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Implementation of a Footprint Calculator

A qualitative study on meal choice and stakeholders' perceptions

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Abstract

The current food system as a whole is responsible for about one-third of Green House Gases around the world. Animal agriculture is responsible for approximately 75,5% of these emissions. The current food system is not sustainable and needs transformation. A transformation requires a change in the diet of consumers towards more sustainable and environmentally friendly foods. Consumers' awareness of global warming and the impact of meat consumption is growing. Nevertheless, consumers are not always aware of the effects of different diets and meal choices. According to dual-process theory, most decisions in daily life is taken with System 1 without much thought and based on heuristics and existing values and attitudes. However, if System 2 is activated, decisions are taken more deliberately, and there is room for education.

This case study examined the effect of implementing a footprint calculator that calculates emissions from meals in a large canteen. Two cases were examined. Case 1 was two canteens that had plans to provide information about carbon footprint, and Case 2 was a canteen that implemented a carbon footprint calculator. Semi-structured interviews with customers and managers were conducted to estimate customs meal choice, reasons for meal choice and barriers to a healthy and sustainable diet, and the effect of the implementation on the kitchen

Customers' meal choice at lunchtime varies from high meat consumption and moderated meal consumption to low meat consumption. This segmentation of customers is intact with previous literature on meat consumption, consumers attitudes regarding a healthy and sustainable diet, views on meat reduction, and barriers to a plant-based diet

Implementation of the footprint calculator has effects on meal choice in the form of more consumption of plant-based meals and attitudes of customers, resulting in a conscious or unconscious reduction mindset. The main barriers identified to more consumption of plant-based meals are perceived lack of appetizing look, perceived lack of protein, and in some cases, lack of variety. Based on the feedback loops identified in the cases, a positive feedback loop model is proposed. The model explains the different feedback loops that occur in Case 1 and Case 2 and how that potentially affects procurement. Finally, the model is used to describe possible case senary where a reduction plan for emission from procurement is in place.

The feedback loops in Case 2 create a spiral. Steering customers away from meat highlights the plant-based meal as an option for suitable protein. The spotlight on the plant-based meal pushes the kitchen to make improvements to the look of the plant-based and to make sure the plant-based meal includes the same amount of protein as the animal-based meal. Offering quality plant-based meals increases the consumption and decreases the consumption of animal-based meals. In some cases, the plant-based meal is as popular as the plant-based meal.

It is proposed that future research should examine the effect of implementing a carbon footprint calculator with a formal carbon footprint reduction plan or policy for procurement. The focus should be on the feedback loops and spiraling effect of the implementation.

Útdráttur

Matvælakerfið í heiminum er ábyrgt fyrir um einum þriðja af losun gróðurhúslofttegunda í heiminum. Dýraafurða iðnaðurinn er ábyrgur fyrir um 75%% þessari losun. Núverkandi matvælakerfi er ekki sjálfbært og þarfnast umbyltingar. Umbyltingin krefst breytinga á mataræði yfir í sjálfbærara og hollara mataræði. Vitund neytenda um hlýnun jarðar og áhrif kjötneyslu fer vaxandi. Engu að síður, þá eru neytendur ekki alltaf meðvitaðir um áhrif mataræðis og fæðuvals. Samkvæmt kenningu um hraða og hæga hugsun (Dual – prosess theory) þá eru flestar ákvarðandi í daglegu lífi teknar með Kerfi 1 án mikillar hugsunar og eru byggðar á leiðsagnarreglum, gildum og viðhorfum. Ef að hins vegar Kerfi 2 er virkjað, þá eru ákvarðanir frekar teknar með meðvituðum hætti og það er pláss fyrir að taka inn nýja þekkingu.
Í þessari tilviksrannsókn voru rannsökuð áhrif þess að innleiða kolefnisreikni fyrir máltíðir í mötuneytum stórra vinnustaða. Rannsökuð voru tvö tilvik annarsvegar, tilvik 1 var tvö mötuneyti þar sem stendur til að innleiða reikni fyrir kolefnisspor matvæla og tilvik 2 var mötuneyti þar sem er búið að innleiða kolefnisreikni. Hálfskipulögð viðtöl voru tekin við gesti og stjórnendur til að meta áhrif innleiðingarinnar á val þátttakenda á máltíð, ástæður fyrir vali á máltíð, þröskulda varðandi val á hollu og sjálfbæru mataræði ásamt áhrifum innleiðingarinnar á eldhús.
Val gesta á máltíð í hádeginu er breytilegt frá því að innihalda mikið kjöt, miðlungs mikið af kjöti og yfir í lítið magn af kjöti. Þessi breytileiki er í takt við fyrri rannsóknir á neyslu, viðhorfum neytenda til þess hvað er heilsusamlegur og umhverfisvænn matur matur, gagnvart minnkun á kjötneyslu og þröskuldum varðandi grænkera-mataræði.
Innleiðing kolefnisreiknisins hefur áhrif á máltíðaval á þann hátt að gestir velja meira grænkera-máltíðir og einnig varðandi viðhorf gesta, sem endurspeglast í vilja til að minnka neyslu á kjöti. Helstu þröskuldar sem borin var kennsl á varðandi meiri neyslu á grænkera fæði voru upplifuð vöntun á girnilegu útliti máltíðarinnar, upplifuð vöntun á próteini og í sumum tilfellum skortur á fjölbreytni. Kennsl voru borin á ákveðið mynstur endurgjafar annarsvega í tilviki 1 og hins vegar í tilviki 2. Út frá þessum mynstrum var sett upp líkan um jákvæða endurgjöf. Líkanið útskýrir mynstur endurgjafar sem á sér stað og hvernig það hugsanlega hefur áhrif á innkaup. Að lokum er líkanið notað til að útskýra tilvik þar einnig áætlun um kerfisbundna minnkun kolefnispor frá innkaupum væri um að ræða auka þess sem reiknir fyrir kolefnispor frá máltíðum væri í notkun.
Endurgjöf í tilviki 2 býr til spíral. Þegar gestum er stýrt frá því að velja kjöt, beinist athyglin í auknu mæli að grænkera-máltíðinni. Aukin athygli á grænkeara-máltíðnni þrýsir á eldhúsið til þess að bæta útlit grænkera-máltíðarinnar og til að gæta þess að grænkera-máltíðin innihaldi jafn mikið prótein og máltíðin sem er með dýraafurðum. Framboð á gæða grænkera máltíðum eykur vinsældir þeirra og minnkar val á máltíðum með dýraafurðum. Í sumum tilfellum er grænkera-máltíðin jafnvinsæl og máltíðin sem inniheldur dýraafurðir.

Rannsóknir í framtíðinni ættu að beina sjónum að því að skoða áhrif þess að innleiða mælitæki sem mælir kolefnispor máltíða ásamt formlegu plani um minnkun kolefnispors frá innkaupum. Áherslan ætti að vera á mynstur endurgjafar og spíral áhrif innleiðingarinnar.

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Abbreviations

BFM Bone free meat

CHD Cardiovascular heart disease

CVD Cardiovascular diseases

FCM Food Choice motivation

GHG Green House Gas

Gt Gigaton

IHC Ischemic heart disease

IPCC Intergovernmental Panel on Climate Change

Kg Kilogram

NCD Non-communicable disease

PCE Perceived consumer effectiveness

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1 Introduction

Global warming results from an accumulation of greenhouse gases in the atmosphere. The global warming of the planet has a vast effect on all planet's inhabitants and threatens our future (IPCC, 2022). It is a global problem that is now more prominent in discourse. The foremost scientists and politicians are working together to analyze and plan changes that our society must undergo to decrease greenhouse gas emissions from humanity. A result of that is the Paris Agreement made initially in 2015. The Paris Agreement is an international treaty with the goal of limiting global warming. The agreement is legally binding and is based on Nationally Determined Contributions to reduce the global warming of the planet to 1.5°C per year before 2050 (Huang & Zhai, 2021).

One of the most significant contributors to global warming is our food system. The food system is responsible for about one-third of the total anthropogenic greenhouse gas emissions (Tubiello et al., 2022). Within the food system, livestock and meat production are the biggest categories (Cheng et al., 2022; Xu et al., 2021). The manufacture of livestock is resource intensive and unsustainable, as the livestock needs immense amounts of food, water, and other resources before being processed for consumption (Heinke et al., 2020). The manufacture of livestock is also a major driver of land-use change (Poore & Nemecek, 2018).

Food is a resource that is constantly needed, but the current way that we approach food is unsustainable for our planet if we are to combat global warming effectively. Substantial meat consumption is ingrained in mainstream western culture (Salomé et al., 2022; Weinrich, 2018). For sustainable and healthy diets to be possible, we need to reduce the consumption of meat and other food items in our diet that produce the highest carbon footprint. To make the diet more sustainable, we must transition the average diet to something with a smaller carbon footprint (Willett et al., 2019).

Generally, consumers are becoming more aware of global warming, carbon emissions, and the food system. However, there seems to be a general lack of consumer awareness about the environmental impact of their diets (Feucht & Zander, 2017; Shi et al., 2018). Consequently, consumers might not understand the vast carbon footprint difference between different meal choices (Feucht & Zander, 2017; Shi et al., 2018). For example, a person might not know that when presented with two meals in a canteen at work, one of those meals could carry a relatively large carbon footprint. However, they might have different choices and attitudes towards their meal when provided with information.

According to dual process theory, thinking may be divided into System 1 and System 2. In System 1, thinking is fast, made without much thought, and based on memory and intuition (Kahneman, 2011). Decisions in System 1 are based on current attitudes and heuristics. When System 2 is activated, thinking is slower, decisions are taken with more deliberate thought, and all options are considered, which provides room for education.

This two-case qualitative study examines the effect of providing information about the different footprints of meals. Case 1 consists of two canteens that plan to provide information about footprint, and Case 2 consists of one canteen that implemented a footprint calculator. All the canteens typically offer two different meals for customers, one animal-based and one plant-based. With semi-structured interviews with customers and managers, we examine meal choice and meal choice motivation, consumers' awareness of the environmental impact of food, the main barriers, and the effect on the kitchen.

The main research question of this thesis is:
What is the potential impact of implementing a meal carbon footprint calculator at a canteen?
Sub-questions

a) How do the information impact meal choice and the reasons for the meal choice?
b) How does the information about emissions from meals impact attitudes regarding global warming and food system impacts on global warming?
c) What barriers to more sustainable meal choices can be identified?
d) How does the implementation of a footprint calculator affect procurement and meal offerings?

This study aims to provide insight into the possible effect of implementing a footprint calculator as well as motivation and determinants of meal choice through a qualitative assessment of perceptions of customers and stakeholders. The research is presented in 7 chapters. Following the introduction, chapter 2 lays out the literature on past research on the carbon footprint from food production and customers' determinants of meal choice, as well as previous literature on ways to steer customers' meal choices to a healthy and sustainable diet. The method is outlined in chapter 3, and the research design in chapter 4.

Chapter 5 presents the study’s findings in detail. Chapter 6 discusses the results and their alignment with the existing literature. In chapter 7, a short summary of the study is presented, and a direction for future research based on the results. In this chapter, the limitation of the study is also discussed.

2 Literature review

2.1 Climate Change

Human activity has warmed the planet by about 1.0°C since the pre-industrialization era due to greenhouse gas (GHG) accumulation in the atmosphere (IPCC, 2021). Global warming has a devastating impact on people, economies, and ecosystems worldwide. To curb global warming, 196 parties entered an international legally binding treaty in 2015 called the Paris agreement. The treaty's goal is to limit global warming well below 2°C, preferably to 1,5°C, compared to pre-industrialization. In addition, the parties would try to reach carbon neutrality by mid-century. Carbon neutrality is reached when anthropogenic CO2 emissions are balanced with anthropogenic removals over a determined period (Wei et al., 2022). The agreement is based on Nationally Determined Contributions (NDCs). NDCs are the climate

actions each country takes and is required to outline and communicate under the agreement. The NDCs are submitted every five years (IPCC, 2019b).

Global Carbon Budget to Limit Warming to 1.5°C

With the goal of keeping global warming preferable below 1,5°C, compared to pre-industrialization and net-zero global warming by mid-century, it is possible to calculate the maximum future carbon emissions allowed for that plan to be realized. The total emission quota remaining is referred to as the global carbon budget (Huang & Zhai, 2021; Jenkins et al., 2021). In 2019, the global yearly greenhouse gas emissions were around 60 Gt of CO2-eq (IPCC, 2022). There are different global carbon budgets for limiting warming below 1.5°C and 2.0°C. The IPCC estimates that the budget is 580Gt with a 50% certainty of not exceeding the 1.5°C limits. In order to have an even 50/50 chance of limiting the warming, we must achieve carbon neutrality before we exceed that total budget. Reaching carbon neutrality means reducing our global emissions to a net-zero (Huang & Zhai, 2021; IPCC, 2018, 2019b). To limit warming below 1,5°C and achieve carbon neutrality before 2050, it is necessary to reduce emissions by about 45% by 2030 and reach net zero in 2050. Currently, the emissions are still increasing (Huang & Zhai, 2021; Masson-Delmotte et al., 2018).

2.2 The Climate Impact of the Global Food System

In 2019, the global food system was responsible for 16,5 Gt CO2-eq out of the total 60 Gt CO2 global greenhouse emissions worldwide (Tubiello et al., 2022). Food and food production is responsible for about one-third of the total emissions caused by humanity on a year-by-year basis and, thereby, a very significant part of the problem (Crippa et al., 2021; Tubiello et al., 2022). With the current NDCs pledges, we will only reach an estimated reduction of 9,8 Gt CO_2-eq from the food system by 2050 (Bowles et al., 2019). Transformation of the food system is needed to reach a net zero by 2050, that includes transition in land use, agriculture, and dietary choices (IPCC, 2019a).

