lunch-related data form the cafeterias and applying chosen analytical frameworks of food sustainability assessment, such as scientific publications, databases, or impact calculators, to communicate environmental impact of the food products. The analytical frameworks would be applied for the following metrics of the index: carbon footprint, material footprint and water footprint. This application involves several activities, such as: a) reviewing relevant databases, academic publications, impact calculators and emission calculating services; b) creating and applying criteria for analytical framework shortlisting; c) data gathering and application to the protein sources at the UniCafe lunch cafeterias.

Ultimately, the second research question aims to recognise the opportunities and limitations of the index application in real-life context, possible design approaches to overcome the limitations, and to define targets and data driving FWSI. The thesis aims to gather, shortlist and design data to inform FWSI to be generalised and applicable to the larger lunch cafeteria context in Finland.

2. LITERATURE REVIEW

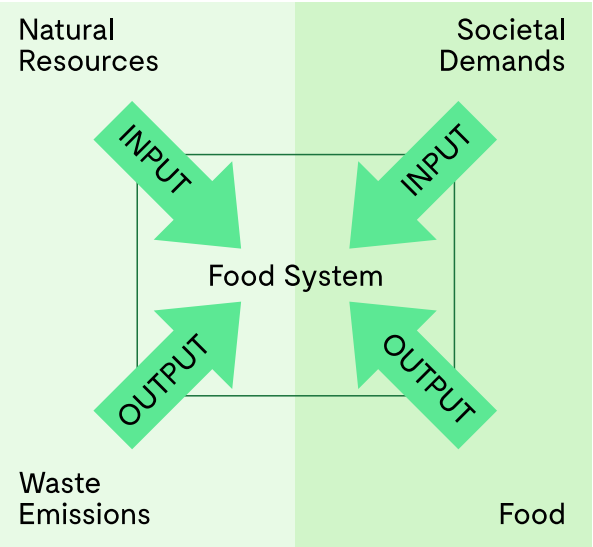
This chapter presents the theoretical lance and the current academic discussion relevant to the research questions. The Section 2.1. investigates the more general discussion about sustainability of food systems and transitions towards more sustainable food futures, by particularly focusing on need for change on the demand-side as one of the drivers of transition. The section discusses the current scientific research and political agencies for consumer-citizen dietary change and their targets to achieve sustainable levels of food consumption. The Section 2.2. investigates the academic literature related to consumer-citizen empowerment for food system sustainability transitions. Moreover, it investigates the opportunities for the dietary changes, barriers, and role of the design interventions. It recognises the limits of the current labelling practice and focuses on actionable communication approaches and recognises the benchmarking academic frameworks. The aim of the Section 2.3. is to recognise relevant and authoritative academic and governmental sources for strategic targets for dietary change towards more sustainable food systems in Finland. Furthermore, the literature review informed the threshold levels and application of FWSI.

2.1. Sustainable food futures and diets

2.1.1. FOOD INDUSTRY AND NEED FOR CHANGE

It is recognised that the global food system is not sustainable as it demands extensive amount of natural and societal resources, as well as negatively affects ecosystems, as illustrated in the Figure 2 (Schanes et al., 2016). The food sector is responsible for 29% of the greenhouse gas emissions (GHG), such as carbon dioxide, methane, and nitrous oxide that are the main cause of anthropogenic warming (Carlsson-Kanyama & González, 2009; Lettenmeier et al., 2019). Additionally, the field accounts for extensive water footprint, land use, loss of biodiversity and resource use that has been constantly growing throughout the past decades (Lettenmeier et al., 2014; Lukas et al., 2016; Mancini et al., 2010). In addition to environmental sustainability challenges, the food industry is causing challenges related to social sustainability, public health, and livelihoods (SYKE 2020).

Figure 2. Inputs and outputs of food system. (Schanes et al., 2016)



The alarming environmental data regarding food system is mostly related to the high meat and dairy product consumption in the western societies (Carlsson-Kanyama & González, 2009; Poore & Nemecek, 2018). The industrial animal farming practice is highly resource inefficient for the following reasons: a) as the animal feed is mostly based on grain crops, whereas the grain could be a source of nutrition to humans directly; b) as the animal farming itself is responsible for large amount of methane gas release (Sabaté & Soret, 2014). Furthermore, the demographic explosion considerably affects the global food security and also results in increased demand for animal-based foodstuffs (Gerten et al., 2020; Sabaté & Soret, 2014).

The global sustainability transition is required to ensure the Earth system stability needed to meet the universal human standards for the current and future generations (Gerten et al., 2020). Furthermore, particularly urgent is to achieve food security through sustainable agriculture patterns that allow to operate within the planetary boundaries (Rockström et al., 2009). While the need for the industry change is already recognised for several decades, the negative impact is still growing, and more radical transition is needed urgently (Turunen & Halme, 2021).

2.1.2. DIETARY CHANGE AND ITS IMPORTANCE FOR FOOD INDUSTRY TRANSITION

All the stakeholder groups, such as food producers, government, non-governmental organisations, and consumer-citizens are important for sustainability transitions within the food industry. To considerably

decrease the global resource use and the negative impact of the food system, the infrastructures and governmental politics should change, as well as production and consumption patterns (Lettenmeier et al., 2014). This literature review particularly focuses on the change driven by consumer dietary change, while also not arguing that all the responsibility should be put on the shoulders of consumers. The importance on demand-side solutions for mitigating climate change has been emphasize within the last IPCC reports, and as proposed by Creutzig et al. (2018), can be addressed by strategies targeting consumption, consumer behaviour, lifestyles, technological innovation, and production-consumption systems. Additionally, Turunen and Halme (2021) argue that the sustainable transitions are co-created, and for instance, if the industries provide more sustainable products, the consumer-citizens supposed to choose those products.

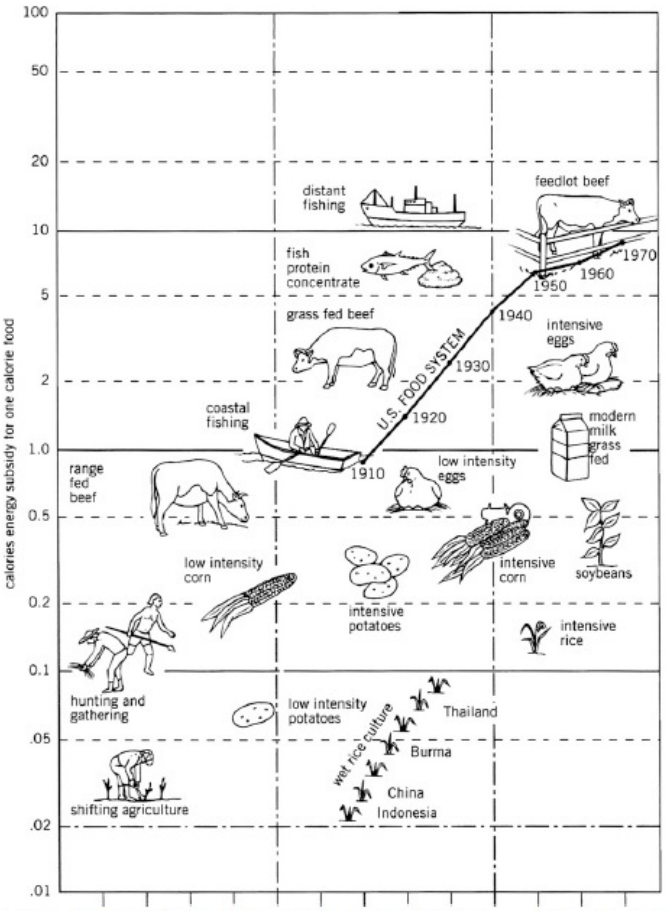
As stated by researchers, large lifestyle changes are needed to implement the Paris Agreement: change in technological solutions and lifestyles (Gerten et al., 2020; IPCC, 2014; Lettenmeier et al., 2014). Particularly, within the food industry, massive reduction in animal-based product consumption is needed. Schanes et al. (2016) has proposed a framework for categorising different options for strategic carbon footprint reduction of consumer-citizen lifestyles, as illustrated in the Figure 3. The overview includes different strategies, such as food consumption reduction by changing dietary habits; changes of consumption patterns and use behaviour; more efficient purchases and changes in the disposal behaviour. However, the researchers also present their view on effectiveness of each the categories. Ultimately, the changes in the dietary patterns, such as animal-based product reduction and replacement, indicated the largest impact (Jungbluth et al., 2012; Lettenmeier et al., 2019; Poore & Nemecek, 2018). In comparison, the strategies to increase locality, seasonality and alternative, communal food cultivation methods showed lower potential of carbon mitigation (Schanes et al., 2016).

2.1.3. SUSTAINABLE DIETS AND ADEQUACY OF MEATLESS DIETS

According to studies, drastic decrease of animal-based food product consumption is needed to reach sustainable food consumption levels (Carlsson-Kanyama & González, 2009; Lettenmeier et al., 2014; Sabaté & Soret, 2014), as the animal products have considerably higher negative environmental impact (Figure 3.) than the plant-based products (Lukas et al., 2016; Mancini et al., 2010). Additionally, Ministry of Agriculture

and Forestry (Finland) and Timeout Foundation (2021) have proposed a sustainable Finnish food future strategy that advocates for increase in fish and plant-based product consumption and decrease of meat and dairy food consumption. Additionally, they emphasize need to consume more seasonal food and reduce food waste in all stages of the food chain.

Figure 3. Graphic summary of various types of food production: ratio of energy requred to food energy delivery. (Sabaté & Soret, 2014)



Diets that mostly consist of plant-based products are generally seen as sustainable (WWF 2021), according to the definition that sustainable diets provide nutrition security for current and future generations while remain resource-light (Sabaté & Soret, 2014). WWF (2021), within their One Planet Plate strategy, argues that the plant-based diets are beneficial for both, climate and biodiversity despite the agriculture practice within this product group; designating that even the plant-based products coming from conventional farming can be defined as sustainable. Therefore, shifting towards more plant-based diets is a reasonable strategy for sustainable food futures. Ultimately, the downshifting from animal-heavy diets can be supported by following actions: a) educating consumers about environmental and health benefits of plant-based diets; b) developing attractive and culturally acceptable plant-based foods; and c) adapting fiscal policy (Sabaté & Soret, 2014).

While plant-based diets are identified as the most sustainable, it is suggested that it should not be "all or nothing" strategy (Sabaté & Soret, 2014). Currently, the ideas of vegetarian and vegan diets sometimes might have negative and misleading connotations, for instance that increase of plant-based products leads to vegan diet adaptation that does not allow exceptions and require to fully restructure daily routines and habits (Kaljonen et al., 2019). Researchers have suggested to educate the consumers about balanced transition, and the benefits of the plant-based diets, as well as the great variety of the environmental impact between the different types of animal based products (Pimentel & Pimentel, 2003); hence, the plant-based product adaptation could be gradual and more approachable for consumer-citizens.

2.2. Consumer-citizen empowerment and actionable communication

2.2.1. ATTITUDE-BEHAVIOUR GAP AND DIETARY RESISTANCE

While there are two different approaches on the demand-side solutions which are behaviour-based or information-based strategies (Langen et al., 2022), the Food Wellbeing and Suffering Index (FWSI) mainly focuses on the information-based strategy that encourages reflective and effortful thinking, but does not forbid any of the available food options at the lunch cafeterias. However, the literature review focuses on both types of demand-side strategies.

Studies recognise an attitude-behaviour gap – environmental awareness that does not necessarily translate into more sustainable actions (Caruana et al., 2016; Spaargaren, 2011; Turunen & Halme, 2021). A study by Young et al. (2010) suggests that around 30% of consumers are concerned about environment, but only 5% take relevant action. Many scholars have investigated dietary resistance, and it is recognised that downshifting from high animal product consumption might be challenging and face many barriers (Sabaté & Soret, 2014), and generally the discussion about dietary change is recognised to be emotional and sensitive for consumer-citizens and farmers (Ministry of Agriculture and Forestry and Timeout Foundation, 2021).

Significance of cultural meanings, traditions and social norms are few of the recognised barriers for dietary change. Studies indicate the complexity and social contextuality of consumer ethics (Young et

al., 2010). Although, extensive animal-based product consumption is unsustainable and related to many health issues, within the Western societies, animal-based products have been seen as the essential source of protein (Sabaté & Soret, 2014). Researchers suggest that some food related practices can be deeply embedded into everyday habits, such as use of dairy or meat products (Clonan & Holdsworth, 2012). Additionally, meat or plant-based product eating have been linked to identity building in many social groups (Kaljonen et al., 2019); therefore, lack of social group acceptance and openness for different approaches, and fear of peer judgement can hinder change (Ministry of Agriculture and Forestry and Timeout Foundation, 2021).

Another barrier for dietary change is consumer individual taste preferences (Sabaté & Soret, 2014). It have been recognised by several studies, that consumers might choose a food option primarily based on how it tastes, looks and smells (Godfrey & Feng, 2017; Ministry of Agriculture and Forestry and Timeout Foundation, 2021). Furthermore, taste preferences that can be also influenced by cultural traditions can overweight the sustainability attributes of the food products when it comes to consumer decision-making (Kaljonen et al., 2020). For instance, although cheese consumption has high environmental impact, it can be seen as essential part of cultural traditions, local cuisine, and lifestyles.

