



Norwegian University
of Life Sciences

Master's Thesis 2018 30 ECTS

The role of information in reducing food waste

A case study of information as a food waste
prevention measure in a Norwegian canteen

Rebekka Helén Kristiansen
M.Sc. Agroecology

Abstract

Food waste represents a major problem that must be resolved in order to achieve a sustainable food system. Most of the food waste in industrialised countries are consumer related and occur at the end of the food supply chain. Food waste prevention measures that targets consumers are thus needed. In Norway, a large number of meals are served in the hospitality and food service sector every day. This study conducts an independent assessment of food waste in a canteen to test how differing forms of information communication to guests can be used to reduce food waste. Furthermore, the study identifies benefits associated with reducing food waste in the studied canteen. A combination of participant observation and surveys are used to document the effect of information on canteen guests, whereas food waste quantification is used to document the effect of information on the amount of food waste. The study found that the information campaign results in periodic short-term decreases in the amount of food waste. The use of a variety of information communication approaches combined over time are suggested to further decrease the amount of food waste. The high benefit-cost ratio of the information campaign shows that the implementation of an information campaign is an efficient investment relative to its costs. In addition to economic and environmental benefits, this study suggests that information campaigns targeting canteen guests may potentially have effects on food waste generation in other parts of the food supply chain. This can provide the basis for further research.

Acknowledgements

First, I would like would like to thank Nortura Tønsberg for allowing me to conduct my study in their canteen. Furthermore, I would like to thank the kitchen staff for their positive attitudes towards my project, and for helping me during the registration period. I would also like to thank Ingvild Gran for helping me during the initial work in the canteen.

Then, I would like to thank Hedvig Bjørge for our weekly meetings at the NMBU Writing Centre. Thank you for your support throughout my writing process.

Furthermore, I would like to thank Hanne Møller and Ole Jørgen Hanssen from Ostfold Research for their valuable input in the beginning of my study. Moreover, I have to thank Matvett for allowing me to attend the KuttMatsvinn2020 Forum, and for enabling me to attend the KuttMatsvinn2020 Expert course.

I would also like thank my supervisors Anna Marie Nicolaysen and Geir Lieblein for their input during my writing process, and for having the Master Programme in Agroecology at NMBU.

The entire process of conducting this study would not have been the same without the support and motivation from my boyfriend, Nikolai. Thanks for listening to my endless talking about food waste, and thanks for naming our WiFi “Reduce food waste”. Moreover, I would like to thank my best friends, or my “study group”, for staying by my side day in and day out at the library.

Lastly, I would like to thank friends and family who have supported me by eating food passed its best-before date. Thanks for saving the world.

Table of Content

ABSTRACT	1
ACKNOWLEDGEMENTS	2
TABLE OF CONTENT	3
LIST OF FIGURES	5
LIST OF TABLES	6
LIST OF ABBREVIATIONS	7
1 INTRODUCTION	8
1.1 PROBLEM AREA AND RESEARCH QUESTIONS.....	9
1.2 STRUCTURE OF THE PAPER.....	10
2 BACKGROUND	11
2.1 WHY REDUCE FOOD WASTE?	11
2.2 WHERE DOES FOOD WASTE OCCUR?.....	14
2.3 FOOD WASTE IN THE HOSPITALITIES AND FOOD SERVICE SECTOR.....	15
2.4 CAUSES OF FOOD WASTE	16
2.5 MEASURES TO INFLUENCE BEHAVIOUR.....	17
3 METHODS	19
3.1 SELECTION OF STUDY SITE.....	20
3.2 PREPARATIONS.....	20
3.3 DATA COLLECTION.....	22
3.3.1 <i>Food waste quantification</i>	22
3.3.2 <i>Information campaign</i>	24
3.3.3 <i>Surveys</i>	27
3.4 DATA ANALYSIS.....	28
3.4.1 <i>Food waste quantification</i>	28
3.4.2 <i>Surveys</i>	29
4 RESULTS	31
4.1 FOOD WASTE QUANTIFICATION	31
4.1.1 <i>Food waste per serving</i>	32