The consumption-based carbon footprint ranges from 0.4 and 1.9 tCO2eq/cap around the world (Girod et al., 2014; Ivanova et al., 2020). The consumption-based carbon footprint of food needs to go to 0.4 tCO2eq/cap to reach the 1,5° climate target (Girod et al., 2014; Ivanova et al., 2020). Two different studies have given estimates that the diet in Iceland results in a total emission of 2,1 CO_2eq/capita (Clarke et al., 2017) and 3,42 CO_2eq/capita (Efla, 2020).

The Significant Impact of Livestock on Climate

The livestock sector is responsible for the vast majority of food system emissions, or around 14,5 Gt CO2-eq (Cheng et al., 2022; Springmann et al., 2018; Xu et al., 2021). Among the livestock sector, ruminant animals such as cattle and sheep are the most significant contributors to emissions, responsible for about half of the agricultural production emissions (Audsley et al., 2010; Searchinger et al., 2019; Zhang et al., 2022). Of the ruminant animals, beef tends to have the highest footprint (Poore & Nemecek, 2018; Zhang et al., 2022).

Generally, animal-based food produces several times more GHG than plant-based food. The GHG from beef production is about 28,73 kg of CO_2-eq per kilogram (Zhang et al., 2022), lamb 25.58 kg CO2-eq/kg, cheese 8.5525.58 kg CO2-eq/kg, and fish 3.49 kg CO2-eq/kg for bone-free meat (BFM) while GHG from pulse production is 0.50–0.51 kg CO2-eq/kg, rice 2,55 CO2-eq/kg, and field grown vegetables 0.37 kg CO2-eq/kg (Clune et al., 2017). Research in Finland shows that animal agriculture is responsible for almost 90% of all emissions from agriculture (SYKE, 2020). In the Nordic countries, Sweden, Norway, Finland, and Denmark, animal products were responsible for 65-75% of emissions from food consumption in 2011-2013 (COM et al., 2019)

Comparison of Climate Impact from Different Dietary Patterns

The current food system is exceeding the boundaries regarding the planet, and industrialized countries have twice the carbon footprint per capita as developing countries (Sun et al., 2022; Tubiello et al., 2021).

There is a strong tradition for an animal-based diet in Europe, North America, and many affluent countries. The result is a much higher emission from diets in those countries, especially those containing large meat portions (Saarinen et al., 2019). For example, meat consumption in Europe is almost two times the world average (FAO, 2021). Meat consumption in Europe has not changed much in recent years, even though 40% of Europeans reportedly intend to cut down or stop eating meat (BEUC, 2020; EC, 2020).

In Europe, the average emissions from an individual's diet are 5 kg of CO^2 a day. In the United States of America, it is about 6,5 kg CO^2a day. In Iceland, the average is about 6,4 CO^2 kg a day. The relatively high footprint of the Icelandic diet is due to the increased consumption of animal products, especially red meat.

Diets have commonly been classified according to restrictions on animal ingredients. The omnivore diet does not restrict animal products as a category. A Flexitarian diet includes 100 grams of plant-based protein a day, and limited animal-based products but does not exclude any food category. The Pescatarian diet excludes only meat, and the vegetarian diet excludes meat and fish but includes cheese, milk, and eggs. A vegan diet excludes all animal ingredients from the diet (IPCC, 2022; Kim et al., 2022).

Within each country, the range of emissions from the different diets is vast. Research in Finland shows well the difference between footprints of individual diets. The calculation is based on a diet of 2200 kcal a day (Saarinen et al., 2019):

- An omnivore diet with an average of 150 grams of meat a day results in **6,9 kg CO2-eq per day** (2519 kg per year)
- A pescatarian diet results in **3,5 kg CO2-eq per day** (1278 kg a year)
- A vegan diet results in **3,1 kg CO2-eq per day** (1132 kg per year)

Recent research in a school canteen in France showed that the average meal emitted 1,8 kg CO_2-eq and provided 659 kcal. Non-vegetarian meals emitted on average 2.1 kg CO_2 and vegetarian 0,9 kg CO_2-eq. Both meals provided good nutrition and protein. The non-vegetarian meal provided 128.7% of the daily proteins recommended intake, and the vegetarian meal covered 97.8% (Dahmani et al., 2022)

Sometimes, comparing emissions from diets can lead to controversial results. For example, a plant-based diet with one animal-based meal per day, sometimes described as 2/3 vegan, can have a lower carbon footprint than a vegetarian diet that includes eggs and dairy. The explanation is the high emission from dairy, which comes from ruminant animals (Kim et al., 2022). The carbon footprint of diets and individual meals also varies depending on production practices and transportation (Poore & Nemecek, 2018).

Research on the consumption of Loyalty card holders of a large food retailer in Finland showed eight purchase patterns. The six patterns explained 55% of the variation of food purchased 1) Animal-based pattern, 2) Easy cooking, 3) Ready to eat, 4) High-energy, 5) Traditional 6) Plant-based pattern. The differences in emissions between the 10% of the highest in of the Animal-based was 869 kg CO2-eq higher than for customers firmly adhering the plant-based pattern. The Animal-based pattern resulted in a 27% lower carbon footprint. Of the food group identified in the study, the meat group contributed 29% of the total carbon footprint, and the dairy food group to 28%. Fruit, vegetables, and berries contributed 12% of the total carbon footprint (Meinilä et al., 2022).

2.2.1 Transformation Towards More Sustainable Diets is Needed

A shift to a more sustainable diet is needed to keep average global warming below 1,5 C compared to pre-industrialization and to reach net zero in 2050 (IPCC, 2021). A transition toward a sustainable diet has primarily been focused on reducing meat consumption and increasing plant-based consumption (de Boer & Aiking, 2021; EC, 2020). By replacing meat with plant protein, the emissions would drop considerably (Hartmann & Siegrist, 2017; Scarborough et al., 2014).

According to a special report by the IPCC, a flexitarian diet would provide little over 5 GtCO2-eq per year in mitigation by 2050. A transfer to a vegan diet has the potential of almost 8 GtCO2-eq per year of mitigation (IPCC, 2022; Mbow et al., 2019). The GHG mitigation potential of rapid diet changes may be underestimated. With rapid diet changes, biomass recovery would provide additional mitigation that could freeze the increase in the warming potential for 30 years (Eisen & Brown, 2022).

A meta-analysis of 53 studies that were published after 2011 to compare the carbon savings from different household food consumption, such as a shift to a vegan diet, lower carbon meats, organic food, and fewer animal products, revealed the highest carbon saving came from the adoption of the vegan diet. Every individual who adopts a vegan diet will have a global average reduction of 0.9 tCO_2eq per capita (Ivanova et al., 2020). A recent assessment of the impact of diet in Finland shows that the estimated mitigation possibility of diets varies from 13% to 37%, depending on the alternative diets (Huan-Niemi et al., 2020). The current diet is about 6 kg CO2e per day. Dietary changes where meat would be cut to one-third would result in about 5 kg CO2e per day, and a vegan diet kg 4 CO2e per day (Huan-Niemi et al., 2020).

Other Environment Impacts of the Global Food System

The Planetary Boundaries framework (PB) has identified nine key earth system processes that regulate the stability and resilience of the Earth systems (Rockström et al., 2009a). The recognized planetary boundaries are climate change, land-system change, freshwater use, biosphere integrity, biochemical flows, stratospheric ozone depletion, ocean acidification, novel entities, atmospheric aerosol loading, and stratospheric ozone depletion. A boundary value has been set for all but two novel entities and atmospheric aerosol loading (Steffen et al., 2015). Four planetary boundaries have already been exceeded, i.e., climate change, biosphere integrity, land-system change, and biogeochemical flows (Biermann & Kim, 2020; Bowles et al., 2019; Rockström et al., 2009b; Steffen et al., 2015).

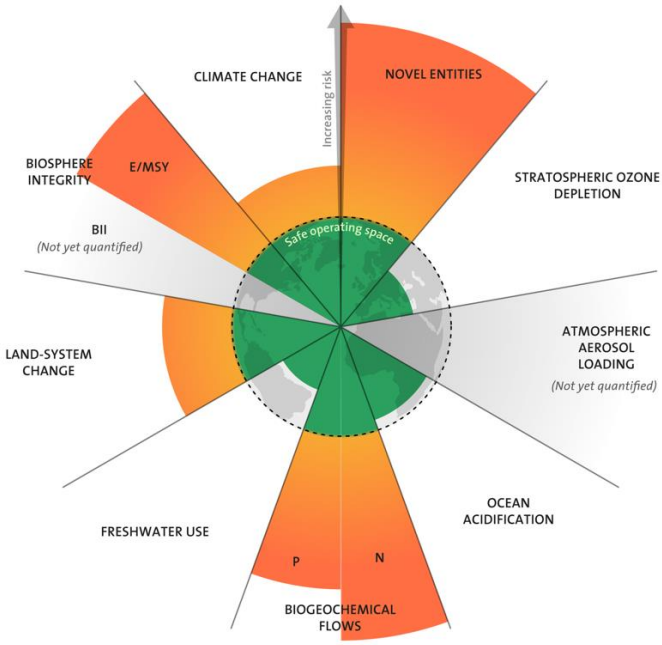

Figure 1.The planetary boundaries framework, (Credit: J. Lokrantz/Azote based on Steffen et al. 2015.).

Food production pushes environmental systems and boundaries. For example, food production is one of the more significant drivers of climate change (Poore & Nemecek, 2018), biodiversity loss, freshwater use, and negatively impacts nitrogen and phosphorus cycles (Bowles et al., 2019; Steffen et al., 2015). The food system is also a major driver of land-use change, chemical pollution, freshwater depletion, eutrophication, and acidification in terrestrial and aquatic ecosystems (Poore & Nemecek, 2018; Willett et al., 2019).

The global food system's environmental impact is primarily driven by livestock production (Bowles et al., 2019). This is explained by the livestock production resource demand regarding GHG emissions (Herrero et al., 2016), land (Poore & Nemecek, 2018), fertilizer (Liu et al., 2016), and water (Ran et al., 2017). In addition, in some regions' the livestock sector is the primary driver of biodiversity loss (Xu et al., 2021). Furthermore, meat production and consumption are associated with health harms related to air quality (Domingo et al., 2021), and in some cased, animal welfare issues are also a concern (Grethe, 2017).

2.3 The Psychology of Meal Choices

2.3.1 Consumer Attitudes Towards Sustainable Food Consumption

Research has shown that people are positive toward carbon labeling on food and are open to considering sustainability when purchasing food items, but only after price and taste are satisfied (Hartikainen, Roininen, Katajajuuri, & Pulkkinen, 2014). Furthermore, even though people want to consider sustainability, they underestimate the environmental impact of their eating habits (BEUC, 2020). Consumers prioritize health goals in their decision-making over environmental concerns (Feucht & Zander, 2017; Wellesley et al., 2015).

Consumers seem unaware of the causal relationship between their meal choices and the climate impact (Feucht & Zander, 2017; Shi et al., 2018). As a corollary to this, consumers, in some cases, do not believe that their effort can contribute to the solution to the problem of global warming. This highlights the importance of perceived consumer effectiveness (PCE) (Vermeir & Verbeke, 2006). This can explain the lack of motivation toward sustainable consumption (Stoll-Kleemann & Schmidt, 2017; Stubbs et al., 2018).

Some research has shown that consumers' positive attitude toward nature correlates with knowledge about the positive effects of lowering meat consumption (Schösler et al., 2012). An unpublished thesis by Heyman (2018) showed correlations between positive attitudes towards the environment and less consumption of animal-based products in Iceland.

2.3.2 What are the Primary Motivating Factors in the Choice of Food?

Dietarian identity reflects self-awareness regarding a person's choice of foods. Dietitian identity is formed by sociocultural conditions, personal preferences, and interpersonal relations (Kim et al., 2022). Food choice decisions are a complex process (Livingstone et al., 2020). Food choice motives refer to the reason a consumer chooses a given food (Kim et al., 2022). The relationship of food choice motives with dietarian identity is bidirectional because food choices are related to how people feel and act regarding what they eat (Kim et al., 2022). Therefore, understanding food choice motives is crucial to interventions and policy development regarding food consumption (Onwezen et al., 2019).

Visual appeal and taste are key drivers of food choice (Januszewska et al., 2011; Salmivaara et al., 2021). Research in Finish canteens supports the complicated nature of food choice motives. Motives such as visual appeal, habit, ability to satiate hunger, and value for money are stronger than health-related motives when it comes to actual food choice. Health-related motives are stronger in intended choice (Salmivaara et al., 2021).

In recent research on food choice motivation, three different categories were defined to identify patterns in variability (M. C. D. Verain et al., 2022):

1) Egocentric motives (appearance, taste, familiarity, convenience, mood, and price)

2) Health-related motives (health and weight control)
3) Sustainability-related motives (environment, animal welfare, natural, and fair trade.

The result showed that egocentric motives were the most common, then health-related and sustainability motives were rated the least important.