Lack of time and safe space for self-reflection can be one of the reasons for dietary resistance. A study of environmental campaign influence at student lunch cafeterias has identified that time restriction for picking a food option can limit student willingness to learn about food product impact and choose food accordingly (Godfrey & Feng, 2017). Furthermore, inaccessibility for time and safe space for individual and community self-reflection can be a barrier for dietary change, as inner transformation is essential for individual and collective lifestyle change in terms of environmental and social awareness and action (Wamsler, 2020; Woiwode et al., 2021). SYKE (2020) also suggests that food system transition take time and that different stakeholders might need different transition periods, as sustainability-enthusiastic consumers adapt faster, but other consumer groups could be more resistant (Godfrey & Feng, 2017).

Economic conditions are recognised as another constraining factor for dietary change (Girod et al., 2014; Sabaté & Soret, 2014). Important concern is whether consumers can afford the alternative plant-based options, as it is recognised that healthy and environmentally sustainable food can be more expensive (Clonan & Holdsworth, 2012),

and lack of alternative, yet affordable plant-based products can be significant barrier for change (Ministry of Agriculture and Forestry and Timeout Foundation, 2021).

Another barrier is misleading information that could lead to extreme "all or nothing" approach. Ministry of Agriculture and Forestry and Timeout Foundation (2021) have reported insights of a public discussion about dietary changes for sustainable Finnish food futures, where the participants voiced that "all or nothing" approach often associated with plant-based diets does not feel encouraging. This relates to misleading information about sustainable diets. Consumers might face confusion when it comes to environmental impact assessment and hierarchy of different aspects. Additionally, consumers might not prioritise food products with sustainability attributes that are not aligned with their values and understanding about sustainable nutrition (Godfrey & Feng, 2017).

All in all, lack of alternative and plant-based options for people with restrictive diets was not mentioned as a barrier in the reviewed academic literature. There might be many reasons that could restrict individual diets, such as health conditions, allergies, personal preferences, or religious beliefs. However, the challenges related to the restricted diets were not mentioned within the reviewed literature related to dietary resistance.

2.2.2. DESIGN APPROACHES TO PROMOTE SUSTAINABLE CONSUMPTION

Designers are influential actors within sustainability transitions (Joore & Brezet, 2015), and design is a powerful tool to promote sustainability transitions (Ceschin & Gaziulusoy, 2019). For already several decades, design practice has been used within government an social organisational units to address sustainability challenges (Ceschin & Gaziulusoy, 2016). Additionally, the role of designers in the sustainability transitions has become very broad, and it can include designers as creators of physical objects, technology, policy (Ehrenfeld, 2008), as well as designers as facilitators of social innovation and change processes (Joore & Brezet, 2015). As described by Ceschin and Gaziulusoy (2019), design approaches can be used and can have positive impact in different ways, in the form of products, product-service systems, and organisational and/or system design.

Ceschin and Gaziulusoy (2019) mention design for sustainable

behaviour, that aims to install new consumer behaviours and can potentially promote societal change. Additionally, Ehrenfeld (2008) introduces idea that designers can un-interrupt or interrupt the every-day life and its flow of consumer-citizens. The author sees user-friendly and reliable design approach to aim to not interrupt the every-life routines. However, also interruptions to every-day life routines can be designed purposely and can positively contribute to more sustainable lifestyles if they interrupt less sustainable practices, force self-reflection and guide towards alternative actions (Ehrenfeld, 2008). However, the ethics of the nudging of consumer behaviour have been widely criticised.

One of the most relevant design approaches for the thesis research and design approach is product-service system design for sustainability. As described by Ceschin and Gaziulusoy (2019), instead of focussing on product efficiency, this approach addresses wider context and structures that are organising production and consumption patterns. Ultimately, the product-service system design for sustainability can incentivise stakeholders' sustainable behaviour, by promoting repairing, recycling, reusing or circularity practices. However, this approach can be also appropriated by companies to increase profit or adapt to new markets. Additionally, this approach is addressing sustainability issues mostly from technological perspectives and can fail to consider cultural context and needs of consumers.

Design for sustainability transitions is an approach that can be adapted within private, public and civil organisations, and can have significant and positive long-term impact (Ceschin & Gaziulusoy, 2019). Additionally, Ehrenfeld (2008) advocates for the sustainability transition design, and argues that sustainable transition can be achieved only if addressing systemic conditions. For it to happen, designers need to re-design the parts of the unsustainable structures, to eventually change cultural structure and global consumption patterns. However, this design approach needs to be complemented by other design approaches, such as product, service, and policy design (Ceschin & Gaziulusoy, 2019).

For the thesis research and overall design for more sustainable food futures, I find several of these approaches relevant. The design for sustainable behaviour could be seen as an approach that could nudge consumer-citizens behaviour towards more sustainable food consumption, by considering and designing interventions into contexts of food consumption that could interrupt everyday routines. For instance, this approach could be used when designing for food-related services, food distributers, retailers and catering services, or

this approach could be applied to the food design itself. Furthermore, product-service system design, such as the Food Wellbeing and Suffering Index (FWSI) which would be embedded into the UniCafe context, could promote more sustainable food consumption by using both: behaviour-based and information-based strategies. For instance, product-service system design could promote adoption of plant-based product consumption. Ultimately, design for sustainability transitions could be a powerful high-level approach to promote adoption of more plant-based food, for instance, by new taxation policies or subsidies for plant-based product development, production, as well as subsidies for educational campaigns to promote more sustainable food consumption.

2.2.3. STRATEGIES FOR COMMUNICATION TOOLS TO CATALYSE DIETARY CHANGE

Eco-labelling schemes and environmental impact calculators aim to steer society towards sustainability, to initiate a rational reflection on lifestyles, and to fight the alienation from the impact of everyday actions by providing environmental information about products; however, the effectiveness of such tools has been widely discussed amongst academics (Bratt et al., 2011; Salo et al., 2019). Therefore, this part of literature review presents the current academic discussion on strategies for bridging the attitude-behaviour gap for more sustainable food consumption and dietary change, with consideration of environmental labelling shortcomings.

One of the strategies for the actionable communication is contextualisation of the communication tools. Within their study, Salo et al. (2019) investigates limitations and opportunities for carbon calculators to catalyse more sustainable consumer-citizen action in Finland, and have recognised that engagement with these calculators is often limited to one-time use. Therefore, Salo et al. (2019) suggests that impact communication tools should be more embodied in consumer-citizen everyday life practices in order to catalyse more sustainable consumption and also reach those consumers who do not already have high environmental awareness and interest (Salo et al., 2019).

Another strategy for actionable communication is going beyond “all or nothing” approach and introduce consumers to the possible variety of food options yet in considerably more sustainable way. As described in the Section 2.2.1., one of the reasons what hinders widespread adaptation of plant-based foot products is negative connotations with vegan or vegetarian diets as being exclusive and radical. In their One

Planet Plate strategy, WWF (2021) suggests a framework that allows choice diversity. Although, the framework highly promotes plant-based products, it allows for consumers to occasionally choose the options that are less sustainable yet indicates the impact variety between animal-based food products.

Researchers argue that food industry is unique in comparison with other fields regarding sustainability transitions, because of its environmental impact that cannot be fully eliminated due to food security and global need for healthy nutrition (Lukas et al., 2016). Population growth that is linked to the growing need for nutritious food should be considered, as well as individual health considerations and recommendations (SYKE 2020). Researchers recommend to establish strong synergy between environmental and health aspects when educating consumers and guiding them towards more sustainable food (Carlsson-Kanyama & González, 2009; Lukas et al., 2016).

One of the opportunities to promote dietary change is to adapt more experimental approaches. For instance, experimentation within restaurants or lunch places, such as experimental campaigns and events that allow consumer involvement. Kaljonen et al. (2019) suggest that experimentation has potential to promote dietary change in several ways: a) experimentation can help reconfiguring cultural meanings related to food and integrate novel products; b) engage people with new practices or food products in playful way; c) provides space for learning from mistakes and unsuccessful experiments. Therefore, the experimentation can provide easiness and joy for consumers to try and adapt new food options and food related habits, as well as food producers and retailers can engage in innovative practice.

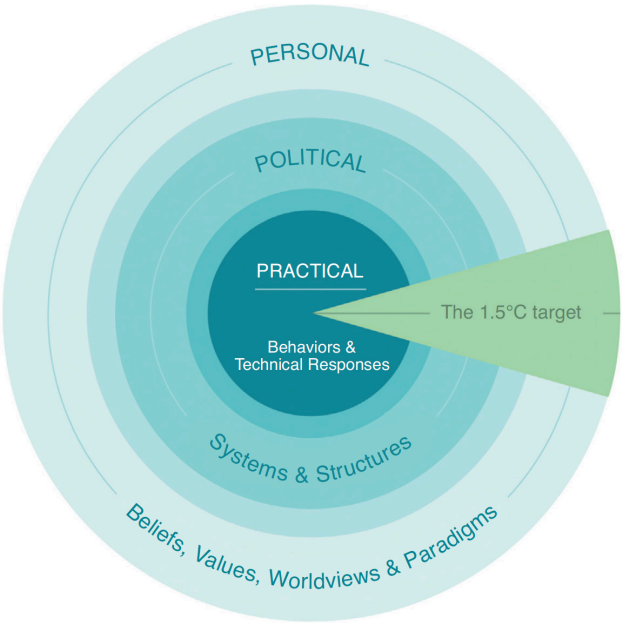
An experiment that was conducted by The Finnish Environment Institute (SYKE) has indicated potential of consumer involvement to catalyse change (Kaljonen et al., 2020). Within their experiment workplace lunch restaurants in Finland, SYKE investigated potential interventions and consumer behaviour change to mitigate climate change. The study suggests that customers often pay little attention to information about the environmental impact of lunch options, but rather decide based on their individual preferences of how food smells, tastes and looks. While the consumers' resistance to dietary change led to recipe adaptation and the overall meat consumption decreased, the environmental benefits were washed out due to increase of dairy products to adapt to consumers' individual preferences and local cultural food traditions (Kaljonen et al., 2020). However, the opportunity to hear customers' feedback allowed the lunch restaurant to

adapt recipes to customer preferences, and eventually develop mutually desirable food alternatives to promote dietary change.

The scholars have also recognised that food sustainability communication alone cannot bring the needed change efficiently enough (Bonnet et al., 2018), therefore the researchers have investigated weather environmental tax on ruminant meat products could efficiently reduce household GHG emissions related to nutrition. Bonnet et al. (2018) argue that even taxation of the most environmentally polluting animal meat, such as beef can achieve significant environmental benefits. However, the scholars argue that the taxation only on the most polluting meat products instead of applying it to all meat products could be more beneficial from welfare point of view.

According to the leverage points perspective, the most widespread change can be catalysed if addressing the mindsets and personal spheres (Meadows, 1997; O'Brien, 2018). Scholars suggest that solutions within the practical sphere not as effective; whereas, the inner transformation can shift overall system, and can catalyse lifestyle and dietary change, as illustrated in the Figure 4. O'Brien (2018) argues that narrow focusing on behaviours and technical responses might distract from more radical change opportunities that might seem unrealistic at the first glance; therefore, inner transformation should be equally considered. One of the prerequisites for inner transformation are opportunities and time for self-reflection on individual and collective level. Nowadays, the fast pace of life does not always allow these opportunities; therefore, creation of spaces and methods to allow self-reflection, can be a transformative and strategic action to catalyse change (Woiwode et al., 2021).

Figure 4. The three spheres of transformation. (O'Brien, 2018)



2.3. Index architecture

2.3.1. DATA RESOURCE INTENSITY

Emerging topics within academic literature are complexity of environmental impact assessment, the large number of different food products and the need for time intensive human labour to run impact communication, labelling or calculating schemes (Bienge et al., 2010; Liedtke et al., 2010). As these communication tools aim to raise awareness about food product impact and inform consumer decision-making (Bratt et al., 2011; Salo et al., 2019), the actual touchpoints with consumers, such as products in grocery stores, at restaurants or lunch cafeterias, as well as other consumer goods are numerous. It is recognised that the widespread environmental life cycle assessment (eLCA) approach is very time intensive for a comprehensive assessment of singular food products (Bienge et al., 2010). Yet it is still the dominating approach for the food product impact assessment. According to Liedtke et al. (2010), there is a growing demand for cost-effective aggregated information tools to inform more sustainable consumption or procurement processes (Liedtke et al., 2010). Additionally, currently available databases on material footprint (MIPS) and environmental Life Cycle Assessment requires concept specific knowledge and specialised software for data analysis. All in all, the analytical framework, and data application to labelling schemes can be time intensive in terms of expert knowledge and labour. To provide feasible solutions to enable effective product impact comparison, data resource intensity should be addressed and limited.

The large number and complexity of the different food products available in market is another challenge for labelling scheme applications. For instance, one of the leading finish retailers S-Group, within their carbon footprint calculator has create food categories, instead of providing environmental impact data for individual food products (Forsman, 2019). Additionally, Lukas et al. (2016) suggest that data from similar food products can be allocated to the food products that are missing data. However, there is a risk for data to become to simplified and not informative or trustworthy.