4.1.2	<i>Food waste in the kitchen</i>	32
4.1.3	<i>Food waste in the canteen</i>	33
4.1.4	<i>Economic cost of food waste</i>	34
4.1.5	<i>Environmental effects of food waste</i>	35
4.1.6	<i>Food waste before and after the information campaign</i>	35
4.2	SURVEY	36
4.2.1	<i>Survey 1 – before the information campaign</i>	36
4.2.2	<i>Survey 2 – during the information campaign</i>	38
4.3	SUMMARY OF RESULTS	41
5	DISCUSSION	42
5.1	INFORMATION CAMPAIGN AND FOOD WASTE	42
5.2	BENEFITS OF THE INFORMATION CAMPAIGN IN THE STUDIED CANTEEN	45
5.3	METHODS DISCUSSION	48
5.4	LIMITATIONS OF THE STUDY	51
5.5	FURTHER RESEARCH	52
5.6	FURTHER PRACTICE	52
5.7	FURTHER RECOMMENDATIONS TO REDUCE FOOD WASTE IN THE STUDIED CANTEEN	52
6	CONCLUSION	54
7	REFERENCE LIST	55
8	APPENDICES	59
8.1	SURVEY 1	59
8.2	SURVEY 2	62

List of figures

Figure 1: Food cycle from production to end treatment	11
Figure 2: WRAP Food and Drink material hierarchy	13
Figure 3: Food waste in different part of the food supply chain	14
Figure 4: Key causes of food waste in different sectors.	17
Figure 5: The three levels of measures to influence behaviour	18
Figure 6: Study timeline.....	19
Figure 7: The studied canteen.....	21
Figure 8: A section of the buffet.....	21
Figure 9: Food waste quantified in this study.....	23
Figure 10: Sheet for registering food waste.....	24
Figure 11: Communication towards canteen guests using notes on the buffet.	25
Figure 12: Signs on each table in the canteen.....	26
Figure 13: Daily communication of results.	26
Figure 14: The food waste table	27
Figure 15: Each step of calculating food waste per portion served.	29
Figure 16: Spreadsheet in Excel where the data from the surveys were analysed.	30
Figure 17: Food waste from the kitchen an the canteen.	31
Figure 18: The number of portions served per week throughout the study.....	32
Figure 19: Food waste in the kitchen	33
Figure 20: Food waste in the canteen.....	34

List of tables

Table 1: Responses to the first survey.....	37
Table 2: General causes behind food waste in the household.	38
Table 3: Responses to the second survey.....	39
Table 4: Responses to the second survey.....	39
Table 5: Summary of main results.	41

List of abbreviations

FSC.....Food Supply Chain

HaFS-sector.....Hospitality and Food Service Sector

Horeca.....Hotels, Restaurants, Cafes

SDGs.....Sustainable Development Goals

EU.....European Union

UN.....United Nations

FUSIONS.....Food Use for Social Innovation by Optimising Waste Prevention Strategies

WRAP.....Waste Reduction Action Plan

FAO.....Food and Agricultural Organisation

GHG.....Greenhouse gas

1 Introduction

Food waste in industrialised countries has received growing attention over the past decades. The increasing concerns about environmental issues, food security, population growth and resource conservation, along with a general global effort towards more sustainable practices, have motivated industrial countries to reduce food waste. Food waste represents a huge paradox and is a considerable challenge in the food system. At the same time as one third of the world's food production is lost or wasted (Gustavsson, et. al, 2011), 815 million people suffer from hunger worldwide (FAO, 2017).

Consumers in developed countries waste nearly as much food as the total food production in Sub-Saharan Africa (FAO, 2014). Sixty percent of food waste occurs at the consumer level, and is largely a result of food surplus and consumer behaviour. Furthermore, consumers' food perceptions and food purchase behaviours influence stakeholder decision making in other parts of the food supply chain (FSC). In the retail sector, grocery stores offer high varieties of food within certain standards, based on the assumption that consumers will be satisfied only if the grocery stores fulfil these standards. Likewise, buffets in the hospitality and food service (HaFS) sector are overflowed with food, often resulting in food being discarded. The degree of food waste demonstrates that there is a need to improve the current food system.

Food waste prevention has become a key priority at a global level. The majority of countries have engaged in long-term efforts towards social, environmental and economic sustainability by adapting the United Nation Sustainable Development Goals (SDGs). In line with the 2030 U.N. SDG number 12.3: To ensure sustainable consumption and production, member states of the EU are committed to halve the per capita food waste at retail and consumer level, and to reduce food losses along production and supply chains (European Commission, 2015). As a result, a number of incentives has been implemented in Norway to prevent food waste. In June 2017, five Norwegian ministries and twelve organisations signed an intention agreement with a target of 50% reduction in food waste by 2030 (Regjeringen, 2016). A follow up on the goal requires documentation of food waste in all parts of the FSC, as well as research to develop effective food waste prevention measures.