In order to understand meat consumption and consumption of plant-based food, it is crucial to understand both food choice motivation and dietarian identity (Kim et al., 2022). Meat consumption, as well as consumption of plant-based food, can be a question of dietary identity. Some people have a strong traditional attachment to meat (Graça et al., 2015). Meat attachment has been defined as a positive bond toward meat consumption. It entails dependence on meat, viewing meat consumption as a source of pleasure, and entitlement (Dhont & Hodson, 2014). Research has shown that level of meat attachment is a significant predictor of consumer willingness to consume plant-based protein alternatives (Circus & Robison, 2018; Graça et al., 2015). Nutritionally meat has many positive characteristics. Many people like meat for its protein source, phosphorus, and zinc (Bohrer, 2017).
The two most important considerations identified in the motivation to shift to a plant-based diet and foods are health and environmental consideration (Aschemann-Witzel, 2015; Lehikoinen & Salonen, 2019; Onwezen et al., 2022). Barriers that have been identified are taste, satiety, and nutritional value (Reipurth et al., 2019)

According to a recent literature review of 21 studies regarding motivation, predictors, and barriers to a more plant-based diet and meat reduction (Eakman & Metallinos-Katsaras, 2022), the motivators for a plant-based diet are: liking the taste of vegetarian food, health reasons like weight management and disease prevention, and environmental reasons like belief in a positive impact and concern for animal welfare. Barriers were liking the taste of meat, sensitivity to bitterness in vegetables, dietary habits, lack of knowledge to cook nutritionally complete vegetarian meals, social situations, and anticipated stigma (Eakman & Metallinos-Katsaras, 2022). The main barrier identified for dietary inclusion of plant-based meat is a lack of sensory attractiveness and familiarity (Hoek et al., 2011). The key factor inhibiting the consumption of plant proteins is taste. Other factors are habits, convenience, and price (Schouteten et al., 2016).

2.3.3 Informing Consumers of Carbon Emissions from Meals can Influence their Dietary Choices

Information is one way to increase consumer awareness and understanding of sustainable consumption. Mitigating action based on information about science has proven to be most successful in promoting a sustainable diet (Bose, 2020). Research shows that education about emissions in the food system can affect the choice of food items. For example, students that took a ten-unit course on emission from different food items increased their vegetable intake and decreased their intake of ruminant meat compared to the control group resulting in an estimated decrease in the dietary carbon footprint of 14% (Malan et al., 2020).

Research on consumers' views on sustainable labeling of food in stores revealed that customers were willing to pay a price premium for CO2 labels, but in most cases, less than for other labels such as animal welfare and locally produced products (Feucht & Zander, 2017). Even though labeling is done at the point of decision, it does not always work if the

customer does not fully understand the information (Osman & Thornton, 2019). In a study where grocery items were labeled with information about emissions, customers reported that they were unsure if the emission was on a high or low level (Upham et al., 2011).

Other studies have used a traffic light color scheme, where the actual emission is presented along with the traffic light colors, green for low emission and red for high emission. A study in the canteen used the traffic light scheme and presented to customers the cumulative score of their meals. Complicated methods were used, both qualitative and quantitative, to estimate the effect of both the traffic light scheme and the presentation of the cumulative result for canteen goers. The result was modest but positive regarding the effect on attitudes and behavior. However, customers reported that they did not have a reference frame to understand the score as compared to their car use, going on holiday, or heating their home (Spaargaren et al., 2013).
A longitudinal study in Finland used simple labeling of sustainable or not sustainable meals at a workplace restaurant (Kaljonen, Salo, Lyytimäki, & Furman, 2020). The labeling was based on both sustainability and health. Life-cycle databases and dietary guidelines were used to underpin the labeling. The simplicity of the labeling confused customers, and the intervention did not yield satisfactory results. Vegetarian meals with some animal ingredients with high emissions would be labeled unsustainable without clarification. Adding a nudging strategy provided better results. In the nudging approach, sustainable food was placed at the beginning of the meal selection before meat and other unsustainable choices. The nudging got positive feedback and increased the selection of sustainable options (Kaljonen et al., 2020).

Dual-Process Theory

According to the Dual-Process theory (Kahneman, 2011), most everyday decisions are made effortlessly and are based on unconscious processes. The theory proposes that decision processing is grounded in two systems, System 1 and - System 1 make fast decisions that are effortless and based on unconscious processes. System 2 takes analytical, slow decisions, and the processes are conscious. Based on Kahneman (2019) it is likely that daily food decisions are taken mainly by System 1 (Kahneman, 2011). When decisions are taken with System 1the choices are based on heuristics and current attitudes and little chance is taken., (Kahneman, 2011). With System 2, on the other hand, dicisision are taken more consciously and deliberately and there is room for education. Based on that, food choice at lunchtime in the workplace canteen is most likely based on current attitudes, heuristics, and doing what others do.

System 1 Decision-Making and Nudging People to a Sustainable Diet

Decision-making in System 1 is fast and little chance is taken. It is based on current attitudes and the use of heuristics (Kahneman, 2011). Behavioral analysts have taken advantage of System 1 thinking to nudge people toward a sustainable diet (Kurz, 2018; Vandenbroele et al., 2019; Yi et al., 2022; Zhou et al., 2019) and healthy eating (Bauer & Reisch, 2019). Nudging is a minimal change in the decision-making context to nudge people in a particular direction (Thaler & Sunstein, 2008).

Nudge theory was formulated by Thaler and Sunstein (2008) and is grounded in three claims: the architecture of choice matters, architecture is unavoidable, and nudging is possible at the same time as freedom of choice is preserved (Leonard, 2008). The architecture of choice

refers, for example, to the menu listing, and the order in which the food is presented can impact meal choice. For example, it is common for customers to order the first item on the menu, and customers tend to choose the meal that is first in the line at buffets (Lorenz & Langen, 2018). With that in mind, by re-ordering the menu, nudging could potentially be used to guide consumers to sustainable meal choices.

System 2 Decision-Making with Detailed Information about Emissions from Meals

When customers are exposed to new information at the point of decision, there is a chance they may stop relying on System 1 and engage System 2 in their decision, using analysis and rationale to make a more deliberate decision. Given this rationale, it is possible that when customers are exposed to information about different emissions from meals, System 2 will be engaged, and an opportunity for education will open.

A recent study provided participants with fabricated menus in an online survey. Participants were asked to choose meals from several menus. The information about carbon footprint was either available or absent. Also, customers could select side dishes labeled or not with emission information. The result showed that the information affected customers' choices, customers that were exposed to the information tended to choose meals and side dishes with a lower carbon footprint. However, the research is limited because the customers neither paid nor consumed the meals (Betz et al., 2022).

2.4 A Synergy of Sustainability and Health in Diets

2.4.1 A Healthy Diet

A healthy diet is the cornerstone of the health of individuals and disease prevention. Dietary habits influence the risk of lifestyle diseases. The dietary patterns that are most problematic in the western world's current diet consist of too much intake of red meat, processed food, refined grains, and sugar-sweetened beverages and low intake of legumes, whole grains, nuts, fish, fruits, and vegetables (Fadnes et al., 2022). High consumption of processed meat, unprocessed meat, and poultry meat has been linked to cardiovascular diseases (CVD), and processed and unprocessed meat is also associated with all-cause mortality (Zhong et al., 2020). In high-income countries, CVD is the leading cause of death (Zampelas & Magriplis, 2020).

In a meta-analysis, fish was not associated with either cardiovascular diseases (CVD) or all-cause mortality (Zhong et al., 2020). Consumption of fatty fish has been related to inverse association with cardiovascular disease (CVD) (Giosuè et al., 2022). Low-fat dairy is not associated with increased CVD risk, and there is no positive association between dairy products and cardiovascular diseases (Bhupathi et al., 2020; Zampelas & Magriplis, 2020). Plant-based protein like legumes has been associated with lower cardiovascular heart disease (CHD) risk, and nuts with lower CVD risk (Afshin et al., 2014; Aune et al., 2017). Nuts were inversely associated with fatal Ischemic Heart Disease (IHC), fatal ICH, and diabetes but not a stroke (Afshin et al., 2014). Consumption of fruits and vegetables has shown a

protective effect on cardiovascular disease (CVD) up to 800 gr. a day (Aburto et al., 2013). Consumption of fruits and vegetables is also beneficial to health in general and better aging (Zhou et al., 2019)

Diets have been classified depending on how much animal food is allowed in the diet. However, the recent classification is based on plant-based diet indexes. These indexes are based on higher consumption of plant-based and lower animal-based foods (Kim et al., 2022). The result shows that adherence to a pro-vegetarian diet with a low frequency of animal foods reduces the risk of all-cause mortality, coronary heart disease, and type 2 diabetes (Kim et al., 2022; Satija et al., 2017).

When healthful plant-based diets (plant proteins, vegetables, and whole grains) were separated from unhealthful-plant based diets (refined carbohydrates and sugar), the unhealthful diets were more strongly associated with type 2 diabetes mellitus and coronary heart disease, and the healthful diets inversely related to these conditions (Satija et al., 2016; Satija et al., 2017).

A new meta-analysis on healthy food shows that with a healthy diet, people can add ten years to their life if they start at 20. This study brought together data from the Global Burden of Disease study and a meta-analysis on studies of diets and longevity (Fadnes et al., 2022). The optimal diet for longevity, according to this research, is increased consumption of legumes (lentils, beans, and peas), whole grains (brown rice, barley, and oats), fruits and vegetables, fish and nuts, and less red and processed meat refined grains and sweetened beverages. (Fadnes et al., 2022).

2.4.2 Current Icelandic Dietary Patterns

A national survey of the Icelandic diet conducted by the Directory of Health in 2022 shows that the consumption is 2044 kcal a day, 40% fats, carbohydrates are 37%, and protein at 18%. Meat consumption in Iceland is 823 gr per week on average. Fish consumption is 315 gr per week. Consumption of nuts and pulses is almost non-existent. 83% reportedly do not consume legumes or lenses, and 77% consume neither nuts nor seeds. Consumption of fruits and vegetables is 213 gr per week. According to the survey, 7% of Icelanders are on a low-carb diet, 1% are vegan, and 1% are on a flexitarian or equivalent diet (grænkeramataræði) (Steina Gunnarsdóttir, 2022).

The sixth edition of the Nordic Nutrition Recommendations (NNRs), The Nordic Nutrition Recommendation 2022 (NNR, 2022), is to be published in 2022. The guidelines will provide dietary reference values and are food-based (Christensen et al., 2020).

2.4.3 Dietary Recommendation for a Healthy and Sustainable diet

Given the need to transform current dietary choices, there is a need for policy and dietary recommendations that integrate both nutritional and sustainable goals (Van Loo et al., 2017). It has been recognized that these challenges are closely connected, but few policies and

actions have been designed to achieve health and sustainability outcomes (Aschemann-Witzel, 2015; Borthwick, 2015).

For high-income countries, various studies have shown the behaviors that have been put forward as good both for the environment and health are consuming less GHG-intensive animal-based foods and consuming more plant-based foods (Aschemann-Witzel, 2015; Godfray et al., 2018; Van Loo et al., 2017; Willett et al., 2019). The focus has been on meat reduction and a flexitarian diet, where there is little to no meat consumption and low consumption of animal ingredients in general, and high consumption of plant-based food (Dagevos, 2021).

A recent study on the environmental impact of 57.000 food products shows that there is a tendency for more nutritious foods to be more sustainable. Replacing animal-based food could have considerable health benefits and reduced environmental impact in places of high consumption of these foods (Clark et al., 2022).

Sustainable diet: The planetary health diet

The EAT-Lancet Commission on Food, Planet, Health brought together leading scientists to make a reference diet to feed a future population of 10 billion a healthy diet within planetary boundaries (Willett et al., 2019). The goal was to construct a framework for a diet that positively affected the planet's climate and would meet nutritional needs - a so-called "win-win" diet that would speed up food system transformation (Audsley et al., 2010; Willett et al., 2019).

The EAT-Lancet report proposed a dietary framework, the planetary health diet (Zhang et al., 2022). The diet is mostly plant-based, with a limited amount of animal ingredients. The conclusion is in line with other studies showing that limiting the intake of animal-based ingredients and increasing the intake of plant-based ingredients have benefits for both health and the planet (Zhang et al., 2022). Achieving the The EAT-Lancet transformation to healthy and sustainable diets a more than 100% increase in vegetables, legumes, fruits, and nuts is needed and a 50% reduction in red meat and sugar (Willett et al., 2019).

The Planetary Health Diet recommendation is primarily more plant-based foods, moderate animal-based foods, and the right amount of calorie intake. The reference diet comprises 2500 calories per day and 300 gr. of meat per week. The dietary recommendation does prescribe the optimal amount of the largest food categories per day. The largest categories are whole grains 232 gr., vegetables 300 gr. fruit 200 gr, dairy foods 250 gr, legumes 50 gr, fish 28 gr., beef, and lamb seven gr., pork, seven gr., chicken 29 gr, eggs, and other necessary ingredients in a lesser amount. Additionally, it contains a limited number of starchy vegetables, added sugar, poultry, seafood, red meat, processed meat, and refined grains. (Willett et al., 2019).

Adherence to the EAT – Lancet diet leads to lower environmental impacts and better nutritional quality (Kesse-Guyot et al., 2021; Marty et al., 2022). With business, as usual, it is estimated that the emission from the food system from 2020 to 2100 is 1356 Gt of cumulative food system GHG emissions (Gt CO_2-we). With a strategy to globally adopt a plant-rich diet, such as a planetary health diet, this could be reduced to 708 Gt CO_2-we (Clark

et al., 2020). Another study comparing the business as usual scenario with a planetary health diet in 2020-2060 estimated the business-as-usual emissions to be 375 Gt CO_2-equivalent of GHGs cumulation and with the planetary health diet 217 Gt CO_2-eq in the same period, resulting in a 41% reduction (Zhang et al., 2022). An estimated health benefit of the planetary health diet is to prevent 11 million deaths annually, or 19-24% of all adult deaths annually (Willett et al., 2019).