Turunen and Halme (2021) have proposed an academic framework for an actionable communication tool to inform more sustainable fashion consumption. They empathise on the need for actionable communication tools to bridge the attitude-behaviour gap. Therefore, their tool is designed to provide environmental product information in

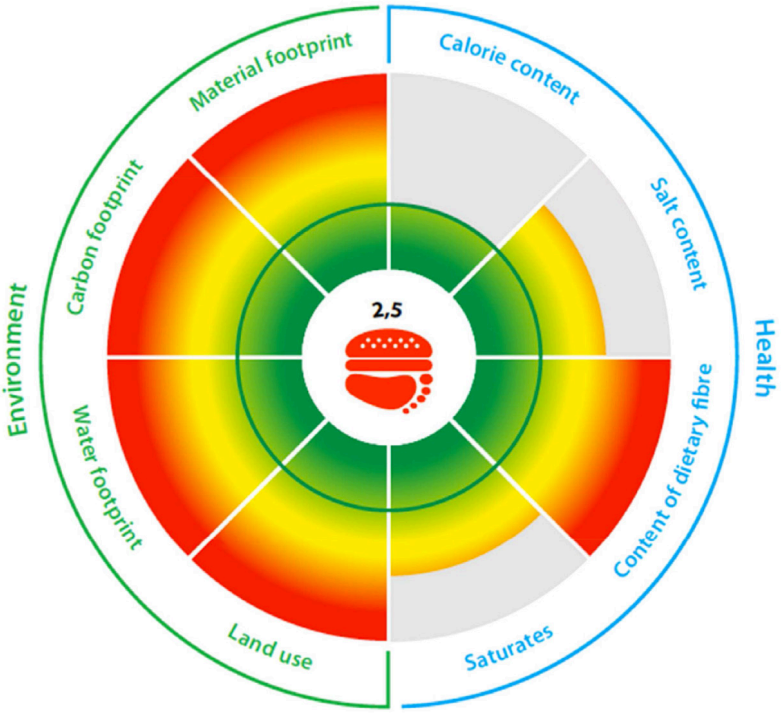
a comprehensive, yet simple way. Similarly, Lukas et al. (2016), suggest that actionable communication tool should be simple enough to limit the data needs and to be approachable for consumers, yet it needs to be scientifically sound to ensure consumer trust, and to reach strategic goals to mitigate environmental impact.

2.3.2. NUTRITIONAL FOOTPRINT FRAMEWORK

The Nutritional Footprint (Figure 5.) is an academic framework for food product impact communication that combines impact on environment and human health (Lukas et al., 2016). The aim of the framework is to promote sustainability of nutrition by informing consumer decisions. The framework has four metrics related to environmental sustainability, and four metrics related to healthy nutrition. The tool aggregates impact into three-threshold levels, and it uses traffic-light colour coding for its visual communication, similarly as the Planetary Boundaries framework (Rockström et al., 2009). Ultimately, the eight metrics are aggregated into one number that represents an index of a food product.

The Nutritional Footprint framework includes eight metrics related to environmental sustainability and human health. The four metrics related to environmental impact are as follows: carbon footprint; material footprint; land use; and water footprint. These metrics have been selected after extensive literature review to define the most impactful aspects of food system, by also considering the feasibility of metric application regarding data availability (Lukas et al., 2016). The food environmental impact is aggregated in three-threshold levels, where the 'Green' threshold level also serves as an indicator for sustainable consumption (Lukas et al., 2016). The three-threshold level intervals of the Nutritional Footprint framework are based on sustainable food production and consumption targets published by academic sources relevant to Finnish context. The target for carbon footprint reduction is based on publication by Macdiarmid et al. (2012); the target for material footprint is based on publication by Lettenmeier et al. (2014); the target for land use is based on publication by Ercin and Hoekstra (2014); and the target for water footprint is based on publication by Noleppa (2012). Additionally, Lukas et al. (2016) suggest the use of relevant databases, such as ECOINVENT to inform the application of food products to the Nutritional Footprint.

Figure 5. Nutritional Footprint framework. (Lukas et al., 2016)



2.3.3. STRATEGIC TARGETS FOR DIETARY CHANGE

The Intergovernmental Panel on Climate Change (IPCC) have proposed the strategic 1.5 C Paris target to downshift the global emissions to net zero by the year 2050 to limit global warming to 1.5°C temperature. According to IPCC (2019), the global warming need to be limited within 1.5°C, because if the rapid warming within the current course would exceed 1.5°C or 2°C it can result in long-lasting or irreversible impacts, such as loss of some ecosystems.

The internationally recognised 1.5°C target has informed international and national level industry-related sustainability proposals. These proposals create more detailed and specific industry-focused strategies that can be translated into action plans with strategic targets. For instance, to reach the 1.5 C target, the WWF One Planet Plate initiative (2021) have proposed limitations for food related CO2e emissions that are calculated into units of daily meals. For lunch meals it is recommended to not exceed 0.5 kg CO2e, and the overall weekly limit is 11 kg CO2e.

Hoek et al. (2021) argues that food system transition requires both: consumer behaviour change, as well as organisation behaviour change across the food system. Furthermore, the food system transition is not possible without changes in consumer-citizen attitude towards food

systems and consumption patterns (Willet et al., 2019).

Researchers from Aalto University and D-Mat have co-created 1.5-degree lifestyles framework, lifestyle-oriented strategy and defined detailed targets to keep the global warming within the 1.5 C limit (Lettenmeier et al., 2019). Furthermore, the Finnish Innovation Fund Sitra has created its summary. It suggests to reduce carbon footprint per-person as follows: 2.5 tCO2e by the year 2030; 1.4 tCO2e by the year 2040; and 0.7 tCO2e by the year 2050. Regarding individual diets, it is suggested to widely adapt vegetarian/vegan diets, and to substitute diary and red meat foodstuffs, thereby to reduce the nutritional footprint in Finland by 47-58% by the year 2030 and 75-80% by the year 2050 (Lettenmeier et al., 2019).

The material footprint also known as the Total Material Requirement (TMR), is an input-oriented impact assessment approach, and it represents the needed resource use and material flows. From impact assessment and communication perspective, material footprint complements output-oriented carbon footprint metric, and is defined as one of the metrics of the Nutritional Footprint framework (Lettenmeier et al., 2014; Lukas et al., 2016). The material footprint sums up categories of abiotic and biotic resources used to produce consumer goods. The researchers have proposed material footprint limits for individual and household consumption to enable sustainable resource use levels (Bringezu, 2017). Lukas et al. (2016) suggest a limit of eight tons of material footprint per capita in Finland per year, and the limit for food and drinks of 3 tons of material footprint per person per year. These targets are also integrated within the Nutritional Footprint framework.

It is known that the food and especially animal product production is very water-intensive and will tend to increase along the population growth and rising demand for animal-based products (Mekonnen & Hoekstra, 2012). As presented by the researchers, the term water footprint refers to all water used throughout the life cycle of a product, and it divides into three categories: blue water footprint that accounts for the surface and groundwater consumption; green water footprint that refers to the rainwater consumption; and grey water footprint that refers to the freshwater required to assimilate the load of pollutants. Within the Nutritional Footprint framework, Lukas et al. (2016) have set a strategic target for water footprint reduction by 35% of the current levels by the year 2050, this target is based on a study by Ercin and Hoekstra (2014).

3. METHODOLOGY

3.1. Qualitative research and constructive design research approach

Nowadays, behavioural and social sciences often inform the design processes (Koskinen et al., 2011). As described by the researchers, design discipline holds knowledge and tools to create new products, technologies, services, systems, or policies that usually take place in the Anthropocene; therefore, human interaction with those needs to be studied. The qualitative research methodologies are well recognised in the design research discipline. These methodologies facilitate study about phenomenon of human behaviour in localised and specific contexts (Crouch & Pearce, 2013; Lunenfeld, 2003). As FWSI was created to disrupt the consumer alienation from food system impact, and to provide an actionable tool to inform more sustainable food choices, the qualitative research methodologies are applicable to the MA thesis research, which takes place in specific context of lunch cafeterias in Finland.

For the MA thesis research, the qualitative research methodology – constructive design research was chosen. The methodology allows to adapt solution-focused strategies, and productive thinking (Cross, 1982), as well as construct new knowledge by constructing new products, systems or media (Koskinen et al., 2011). This approach is experimental in its nature as is design practice and allows to explore possible futures by also bringing the social context into consideration (Binder & Brandt, 2017; Koskinen et al., 2011). The constructive design research methods allow to generate new knowledge by analysing both: the design process and the experimental results of it, such as prototypes (Stappers, 2014). Therefore, the thesis used the constructive design research approach to study the application of FWSI within a real-life context, as illustrated in the Table 1.

Table 1. The constructive design research and prototyping plan. (Jumite, 2022)

	Stage	Research focus & practicalities
01	Literature review to inform prototyping	Described in detail in the Table 4
02	Semi-structured expert and stakeholder interviews inform prototyping	Described in detail in the Table 2
03	Initial prototyping phase	3.1. Protein source product data gathering from the UniCafe 3.2. Creating the initial application of FWSI, that is informed by global average data 3.2. Applying FWSI to the UniCafe lunch menu of one week
04	Focus group	4.1. Participant testing of FWSI prototype within the UniCafe context for one week, before the focus group discussions 4.2. Focus group, described in the Table 3
05	Final prototyping phase	5.1. Analysing the focus group insights and iterating on the prototype 3.2. Protein source categorisation 3.3. Shortlisting the analytical frameworks that are relevant to Finnish context to inform protein source categories within carbon, material and water footprint metrics 3.4. Applying the analytical frameworks to the protein sources and creating an online data depository 3.5. Applying of the strategic targets to the FWSI and defining the three-threshold level intervals, based on targets relevant to Finnish context 3.6. Conceptualising the three-threshold levels

3.2. Prototyping

To research the Food Wellbeing and Suffering Index (FWSI) application in real-life context at the Unicafe and to define its targets and threshold levels, I chose prototyping as my primary research method. Prototyping, as a research approach, holds the promise of using the design action as a knowledge-gathering method, and allows the evaluation of a "physical hypothesis" (Stappers, 2014) that in this case was an food sustainability communication tool with online information depository. Additionally, prototyping can not only test hypothesis, but also provide an opportunity to construct and test new material or non-material design artifacts. As described by the researcher, prototyping allows an iterative research process that can be informed by behavioural insights, gained from prototype user-testing, focus groups, or user interviews. Since the FWSI is targeted to consumer-citizens, and is dependent on several stakeholder groups, the prototyping process will help to involve these stakeholders in the FWSI application process. The prototyping process was documented in a field diary. The prototyping

diary and the transcribes of the semi-structured expert interviews and the focus group were analysed by using thematic coding approach (Taylor-Powell & Renner, 2003). When analysing the data, many emerging themes were identified. Furthermore, these many themes were categorised and combined into few themes that I found the most significant and relevant for the thesis research.

3.3. Semi-structured expert interviews

I find semi-structured expert interviews suitable for the inquiry related to both research questions. Firstly, to study about broader context of FWSI, and to propose complementary strategies to support effective application of FWSI to catalyse dietary change. Secondly, to inform prototyping process and application of FWSI in the real-life context. Semi-structured interviews have balanced nature between structure and flexibility (Gillham, 2005). As explained by the author, semi-structured interview method provides clearly prepared question base that ensure equivalent coverage of the topic within different interviews, as well as allow unexpected discussions and insights to emerge. The interviewee plan is illustrated in the Table 2. The results form expert interviews were analysed by applying thematic coding method.

Table 2. Interviewee plan for the semi-structured expert interviews. (Jumite, 2022)

Stakeholder group	Interviewees	Interview focus
Organisations that focus on assessment, aggregation, and communication of food sustainability	1) Natural Resources Institute Finland Luke 2) D-Mat	· Dietary change and the role of impact communication · Challenges and opportunities to facilitate dietary change with impact communication schemes · Food sustainability data and analytical framework availability · Targets for food sustainability communication · Targets of a food sustainability index, three-threshold level definition · Practical application of a food sustainability index in a real-life context: opportunities and challenges
Hosts/ creators of sustainability communication tools	3) Shades of Green 4) Klimato	
NGO focusing on sustainable food future transitions	5) WWF Suomi	
Lunch cafeteria representative	6) UniCafe management and in-house sustainability expert	· UniCafe sustainability strategy and their view on FWSI · Food sustainability data and analytical framework availability · Dietary change at lunch cafeteria context: opportunities and limitations for more sustainable diets · Data availability at UniCafe · Targets for food sustainability communication · Targets of a food sustainability index, three-threshold level definition · Protein source categorisation

3.4. Focus group

A focus group can be seen as a convenient way for data collection, because it allows discussion and expression of opinions for several people simultaneously (Lune & Berg, 2017). As described in the study, focus groups allow for the researchers to gather insights about participant's motivations, decisions, and priorities, and in the MA thesis case those would be related to the criteria development for shortlisting analytical frameworks, as well as gaining consumer-citizen feedback on practical application of the Food Wellbeing and Suffering Index (FWSI) at the real-life context at the UniCafe lunch cafeterias. A focus group was organised as a part of the experimental MOOC at the University of Helsinki called "Sustainable Consumption, in the Spring 2022. Since the course students were already regular visitors of the UniCafe, the context where FWSI was applied, was familiar to them. The student group was involved within one of the initial phases of the prototyping process, to gather insights that represent the user perspectives. The focus group was divided into two different groups with six students in each; however, the content and discussion topics were the same for both groups. Within the focus groups, students expressed their opinions about following topics illustrated in the Table 3.

Table 3. The discussion topics of the focus group. (Jumite, 2022)

01	How do the focus group participants engage with the prototype (more open discussion question)
02	Would they see using FWSI on daily basis, what opportunities and risks do they see
03	What sources would be relevant to be utilised for FWSI application, to define the strategic targets, as well as to apply the index to the protein sources
04	What information should be provided by the index
05	How the food products should be compared, and in what level of detail

3.5. Role of the literature review to inform the FWSI application and the definition of the three-threshold levels

The literature review has been partly used to also inform the prototyping process and the application of the Food Wellbeing and Suffering Index (FWSI), as well as to inform the strategic targets of the index. The selected literature was mostly relevant to the Finnish context. The aim of the literature review for the prototyping purposes was to provide insights about strategic targets of food system impact reduction that could inform the targets and three-threshold levels of FWSI; to review similar food sustainability communication schemes to inform the FWSI application process; and to create a list of potential analytical frameworks for the FWSI application, such as databases, academic publications and impact calculators.