An increasing number of studies have examined food waste in Norway. This enables well-documented food waste statistics in large parts of the Norwegian FSC. Despite this, data on food waste in the HaFS- sector are lacking. There are currently no national statistics on food waste from this sector, which covers restaurants, canteens, hotels, cafés and other public and private kitchens that serve food. Yet, studies demonstrate the extent of food waste from the sector. Key numbers from the Nordic Council of Ministers indicate that about 840,000 tonnes of food waste per year are generated in the Nordic Horeca-network (Marthinsen, et al., 2012). Furthermore, research from WRAP suggests that 13% of the food purchased in the UK HaFS-sector is thrown away, despite that it could have been eaten (WRAP, 2018).

The still low, but increasing, awareness on the extent of food waste from the hospitality sector, combined with a lack of food waste statistics and limited cooperation among actors within the sector, have resulted in several initiatives. KuttMatsvinn2020 is a cooperative project between Matvett and large parts of the Norwegian HaFS-sector, which aims to put food waste prevention on the agenda. Through food waste quantification and implementation of food waste prevention measures, the goal of the project is to reduce food waste from the sector by 20% within 2020.

Information and communication has been recognised as efficient measures to educate the population on environmental issues, and to maintain motivation and good practices among the population (Raadal, et al., 2016). A Swedish case-study found that increasing awareness about food waste among students contributed to reduce the total amount of food waste in a school restaurant (Casimir, 2014). Information and communication aimed at guests thus have the potential to reduce food waste in the HaFS- sector.

1.1 Problem area and research questions

This study is an independent assessment of food waste in a workplace canteen to test how different approaches of information can be used to reduce food waste. The motivation behind this project was to contribute research to KuttMatsvinn2020, as well as to supplement general food waste research. A combination of food waste quantification, participant observation and surveys were used to investigate how an information campaign on food waste has the potential to change people's attitudes, and thereby reduce the food waste

generation in the studied canteen. The overall objective of reducing food waste is to contribute towards national and international targets on food waste reduction, to lower the negative impacts associated with food waste, such as: hunger, environmental degradation, emissions of climate gases and unnecessary economic costs.

The aims of the study are to answer the following questions:

- 1.1.1 To what extent can different approaches of communicating information to guests be used to reduce food waste in a canteen?
- 1.1.2 What are the benefits associated with reducing food waste in the studied canteen?

1.2 Structure of the paper

This paper is divided into six chapters. The background information and relevant research for the topic is presented in the second chapter. Chapter three summarises the research methods used in this study. The results are presented in the fourth chapter and discussed in chapter 5, along with limitations of the study and suggestions for further research. The conclusion is presented in the final chapter.

2 Background

Food waste occurs along the entire food supply chain (FSC), from initial agricultural production on the farm, to manufacturing, to wholesale, retail, and at consumer level. In lack of an illustration based on Norwegian records, a model adapted from WRAP provides a good illustration (Figure 1). The model below shows food wastage throughout the FSC, along with inputs, emissions, losses and by-products.