3 Method

Section 3 introduces the research methods used in the study. A qualitative case methodology was selected as a research method to answer the research questions. In qualitative research, two methods are needed, one for data collection and one for data analysis. For data collection, semi-structured interviews were deemed the best suitable and for data analysis discourse analysis.
The structure of section 3 is as follows. First, the background of basic theories of qualitative and case study research are presented. Then the methodology of semi-structured interviews and discourse analysis as an interpretation method is detailed.

3.1 Qualitative research

Qualitative studies use non-quantitative methods (Sofaer, 2002) and are well suited to uncover aspects that are not visible in quantitative datasets (Creswell & Inquiry, 2007). Qualitative methods are exploratory in nature, and the strong suit of qualitative research is to prioritize depth over breadth and study a limited number of individuals (Merriam, 2002). Qualitative research's overall purpose is to achieve an understanding of how people interpret their world and the meaning of the experience, and how they construct their world (Merriam & Tisdell, 2015).
Qualitative research can be classified as basic and applied, and there are six common types of qualitative research 1) basic interpreted study, 2) phenomenological research, 3) ethnographic study, 4) grounded theory design, 5) narrative study, and 6) case study (Merriam & Tisdell, 2015).

Given the uncontrolled environment and the need to understand the reason for meal choice, a qualitative approach was suitable. Moreover, the qualitative approach fits for identifying the drivers and thresholds for choosing a more sustainable meal and understanding the complex reasons people might have for their meal choice (M. C. D. Verain et al., 2022).

The choice of the qualitative method for this study was driven by the need to understand how individual and contextual variables determine meal choice and the reason for meal choice in a workplace canteen. Furthermore, to understand the dynamic between the meal offering, the information is given, and meal choice. not

3.1.1 Case study research

The case study has been defined in many ways, but many include that a case study should be a study of a contemporary phenomenon in a real-life context (Wohlin, 2021). Wohlin (2021) argues that in addition to previous definitions of what constitutes a case study should constitute an active role of an investigator and empirical data triangulation because controlling the independent variable is impossible in a real-life context (Wohlin, 2021).
Case studies are important in evaluating complex phenomenon in a real-world context. Case studies are also well suited to empirically address the question of how or why (Yin, 2014). Case studies are, by definition, ideal for focusing on an exploratory way in a development of a given unit (Flyvbjerg, 2011). Flyvbjerg (2012) stresses that case studies should be read like narratives and that the examples and narratives are powerful and can complement other methods and contribute significantly to scientific inquiry.

3.1.2 Semi-structured interviews

Interviews are categorized broadly as structured, semi-structured, and unstructured. Structured interviews have a pre-determined script regarding questions and the order of questions. Unstructured interviews, on the contrary, have a general theme, but the participant is encouraged to speak freely (Corbin, 2015). Semi-structured interviews in qualitative research are commonly based on an interview guide that is focused on the main topic but is flexible regarding how the questions are brought forward and allows new questions to be asked in response to the contact in the interview (Ruslin et al., 2022). An interview guide in semi-structured interviews provides a frame for the interviewer that contributes to obtaining reliable qualitative data (Kallio et al., 2016).

Semi-structured interviews are more commonly used in qualitative research than the other two, and they are more potent for two reasons. First, they allow the researcher to acquire in-depth information as evidence while focusing on the study, and second because they allow adaptability for the researcher more than in unstructured interviews (Ruslin et al., 2022). Furthermore, semi-structured interviews allow the researcher to inquire further if unexpected topics arise (Berg, 2009), and participants can add to the discussion something they find essential (Merriam & Tisdell 2016).

3.1.3 Discourse analysis

Discourse analysis is one of five major approaches to qualitative analysis. Others are grounded theory, phenomenological psychology, narrative research, and intuitive inquiry (Wertz, 2011). Discourse analysis was initially developed by Potter and Wetherell to focus on language and how people's statements are produced in interpersonal and communal contexts (Wertz, 2011). Discourse analysis is an interpretive method. Interpretation is based on material and contextual knowledge. Discourse analysis is a method that looks behind the literal meaning of language. The interpretation is based on details and contextual knowledge (Shaw & Bailey, 2009).

Coding frames

The coding frame design includes themes, names of codes, definitions, and rules for assigning codes (Lozano, 2015). For coding frames, there are both inductive and abductive approaches. The inductive approach is based on conclusions drawn from previous literature. The abductive method is to identify patterns and categorize phenomena (Berg, 2009).

4 Research design

The traditional diet in Europe is animal-based rather than plant-based, resulting in high emissions from diets (Saarinen et al., 2019). The relationship between dietarian identity and food choice is bidirectional (G. Kim et al., 2022; Rosenfeld, 2019). The literature review discussed many of the variables that influence meal choice. Previous studies have examined the effect of information on dietary choices and food choices (Betz et al., 2022; Kaljonen, Salo, Lyytimäki, & Furman, 2020). Still, it is hard to find studies that have explored providing detailed information about sustainability at the point of decision. Workplace restaurants affect the dietary habits of thousands of people daily and are in a position to shape the production, processing, and consumption of food (Goggins, 2018). Workplace canteens offering plant-based meals daily as an option to the traditional animal-based meals have opened up the possibility of the customer to try plant-based meals and lower their carbon footprint.

Furthermore, footprint calculators with detailed information about the carbon footprint of meals have only recently been available to canteens and restaurants, which also propels the fact that there are not many studies on the usefulness of providing customers with this information. Is possible that being exposed to information about the carbon footprint of the two meals can lead to more sustainable meal choices and changes in meal choices and dietary identity in the long run.

In section 4.1, the method for the case study is explained, and the reason case study is an appropriate method for this study. The section introduces the cases and their qualities for the study. In section 4.2. the interview method is detailed, the choice of semi-structured interviews is outlined, and how the participants were chosen. From there, the information about the participants is revealed, and the meal footprint calculator is described as well as the qualitative data analysis and construction of the interview guide. Finally, section 4.3 provides the research process and research framework.

4.1 A two-case study

The research question and focus are on the effects of providing information about meals in a canteen setting and studying the impact on attitudes and meal choice. For this research, two cases were explored. Case one is workplace canteens, where there is a plan to implement information about meal carbon footprint, and case two, where a footprint calculator has been implemented. The reason the case study was chosen as an appropriate method was that it is important to examine the meal choice and reason for meal choice in a real-life setting, both

where the information about carbon footprint is not available and also where this information has been made available to the customer.

Case 1 The City of Reykjavík (CR) and The University Hospital of Iceland (UHI)

The canteen for staff in the city of Reykjavík

The canteens for the staff of the city of Reykjavík are located in two places, Borgartún 26, where most of the city staff have lunch, and in the City Hall. The cooking takes place in Borgartún, where the larger canteen is. The main meals are the same in both places, but the side dishes vary. It is standard to offer two main meals, one with animal ingredients and one plant-based, that can be either vegetarian or vegan. Meals are labeled with information about their ingredients, but side dishes are not labeled. Side dishes can include fish or meat. Nutritional information about the ingredients of main meal ingredients is available. Information about carbon footprint or nutritional ingrediency is not available. In January 2022, a new catering service started. As was part of the contract, they are expected provided information about the carbon footprint at some point.

The canteen for staff at The University Hospital of Iceland

The canteen for the staff and patients at the University Hospital of Iceland is located in the main hospital building at Hringbraut. The cooking takes place there, and the kitchen serves all staff and patients. Meals are transported from there to smaller other units of the hospital. The canteen for staff offers two main meals, one with animal ingredients (proteins) and one vegan or vegetarian. Information about meal ingredients and nutritional information is available on a monitor at the canteen entrance and online. A specific label is for the main plant-based meal to indicate if it is vegan or vegetarian. Information about the nutrition of the main meals is available online but is not on display in the canteen. Information about emissions from meals is not available, but it has decided to make an in-house footprint calculator in 2023, in addition to the nutritional information available already (Jón Haukur Baldvinsson, 2022).

Case 2. Reykjavík Energy (RE)

The canteen for staff at Reykjavík Energy

The central kitchen and canteen for RE are located in the company's headquarters at Bæjarháls. Meals are transported from there to other workstations. It is standard to offer two main meals, one with animal ingredients and one vegan. Main dishes and all side dishes are labeled with information about the various food items they contain. A footprint calculator was first implemented in 2019. During the pandemic, the footprint calculator was not in use. In the middle of February 2022, the footprint calculator was set up again, now with nutritional information as well as an updated user interface. In the beginning, the information was only available online. From the middle of Mars, or about one week, before the interviews took place, the information was made available on a monitor at the main canteen entrance as well as online.

The meal carbon footprint calculator

The meal carbon footprint calculator implemented at Reykjavík Energy was developed by the Icelandic company EFLA in 2019 (EFLA, 2019). The calculator works both for canteens and restaurants. The information is based on life cycle assessment both from the company's own research and from international databases. The footprint calculator can summarise the footprint of up to five meals. Once implemented, chefs on-site enter the information about the food items of the meals offered each day, including the side dishes suggested for each meal. The emission from each meal is typically displayed by a graph, with a column for each meal. In each column, the main ingredients are represented with color and information about the relative emissions of each main ingredient in the meal. However, only information on total emissions is given for each meal. Therefore, the total emission for each meal is represented as the number of kilometers an average Icelandic could drive, resulting in the same amount of emissions (EFLA, 2020). The result can be available online or on the canteen monitor (see figure 2. Early in 2022, an updated version was introduced with a more friendly user experience and nutritional information about each meal offered.

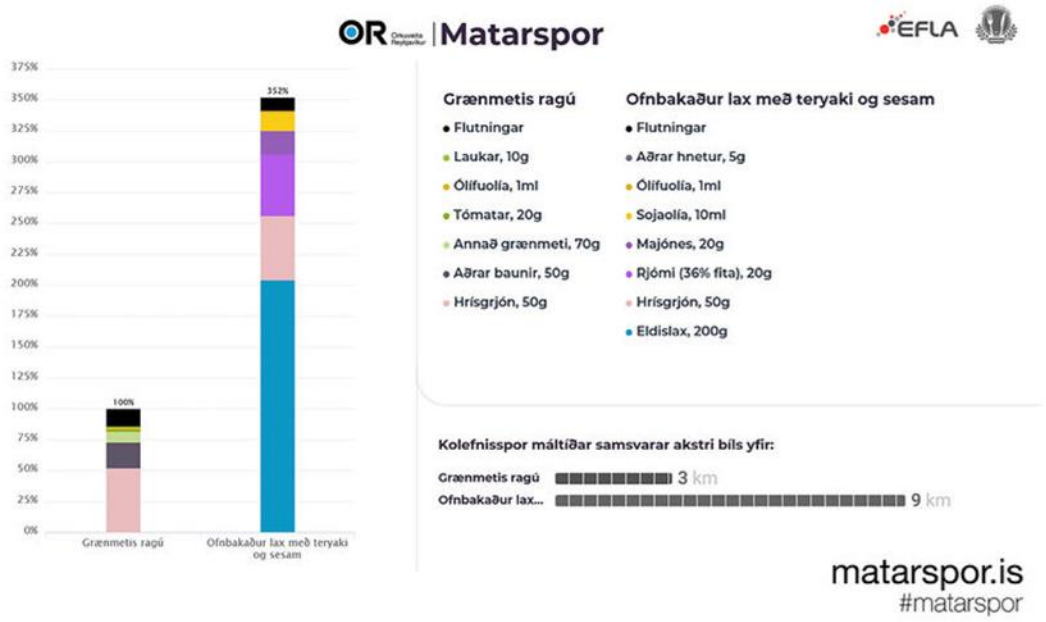

Figure 2. Information from the meal footprint calculator, Matarspor (EFLA, 2022).

4.2 Data collection

Semi-structured interviews were chosen as they give an opportunity for flexibility and to explore issues that come up in the interviews. At the same time, they are loosely structured by the interview guide to not to miss accidentally out on any questions that the researcher had prepared beforehand. Given the study focus, it was important also to stay on course with the main theme of the research.

4.2.1 The development of the interview guides

Two interview guides were made for customers and managers and were organized into themes (see Appendix). In the development stage of the interview guides, practice interviews were taken with chefs and customers of various companies. After each 3-4 interviews took place, the result was discussed with the main supervisor, and the guide was refined to suit the research questions better. The final interview guide for customers consisted of five themes: 1) meal choice, 2) reasons for meal choice, 3) climate concern, 4) need for information, 5) satisfaction with meals, and information from the canteen.
The outcome of the interview guide for chefs consisted of four themes: 1) policy regarding emissions, 2) policy enforcement, 3) the result of the policy, 5) and climate concerns.

4.2.2 Selection of participants

Participant selection was based on purposive sampling, based on their position and knowledge in the company (Andrade, 2020). The participants were nine customers and two managers. Four customers from the city of Reykjavík were interviewed, one from the University Hospital of Iceland and four from Reykjavík Energy. The managers were both from Reykjavik Energy and the executive chef of the canteen, and the Director of Environmental Matters.

The selection phase of customers was in cooperation with the contact person at each place. The criteria were that the customers should vary in age and gender and preferably have different dietary habits. The customers were chosen for their direct experience of having the opportunity to choose between two meals at the companies.

The selection of the managers was based on their knowledge of the implementation and how the implementation affected meal choice and meal offerings at Reykjavik Energy. Another reason they were selected was they were representative of higher-order decision-making regarding procurement and policy and policy enforcement at Reykjavik Energy.