Table 4. The plan for the literature review that informed the prototyping process. (Jumite, 2022)

Purpose	Keywords
To inform FWSI strategic targets and three-threshold levels	1.5-targets, food industry targets, 1.5-degree lifestyles targets, sustainable water footprint targets, sustainable material footprint targets, sustainable food futures and targets in Finland
To inform FWSI application process and learn from other relevant food sustainability communication schemes	Food carbon footprint calculators, material footprint calculators, water footprint calculators, food sustainability communication tools relevant to Finnish context, food sustainability labelling schemes relevant to Finnish context
To create a list of potential analytical frameworks that would be applied to the protein source product categories	Databases, impact calculators and academic publications on carbon, material, and water footprint calculations of singular food products within Finnish context

4. CONSUMER-CITIZEN EMPOWERMENT FOR SUSTAINABLE FOOD FUTURES: STRATEGIES TO SUPPORT FOOD SUSTAINABILITY COMMUNICATION TOOLS TO PROMOTE DIETARY CHANGE

This section explains the finding from the semi-structured expert interviews to study the barriers of dietary change, as well as to recognise possible strategies that could complement food sustainability communication tools application. The findings are structured in two parts: as more industry-specific, and as more consumer-citizen-centred.

4.1. Stakeholder and industry resistance and sensitivity – choosing the considerate approach

4.1.1. CHALLENGE OF THE CONTEXT: FOOD SECURITY AND DOMESTIC PLANT-BASED PROTEINS

As identified by some of the interview respondents, food crisis and food security are important themes related to the current state of the food industry and are crucial aspect when considering sustainable food futures and transitions. Although, the thesis research is related to sustainable food futures and particularly consumer-citizen role, the interviewees empathised the importance of the global context and crisis. Interviewee pointed out several global challenges, such as the Covid-19 pandemic and the war in Ukraine, that both catalysed global food crisis. Furthermore, both catastrophic events have brought attention for food system fragility, especially when nations were often not self-sufficient within their domestic food supply. These events have catalysed a discussion about need for domestic food supply and security.

The need for food security was also linked to the challenge of population growth. In contrast to the need for environmental impact reduction within the agriculture industry, there is the wicked problem of population growth, and therefore growing demand for nutrition. Therefore, environmental impact reduction needs to be balanced and well planned to ensure healthy nutrition for global communities. As described by a respondent: *"Sustainable food is nutritious and healthy food for growing population."*

Another theme related to food security is food affordability. Within the stakeholder interview, the UniCafe management and sustainability expert identified an emerging issue within food security in Finland and particularly affordability of animal-based products. There has

been a trend of raising prices of animal-based products, and that has raised a concern that these protein sources might not be affordable in near future for some food vendors, such as student lunch cafeterias that receive governmental subsidies for student meals. In addition, several interviewees mentioned that there is increasing demand for various domestically produced plant-based proteins within Finland.

4.1.2. CHALLENGE OF THE INDUSTRY: AGRICULTURE FIELD SENSITIVITY

Sensitivity of the agriculture field and its chronical decade-long economical underproductivity puts additional challenge on the food system change, as it was empathised by one of the interview respondents. While there is a recognised need for agriculture field transition, the essential stakeholders that are required to drive the change might be underprepared. The agricultural field has received governmental subsidies for decades and has faced many economic challenges. Change of the agricultural practice from animal farming to plant-based food production might be radical for farmers, and their attitude for industry and dietary change have been rather defensive and resistant to change. The interviewee empathised the need to consider these stakeholders, when planning food sustainability communication schemes for dietary change. Additionally, the interviewee suggested that targets and data applied for the FWSI implementation should be based on sources that are recognised and trusted within Finland to ensure farmers' trust.

4.1.3. CONSUMER-CITIZEN DIETARY RESISTANCE

Several respondents mentioned dietary resistance as a barrier that fosters sustainability transitions. Currently, large the average Finnish diet is meat-heavy and has high environmental impact. There are many reasons that might hinder the change, such as alienation from food consumption impact, cultural meanings embedded in the current dietary practices, and individual taste preferences. As recognised by few respondents, opportunities to adapt more plant-based food products have already been available for past years; however, there has not been extensive adaptation. As one respondent described: "*It seems that the dietary adaptation to plant-based proteins has slowed down since all of the people who had the willingness to change has done it.*" It remains a challenge, how to facilitate this change further from now in a speed that would allow to reach the carbon neutrality targets by the years 2030

and 2050. Although, the alternative plant-based options are available for consumer-citizens, that might not be enough. Additionally, another respondent indicated an attitude-behaviour gap, that is a phenomenon related to sustainable consumption. Although consumer-citizens' awareness of their consumption impact might raise, it is not necessarily translating into action. The reasons for that might be difficulties to translate the awareness and environmental concerns in feasible and culturally acceptable everyday food choices. The alternatives should also be affordable, and the impact communication should be clear and contextual.

Another challenge for dietary change is reaching people who are not prioritising climate action within their daily consumption habits. One respondent referred to the idea of *"hard-to-reach households"*, that signifies consumer target groups that are not taking considerable steps to achieve more sustainable lifestyles and are not enough concerned about climate change in general. The interviewee pointed out, that people who are willing to participate in such campaigns and experiments related to alternative and more nature-friendly diets, have already earlier showed interest about these issues. How to reach or incentivise consumer-citizens who lack time and interest remains unclear.

In consideration of food transitions, one respondent mentioned the need to avoid *climate dictatorship*. Additionally, most of the interviewees mentioned the need to avoid the *"all or nothing"* thinking when considering dietary change. The interviewed experts argued that the food transition as a steady and considerate transition, especially for the most resistant consumer-citizen audiences. It might not be strategic and effective to communicate need for drastic change, because it can cause the opposite effect, such as consumer-citizens could become defensive, and could choose to stagnate. Dietary change should not feel forced or as a burden, but rather as an opportunity for consumer-citizens to experiment with new and delicious food, learn new skills, learn about health aspects of the plant-based products, and try them in a joyful way. The positive and experimental attitude towards dietary change and wider adaptation of plant-based proteins, seems to be the most encouraging for consumers. Additionally, the transition should be slow and patient, and empathetic towards consumer-citizens and their individual speed of adaptation.

One of effective strategies to catalyse consumer-citizen dietary change is awareness rising and climate action campaigns, such as "Veganuary", which is a month-long challenge when everyone is encouraged to eat

mostly vegan. One of the interviewees suggested that arranging a campaign is one of the opportunities to promote dietary change, even if most of the consumer-citizens who have wanted to adapt more plant-based product have already done that, and overall progress of change has reached plateau. Although, the potential of campaigns to create long-lasting change should be still researched. However, the interviewee suggested that campaigns have potential to catalyse change in a playful and experimental way that feel approachable for different audiences and does not feel forced.

An index, that communicates more than one sustainability aspect, was seen as an educative and convincing approach. One of the respondents claimed that there is a need for more actionable communication for consumer-citizens, and that there is a lack of clear and sufficient information about food products' impact. Additionally, they suggested that communication of several aspects of a products' impact could promote wider understanding of sustainability impact and could empathise the negative impact of the most emission-heavy animal-based products. The expert mentioned that ominilablel index could be a convincing approach for the most resistant and defensive consumer-citizens who are actively advocating for meat consumption.

One of the respondents expressed a concern that the most effective catalyst for a widespread behaviour change is a global crisis. While there are many governmental strategies, civil society organisation actions and initiatives, the expert interviewee suggested that the most significant change follows large crisis, such as Covid-19. Within such conditions, people were able to adapt very drastic measures and new habits quickly, while such a rapid and widespread adaptation is not likely to happen otherwise. The respondent also emphasized the importance of impact communication and political actions that are informed by science. However, the interviewee admitted that they see global crisis as one of the most effective change catalysts.

4.2. Consumer-citizen empowerment through knowledge and alternative option accessibility

One of the emerging topics within the expert interviews was knowledge accessibility to consumer-citizens that could inform and empower their decision-making. Currently, customer-citizens are expected to gradually make more sustainable food choices, as they are one of the

essential stakeholder groups for the food system transition. However, few expert interviewees empathised the need to bridge the knowledge gap. While the information about environmental impact is continuously expanding, it might leave consumer-citizens confused about the impact spectrum and the actual impact of their actions. The knowledge accessibility also refers to information that would reach different consumer-citizen audiences. While consumer-citizens who are already more interested in climate action might acknowledge the importance of the action and seek for information themselves, audiences who have smaller interest in climate action might not have time or enthusiasm to investigate the product sustainability attributes. Actionable communication is needed to facilitate more sustainable consumption and link consumer-citizens with more sustainable products. Particular attention and communication are needed to promote plant-based products an increase attractiveness and positive attitude towards them. Few of the respondents indicated that plant-based product supply is not enough, and the sustainability and health attributes of vegan food products could be communicated more.

4.2.1. IMPACT SCALE AWARENESS

Sustainability often has been associated with *"on and off"* thinking, and the understanding of environmental impact scale could be lacking or being misinterpreted. Firstly, consumer-citizens often can be alienated from the food system impact in general, and they can miss the actual impact of individual choices. Secondly, as mentioned by one interviewee, the consumer-citizens are often lacking the understanding beyond the *"on and off"* thinking of sustainability matters. The respondent empathised the need to popularise understanding of sustainability as a spectrum and rather *"progress versus regress"* thinking, because all consumer-citizen choices have impact, but the difference is within the scale of it. The understanding of the scale could also encourage consumer-citizens to act more frequently, and not to try achieving the perfect sustainable consumption that can also feel paralysing. The *"progress versus regress"* thinking could also help to create safe space for more open discussions and diverse opinions, and to welcome consumer-citizen audiences that are more resistant. The expert interview respondent argues that sustainability spectrum approach could shift the sustainable consumption discussion to be more accessible for everyone.

Another aspect of sustainability spectrum awareness is the misuse of the climate arguments. Although nowadays the sustainability

discussion is very relevant within the fields of business, governmental actions, civil society organisations and individual lifestyles, the understanding of this term can vary drastically and can often be misleading. Few interviewees empathised the need to fight the misuse of sustainability arguments. Every action or consumption choice has an environmental impact on many different aspects, such as biodiversity, water pollution, carbon emissions, as well as every process of the products life cycle has an impact, such as production, processing, transportation, storage, and use. However, consumer-citizens often tend to misunderstand the impact aspects in comparison to each other. For instance, producers or consumers could be empathising the importance of the locality of food products because of the emissions related to transportation, whereas, according to the environmental life cycle assessment (eLCA) approach, the environmental impact of the primary production is considerably more significant. All in all, the emissions regarding product transportation are important, but they become irrelevant, if distracting from focusing and reducing the environmental impact from the most polluting life cycle phases. Another example of climate argument misuse that was mentioned by an expert, was over-empathising the harm of the packaging waste over the impact of the production phase of food, which often can be many times more polluting. Although, the packaging waste is environmentally harmful, the impact reduction attention should not be focused on packaging waste as an equally harmful aspect as overall carbon footprint of food product life cycle.

Although, vegetarian diets have been seen as more sustainable than widespread meat-heavy diets, the high environmental impact of cheese products is often missed. Within the sustainability communication, vegetarian and vegan diets have been promoted as sustainable; however, there is a significant impact difference between those. The vegetarian diet can include dairy products that have considerably high impact. In comparison with other dairy products, particularly polluting is cheese, which produces even more carbon emissions than pork or chicken. The impact of cheese is often missed because vegetarian diet seems more sustainable in general, caused by the assumption that animals are not killed to produce the food. All in all, the expert argued that the *"invisible"* impact of cheese needs to be clearly communicated to consumer-citizens to raise their awareness.

4.2.2. SCALE OF NEEDED DIETARY CHANGE

Evolved understanding about sustainable food consumption is needed, beyond extreme diet change expectations. The experts suggest a need to explore *"planetary diets"* concept that is diverse enough to allow little animal-based product consumption and is not seen as strict as the vegan diet. As the experts described, sustainable food consumption is not about strict vegan diet, but a wide-spread meat consumption reduction, as well as normalisation and adoption to plant-based products. The current assumption about extreme adaptation to vegan diets can be misleading and discouraging. Experts see the food system transition as a process that allows experimentation, innovation, and adaptation of different types of diets. The *"planetary diets"* can differ within what kinds of products are consumed if the overall impact is considerably lower than the impact of the current diets. There needs to be a clear and straightforward communication about the sustainable food consumption beyond extreme veganism, to promote consumer-citizen awareness and climate action.

One of the interviewees suggested the dietary-budget analogy to the *"planetary diets"*. Quota systems are already introduced to some industries to manage the resource use. While it might be extreme to apply real quotas to individual food consumption, the dietary budget could be rather applied on a mental level, to encourage consumer-citizens to acknowledge the limits of resources related to food production. The dietary budget consideration could be helpful for consumer-citizens when making food-related decisions. Additionally, the dietary budget approach could promote the adaption of mainstream use of plant-based products, while also allowing to occasionally consume some animal-based products. However, as empathised by the interviewee, the animal-based product impact spectrum should be also considered, for instance, to increase wild fish consumption over other animal-based proteins, and to drastically reduce beef consumption.