The reason people in the same position in the other canteens were not interviewed is that it was not deemed to serve the research question further.

Table 1. Overview of the participants in the study.

ID	Canteen	Gender	Role	Diet
Study phase 1				
P1.	The City of Reykjavík	Female	Customer	Omnivore
P2.	The City of Reykjavík	Male	Customer	Omnivore
P3.	The City of Reykjavík	Male	Customer	Omnivore
P4	The City of Reykjavík	Female	Customer	Omnivore
P5	The University Hospital of Iceland	Female	Customer	Omnivore
Study phase 2				
P6.	Reykjavík Energy	Male	Customer	Omnivore
P7	Reykjavík Energy	Female	Customer	Pescatarian
P8	Reykjavík Energy	Female	Customer	Omnivore
P9	Reykjavík Energy	Male	Customer	Omnivore
P10.	Reykjavík Energy	Male	Executive chef	
P11	Reykjavík Energy	Female	Director of Environmental affairs	

4.2.3 Interview process

Data collection took place first for case 1, the canteens at CR and The UHI in November 2021, and case 2, in late March and beginning of April, at the canteen at RE. All the interviews took place at the respective companies in quiet meeting rooms chosen by the participants, except for one participant who wished to be interviewed at a nearby coffeehouse. The reason for the in-house interviews was that it was deemed essential to cause as little disruption to the workday of the participants to increase the likelihood of them agreeing to participate. The interviews all followed the format of semi-structured interviews. The interviews were all conducted face to face.

4.3 Qualitative data analysis

Discourse analysis was chosen as the appropriate method for analyzing the interviews. The reason was that discourse analysis looks at the meaning behind the words and looks at the context of the discourse. Coding themes were created with the aim to answer the research sub-questions and also to gauge the overall discourse of the interviewers in the context. For customers, three themes were created. The three themes were 1) Customers' dietary identity and reason for meal choice. 2) What would potentially facilitate a more sustainable meal choice 3) Environmental attitudes regarding the effect of the food system. For managers and policymakers, the coding frame consisted of four themes. The four themes were 1) Attitudes towards existing policy about emissions, 2) The enforcement of the policy at RE, 3) The effect of the implementation on the meal offering 4) General climate concerns related to the food system.

5 Results

5.1 Main Findings

The implementation of the footprint calculator in Case 2 had some effect on both meal choice and meal offering. According to managers at RE, there has been an increase in customers choosing plant-based meals as a result of the implementation of the footprint calculator. However, according to the Director of Environmental Affairs, the customers might not be aware of the effect of their meal choice. According to the Head Chef, following the implementation, he received feedback from customers that there was less protein in plant-based meals than in animal-based meals. The feedback caused the kitchen to add protein to the plant-based meals.

Findings show that the implementation potentially affects customers' meal choices resulting in more consumption of plant-based meals. The Director of Environmental Affairs has also noticed an increased awareness of the environmental footprint of meat among customers. The primary barriers to plant-based meal choice were perceived lack of appetizing look, perceived lack of protein and nutrients in plant-based meals, and perceived plant-based meals as not filling or providing satiety. The barriers to the more sustainable meal offering and procurement at RE are, according to the Head Chef, lack of education for staff, a lack of supporting policies, both in-house and national policy, and policy accountability in procurement.

From here on, chapter 5 is divided into two main sections. The first section (6.4.1 - 4.4) will cover customers' meal choices at lunchtime, both in Case 1 and Case 2. The reason for meal choice, customers' attitude towards global warming, and what are their perceived barriers to more consumption of plant-based meals. The second section (6.4.5 - 4.6) will cover the effect of the implementation of the footprint calculator in Case 2. The impact on customers' meal choice and meal offering is perceived by both the Head Chef and Director of Environmental Affairs.

5.2 Canteen Results for Case 1 and Case 2

This section will present the results from both cases jointly regarding customers' meal choices and attitudes. The chapter is in three parts. The first part will detail the dietary preference of customers, followed by the results regarding what food the customers typically pick at lunchtime and the three categories identified regarding food choice and reasons for food choice. The second part will present the finding regarding customers' attitudes towards global warming in relation to the food system. The third part will introduce the perceived barriers to a healthy and sustainable diet.

5.2.1 Results on Customer's Meal Choices at Lunchtime

All nine customers interviewed identify as omnivores except one at RE, who identifies as a pescatarian. (P7) Most customers elected to pick animal-based meals, while others preferably chose plant-based meals at lunchtime, regardless of their dietary preferences.

From the interview results, customers can be categorized into three groups based on their signature diet. Group one consists of customers with low consumption of animal ingredients. Customers in group two seldom or never choose only the animal-based option and instead prefers a hybrid meal with both options or a plant-based meal. Group three consists of customers that always select the option with the animal ingredients and a hybrid meal.

Table 2. Customers' meal choices at lunchtime.

No.	Participants' descriptives	Meal choice at lunch time
	High meat eaters	
P2	M. Customer at CR	Always meat
P9	M. Customer at R.E	Always meat (full or half portion)
P8	F. customer at RE.	Meat (full proportion)
	Moderate meat eaters	
P5	F. Customer at UH.	Sometimes meat
P4	F. Customer at CR.	Sometimes meat
	Low meat eaters	
P3	Participant 3. M. customer at C.R.	Never meat
P1	Participant 1 F. Customer at. C.R. O.	Very seldom meat
P6	Participant 6. M. Customer at RE. O.	Seldom meat (half portion)
P7	Participant 7. F. Customer at RE. P.	Never meat

Three customers regularly chose the meal with animal ingredients every day. Three customers chose the main meal, or both, based on the daily option. Four customers mainly chose the plant-based meal or some sort of a hybrid meal, see figure 3. The meal choice motivation varied from sensory motivation and health to environment. Many customers expressed that they are trying to eat less meat (P1, P4, P5, P6)

Group with High Meat Eaters, Participants 2,8 and 9

Three customers had an animal-based diet and usually ate the animal-based options in the canteen. They chose the food because they had been brought up with this food and were relatively happy with their choices. The customers in this group are two males from Case 1 (P2) (P9), and one female of them is from Case 2 (P8). They consistently choose the main

meal with animal ingredients. However, one mail customer at RE (P9) typically chooses the animal-based mal and the vegan meal half and half when meat is served, combining the meals into a hybrid meal. And the female customers at RE choose meat and/or cheese or other animal products and only opts for some sort of hybrid meal if the plant-based meal does not contain beans or alternative protein that has sugar.

A male customer at CR had never tasted the plant-based option and does not have interest or plan to taste it.

*I have to be brutally honest and say no, I've never tasted it. I have a colleague here who is vegan, and he always gives me a heads up on what's going on with the food because that's what he does. There have been times that I thought to myself to try it after he told me. But the food doesn't have protein. For example, I haven't tried anything called bean burger or anything like that. (P*2)

When asked about the reason for the meal choice, the customer cited upbringing and satiety.

*I feel that it helps me a lot with the buffet and with the price of the food as well that, you know, I have a good lunch meal that it helps myself in the evening when I get home, I don't need [to make] as much of an effort to fill myself up. (*P2)

*I was raised in my family, that you know at dinner time, you finish your dinner. We have a similar thing going on where you know you try to eat healthy at the beginning of the week, and then you reward yourself a little bit more into the weekend, so I would say why I pick this food is I was raised with it. I like eating, it tastes good, and as long as you don't overeat, it feels good. (*P2)

Two customers at Reykjavík Energy are reducing their meat intake but do not mention sustainability as a reason.

I eat clean meat and a lot of vegetables, I exercise a lot, but that is not a reason for eating meat, rather a reason to eat protein. I have decreased my meat-eating, but not for any particular reason. It is more convenient for me to grab and prepare cheese than meat. I think I am just lazy cooking. I do not eat beans, so I usually do not pick the vegan option, except it only consists of vegetables, like grilled broccoli or something like that. (P8)

There were reported reasons for the meal choice as reported by customers, but none relating to sustainability:

I just eat less meat, I am just bored of eating meat, somehow just lost interest in it. (P8)

*My diet makes it impossible for me to cut animal products, I don't eat beans or nuts, and so I have to get my protein from somewhere. (*P8)

*Usually, I choose the main course, whether meat or fish, and I often choose the vegetarian meal. I think they are good, though I am not vegan. Usually, when I do that, it is fifty-fifty. When there is fish, I only choose the fish. I look at the menu, and if the meals look appetizing, I go for the fifty-fifty option. (*P9)

Group with Moderate Meat Eaters, participants 4 and 5

Two female participants in Case 1 mainly choose hybrid or plant-based meals. These participants are not keen meat-eaters and have considered eating less meat. They expressed that they would like to eat more sustainably or healthily by eating more local food. (P4, P5)

They have reduced their meat consumption and empathise having vegetables and fruits on the plate.

It is different. Sometimes I choose meat, and sometimes I take the vegan. (P4)

I think I have decided to eat less red meat. I am nearly done with beef. It is very seldom that I take that. I never buy it, and I don't have it at home. (P4)

It kind of depending on what the meat option t is, if it is fish, it depend on the meat in qestoin and wheter or not the cours looks apperticing. (P5)

The vegetarian option is usually safe for me because but there is nothing that I like when it comes to vegetables but when it comes to meat. I usually go for the fish and the vegetarian option and then occasionally I go for the meat option. (P5)

A customer at the CR also, cites that choosing animal-based options or a filling meal at lunch results in it sustaining her longar and results in less need for cooking in the evening (P4).

Kind of depends on what looks appetizing and what looks like it is going to taste nice, but it also has to do with, one thing that comes into question, is that I sometimes have a long day. I have to work out after work, so then means that usually I have to make sure to have big lunch, I need something that is filled with energy and filling, so these days I go for the meat option because it fills me better and sustains me longer. (P4)

When asked about views regarding further meat reduction and plant-based diet. A female from UHI expressed that she is looking to reduce red meat but reluctant to skip the meat and fish altogether, citing that it is tempting, filling, and familiar, and the only way they would not eat it would be if the option were not there. (P5)

I think I have decided to eat less red meat, nearly done with beef. It's very seldom I'll take that. And also, pigs. So, the lamb and chicken are [my] main meat [choice]. (P5)

And customers at CR express that meat redcution can be a first step in a plan towards skipping meat but dobts the need of being compleatly vegan in Iceland. (P4)

I don have any emotional qualms about meat, but kind of I see it as a luxury, especially in the current climate. While we are trying to find out what best to do, I i think you should try to minimize not, and then later, you can maybe skip it. (P4)

I was talking about someone who is vegan, and we were talking about being vegan for the environment, and I would be saying I feel like I would like to see more research on whether or not it is more beneficial for the environment to be vegan in Iceland compared to the benefits of to be vegan in a country where there is more tropical. (P4)

Group with Low Meat Eaters participants, 1,3,6 and 7

Four customers can be categorized as low meat eaters. Two of the customers never eat meat at lunchtime. One is a pescatarian (P7), and the other (P3) dislikes how the meat is cooked at the canteen (P6), so he always chooses the plant-based options at lunchtime. The other two try to minimize the meat they consume in their respective canteens for environmental and health reasons (P1, P3). They prefer to go for the plant-based option as often as possible.

Two customers always choose the vegetarian option but add the animal-based option to the dish sometimes. (P1, P6)

*It is a little different. I often choose both, take less of the meat, and sometimes only take the vegetarian option. I always choose the vegetarian option. (*P6)

*I don't eat pork. It is a combination, I don't like the taste, and I don't like the way the pigs are handled. I have no particular interest in supporting that treatment" "I don't consume milk products, except as a part of a meal. (*P6)

*Yeah, sometimes I take it, and it tastes good, so as I say, I eat everything, but something in my mind says I'm never going to buy beef. (*P1)

Yes, I did have ground beef yesterday, it happens, and sometimes I have fish, but I eat very little meat, just chicken, but yes plant-based in the first opinion, and I am moving more in that direction. My plate at the canteen is 70-80% plant-based. If there is not enough protein on my plate, I use eggs to fill that need. (P1)

The perceived lack of protein in the plant-based meal turns customers towards choosing meat.

It is like it is the same vegetable dish every day. We discussed it yesterday at lunch. We hope it will be better with new chefs in December. The feeling is that they take the same vegetable bag, put it on a tray, and then add different spices and give it different names. I don't like how it tastes. But I use eggs to get protein. (P1)

When asked what the motivation for meal choice is, many customers say they choose what looks good, and it differs between days.

I eat just what it offered. If something else would be there, then one would just eat that; often, there is meat as a main meal, and, sometimes, I feel like the vegetarian dish does not give me satiety. (P6)

Reasons for meal choice are partly based on environmental concerns and health.

The little I know, it looks like plant-based food has a lower impact, and that has affected my choice, but I would like to go further, and I am truly ashamed of doing some of the things I do, and that has to do with food, just as other areas in daily life. (P1)

Animal welfare concerning animal agriculture and animal welfare, in general, is also cited as a reason not to eat meat. (P6)

*Environmental reasons and animal welfare, carbon footprint, and health reasons; I think it is better for the body. (*P6)

The pescatarian female at RE expresses that she prefers the vegetable dishes and

I usually choose fish or vegetables, no meat or chicken. Usually, I prefer the vegetable meal to the fish meal. Then I often think it is not enough just to eat salad. I need more calories and protein. If there is a meal with beans, I choose that over the fish dish., I like it better and it gives me a better conscience. (P7)

The reason for the pescetarian diet are mainly animal welfare.

For emotional reasons, not necessarily because of global warming or animal welfare in the beginning. I stopped eating meat at fourteen-fifth years old, and I just thought it was wrong and not appealing. The more I learn, the stronger my decision becomes. I have never wanted to turn back. I feel better-eating vegetables and fish. I have nothing against meat, and it is just for myself, my feeling. (P7).

The reason I have thought about it is that I have seen many documentaries about how cows are treated. It is terrible torture. It is not nice to consume something where someone has had to suffer. (P7)

The pescetarian at RE (P7) has considered reducing further animal products but do finds it difficult.

I have thought about stopping eating milk and egg, but I like cheese very much, so it is difficult to take it entirely out. Also, because I do not eat meat, there are fewer options, and If I completely cut milk products, it will be even less. I just like milk products, and I have not cut them. (P7)

5.2.2 Customer Awareness of Global Warming and the Food Systems' Impact

All participants that were interviewed were aware of global warming. And their attitudes reflect moderate concern about global warming impacts.

I don't get sleepless nights [because] of it, you know, but of course, I'm thinking about it, so I would we want our grandchildren to get a life here on the earth, so of course, I'm thinking about it, but maybe I'm not doing so well to prevent it, but well I'm trying.
(P1)

It is somewhat strange to be worried or anxious about things that will happen long after you're gone. […] It can drive you insane thinking about it and also the thing that you're not going to be able to do anything about it. It's just going to come no matter what.
(P3)

*I don't have paralyzing worries about the environment, but I do worry about the coming generations, and I do my thing to weigh in., If everybody says they cannot do anything, nothing happens, but there is not much anyone person can do. But I try to sort waste, use a bicycle, and so on. (*P8)

It doesn't cross my mind too much. I am very busy, but I do try to think about how our meals and home are, and I think about how I come to work.
I probably could be more concerned and probably should be doing more, but I don't have the energy or space in my brain to kind of fit that in. (P5)

What worries me the most, I would like to point out that I am guilty of this myself, but people don't when people really seem not to care that much, especially when it comes to like bigger policies, kind of related things, and more political-related things that have to do with to the climate. People think. it it to big and outside of their control, and that worries me that people think it is out of our control. It is a very big question, I don't know if I can answer that. (P5)

The customers are aware that animal ingredients, especially meat, are causing global warming, but they don't believe their food choice directly results from their environmental attitudes.

*Cows: it's an enormous amount of food, and they produce a lot of gasses and other things that have an effect. If we had less beef farming, I think that would have an impact for the better. On the other hand, I think it would not be good to have only vegan food because you would also need land, and then we would have to fell trees, so it is not necessarily suitable to go to the extreme. (*P5)

Fertilizers and feeding have many consequences for the animals. (P6)

One male customer at CR Mentions intensive farming, but in his case, it does not lessen customers' choice regarding animal products.

The business aspect of it is when those companies are trying to show growth and get more money, they find a way to fix their business, and that it harms the animals or has a bad effect on the environment. (P2)

Many believe the most harm from animal agriculture is due to transport (P2, P9), and uncertainty about the environmental gains of substitute meat was also expressed. (P5)

Some participants are very conscious about the consequences of the animal agriculture on the global warming. (P1, P6, P3, P8)

Everything I have gathered and read, I am not a specialist in this, but everything points to that food production has a gigantic footprint and that the products the way we have been operating is not smart. (P1)

Yes, from the news and information one has, I think there is reason to worry about that. Many things nothing in particular, just in general, and global warming is on the top of the list and the consequences of that. (P6)

Loss of forest and all industry requires energy, and it is the energy that is killing us because it is not clean energy, coals are used, and other dirty fuels and that has an impact. (P8)

Barriers to a Sustainable and Healthy Diet Among Customers

Barriers to the consumption of plant-based meals among customers concern the perceived lack of appetizing look and dissatisfaction with the quality of the food, especially regarding the perceived lack of protein in plant-based meals.

Customers at CR had doubts about the health benefits of a plant-based diet.
(P2, P3)

*If I put more thought into what I am eating and how much, then definitely health-wise as well, [my] mother would tell me that I would live five years longer without eating any specific kind of meat. I would consider it for sure. (*P2)

Doubt was also expressed about the environmental benefit of choosing a plant-based diet:

I mean, just what is the benefit if we [reduce] the animals [in our diet]? What is the benefit and what is not good? I have conflicting ideas about the whole thing. (P 2)

*I know I can get this information from the Internet if I take my time to do my research, but […] if there would be a marketing campaign related to those issues and there could be a website with videos and texts explaining, then definitely yes. (*P2)

In some cases, the lack of good vegan options is a barrier to meat reduction. (P1) While in some cases, it is mainly a temptation to choose appetizing animal-based options, even for customers trying to cut down on meat. (P6, P5)

Barriers to plant-based meals choices of customers

The Head Chef has identified two barriers to plant-based meals. First, there seems to be a barrier to trying new plant-based food at the canteen at RE. And the way it is prepared and served in the buffet has a significant effect on meal choices. For example, meals with a simple look in small containers are less popular than colorful meals in big open containers. (P10)

5.3 Case 2

5.3.1 Footprint calculator – effect on meal choice and meal offering

Both the Head Chef and Director of Sustainable affairs have noticed the positive effect of the implementation of the footprint calculator in Case 2. The Head Chef has noticed a clear increased choice of plant-based meals and is contemplating it will stabilize in fifty-fifty.

*It is started to happen. There is more increase in customers choosing the plant-based meal, and maybe one day, it will be fifty-fifty. (*P10)

The Director of Environmental Affairs has also noticed a discussion about meal choice.

Not a question, I can take an example of one executive manager who was not going to let himself be influenced by the footprint calculator, but when he saw the lamb, he said yes, that influences me when I see that the carbon footprint from the meal is compared to driving 30 kilometers or even 100 km. It has an unconscious impact on customers and especially if people start to talk about it. For example, last Thursday, there was lamb, and the carbon footprint was much higher than from the vegetarian dish. The vegetarian plate was great. It got me talking about how much the difference was. If it is a lamb on the menu, I just take from both dishes because I like to have some lamb, and then I have one whole proportion on my plate. (P11)

And the implementation of the footprint calculator has also affected the kitchen regarding meal offerings. There are discussions taking place in the kitchen about meatless days.

It does have an effect; we are trying to buy Icelandic products because there is this policy and propaganda. We, of course, know that it is worse to buy imported meat and vegetables. I would say it has an effect, because of quality and of the carbon footprint. When you put it in the carbon footprint calculator, then you have to register if it is imported or Icelandic. If you have chicken, for example, you can register continent, and the carbon footprint is much higher the further away. So, if you want to minimize the carbon footprint, then it would have an effect, even though transport is a low part of the carbon footprint. Considering everything, that was a big surprise. It seems like it doesn't matter where the animal lives. The carbon footprint is always large. (P10)

We are currently discussing having fewer days in the week that we offer red meat. That would be a big step. Red meat has a high carbon footprint, but there is currently no written policy. (P10)

And the Director of Environmental Affairs at RE has noticed the effect on the kitchen regarding their meal offering and procurement.

Putting the data in the footprint calculator influences the chefs. They can see the difference. I just bought these tomatoes. They were cheaper because they are imported, but what is the carbon footprint? This provides education to the people in the kitchen because they see the result every single day. They feed the footprint calculator with information about where they bought the product and immediately got the information about the emission. This can lead to different purchasing behavior. It is no doubt that this has an effect. (P.11.)

*The executive chef knows how much meat he has to prepare. He sees what is left after each day. (*P11*)*

The kitchen is contemplating ideas about the maximum quota of carbon footprint per week.

We are not currently considering the carbon footprint from a meal when we make it. We are not there yet. But that might change. For example, we have beef, and we think we should instead have chicken because we have crossed the maximum emission for this week. So it would be possible to control the emission in that way. For example, not having beef two times a week, not having ground beef on Tuesday, and beefsteak on Thursday would result in a very high footprint. (P10)

*If we are to reach this goal, something has to change. Currently, there is no policy for this, or the policy has not been executed. But it is necessary to put down some measurements. The only measure now is objective. (*P10*)*

According to the Director of Environmental Affairs (P11), the implementation of the footprint calculator has empowered the kitchen staff end provided meaning for them.

5.3.2 Barriers to a more sustainable meal offering at Case 2

Barriers to a more sustainable meal offering at RE are, according to the Head Chef (P10), a lack of continuing education for chefs, a lack of guidelines that include a sustainability factor from The Directorate of Health, and a lack of internal policy at RE.

Lack of continuing education

The kitchen prepares vegan meals every day for the staff, and they have already got some continuing education to provide more variety of plant-based meals. But the Head Chef express that they have planned to get more education. He has got an introduction to the upcoming guidelines from the Directory of Health, and he wants to be prepared to further reduce meat from the menu.

I can see that we need continuing education for the kitchen staff and that the customers have to be more open. Now when we introduce quality meals made of beans, the receiving is lower than expected. People have to get used to getting protein from a plant-based source. (P10)

Lack of clear sustainable guidelines from The Directorate of Health

The kitchen at RE takes the policy from The Directorate of Health. The current guidelines do not take sustainability into account. New guidelines that take sustainability into account are under revision but have not been made public yet.

*Currently, we are working with the old guidelines, so we have to change course if this will be the new guidelines. It is interesting because we are not following any trends like keto or something like that. So, we are just looking to these guidelines, and things will certainly change for us if the policies change. So, we have to change. That is only positive. I think this will materialize soon. (*P10*)*

*It would be great to take this further, it would be good if a roof would be established, and we would make menus accordingly. I know the Directory of Health is on the way with new dietary guidelines for the recommended daily intake. A third of the plate contains carbs, one-third of vegetables, and one-third of meat or fish. The meat and fish weighing will be less and more emphasis on beans and plant-based protein. The reason is that they are now taking sustainability into account, not only nutrition. So, we have to be ready. (*P10*)*

Lack of internal policy at RE

The overall policy at RE is climate-oriented, but currently, there is not a policy regarding the canteen. There is a general policy about limiting waste but not regarding the carbon footprint from the canteen. (P11)

*There is something about the carbon footprint from the food in the policy. It has not been introduced to me, but I am aware of it. And we are ready to comply if we get direct orders, but we are starting already. (*P10*)*

According to the Director of Environmental Affairs at RE, all procurement at RE are estimated in regard to emission except the procurement for the kitchen.

*No, we do not do the procurement in the kitchen, but it started last year. We are doing that with every other procurement, but we might do that. Maybe we need to talk to Benedict again because he is responsible for the procurement of the kitchen. (*P11*)*

The general policy is that sustainable aspects should be considered in procurement. We ask our suppliers if they have EBT papers, which include the carbon emission and information about life cycle assessment. But that policy does not include food procurement. But we should do something about that. We would have to talk me, and the executive chef.
(P11)

6 Discussion

The aim of this study was to examine the impact of carbon footprint information on meal choice and meal offerings at large canteens. The following research question was posed.

What is the potential impact of implementing a meal carbon footprint calculator at a canteen?

Sub-questions

a) How does the information impact meal choice and the reasons for the meal choice?
b) How does the information about emissions from meals impact attitudes regarding global warming and food system impacts on global warming?
c) What barriers to more sustainable meal choices can be identified?
d) How does the implementation of a footprint calculator affect procurement and meal offerings?

Based on the findings from the semi-structured interviews with customers and managers, the results of this study show that the information from the meal footprint calculator affects meal choice and reasons for meal choice in two ways. First, they create a reduction mindset in customers and among the chefs. And secondly, the information from the footprint calculator creates a positive spiral. The spiral is created by customers' increased attention to the plant-based meal and them providing feedback to the kitchen on the perceived lack of quality of the plant-based meal, in regard to there being less protein than in the animal-based meal. This causes the kitchen to focus on increasing the protein in the plant-based meal, which leads to more consumption of the plant-based meal.
In this chapter, the main results will be discussed further. The chapter is divided into two sections.

In the first section, the psychology of meal choice and determinants of meal choice are discussed. The three segments of meal consumption identified in the results are discussed in relation to previous literature about attitudes regarding food choice motivation, the components of healthy and sustainable food, barriers to meat reduction, and barriers to eating healthy and sustainable food.

In section two, the impact of the footprint calculator implementation is discussed, and the different feedback loops are identified in the canteens in Case 1 and Case 2, as well as proposing Case 3, where the maximum effect of the footprint calculator is reached with a carbon emission reduction policy.

6.1 Three Segments of Meat Eaters in Perspective

As covered previously, the results in this study show that the customers' meal choices at lunchtime can be divided into three segments, ranging from high to low meat consumption. Additionally, it was revealed that all the customers identified as omnivores except one who identified as a pescetarian. In this section, those three segments will be discussed and put into perspective regarding previous literature.

When the segments are compared to previous literature regarding the determinant of meal choice, a common theme became apparent in all of the research. The theme is illustrated through traffic light coloring (see table 3 below). In the first segment, which is red,

consumers consume a high amount of animal products, and their attitudes ad motivation reflect that. In the second segment, which is yellow, consumers are a little bit more environmentally conscious but still consume moderate amounts of animal products, and their attitudes and meal motives reflect that. In the last segment, which is green, consumers are already consuming healthy and sustainable diets, with primarily plant-based diets and minimal animal-based products.

The comparative literature in the table below represents a study on consumers' motivation for meal choice consumption (Verain, Dagevos, & Jaspers, 2022), the definition of sustainable and healthy meals (Verschuren et al., 2022), consumers' attitude toward reducing meat consumption (M. C. D. Verain et al., 2022), and finally, perceived barriers for increasing plant-based diets (Reipurth et al., 2019).