4.2.3. AFFORDABILITY AND ACCESSIBILITY OF THE ALTERNATIVES

Although the consumer-citizen awareness is essential for change, it can also be limiting if there is a lack of accessibility of alternatives. Several of the expert interviewees argued that dietary change goes beyond awareness, and aspects such as affordability of alternative choices, accessibility, easiness, and attractiveness of alternative food options should be equally considered when promoting dietary change. While the

consumer-citizens can have awareness and interest in more sustainable choices, they might hesitate to act if there are any of these limiting factors.

A crucial and relevant topic regarding sustainable food futures is food security and affordability. As empathised by an expert interviewee, the climate crisis and the Ukraine war causes the economic inequality growth, as well as stresses the food affordability. For the food transitions to be just, alternative option affordability for everyone needs to be considered. Additionally, there is a wide-spread assumption that vegan diets can be more expensive; therefore, not feasible for everyone. However, as described in the Section 4.1.1., there is an ongoing trend of increasing prices of animal-based proteins in Finland. As the expert assumed, due to the price increase, the animal-based proteins might become less accessible for consumer-citizens, while the plant-based proteins could still be affordable. Regardless of the varying assumptions and arguments about animal and plant-based food affordability, it was empathised by most of the expert interviewees, that the affordability of alternative options needs to be strongly considered when promoting dietary change.

Apart from affordability, easiness of plant-based options is also crucial for dietary change. Some of the exerts empathised the need for attractive and easily accessible plant-based options. Due to the individual taste preferences and lack of time, consumer-citizens often are prioritising convenience of the food products when making consumption choices. Additionally, there are several risks linked to adaptation of new plant-based products, such as: consumer-citizens might not have time to adapt new cooking habits; or consumer-citizens might not have willingness to choose alternative products if it would require additional effort or would not meet their taste preferences. Therefore, the easiness and attractiveness of plant-based options for consumer-citizens to choose is crucial.

5. FOOD WELLBEING AND SUFFERING INDEX APPLICATION

5.1. Exploring the index application at the lunch cafeteria context

5.1.1. DATA SCARCITY AND UNPREDICTABILITY

The data gathering for the Food Wellbeing and Suffering Index (FWSI) application at the context of the UniCafe lunch cafeterias has indicated several challenges related to data availability and reliability. These findings were discovered after reviewing all the protein sources of the daily lunch menu at the UniCafe website. The data was gathered over a time period of few weeks, and it was also compared with the lunches that are actually served at the UniCafe lunch cafeterias. The recognised challenges were as follows: a) an extensive diversity of animal-based and plant-based protein sources, for instance, many kinds of fish products; b) unpredictable changes of the lunch products within one day at a lunch cafeteria that are not synchronised with the online lunch menu.

The list of the protein sources at the UniCafe has been extensive within all the product categories, especially the plant-based proteins. Although, all of the protein source categories within the UniCafe are generic and widely used in Finland, such as chicken, pork, and fish, the food products under each category were many, and included different animal, or plant species within one category, as well as variety of raw ingredients to processed food products. Additionally, since the demand for plant-based proteins over past years have been constantly increasing, the supply and diversity of these products have considerably grown, and many new plant-based proteins have been introduced to the market and furthermore to the lunch cafeterias, such as seitan, beanit and pulled-oats.

Another challenge for data gathering for the FWSI application was unpredictability of the protein sources served within one day at a UniCafe lunch cafeteria. While the general categories of lunch options remained invariable (e.g., vegan, fish, chicken options), the types of meals that were served under each category could differ throughout a day. Although, the initial lunch options were published within the UniCafe online lunch menu every day, later in a day these options can be replaced with alternatives at the lunch cafeterias, but the online menu is not updated. Therefore, the application of FWSI for each specific protein source would require systematic improvements of the lunch related communication.

In contrast to the extensive protein source list, the variety of relevant

datasets from applicable analytical frameworks were limited. The Food Wellbeing and Suffering Index (FWSI) application required to find protein source list corresponding datasets from relevant and scientifically sound sources (e.g. scientific publications, databases, impact calculators). However, lack of datasets on environmental impact for specific protein sources was identified. For instance, there were limited corresponding datasets to the extensive variety of fish products, novel and processed plant-based products, and different types of cheeses. Although, there was a larger variety of datasets in the carbon footprint category, datasets for material footprint and water footprint were very general and not applicable to the extensive protein source list. While there were some exceptions within several food categories at some publications; in most of the publications, databases and environmental impact calculators, coverage of the protein sources is considerably less detailed as required and cover only the most popular protein sources.

5.1.2. CATEGORISATION

The two-fold challenge of the scarcity of available datasets from analytical frameworks and the extensive list of the protein sources transformed the index application process. Despite the consumer-citizen preference for a more detailed information about each protein source, the data needs were limited by categorisation of the protein sources, as illustrated in the Figure 6. Additionally, in the future, the protein source categories could help FWSI to be applicable at the UniCafe and other lunch cafeterias without excessive technological advancement or human resources, while considering the current availability of relevant analytical frameworks. The product categorisation for impact communication also has been an established practice in other food related businesses, such as food retail (Saarinen et al., 2019), and has been recognised as a relevant practice by the Finnish environmental impact research and communication authorities, such as D-Mat.

The protein source categories were developed applicable to a wider context by adding beef as an additional category. While most of the categories were based on the currently used protein sources at the UniCafe, beef was added as an additional protein source category, although it is not served in the cafeterias. Beef is one of the widely used protein sources in Finland (Saarinen et al., 2019), and has particularly high environmental impact (Poore & Nemecek, 2018); therefore, the consumption of this product need to be reduced. Furthermore, this addition could allow a wider application of FWSI in wider lunch cafeteria context in Finland.

In total, six protein sources categories were created for the FWSI application, as illustrated in the Figure 6. All the plant-based proteins were combined into one category, as they are quite sustainable already, and the impact difference within the category is not significant enough when considering FWSI targets of carbon, material, and water footprint reduction. Singular categories of pork, chicken and beef were created. Although, the UniCafe management have categorised each of these products into “raw” and “processed” product categories, the difference was not recognised as significant enough in comparison to the impact of the primary production of these products. Wild fish, farmed fish and shrimps were combined into one category due to data need limitations and the limited frequency of shrimp use within the UniCafe lunches. However, it was explained by one of the expert interviewees that wild fish has less negative environmental impact and should be promoted over farmed fish. Despite of this argument, a separate category for wild fish was not created to limit data needs. Finally, one cheese category was created to combine many different cheese types, to convincingly communicate overall significantly negative impact of cheese that is not often recognised by consumer-citizens (Poore & Nemecek, 2018).

Figure 6. Protein source product categorisation at the UniCafe lunch cafeteria context. (Jumite, 2022)

5.2. Analytical framework shortlisting for FWSI application on protein source products

For the Food Wellbeing and Suffering Index (FWSI) application on the protein source categories that were described in the previous section, relevant analytical frameworks were shortlisted. As the thesis explores FWSI application within the metrics of carbon footprint, material footprint and water footprint, relevant and scientifically sound sources were needed to identify the footprints of the protein source categories. A comprehensive overview was conducted, that covered relevant academic or governmental publication, databases, and impact calculators. Additionally, alternative data sources were considered such as producer specific data about their food products and emission calculation services. To limit the overview, analytical frameworks that contained individual food product or food product category datasets.

After creating a list of potential analytical frameworks, criteria were created to shortlist the most applicable ones (Table 5). The criteria were created based on insights of the expert interviews, and the interview with the UniCafe management. A scorecard was created to colour code the analytical frameworks from the list according to the applicability of each framework, and to eventually shortlist the most relevant ones. Additionally, since the research objective was to apply FWSI to lunch cafeterias in Finnish context, it was crucial to consider the stakeholder sensitivity and relevant data availability. As described in the section 4.1.2., food system transition related communications, strategies and actions can be seen as risky and radical for some stakeholders, especially farmers and food producers. Therefore, when considering analytical framework shortlisting criteria, relevancy of data to the Finnish context become the prior criterion.

Table 5. Criteria for analytical framework shortlisting. (Jumite, 2022)

Criteria In hierarchical order	Optimal	Satisfactory	Not applicable
01 Relevancy	Relevant to Finnish context	Global averages; Specific to another EU country	Specific to an non-EtU country
02 Source transperency	Academic peer reviewed; Governmental; Institutional	Academic, not peer reviewed; Private business research	Source not found
03 Product category coverage	Full coverage of the food categories	Partly coverage of the food categories	No corresponding data
04 Affordability	Available for free	Moderate costs	Not affordable
05 Applicability	Easily applicable format	Requires additional calculation	Not applicable

CARBON FOOTPRINT. From thirty-nine shortlisted analytical frameworks, a publication by the Finnish Innovation Fund Sitra was selected as the most applicable (Figure 6). In comparison with the analytical framework availability for material and water footprint metrics, the availability of the analytical frameworks for carbon footprint was considerably higher. The reason for it might be the widespread demand for carbon emission communication of consumer products. Additionally, the data published by food product producers was also considered relevant, when considering the stakeholder sensitivity. However, the producer specific data tended to show lower impact than the data from academic and governmental publications.

Table 6. The shortlisted analytical frameworks for the carbon footprint metric. (Jumite, 2022)

	Plant-based	Fish	Chicken	Pork	Cheese	Beef
Per 100g of the protein source product	200g CO2e (Sitra, 2019)	300g CO2e (Sitra, 2019)	380g CO2e (Sitra, 2019)	570g CO2e (Sitra, 2019)	1300g CO2e (Sitra, 2019)	1900g CO2e (Sitra, 2019)

MATERIAL FOOTPRINT. From nine listed analytical frameworks, one academic publication was selected and was identified as relevant to Finnish context, as well as fully applicable (Table 7). However, the availability of analytical frameworks for material footprint was limited, as the impact measurement approach is relatively new, and not widely understood, and these impact calculation services have not been highly demanded yet. Additionally, several other relevant academic publications within Finland were based on the same publication that was shortlisted within the thesis process, this publication is authored by Kauppinen et al. (2008).

Table 7. The selected analytical framework for the material footprint metric. (Jumite, 2022)

	Plant-based	Fish	Chicken	Pork	Cheese	Beef
Per 100g of the protein source product	300g TMR (Kauppinen et al. 2008)	760g TMR (Kauppinen et al. 2008)	1290g TMR (Kauppinen et al. 2008)	2120g TMR (Kauppinen et al. 2008)	4320g TMR (Kauppinen et al. 2008)	4590g TMR (Kauppinen et al. 2008)

WATER FOOTPRINT. From sixteen analytical frameworks, one academic paper from Finland was selected (Table 8). However, the publication did not cover all the product categories; therefore, one other academic paper was selected to compensate the missing information. The complementary publication which was selected, is based on the global averages of water footprint.

Table 8. The shortlisted analytical frameworks for the water footprint metric. (Jumite, 2022)

	Plant-based	Fish	Chicken	Cheese	Pork	Beef
Per 100g of the protein source product	93 l (Jalava & Kummu, 2018)	197 l (Petersson et al., 2021)	300 l (Jalava & Kummu, 2018)	506 l (Petersson et al., 2021)	537 l (Jalava & Kummu, 2018)	1496 l (Jalava & Kummu, 2018)

5.3. Actionable and equable communication: Defining the strategic targets of FWSI

FWSI aims to communicate the environmental impact of food products in an actionable and effective way, as it is embedded into student daily lunch context. As described in the Section 4.1.3., the environmental impact labelling needs to consider the context of its use to be effective and bridge the attitude-behaviour gap. Actionable communication empowers consumer-citizens with impact information and opportunities to make more sustainable, yet desirable and affordable food choices. Therefore, the FWSI application to the lunch cafeteria context is designed to help consumer-citizens to compare relevant functional units – environmental impact of different protein sources, which are all on relatively equal price range and affordable for the vendor to provide. Additionally, to limit the data needs, the average wight of a lunch protein source – 100 g is defined as the functional unit.

The communication of FWSI is designed to be equable, by presenting the different food options within the spectrum of negative environmental impact and not as extremes. As recognised within the focus group and the expert interviews, the stakeholder sensitivity requires equable communication. Therefore, the three-threshold levels of FWSI are named in non-excluding manner and are formulated as rather recommendations. These recommendations related to the three-threshold levels of FWSI are as follows:

- Green. “Eat often.”
- Yellow. “Eat sometimes.”
- Red. “Eat rarely.”

Although, the three-threshold level communication suggests frequency of product use, the three indicators “Eat often”, “Eat sometimes”, “Eat rarely” are not tight to precise numbers of frequency of product use. Furthermore, additional research of consumer-citizen interpretation of the *often*, *sometimes* and *rarely* would be needed; however, it is suggested to not to restrict these indicators to strict count of meals to avoid strict and extreme approach, and to allow consumer-citizen to adjust gradually.

5.3.1. CONCEPTUALISATION OF THE THREE-THRESHOLD LEVELS

The Food Wellbeing and Suffering Index (FWSI) consists of three-threshold levels that aim to communicate the food item impact in a simple manner. As recognised by the focus group participants and expert interviewees, the traffic-light colour labelling is intuitive and user-friendly approach to communicate gradation of the impact. Additionally, the traffic-light labelling has been used in several relevant environmental impact communication frameworks, such as Planetary Boundaries (Rockström et al., 2009) and Nutritional Footprint (Lukas et al., 2016). The three-threshold levels of FWSI were conceptualised as follows:

GREEN. The Green category of FWSI represent the most sustainable food options that has the least negative environmental impact, as similarly defined within the Nutritional Framework (Lukas et al., 2016). Mainstream adaption of these proteins could help to transitions towards and sustain 1.5-degree lifestyles. The suggested intake of the food options from this category is unlimited, and it is highly recommended for the consumer-citizens to mostly consume meals that are labelled Green. Ultimately, also people practicing omnivore diets would eat plant-based proteins every day; however, the options to choose meals from the other categories than Green are not fully excluded either.