Table 3. Traffic light illustration of the three meat consumption segments in comparison to related segments identified in previous literature.

	Segments of Meal Choices at Lunchtime	**Consumer motivations for their meal choice**	**Definition of a sustainable, healthy meal as perceived by consumers**	**What is the consumer attitude towards reducing meat consumption**	**Perceived barriers in consumers to increasing plant-based diets**
The least unsustainable segment	High Meat Meal Choice	Ego-centric Taste, sensory motives, and health motives	Consumers' definition: A sustainable and healthy diet includes meat, fish, and dairy.	Meat-oriented consumers: Compulsive meat consumers and meat lovers.	Consumers with high meat intake and high dairy consumption. Barrier: Plant-based, not filling nor appetizing.
The moderately sustainable segment	Moderate Meat Meal Choice	Eco-centric, taste sensory, and health motives	Consumer definition: A sustainable and healthy diet is less meat and dairy, organized and local	Consumers with moderate meat consumption: Unconscious flexitarians and potential flexitarians: Moderate meat consumption. And moderate resistance to meat reduction	Consumers with high consumption of dairy. Barrier: No barrier to the consumption of plant-based food is identified in the segment.
The most sustainable segment	Low Meat Meal Choice	Environmental and animal welfare	Consumer definition: A sustainable and healthy diet is vegan or vegetarian, or flexitarian with low animal ingredients	Consumers' low meat consumption: Conscious flexitarians. High intake of plant-based food, low intake of animal-based. No resistance to meat reduction.	Consumers with low consumption of meat and dairy. Barrier: No barrier to a plant-based diet. Plant-based good for the environment, with enough protein and taste. Facilitator/Moderator: Believe plant-based food tastes good.
	(As identified in this study)	(M. C. D. Verain et al., 2022)	(de Boer & Aiking, 2022)	(Muriel C. D. Verain et al., 2022)	(Reipurth et al., 2019)

6.1.1 Reductarian Diets

Previous literature has acknowledged that there are a few segments of meat eaters (Muriel C. D. Verain et al., 2022). The traditional definition of an omnivore is a person who does not refrain from meat consumption. Many omnivores, however, are reducing their meat consumption to a different extent. This particular diet to has been labeled as meat reduction or flexitarians, and research shows that this is not a fringe (Dagevos, 2021). However, a clear definition of how much meat is included in this diet has not been established. But the common factor is that the person abstains from eating meat occasionally, and reduction is a person who is deliberately reducing meat consumption (Dagevos, 2021).

The ideal diet for health and a sustainable future is what has been identified to be comparable to low flexitarian (Dagevos, 2021). Low flexitarian has been referred to as predominantly plant-based flexitarian diets (Muriel C. D. Verain et al., 2022). Low flexitarians or predominantly plant-based flexitarians are still low in numbers compared to other meat-eating groups (Muriel C. D. Verain et al., 2022)

The group labeled in this study was labeled to three segments, high meat eaters, moderate meat eaters to low meat eaters, but there is not enough data to verify how much meat they eat, neither at lunchtime nor in their life in general. Below is a discussion on how the three segments identified in this study relate to four research papers that have identified similar segments, that is, from high meat consumption to lower meat consumption and attitudes that reflect these meal choices. For the sake of clarity and simplification, the segments in the other researchers are also labeled from red to green (see table 3).

6.1.2 Customers reason for meal choice compared to previous literature.

The results show how food being perceived as appetizing and/, or filling plays a role in food choice. This is in line with the literature, Verein et al. (2022) classified food choice motivation into three groups; eco-centric, health, and environment (M. C. D. Verain et al., 2022). Verein et al. (202) theorized that for most people, egocentric motives are the most common, then health, and lastly, environment. As stated, an appetizing look of meals and satiety are generally important to the customer from all segments identified in this study.

Ego-Centric and Health-Centric Motivations
Research confirms that it is important that the food looks appetizing, is perceived to be filling, and provides satiety. The Head Chef further confirmed this at RE, which states that sometimes the plant-based food he prepares, which he believes will taste good and be of good quality, is not touched by customers because they don't perceive it to be appetizing. Many customers also mention health as a motive, that they are looking for food that is healthy and contains enough protein or are concerned about satiety from meals.
It was apparent in the research that all consumers had these motives in their meal selection at the canteens. Ego-centric motivations were shown to be relevant to consumers in all three segments alike. However, for the red and yellow segments, environment and animal welfare are generally not weighed in the meal choice (red and yellow in the table above).

Environment and Animal Welfare Motivations

Environment and animal welfare motives, as defined by Verein, were only present for the green segment – e.g., low meat eaters (in green in the table above).

It is of note that in the review of the research, it may be that Verein's model does not adequately explain the moderate meat groups motives. Consumers that are consciously or unconsciously reducing meat consumption seem to be somewhat unexplained.

6.1.3 Customers' attitudes regarding healthy and sustainable diet

Although customers in this study were not directly asked about their ideas for healthy and sustainable diets, many of their statements revealed their views on the matter. Their views regarding global warming and the food system's impact were often in line with their reason for meal choices. Customers who were less aware of how the food system affects global warming tend to eat more animal-based food and cite many reasons for that choice. At the same time, customers that were fully aware of the impact of the food system tended to choose a more plant-based diet and have various reasons for that. The reason customers cite for the choices seems to correlate with three segments of dietary thinking identified in a study conducted in the EU on people's ideas about the markers of a healthy and sustainable diet (de Boer & Aiking, 2022).

The study (de Boer & Aiking, 2022) asked consumers what components they thought made up a healthy and sustainable diet. People's ideas about what was considered a healthy and sustainable diet were very different. Generally, the ideas fell into three different categories from least sustainable to most sustainable. The least sustainable group was ladled as "Nutritious," which focused on eating more fish and vegetables but did not mention sustainability factors. The next group was labeled "Light Green," which mentioned some sustainable factors such as eating seasonal, organic, and local foods. The third group, labeled "Deep Green," was most on par with what generally is considered sustainable and healthy diets – such as lower meat eating.

High Meat Eaters compared to Nutritious Group
The group of high meat eaters in this study (labeled red in the table above) is not consciously reducing their meat intake or otherwise referring to sustainability in their statements. One of the participants had never tried the plant-based option, citing health reasons and the fact that he found the meat to be filling. The other participants did not state the environmental reasons for their meal choices. Their meal view on healthy and sustainable died are very comparable with the segment labeled Nutrition (red in the table above) in de Bauer & Aikin's study (de Boer & Aiking, 2022).

Moderate Meat Eaters Compared to Light Green Group
The participants in the group labeled moderate meat consumption fit well with the light green definition as it is defined (de Boer & Aiking, 2022). They mentioned the footprint of traveling and the importance of food being organic and locally sourced.

Low Meat Eaters compared to Deep Green Group
In this study, the low meat group either did not eat meat at lunchtime or consumed very little meat at lunchtime. They all chose the plant-based option primarily and were conscious of

the footprint of meat and, in some cases, dairy. They are aware of the impact of meat on carbon footprint, although they were not as aware of the high carbon footprint of milk and cheese. The customers in this study mentioned that it is important to consider diets with a low carbon footprint, such as vegetarian or vegan. The views of customers in this group, in many ways, resemble the description labeled deep green by de Bauer & Aiking (2022).

6.1.4 Different segments of customers' attitudes towards meat reduction

Customers in this study were asked if they had thought about eating more sustainably in regard to meat consumption and, in some cases, dairy and eggs. The result shows that customers have different attitudes toward reducing meat and was in some relation to their current meat consumption. The less meat they reported consuming a lunch, the more positive their views were towards meat consumption. This is in some way aligned with previous literature (Muriel C. D. Verain et al., 2022) on five segments of meal consumers' attitudes toward meat reduction based on their current diet and meal choice, specifically the amount of meat consumed per week.

The study (Muriel C. D. Verain et al., 2022) concludes that meat consumers can be classified into groups based on their views on meat reduction from strong to moderate, resulting in five categories. Those five categories can be compared to the three segments we have defined in this study, as illustrated in the table above.

Meat oriented segments
Two segments (red in the table above) were defined as meat-oriented segments (Muriel C. D. Verain et al., 2022). The highest meat consumers, defined as compulsive meat consumers (15,6%), were least in favor of meat reduction (Muriel C. D. Verain et al., 2022). They consumed meat six days a week and had no intention of reducing meat consumption. The group defined as meat lovers (13,3%) consumed meat 5,5 times per week, were more in favor of meatless days, were already on the road to consuming less meat, and intended to continue slowly reducing their meat consumption (Muriel C. D. Verain et al., 2022).
The description of these two groups that were labeled meat-oriented does align well with the group labeled High meat identified in the study (red in the table above). Some customers in this group have been not at all in favor of meat reduction, while others were reducing their meat reduction and are, in some cases choosing a vegan meal with the meat meal.

Unconscious and Potential Flexitarians
The unconscious flexitarian (39%) consumed meat less than five times weekly. They were not outspoken about having a neutral attitude toward meat reduction (Muriel C. D. Verain et al., 2022). Potential flexitarians (17,5%) consumed meat about four days a week, appreciated meatless days, and reported environment and animal welfare as important. This group falls within the moderate meat (yellow) segment of this research.
The group identified in this study as moderate meat eaters (yellow in the table above) do in some way liken the unconscious flexitarians and potential flexitarians identified in the meat reduction study. They are somewhat reducing their meat intake but not connecting their reduction to environmental matters or animal welfare, even though they are conscious of global warming and, in some ways, the harmful effect of the food system.

Conscious Flexitarians

Conscious flexitarians (green in the table above) had meat three times a week for the environment, animal welfare was very important, and they disliked meat originating from animals (Muriel C. D. Verain et al., 2022). This group is similar to the group identified as low meat eaters in this study. They were environmentally conscious and, in some cases, expressed that they would like to eat less meat for animal welfare as well as environmental reasons.

All flexitarians intended to reduce their meat consumption further (Muriel C. D. Verain et al., 2022). Different barriers in the three groups identified in this study compared to three segments.

6.1.5 Barriers to a Plant-Based Diet

A Danish study identified different barriers in different segments of meat eaters (Reipurth et al., 2019). The segments were high intake of animal products, labeled High All, high intake of meat labeled High meat, high intake of Dairy labeled Hight Dairy, and a segment with low intake of animal products labeled Low All. Sociodemographic variables like age, education, and sex were not significant in the model (Reipurth et al., 2019).

The High All
The High All segment identified perceived plant-based diets as not good for the environment and not healthy (Reipurth et al., 2019). The High Meat segment perceived a plant-based diet as not tasty. The participant in the High meat group in this study did not share the views that All High and High Meat had. They did not express that plant-based foot is not healthy or bad for the environment. However, participant 2, who is a high meat eater, said that to add a plant-based diet to his meal choice, he would have to be convinced about the health benefits of that.

High Dairy
No significant barriers to a plant-based diet were found in the group of High Dairy (Reipurth et al., 2019). The High Dairy group might be related to the moderate meat group in this study. They expressed that they liked plant-based meals and had no barriers to consuming plant-based meals, but in some cases, they expressed that they were not ready to cut cheese altogether.

The Low All
The Low All segment disagreed that plant-based food does not provide enough protein or satiety, and they also disagreed with the statement that plant-based food does not taste good. (Reipurth et al., 2019)
While views of the Low All group are in many ways like the low meat group identified in this study, they have no barriers to plant-based food and like the taste of plant-based food.

6.2 The Effects of the Implementation in Case 2

The effect of the implementation is positive. According to the Head Chef, the implementation has caused increased consumption of plant-based meals. The Director of Environmental Affairs noticed a discussion about the carbon footprint of the meal and

testified that it had affected her choices and the choice of another customer. However, the Director of Environmental Affairs stated that customers might not be aware of the effect of the implementation on their meal choice. Of the four customers at RE, one was a pescetarian, and the other three often chose a hybrid meal or the plant-based meal when meat was the main animal-based meal. One customer stated that she did not need a carbon footprint calculator to tell her that meat has a high carbon footprint.

The biggest effect of the carbon footprint implementation was on the feedback loop identified in Case 2. In canteens, there is a constant conversation between the customer and the kitchen about the food offered. In Case 1, there is business as usual, and the carbon footprint calculator does not influence the conversation or feedback the kitchen gets about the meal choice.

In Case 2, the implementation of the carbon footprint calculator caused conversation amongst customers and between customers and the kitchen. This created new feedback loops in relation to sustainability, the ingredients of the plant-based foot in regard to the animal-based food, and the overall quality of the plant-based food. The footprint calculator created a reduction mindset among customers and the kitchen, which led to a focus on plant-based protein and the quality of the plant-based food.

In the following sections, these feedback loops will be explained as well as the ideal case

6.3 Feedback Loops Identified in Case 1 and Case 2

A canteen is a system with many stakeholders. Meal offerings and how appetizing meals are can impact customers' motivation and meal choices. Customers' meal choices and attitudes can influence procurement and meal offerings. Interactivity between different stakeholders in the canteens creates feedback loops. Additionally, company policy regarding procurement and national dietary guidelines affect procurement and meal offerings. Implementation of the footprint calculator at RE is a new factor in the system that impacts these feedback loops. The identified feedback loops for case 1 and case 2 were put in a model. The third case scenario is implementing the footprint calculator, procurement, reduction policy, and new dietary guideline from the Directory of Health.

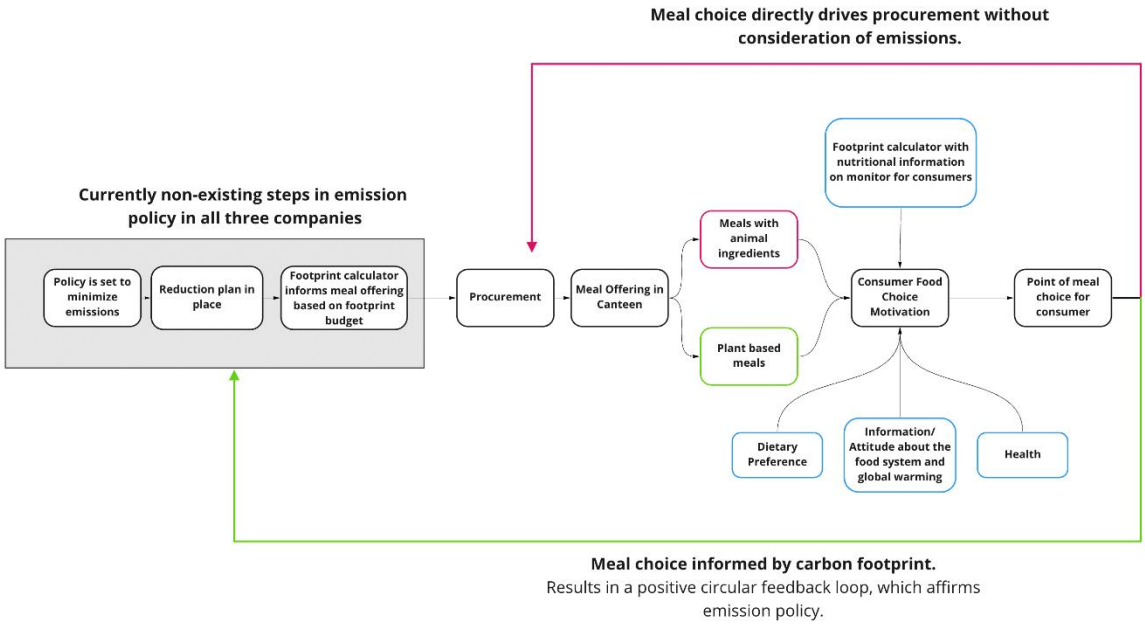

Figure 3. Positive circular feedback loop model.

The model explains the different feedback loops in the canteens and a possible situation where all positive influencing factors would be at play in future Case 3. with and without the footprint calculator. The identification of different situated feedback loops possibly leads to different procurement.

6.3.1 Case 1. Feedback Loops Tied to Eco-centric Motives and health

Canteens without a footprint calculator and an emission policy procurement and meal offers are marked with a red line.

Meal Choice and Ideas about Healthy and Sustainable Diet

The customer's FCM mainly derives from current dietary preferences, health, and attitudes (Kahneman, 2011). In this case, heuristics could be based on the traditional value of meals with high animal ingredients. And with no footprint calculator or nutritional information, it is more difficult for customers to identify protein in vegetarian or vegan meals. And for a customer who is avoiding meat, sometimes the only way to get protein in lunch is to choose the meal with animal protein. At UHI, where there is not always the option of choosing a vegan meal, vegan customers without a good choice at lunchtime. The lack of quality of plant-based meals makes them less likely to be chosen as a part of a hybrid meal.

Meal Offering

Where there is no footprint calculator, the feedback is derived from customer satisfaction with the meals offered without considering sustainable factors. The red line on the model identifies this case scenario. Mainly catering to the traditional majority of customers. The vegan meal is offered irregularly. This meal offering constricts customers' choice to choose either a vegetarian meal or meal with animal protein and minimizes their option in lowering their emissions.

Procurement mainly depends on customer feedback, where most customers create the loudest feedback. And little exterior motivation for the kitchen to create more quality plant-based meals. This can potentially lead to a negative spiral regarding emissions, where serving large steaks with animal proteins tends to give the kitchen the greatest compliments. On the other hand, this feedback loop can result in minimum effort to provide high-quality and sufficient proteins for plant-based meals.

This could explain why UHI and CR offer vegan or vegetarian meals as a plant-based option instead of constantly offering vegan meals as a choice.

6.3.2 Case 2: Added Feedback Loop Tied to Sustainability

The footprint calculator is implemented, and sustainable elements become visible, as well as nutritional information, but the kitchen is not made accountable.

Meal Choice and Ideas about Healthy and Sustainable Diet

The implementation of the footprint calculator can influence 'customers' FCM.
In this case scenario, there is an additional likelihood that customers make decisions more deliberately (Kahneman, 2011). Also, the information about sustainability and nutritional information can impact dietary thinking (de Boer & Aiking, 2022), what people consider a healthy and sustainable diet, and consequently, their view on meat reduction.

Procurement and Meal Offering

As a result, some feedback loops were identified. For example, feedback from customers regarding procurement. In the beginning, there was a lot of discussion about emissions from beef, and customers were asking why the canteen kept buying foreign meat regardless of the emissions. Even though that did not immediately affect meal-offering and procurement, there is a discussion about it currently in the kitchen.

Another feedback from the initial implementation was that low emissions from plant-based meals might easily be explained by a lack of nutrition, mainly proteins. When the updated version of the footprint calculator was implemented in 2022, nutritional information laid bare for the kitchen that the plant-based meal had less protein. The kitchen responded by adding more protein to the plant-based meals. According to the Head-chef, it remains a challenge to have an equal amount of protein in the plant-based meal as in the animal-based meal.

An argument can be made that the kitchen is also more likely to decide on sustainability based on System 2. The information provided by the footprint calculator on emissions from meat regardless of the place of origin has resulted in discussions about lowering the offering of meat altogether.
A positive circular feedback loop is formed where the plant-based meal is upgraded to the same standards as the meal with animal ingredients. When looking at these feedback loops, it became noticeable that crucial variables were missing to realize the full potential of the footprint calculator, so the third feedback loop was created. The third feedback loop includes

an emission policy with accountability and a reduction plan. As a result, sustainable aspects are visual and accounted for, and emission from the canteen is regulated.

6.3.3 Case 3 - Possible Future Case. Information About Emissions from Procurement added to Feedback Loops

To this author's knowledge, none of the canteens currently have a policy to lower the emission from meal choice and procurement. Besides implementing the footprint calculator, this model requires a sustainable procurement and carbon budget policy with an active reduction plan for procurement. In that case, both the customers' FCM and the chefs' meal-offering motivation are influenced by the footprint calculator addition

Meal Choice

Implementing the policy regarding emissions and a plan to reduce emissions would provide a new feedback loop and a reward system for the kitchen. As a result of the procedure, the kitchen would have a maximum of allowable emissions per week and a plan to lower them over time. In addition, the footprint calculator would function as a useful policy tool and create a learning curve that prepares staff for further budget cuts. Research shows that public food procurement policy has significant potential (Parsons & Barling, 2022).

The sixth edition of the Nordic Nutrition Recommendations (NNRs), The Nordic Nutrition Recommendation 2022 (NNR2022), is to be published in 2022. The guidelines will provide dietary reference values and are food-based (Christensen et al., 2020)

Meal Offering

Meal offering takes accountability regarding sustainability. Vegan meal choice is offered every day. In addition, a reduction plan restricts procurement. Policy and a reduction plan are in place. A plan to minimize animal products, especially meat, creates motivation for the kitchen to make appetizing plant-based meals and meals that have a lower carbon footprint. In addition, the kitchen is motivated to pursue continuing education to cook appetizing meals with lower emissions, thus creating a further increase in quality plant-based choices, resulting in lower emissions and an increased possibility of a positive FCM with customers.

This can potentially create more meaning to work and new career opportunities for staff. According to the executive chef at RE, he would welcome a policy restricting emissions from the meals of any given week. Research shows that public food procurement policy has significant potential (Parsons & Barling, 2022). It is reason to believe that a strict policy about emissions from procurement would be effective, and the footprint calculator would be a helpful tool to navigate the process of lowering the emissions.

6.4 Study Limitations and Validity

The study's limitations lie in the fact that the investigation is qualitative, and only a limited number of people were interviewed. Another possible limitation is the validity of the participant' selection and researcher bias. Nevertheless, the analysis can provide good

preliminary data and a narrative for further study of policy tools to limit emissions from food. Regardless of the qualitative nature of the study, the study provides a narrative based on participants' experiences.

Case studies have been ignored as a methodology and held in low regard in academia, although they are widely used (Flyvbjerg, 2011). According to Flyvberg (2011), case studies have been underestimated in terms of reliability and validity. Flyvbjerg (2011) claims that there are five misunderstandings about case studies and these misunderstandings have been diminishing case studies as a method. The five misunderstandings are the following: First, (1) practical knowledge is less valuable than theoretical knowledge; second, (2) one cannot generalize based on a single case study; third, (3) case studies are not well suitable for theory building and hypothesis testing; fourth, (4) researchers tend to have a bias towards verification, and fifth, (5) it is difficult to develop general propositions from a single case study. Flyvbjerg (2011) argues that none of this is correct and that concrete case knowledge can be more valuable than predictive theories (Flyvbjerg, 2011). Firstly (1) Content-related knowledge is more valuable than rule-based knowledge. Secondly, (2) transferability matters more than generalization, and it is often possible to generalize based on a case study. Thirdly (3), analyses are suitable for developing and testing hypotheses. Forth (4) evidence is that researchers in case studies are less prone to confirm preconceived notions. Fifth, (5) there should be an emphasis on the narrative of studies and less on generalizing. Data triangulation was achieved to estimate the changes in meal choice to increase the internal validity of this study. Data triangulation was managed by interviewing customers and getting information about procurement and meal offerings. Managers were interviewed about the effectiveness of the footprint calculator on overall meal choice and policy—policymakers about the policy and effectiveness of the implementation. Customers were interviewed about attitudes and meal choices.

7 Conclusion

The food system is responsible for about one-third of all emissions. Production of livestock and especially ruminant animals, produces the highest emissions. The diet in Europe and other affluent countries is high in meat and other animal products, and there is little tradition for plant-based food. Transition to a more sustainable and healthy diet is needed to reach the goal of limiting global warming to 1,5. A healthy and sustainable diet is predominantly plant-based, with a small amount of animal-based food (Willett et al., 2019).

Consumers are, in many cases, aware of global warming but continue to consume meat at levels that are utterly unsustainable for the planet. There are still barriers for consumers to transition to more sustainable foods. This is both in the case of lowering meat consumption and increasing consumption of more sustainable, plant-based foods.

This study explores the effect of implementing a carbon footprint calculator in a large canteen in Iceland. A qualitative study was conducted in three canteens, resulting in two cases: Case 1, where there was a plan to implement a footprint calculator, and Case 2, where

a footprint calculator had been implemented. Interviews were conducted with 11 customers from the three canteens and two managers from case 2.

The meal choice of customers can be categorized into three segments, High meat eaters, moderate meat eaters, and low meat eaters. Generally, how appetizing the meal looks and the perceived safety is important for customers. The meal choice reflects what customers think is a sustainable and healthy diet. What they think is a sustainable and healthy diet is also reflected in their views on meat reduction. Barriers to a plant-based diet are more evident among customers that are generally high meat eaters. Moderate meat eaters and low meat eaters are more open to a plant-based diet. The main barrier is perceived lack of protein and lack of appetizing look.

In Case 2, the implementation of the footprint calculator affected meal choice and meal choice motivation. The implementation makes customers more aware and creates a reductionary mindset. According to managers' observations at RE, customers changed their meal choice towards more plant-based options, and it was noticed that the plant-based meal did not have the same amount of protein as the animal-based meal.

The implementation affected the kitchen also. The kitchen response to the feedback and plant-based meals were improved. And the Head Chef noted that he wasn't aware of how high-footprint meat produces in general, regardless of whether it was locally sourced or not. The kitchen is now contemplating having meatless days and are looking for ways to offer more variety of plant-based food that looks appetizing and provides satiety to customers.

7.1 Main Conclusion and Potential Future Research

The main conclusion of the study is that for the transformation to a healthy and sustainable diet to happen, consumers need to be aware of their meal decision regarding sustainability. In Case 2, implementing a carbon footprint calculator yielded promising results to that end. Primarily, any such implementation can potentially create a carbon reduction mindset among customers as well as chefs and procurement teams, which can lead to more sustainable meal choices and procurement.

The Positive Feedback Loop Model

In Case 1, the business-as-usual model, the feedback loops revolve mainly around how appetizing the meals look and the satiety it provides. In Case 2, The awareness about the emission makes customers explore the plant-based option more. The focus on emissions from animal-based meals led to pressure on the kitchen to add protein to the plant-based meal and to provide more variety of plant-based meals.

Case 3 paints the picture of a future model. This would be the ideal case where the footprint calculator would work as a policy tool for carbon reduction. The result would be a reductional mindset were collective goals would be clear for both customer and kitchen, and positive feedback loops would ensure a result.

Finally, the role of the chefs and procurement teams is critical. Quality plant-based meals are very important to sustain a positive feedback loop towards a more plant-based diet. It is not viable to expect customers to eat less meat except by offering them appetizing and nutritious plant-based meals as replacements.

Opportunities for Future Research

Creating a reactionary mindset is the first step toward a healthy and sustainable diet. Implementing a footprint calculator challenges customers' previous ideas about what is a healthy and sustainable diet. This study suggests that it is beneficial to study meal choices and meal choices with an emphasis on segments that have been identified in previous studies in regard to customers' ideas about what is a sustainable and healthy diet.

Future work should investigate the effect of carbon reduction policy for procurement with a footprint calculator as a policy tool. The research should focus on the effect on customers, the kitchen, and procurement.

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