According to the expert interviewees, the green threshold level could represent all plant-based protein sources as they are already quite sustainable compared to animal-based protein sources, regardless their origin. The practical application of FWSI identified that the plant-based proteins indicated Green on all metrics – carbon footprint, material footprint and water footprint. According to the expert interviewees, the consistency of the different indicators can help to raise awareness about environmental impact of the food products and the importance of dietary change.

YELLOW. The Yellow category of FWSI represents the less sustainable food options yet suggested to consume in moderate frequency. Although, the animal-based options are not recognised as sustainable protein sources in general, the Yellow category presents the more sustainable ones. Therefore, the division between the Yellow and the Red categories aims to educate consumer-citizens in the differences of the environmental impact of vegetarian, fish and meat products, and to avoid the militant veganism communication approach. The meal options that are mostly mark as Yellow could be suggested for consumer-citizens

to eat once or twice per week (Lukas et al., 2016).

RED. The Red category represents the least sustainable food options that are suggested to consume rarely. This category includes the most polluting animal-based protein sources. Regarding environmental impact assessment of carbon, material and water footprint, beef has the highest environmental impact, and it naturally belongs to the Red category; however, also cheese and pork are allocated to the Red category considering their relatively high impact.

5.3.2. STRATEGIC INTERVALS OF THE THREE-THRESHOLD LEVELS

Additionally, to the three-threshold level conceptualisation, three different impact intervals were allocated to the threshold levels. As recognised by scientists, the negative food systems impact should be drastically reduced for humanity to sustain the safe ecosystem for the current and next generations (Rockström et al., 2009). Furthermore, researchers have recognised strategic targets of the negative impact reduction related to all the fields of production. There are also specific targets for individual food consumption, to ultimately, achieve 1.5-degree lifestyles (Lettenmeier et al., 2019). Within the thesis research and FWSI application at the UniCafe lunch cafeteria context, these internationally and nationally recognised climate impact mitigation targets were adapted to the FSWI three-threshold level intervals.

CARBON FOOTPRINT METRIC THRESHOLD LEVEL INTERVALS. The Finnish Innovation Fund Sitra is recognised as one of the main authorities developing sustainable food future strategies in Finland. Therefore, the strategic intervals of three-threshold levels regarding the carbon footprint metric are based on the Sitra Lifestyle test which is developed for individuals to assess their carbon footprint in the context of 1.5-degree lifestyle targets (Toivio & Lettenmeier, 2018). Within the report of the calculation basis for the Sitra lifestyle test, the researchers have allocated the most polluting protein sources under two categories to inform consumer-citizen decisions towards 1.5-degree lifestyles (Toivio & Lettenmeier, 2018):

- THE MOST POLLUTING PROTEIN SOURCES.
  Beef (19kg CO2e/kg); cheese (13kg CO2e/kg); pork (5.6kg CO2e/kg)

- THE LESS POLLUTING PROTEIN SOURCES.
  Chicken (3.6kg CO2e/kg); fish (3kg CO2e/kg)

The Sitra protein source categories have informed the three-threshold level intervals for the FWSI application. Firstly, the interval boundaries were set in-between the product categories, by also considering plant-based proteins (2kg CO2e/kg) (Toivio & Lettenmeier, 2018) as the sustainable consumption level. The boundaries are like follows:

- GREEN. EAT OFTEN. < 2.5kg CO2e/kg
- YELLOW. EAT SOMETIMES. 2.5 – 4.7kg CO2e/kg
- RED. EAT RARELY. > 4.7kg CO2e/kg

Secondly, the intervals of the three-threshold levels were adapted to lunch meals units of 100g on average. Therefore, the threshold level intervals applied at the UniCafe context are as follows:

- GREEN. EAT OFTEN. < 250g CO2e/100g
- YELLOW. EAT SOMETIMES. 250 – 470g CO2e/100g
- RED. EAT RARELY. > 470g CO2e/100g

MATERIAL FOOTPRINT AND WATER FOOTPRINT METRIC THRESHOLD LEVEL INTERVALS. The three-threshold level intervals of the Material Footprint and Water Footprint metrics for FWSI were informed by the Nutritional Footprint framework. The framework is an academically developed suggestion for a communication tool to inform consumer-citizen decisions about food system impact to promote sustainable food consumption in Finland (Lukas et al., 2016). The researchers have defined the intervals of the three-threshold levels based on the following academic recommendations. Firstly, the targets for the Material Footprint of food consumption are based on the Lettenmeier et al. (2014) study on suggested individual material footprint reduction for sustainable food futures relevant to Finnish context. Secondly, the targets for the Water Footprint are informed by Mekonnen and Hoekstra (2012) study on global assessment of water footprints of foodstuffs and strategic targets for the reduction. The proposed intervals for the three-threshold levels are as follows:

MATERIAL FOOTPRINT

- Small impact. <2670g /per meal (Lukas et al., 2016)
- Medium impact. 2670-4000g /per meal (Lukas et al., 2016)
- Strong impact. >4000g /per meal (Lukas et al., 2016)

WATER FOOTPRINT

- Small impact. <640l /per meal (Lukas et al., 2016)
- Medium impact. 640-975l /per meal (Lukas et al., 2016)
- Strong impact. >975l /per meal (Lukas et al., 2016)

Additional calculation of the protein source impact was made, to apply the threshold level internals to FWSI at UniCafe context. According to Saarinen et al. (2019), in the current widespread diets meat and dairy products are responsible for 65% of the climate impact. The percentage informed the calculation for the impact interval particularly for the protein source of the meal. The final intervals for FWSI for UniCafe context are as follows:

MATERIAL FOOTPRINT

- Small impact. <1018g TMR/150g (Lukas et al., 2016)
- Medium impact. 1080 – 2348g TMR/150g (Lukas et al., 2016)
- Strong impact. >2348g TMR /150g (Lukas et al., 2016)

WATER FOOTPRINT

- Small impact. <237l /150g (Lukas et al., 2016)
- Medium impact. 237 - 572l /150g (Lukas et al., 2016)
- Strong impact. >572l /150g (Lukas et al., 2016)

Table 9. Strategic targets of FWSI three-threshold levels and application on the UniCafe protein source groups. (Jumite, 2022)

Carbon Footprint	Green. Eat often.	Yellow. Eat sometimes.	Red. Eat rarely.
Threshold-level intervals	< 250 g CO2e / 100 g	250 – 470 g CO2e / 100 g	> 470 g CO2e / 100 g
Protein source categories	Plant-based proteins (200 g CO2e / 100 g)	Fish (300 g CO2e / 100 g) Chicken (380 g CO2e / 100 g)	Pork (570 g CO2e / 100 g) Cheese (1300 g CO2e / 100 g) Beef (1900 g CO2e / 100 g)
Material Footprint	**Green. Eat often.**	**Yellow. Eat sometimes.**	**Red. Eat rarely.**
Threshold-level intervals	< 679 g TMR / 100 g	679 – 1565 g TMR / 100 g	> 1565 g TMR / 100 g
Protein source categories	Plant-based proteins (300 g TMR / 100 g)	Fish (760 g TMR / 100 g) Chicken (1290 g TMR / 100 g)	Pork (2120 g TMR / 100 g) Cheese (4320 g TMR / 100 g) Beef (4590 g TMR / 100 g)
Water Footprint	**Green. Eat often.**	**Yellow. Eat sometimes.**	**Red. Eat rarely.**
Threshold-level intervals	< 158 l / 100 g	158 – 381 l / 100 g	> 381 l / 100 g
Protein source categories	Plant-based proteins (93 l / 100 g)	Fish (197 l / 100 g) Chicken (300 l / 100 g)	Cheese (506 l / 100 g) Pork (537 l / 100 g) Beef (1496 l / 100 g)

Figure 7. FWSI visualisation and application to the UniCafe protein source categories. (Jumite, 2022)

5.4. Focus group insights

As the focus group was organised within one of the initial stages of prototyping for the Food Wellbeing and Suffering Index (FWSI), the gathered insights informed the prototyping process. The focus group participants were discussing predefined topics that are described in the section 3.4. The focus group was conducted after participants had already used the index for few times when choosing lunch at UniCafe.

Regarding the index visual design, the participants noted that the use of traffic-light colour coding is intuitive and user-friendly. However, they expressed a wish to have more detailed information available, such as exact numbers of carbon footprint, material footprint and water footprint that are related to their meal options, as this information was not included into the initial prototype.

When discussing if the students would see using the index on daily basis, most of them expressed the willingness to use it. Although, several of the focus group participants had already adapted to vegan diet since earlier, they noted that they would like to use the index to feel apricated for their sustainable food choices and to receive tokens. In general, most of the participants were mentioning that the index use seems useful for them to see the actual impact of their food choices within the lunch cafeteria context. Some of the students mentioned that they did not feel guilty when choosing the less sustainable food options; however, they noticed overall change in their food consumption pattern towards being more sustainable. All in all, students noted that it has been an enriching and

educative experience of using the index. For instance, for some students the considerably high impact of cheese was something that they did not know before.

Regarding other concerns that influence food decisions, some students mentioned that they sometimes chose less sustainable food options within the UniCafe, because they looked tastier. In contrast, one student mentioned that they do not see significant differences within the food option taste; therefore, they can easily choose the most sustainable one.

The focus group participants expressed a concern, that there might be different level of interest of sustainable food consumption, within other student communities. The participants described themselves as students who are already highly interested in the environmental impact mitigation and climate activism. Additionally, they mentioned that they would like to see more experiments of the index application and use within the student communities with lower interest in climate action and defensive attitude towards meat reduction.

Regarding data and analytical frameworks that would inform the FWSI application, the focus groups participants argued that data should be as precise as possible and preferably relevant to Finnish context. Furthermore, participants wanted to access more detailed information about the data sources and the methodologies how the data behind the index is calculated to ensure that it is trustworthy. The participants were sceptic about use of global averages to inform the protein source categories.

6. DISCUSSION AND CONCLUSIONS

Climate crisis and biodiversity loss have created urgency for industries, and production-consumption patterns to drastically change. As one of the most polluting is agriculture industry, the need for reduction of its impact has been recognised widely. The agriculture field is responsible for extensive amounts of natural resources, and one of the most effective actions for the impact reduction is widespread dietary change. Furthermore, apart from being environmentally unsustainable, the current Western diets are also often not healthy and often causing obesity and cardiovascular diseases. Researchers have recognised the opportunities and targets for more environmentally sustainable and healthy diets. The Planetary Diets that would be environmentally sustainable include considerable reduction of animal-based products, as well as mainstream adaption of plant-based products. Additionally, these diets can allow occasional animal-based product consumption by prioritising the less polluting animal-based options, such as farmed fish, wild fish, and chicken. However, the current dietary patterns that are heavy on animal-product consumption are deeply embedded in Western societal norms and cultural traditions, often even linked to the personal identity-creation. Plant-based products are sometimes associated with extreme vegan diets, and this association can cause discouraging attitude towards widespread plant-based product adaption. These reasons shortly indicate the challenge of dietary resistance. Although there are many attempts to catalyse dietary change with food labelling, indexing and impact calculations by rising consumer-citizen awareness of the food system impact, there is a significant attitude-behaviour gap that hinders the change.

The aim of this thesis was twofold: Firstly, to study a wider context of the FWSI application, barriers for dietary change, and to propose complementary strategies for more effective application of FWSI. The study was executed by conducting and analysing several expert interviews with experts in food sustanability assessment and communication, as well as developers of sustainable food future visions and strategies for Finland. Secondly, the aim was to research and define possible strategic targets for a consumer-oriented index of food system impact and to apply it in the real-life context of lunch cafeterias in Finland. The second research goal was achieved by using constructive design research approach and by creating the Food Wellbeing and Suffering Index (FWSI) prototype as well as data depositary that covers protein source categories for FWSI. The research was executed within the context of the UniCafe lunch cafeterias in Helsinki.

6.1. Consumer-citizen empowerment to promote dietary change by using food sustainability communication tools: limitations and opportunities

Dietary resistance has been recognised as one of the essential barriers for food system change towards sustainable food futures. The thesis research has indicated the complexity of dietary change at many levels. These findings are also supported by current academic discussion about food system change; as it is suggested by Sabaté and Soret (2014) that downshifting from high meat consumption faces many barriers. The thesis has recognised that there are barriers that are linked to the lack of awareness of food system impact, alienation of it, and consumer-citizen misunderstanding of the scale of the food product sustainability. The thesis research findings also suggest that in many scenarios, consumer-citizens lack interest in prioritising sustainability within their decision-making process. These findings are also recognised by Kaljonen et al. (2020), who suggest that personal preferences can overweight the sustainability attributes of food products in many cases. The academics suggest that that often the consumers-citizens' understanding of environmental impact might not be holistic or sustainability arguments can be misused. Secondly, the thesis research has recognised barriers related to the attitude-behaviour gap, and consumer-citizens with existing awareness and interest of food system impact often do not translate this attitude into action. This attitude-behaviour gap is also widely recognised in the current academic literature (Caruana et al., 2016; Spaargaren, 2011; Turunen & Halme, 2021). The academics also describe, that there are several barriers that are linked to the attitude-behaviour gap, such as affordability and easiness of alternative food options, as also recognised by Clonan and Holdsworth (2012). Additionally, Ministry of Agriculture and Forestry & Timeout Foundation (2021) have suggested that cultural norms and traditions might also cause the attitude-behaviour gap in dietary change.

While there are serious concerns about feasibility of a widespread dietary change, the research has identified opportunities and possible strategies that could complement food sustainability communication tools to facilitate dietary change. One of the approaches for the consumer-citizen behaviour change that is has been recognised by academics is actionable communication approach (Turunen & Halme, 2021). This approach suggests that consumer-citizen decisions could be

informed by simple yet scientifically-sound communication tools (Lukas et al., 2016). However, the thesis research has identified the need for consideration of the context of the food sustainability communication tools, such as recognising the limitations of practical implementation and maintenance of the tools, as well as consumer-citizen lifestyles, personal taste preferences, cultural traditions, and social norms, as well as accessibility and affordability of sustainable food options. The thesis research suggests that over-focusing just on the communication tool development could face several shortcomings. Some of these findings are also supported by Salo et al. (2019), who suggest that impact calculators should consider consumer-citizen everyday life practices; and Kaljonen et al. (2020), who indicate the need to consider consumer-citizen taste preferences and cultural norms around food consumption; as well as Clonan and Holdsworth (2012), who identify the need to consider economic context of dietary change. However, there was no academic discussion or arguments found that would support thesis finding of over-focusing on the tool development which leads to missing all other important aspects of the practical use of the tools.

The thesis research findings suggest that the current understanding of dietary changes, scale of food product sustainability is misleading and discouraging; therefore, higher awareness about these matters would be needed. Within the academic literature similar finding were not found; however, academics address the inner-transformation as essential for change in consumption patterns (O'Brien, 2018; Woiwode et al., 2021). When contrasting the thesis finding and this academic discussion, the knowledge accessibility, awareness rising could be linked to the inner-transformation processes.

The research suggest that experimental campaigns can provide opportunities for dietary changes. This finding has been supported by the academic discussion. Firstly, Woiwode et al. (2021) suggest that safe space and time is needed for self and community reflection to happen and catalyse inner-transformation that ultimately catalyses dietary change. Secondly, Kaljonen et al. (2019) have suggested that experimental campaigns can help to construct new meaning of food products, as well as allow to engage with new food practices in a playful way that could allow more easy and gradual adoption of plant-based products.

Another finding of the thesis research is the potential positive impact of complementary governmental actions such as policy change or new taxation models that could support and incentivise more sustainable food consumption. This finding is supported by the academic

research by Bonnet et al. (2018) who suggest that taxation of the most environmentally-polluting meat products can bring significant environmental benefits; however, they also suggest that this taxation strategy leads to product substitution within other meat types and does not necessary lead towards increase of plant-based product consumption. Therefore, the researchers have suggested future research direction for more elaborate taxation policies that consider all product categories.

6.2. Best practice for food sustainability indexing at lunch cafeterias

6.2.1. LIMITING THE DATA NEEDS

The thesis study and the practical application of FWSI has identified that the food system impact assessment is resource intensive, and its communication process is complicated, as it requires data collection, aggregation, simplification, and application on many levels that eventually can strategically inform consumer-citizen decisions. Although, the environmental Life Cycle Assessment (eLCA) is very time intensive for impact assessment of singular food items (Bienge et al., 2010), it is still the dominating approach, according to literature review and research findings. However, the research findings also identified existing attempts of data need limitation, such as food product categorisation and data allocation for the food products that do not have corresponding data in databases or academic publications. However, the notion of actionable communication in the academic literature refers to impact communication that is simple enough (Lukas et al., 2016; Turunen & Halme, 2021), yet it is more from consumer-friendliness perspective. When contrasting the research findings and academic literature, the notion of limiting the data needs was less represented in the literature. The reason might be theoretical level of academic research that lack the considerations of the real-life application constrains, such as labour intensity, expert knowledge, and budget for a specific LCA software. Although, in relation to the Nutritional Framework, Lukas et al. (2016) identify the need to allocate the food product impact data to the food products that lack this data, the need for food product categorisation is not empathised. However, it has been recognised within the thesis research that food product categorisation drastically decreases the data needs and provides the opportunity to implement food sustainability communication tools in real-life context of lunch cafeterias.

Another strategy for limiting the data needs is use publications instead of databases to source product-specific data. Although, the academics have suggested to use relevant databases, such as the Ecoinvent (Lukas et al., 2016), the research findings suggest that such databases are cost intensive and require specific Life Cycle Assessment related expertise. Food product categorisation and use of data from relevant academic publications to create a local online data inventory seem to be a feasible way to limit the data needs. However, these are findings regarding food index application to protein sources; therefore, there would be need to research the index application to other food product groups.

6.2.2. STRATEGIC AND SENSIBLE COMMUNICATION OF THE INDEX

Effective food sustainability communication tools should clearly communicate about the spectrum of needed dietary change. Research findings suggest that, although, the index aims to limit individual environmental footprint within 1.5-degree lifestyle target, it should avoid extreme approach which could discourage consumer-citizens to make action. Therefore, the communication should have suggestions and not strict requests for excluding highly polluting food products or to adapt extreme diets. This argument is also supported by academic literature; for instance, Sabaté and Soret (2014) and Kaljonen et al. (2019) suggest to go beyond "all or nothing approach" to avoid misleading and discouraging connotations of diets with high plant-based product content.

Another aspect of strategic index communication is awareness rising and clarification of food sustainability spectrum. The thesis research suggests that there is a misunderstanding of food system impact, and some aspects might be seen as overly important, whereas some might remain invisible to consumer-citizens. The food sustainability spectrum can be communicated by not categorising food products as "vegan", "vegetarian" and "animal-based", but bringing more clarity between the actual impact between different product groups. For instance, some clarifications would be needed to highlight the invisible but considerably high impact of cheese, or to shift the focus from the relatively low environmental impact of food transportation to the other parts of food life cycle that are more polluting. Additionally, it is recommended to provide knowledge and education about these impact differences to promote understanding of sustainability as *"spectrum"*. It is also suggested by literature that sustainability should be viewed more as a *"progress versus regress"* problem, and not *"on or off"* matter (Turunen & Halme, 2021).

6.2.3. CONSIDERING THE CONTEXT: LOCALLY DESIGNED AND INFORMED INDEX, SUPPORTED BY GOVERNMENTAL STRATEGY FOR JUST FOOD SYSTEM TRANSITION

The use of locally relevant climate targets and food sustainability data could help to tackle stakeholder sensitivity. The discussion about the food system change is sensitive to all involved stakeholders, especially animal-biased product farmers who would be required to shift their practices, and consumer-citizens who are recommended to downshift their animal-based product consumption. The agriculture field and dietary change sensitivity is also recognised by Ministry of Agriculture and Forestry and Timeout Foundation (2021). However, the unique finding of the thesis research was that the local context consideration is essential to tackle food system stakeholder sensitivity. Ultimately, if the food system impact data, and the strategic targets are locally acknowledged and agreed upon, it might help to prevent stakeholder resistance and militancy. While the Nutritional Footprint framework is partly based on Finnish specific climate targets (Lukas et al., 2016), it was not specifically stated that it would be a priority. Therefore, the strategic targets for the Food Wellbeing and Suffering Index (FWSI) application were adapted from academic publications and targets relevant to Finnish context, as well as the analytical frameworks to inform the specific product categories.

The context of its use and the target audiences should be considered when designing food sustainability communication tools. Often impact calculators, indexes and frameworks when designed merely in the academic environment, are prioritising data and scientific accuracy; however, over-empathising the scientific reliability might shift the focus from considering the context of its implementation, maintenance, and use. Prototyping process has allowed to investigate the real-life application of a food system index and the potential shortcomings of scientifically sound yet too resource intensive tools. Furthermore, the shortcomings of impact communication tools that are not embodied in consumer-citizen every-day lifestyles are also recognised within academic literature, for instance by Woiwode et al. (2021). Additionally, the impact data communication can miss the targets to promote the dietary change if the targets are not clearly communicated to consumer-citizens in the relevant way, especially if the consumer-citizens are not familiar with the sustainability concerns. It is also suggested by Kaljonen et al. (2020) that sustainability attributes that are not seen as important or relevant can be easily overweighted by consumer-citizens' personal preferences. Therefore, a comprehensive study of target audience and their lifestyles is needed, when designing the communication tools.

6.3. Potential impact of Food Wellbeing and Suffering Index application within the ATARCA Food Future experiment

The research findings have identified strengths and positive impact potential for the Food Wellbeing and Suffering Index (FWSI) application within the ATARCA Food Futures experiment. Additionally, some aspects for improvements and future considerations are suggested to tackle the dietary resistance. However, when contrasting FWSI and its application to the strategy suggestions that could complement food sustainability communication tools, that has been described within the Sections 4.1. and 4.2., it shows promising results and potential.

One of the strengths of the current experiment and the application of FWSI is the fact that it is embedded in the context of consumer-citizen decision-making in a user-friendly way. The UniCafe lunch cafeterias in Helsinki already provide alternative and feasible options for the animal-based protein sources; therefore, the consumer-citizens can be guided towards more sustainable choices that they can easily choose and afford on daily basis. It might be more challenging to apply FWSI within other countries and contexts with restricted access to affordable and attractive plant-based options, or in locations where plant-based proteins are not so culturally normalised and attractive for consumer-citizens. Furthermore, the student audience that has been targeted within experiment has shown interest in sustainable food consumption; therefore, there is potential for implementation of the FWSI tool that goes beyond one time use. However, larger study of student audiences, their sustainability awareness and interest would be needed to discover the potential widespread adaption to FWSI.

As this thesis has explored the practical application of FWSI within Finland by using data and climate targets relevant to Finnish context, it has a potential to build consumer-citizen trust and relevancy within the local context. The food industry is a sensitive for drastic change, as the agriculture and farming industries have been economically underproductive; therefore, strategies and actions should consider local context and source the most relevant data for these contexts. Another advantage of application of FWSI within Finland is the alignment with the current governmental strategy for sustainable food futures in Finland, as well as the current UniCafe strategy for more sustainable food consumption that also empathises reduction of animal-based product consumption. However, when applying FWSI outside Finland, the local context and governmental sustainability strategies should be considered.

FWSI as a communication tool, helps to promote *"progress versus regress"* thinking about sustainable food consumption and communicates the spectrum of food product impact. The general understanding about sustainable diets is often associated with extreme *"on or off"* approaches that might be misleading and discouraging for consumer-citizens and causes dietary resistance. Therefore, there is a need for more accurate understanding of sustainable consumption that goes beyond extreme approaches and makes sustainable consumption easer to adopt. The transition towards more sustainable consumption is a gradual process that should give a space for experiments, failures, and time for reflection. FWSI and its communication by not forcing people to exclude the most polluting products but recommend eating them rarely, avoids the negative connotations associated with vegan diets. Additionally, FWSI avoids misuse of environmental impact facts, and clearly prioritises the most significant sustainability aspects, by excluding aspects that are less significant in comparison, such as emissions related with transportation, and the factor if food products are vegetarian (yet contains dairy).

As a future development, FWSI could consider how to allow consumer-citizens to provide feedback about their preferences, as well as to intervene in the food product selection. The dietary change requires safe space for experiments, community self-reflection and is often hindered by personal and culturally embedded taste preferences. Therefore, the ATARCA Food Futures experiment and FWSI could develop mechanics how to allow a two-way dialogue and co-creation with consumer-citizens. That would require involvement and openness form the food vendors to engage in more experimental settings but could be started as short-term initiatives and campaigns.

Another challenge and focus for future developments of FWSI would be working within contexts of higher dietary resistance due to the cultural meanings associated with meat consumption. As in the more rural areas of Finland the meat-consumption is more embedded within culture and is often associated with personal identity-building and concept of masculinity, new and experimental approaches and possibly new terminologies would be needed to promote the plant-based protein consumption.

Ultimately, the Food Wellbeing and Suffering Index (FWSI) could be more linked to the governmental sustainability strategies, as well as recognised and introduced by the authorities. It could help to gain its credibility and promote its effectiveness if it would be linked to sustainably-related governmental actions, such as taxation related to environmental impact of food products.

6.4. Conclusions

In this section, I will revisit the research questions that guided my work.

RQ1: What complementary strategies could support food sustainability communication tools to empower consumer-citizens to make more sustainable food choices?

The thesis research has recognised several possible strategies (Figure 8), that could complement environmental impact communication tools, such as the Food Wellbeing and Suffering Index (FWSI). The strategies are described as four different suggestions that complement each other.

The first suggestion is to provide knowledge accessibility to consumer-citizens, to raise the awareness about the scale of different food product sustainability, as well as awareness about the needed dietary change beyond strict veganism. As the current widespread understanding about the dietary change can be misleading and discouraging, more precise information could be provided to facilitate change.

The second suggestion is to consider the context of the communication tool application and create interventions to link the tools to affordable, accessible, attractive and socially acceptable food alternatives. The food sustainability communication tools themselves can face shortcomings, if linked to food options that are sustainable, yet consumer-citizens cannot afford them, or do not see them as desirable.

The third suggestion is to run parallel and supportive campaigns and activities that allow experimentation and consumer-involvement. Dietary change can face resistance due to many reasons, such as negative connotations with vegan diets, lack of time to adopt new habits and recipes, lack of time and opportunities for self-reflection on food choices. However, playful and experimental approaches that allow consumer-involvement can create safe and joyful environment to develop new meanings for plant-based food products, as well as encourage new practices and habits.

The fourth suggestion is to develop and connect with supportive governmental strategies, such as taxation policy change. A food sustainability index that is developed within academic context could be linked to supportive policy or new taxation models, to incentivise consumer-citizens to make more sustainable choices, to support farmers to adopt their production, as well as to support food producers and retailers to adopt new practices.

Figure 8. Complementary strategies to support food sustainability communication tools. (Jumite, 2022)

RQ2: How to define the strategic targets of a food sustainability index, and how to apply it to a real-life context of lunch cafeterias in Finland?

To respond to the agriculture field and consumer-citizen sensitivity about dietary change, data relevant to Finnish context was prioritised when defining the strategic targets and analytical frameworks for the Food Wellbeing and Suffering Index application. Strategic targets of the leading and relevant academic research within Finland, as well as governmental innovation foundation were adopted to define the strategic targets and intervals of the three-threshold levels of FWSI.

To address the dietary resistance and to allow gradual and self-phased adaptation to more sustainable diets, as well as to promote progress vs regress thinking about sustainability, the three-threshold levels of FWSI were defined as rather suggestions for approximate product-use frequency.

To respond to the challenge of the resource-intensity of the widespread eLCA approaches for singular food product impact communication, all the singular protein source products were categorised, and an online data depositary was created for food sustainability index applications at any lunch cafeteria in future.

7. REFERENCES

Bienge, K., Geibler, J. v., Lettenmeier, M., Biermann, B., Adria, O., & Kuhndt, M. (2010). Sustainability Hot Spot Analysis: A streamlined life cycle assessment towards sustainable food chains. Conference proceedings of the 9th European International Farming System Association Symposium.

Binder, T., & Brandt, E. (2017). Design (research) practice. *Practice Based Design Research*, 101-110.

Bonnet, C., Bouamra-Mechemache, Z., & Corre, T. (2018). An environmental tax towards more sustainable food: empirical evidence of the consumption of animal products in France. *Ecological economics*, 147, 48-61.

Bratt, C., Hallstedt, S., Robèrt, K.-H., Broman, G., & Oldmark, J. (2011). Assessment of eco-labelling criteria development from a strategic sustainability perspective. *Journal of Cleaner Production,* 19(14), 1631-1638.

Bringezu, S. (2017). Visions of a sustainable resource use. *In Sustainable resource management* (pp. 155-215). Routledge.

Camilleri, A. R., Larrick, R. P., Hossain, S., & Patino-Echeverri, D. (2019). Consumers underestimate the emissions associated with food but are aided by labels. *Nature Climate Change*, 9(1), 53-58.

Carlsson-Kanyama, A., & González, A. D. (2009). Potential contributions of food consumption patterns to climate change. *The American journal of clinical nutrition*, 89(5), 1704S-1709S.

Caruana, R., Carrington, M. J., & Chatzidakis, A. (2016). Beyond the attitude-behaviour gap: Novel perspectives in consumer ethics: Introduction to the thematic symposium. *Journal of Business Ethics*, 136(2), 215-218.

Ceschin, F., & Gaziulusoy, I. (2016). Evolution of design for sustainability: From product design to design for system innovations and transitions. *Design studies,* 47, 118-163.

Ceschin, F., & Gaziulusoy, İ. (2019). *Design for sustainability: a multi-level framework from products to socio-technical systems*. Routledge.

Chater, N., & Loewenstein, G. (2022). The i-frame and the s-frame: How focusing on the individual-level solutions has led behavioral public policy astray. *Available at SSRN 4046264*.

Clonan, A., & Holdsworth, M. (2012). The challenges of eating a healthy and sustainable diet. In (Vol. 96, pp. 459-460): Oxford University Press.

Creutzig, F., Roy, J., Lamb, W. F., Azevedo, I. M., Bruine de Bruin, W., Dalkmann, H., Edelenbosch, O. Y., Geels, F. W., Grubler, A., & Hepburn, C. (2018). Towards demand-side solutions for mitigating climate change. *Nature Climate Change*, 8(4), 260-263.

Cross, N. (1982). Designerly ways of knowing. *Design studies*, 3(4), 221-227.

Crouch, C., & Pearce, J. (2013). *Doing research in design*. Bloomsbury Publishing.

Ehrenfeld, J. R. (2008). A Subversive Strategy for Transforming Our Consumer Culture. In: USA, Yale University Press.

Ercin, A. E., & Hoekstra, A. Y. (2014). Water footprint scenarios for 2050: A global analysis. *Environment international,* 64, 71-82.

Forsman, S. (2019). Leading Finnish retailer S Group launches a calculator that indicates the climate impact of one´s shopping basket. [available online] https://s-ryhma.fi/en/news/leading-finnish-retailer-s-group-launches-a-calcul/7bJ1UjgsE6C47YBQxdr6s6

Gerten, D., Heck, V., Jägermeyr, J., Bodirsky, B. L., Fetzer, I., Jalava, M., Kummu, M., Lucht, W., Rockström, J., & Schaphoff, S. (2020). Feeding ten billion people is possible within four terrestrial planetary boundaries. *Nature Sustainability*, 3(3), 200-208.

Gillham, B. (2005). *Research Interviewing: The range of techniques: A practical guide*. McGraw-Hill Education (UK).

Girod, B., van Vuuren, D. P., & Hertwich, E. G. (2014). Climate policy through changing consumption choices: Options and obstacles for reducing greenhouse gas emissions. *Global Environmental Change*, 25, 5-15.

Godfrey, D. M., & Feng, P. (2017). Communicating sustainability: Student perceptions of a behavior change campaign. *International Journal of Sustainability in Higher Education.*

Hoek, A. C., Malekpour, S., Raven, R., Court, E., & Byrne, E. (2021). Towards environmentally sustainable food systems: decision-making factors in sustainable food production and consumption. *Sustainable Production and Consumption*, 26, 610-626.

IPCC. (2014). Summary for Policymakers. In Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press.

IPCC. (2018). Summary for Policymakers. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

Jalava & Kummu. (2018). Nyhtökauran vesijalanjälki. Tutkimusraportti, Aalto-yliopisto. 7 sivua.

Joore, P., & Brezet, H. (2015). A Multilevel Design Model: the mutual relationship between product-service system development and societal change processes. *Journal of Cleaner Production*, 97, 92-105.

Jungbluth, N., Itten, R., & Schori, S. (2012). Environmental impacts of food consumption and its reduction potentials. Proceedings of the 8th International Conference on LCA in the Agri-Food Sector, Rennes, France.

Kaljonen, M., Peltola, T., Salo, M., & Furman, E. (2019). Attentive, speculative experimental research for sustainability transitions: an exploration in sustainable eating. *Journal of Cleaner Production*, 206, 365-373.

Kaljonen, M., Salo, M., Lyytimäki, J., & Furman, E. (2020). From isolated labels and nudges to sustained tinkering: assessing long-term changes in sustainable eating at a lunch restaurant. *British food journal.*

Kauppinen, T., Lähteenoja, S., & Lettenmeier, M. (2008). Kotimaisten elintarvikkeiden materiaalipanos ElintarvikeMIPS.

Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., & Wensveen, S. (2011). *Design research through practice: From the lab, field, and showroom*. Elsevier.

Langen, N., Ohlhausen, P., Steinmeier, F., Friedrich, S., Engelmann, T., Speck, M., Damerau, K., Bienge, K., Rohn, H., & Teitscheid, P. (2022). Nudges for more sustainable food choices in the out-of-home catering sector applied in real-world labs. *Resources, Conservation and Recycling*, 180, 106167.

Lettenmeier, M., Akenji, L., Toivio, V., Koide, R., & Amellina, A. (2019). 1, 5 degree lifestyles: targets and options for reducing lifestyle carbon footprints.

Lettenmeier, M., Liedtke, C., & Rohn, H. (2014). Eight tons of material footprint—suggestion for a resource cap for household consumption in Finland. *Resources*, 3(3), 488-515.

Liedtke, C., Baedeker, C., Kolberg, S., & Lettenmeier, M. (2010). Resource intensity in global food chains: the Hot Spot Analysis. *British food journal.*

Lukas, M., Rohn, H., Lettenmeier, M., Liedtke, C., & Wiesen, K. (2016). The nutritional footprint–integrated methodology using environmental and health indicators to indicate

potential for absolute reduction of natural resource use in the field of food and nutrition. *Journal of Cleaner Production*, 132, 161-170.

Lune, H., & Berg, B. L. (2017). *Qualitative research methods for the social sciences*. Pearson.

Lunenfeld, P. (2003). *Design research: Methods and perspectives*. MIT press.

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.

Mancini, L., Lettenmeier, M., Rohn, H., & Liedtke, C. (2010). MIPS as a tool for analysing food chains sustainability. Proceedings of the 9th European International Farming Systems Association (IFSA) Symposium Building Sustainable Rural Futures, Vienna, Austria.

Meadows, D. H. (1997). PLACES TO INTERVENE IN. *Whole Earth*.

Mekonnen, M. M., & Hoekstra, A. Y. (2012). A global assessment of the water footprint of farm animal products. *Ecosystems*, 15(3), 401-415.

Ministry of Agriculture and Forestry & Timeout Foundation. (2021). What shall we eat? Timeout discussions on sustainable food.

Noleppa, S. (2012). Climate Change on Our Plates. Berlin. Retrieved from. http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Klimawandel_auf_dem_Teller.pdf.

O'Brien, K. (2018). Is the 1.5 C target possible? Exploring the three spheres of transformation. *Current Opinion in Environmental Sustainability*, 31, 153-160.

Petersson, T., Secondi, L., Magnani, A., Antonelli, M., Dembska, K., Valentini, R. (2021). SU-EATABLE LIFE: a comprehensive database of carbon and water footprints of food commodities. figshare. Dataset. https://doi.org/10.6084/m9.figshare.13271111.v2

Pimentel, D., & Pimentel, M. (2003). Sustainability of meat-based and plant-based diets and the environment. *The American journal of clinical nutrition*, 78(3), 660S-663S.

Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360(6392), 987-992.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., & Schellnhuber, H. J. (2009). Planetary boundaries: exploring the safe operating space for humanity. *Ecology and society*, 14(2).

Røpke, I. (2009). Theories of practice—New inspiration for ecological economic studies on consumption. *Ecological economics*, 68(10), 2490-2497.

Saarinen, M., Kaljonen, M., Niemi, J., Antikainen, R., Hakala, K., Hartikainen, H., Heikkinen, J. (2019). The effects of dietary change and policy mixes to support change. Luke. Final report of the FoodMini project.

Sabaté, J., & Soret, S. (2014). Sustainability of plant-based diets: back to the future. *The American journal of clinical nutrition*, 100(suppl_1), 476S-482S.

Salo, M., Mattinen-Yuryev, M., & Nissinen, A. (2019). Opportunities and limitations of carbon footprint calculators to steer sustainable household consumption–Analysis of Nordic calculator features. *Journal of Cleaner Production*, 207, 658-666.

Schanes, K., Giljum, S., & Hertwich, E. (2016). Low carbon lifestyles: A fr amework to structure consumption strategies and options to reduce carbon footprints. *Journal of Cleaner Production*, 139, 1033-1043.

Spaargaren, G. (2011). Theories of practices: Agency, technology, and culture: Exploring the relevance of practice theories for the governance of sustainable consumption practices in the new world-order. *Global Environmental Change*, 21(3), 813-822.

Stappers, P. J. (2014). Prototypes as a central vein for knowledge development. *Prototype: Design and craft in the 21st century* (pp. 85-97). Bloomsbury Academic.

Sitra. (2019). Keskivertosuomalaisen Hiilijalanjälki. [available online] https://www.sitra.fi/app/uploads/2018/02/2019-12-09-sitra-keskivertosuomalainen-graafit-fi.pdf

SYKE. Just Food Policy Brief. (2020). Just food system transition requires a policy bringing together different objectives and a broad range of stakeholders. SYKE. https://justfood.fi/en-US.

Toivio, V., Lettenmeier, M. (2018). Calculation basis used in the Sitra lifestyle test.

Turunen, L. L. M., & Halme, M. (2021). Communicating actionable sustainability information to consumers: The Shades of Green instrument for fashion. *Journal of Cleaner Production*, 297, 126605.

Taylor-Powell, E., & Renner, M. (2003). *Analyzing Qualitative Data.* University of Wisconsin-Extension.

Wallbaum, H., & Kummer, N. (2006). Entwicklung einer Hot Spot-Analyse zur Identifizierung der Ressourcenintensitäten in Produktketten und ihre exemplarische Anwendung: Projekt-Ergebnisse.

Wamsler, C. (2020). Education for sustainability: Fostering a more conscious society and transformation towards sustainability. *International Journal of Sustainability in Higher Education,* 21(1), 112-130.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... & Jonell, M. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet,* 393(10170), 447-492.

Woiwode, C., Schäpke, N., Bina, O., Veciana, S., Kunze, I., Parodi, O., Schweizer-Ries, P., & Wamsler, C. (2021). Inner transformation to sustainability as a deep leverage point: fostering new avenues for change through dialogue and reflection. *Sustainability Science*, 16(3), 841-858.

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: green consumer behaviour when purchasing products. *Sustainable development*, 18(1), 20-31.

8. LIST OF FIGURES AND TABLES

FIGURES

TABLES