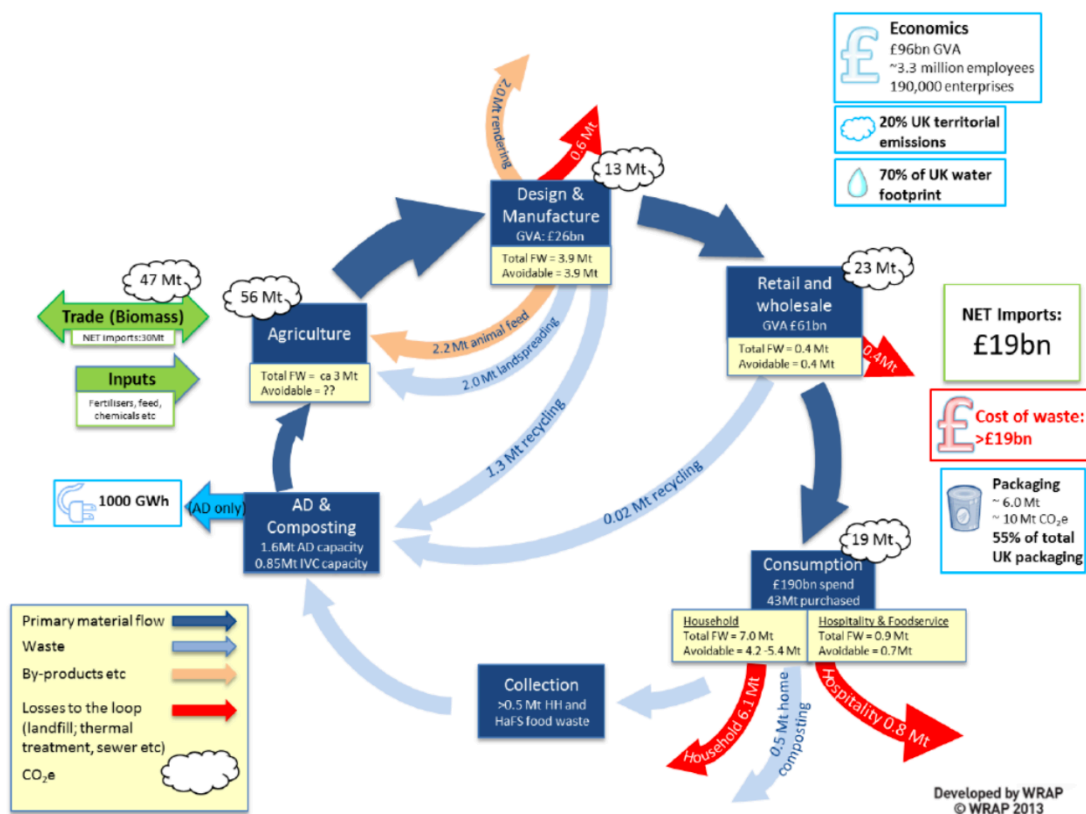


Figure 1: Food cycle from production to end treatment (WRAP, 2013).

2.1 Why reduce food waste?

Food waste leads to unnecessary environmental impacts and affects the health of our planet. Producing food that will not be eaten is a waste of land, labour, energy, capital and water. In addition, grown but uneaten food creates excess pollution throughout the different stages of its life-cycle. In Norway, most of the emissions occur under production, mainly as methane from husbandry (Miljøverndepartementet, 2013). In countries where landfill is still allowed, there are considerable emissions linked to decomposition of food as it gives off methane.

Methane is a greenhouse gas that is at least 20 times more potent than carbon dioxide and contributes directly towards climate change.

The UN Food and Agricultural Organisation (FAO) estimated the total carbon footprint of produced, processed, transported, commercialised and eventually wasted food to 3.3 billion tons of CO₂- equivalents (FAO, 2013). This means that food waste accounts for 8% of annual anthropogenic greenhouse gas (GHG) emissions, which is almost equivalent to global emissions from road transport. These emissions have potential harmful effects on ecosystems, biodiversity and the livelihoods of people worldwide (IPCC, 2014).

Reducing food waste has become a global priority, not only to conserve natural resources and prevent GHG emissions, but also to deal with food insecurity. Hunger is number one on the list of the world's top 10 health risks, causing more deaths than any other disease (World Food Programme, 2013). Hunger is also the single biggest solvable problem facing the world today, considering that there is a food surplus in many industrialised countries. Although one might question the link between consumer behaviour in industrialised countries and hunger and poverty in developing countries, it can be deduced that wasting food in rich countries will increase the global demand for food. A growing demand for food worldwide will lead to higher prices in the world market, which will further negatively affect the purchasing power of impoverished people. Tackling the issue of food waste in industrialised countries will therefore have positive effects globally.

Despite hunger and food waste being global issues, it is not necessary to look to the other side of the world to see the paradox of food waste. European countries as a whole annually generate 179kg food waste per capita (Monier, et al., 2010), while nearly 43.6 million Europeans live in food insecure conditions. Accordingly, reducing food waste is listed as necessary to achieve sustainable food security at global level (Godfray, et al., 2010) (Foley, et al., 2011).

In addition to negative social and environmental impacts, food waste causes significant monetary losses for the individual consumer, and affects the world economy. According to the FAO, the global volume of food wastage is estimated at 1.6 billion tonnes per year, which equals a global cost of 750 billion USD annually (FAO, 2014). This includes money spent on producing, distributing and purchasing food that ends up as waste. Costs related to food

waste management must also be considered. It is therefore imperative that food waste reduction become a global priority.

As well as environmental, social and economic reasons for reducing food waste, food waste prevention is also the most preferable solution from a circular economy perspective. In their strategy towards a resource efficient Europe, the EU presented a priority order for waste management through the waste hierarchy. Like the waste hierarchy, the *food* waste hierarchy favours solutions with more desirable social, economic and environmental effects. The food waste hierarchy (Figure 2) is supported by a number of countries and organisations.

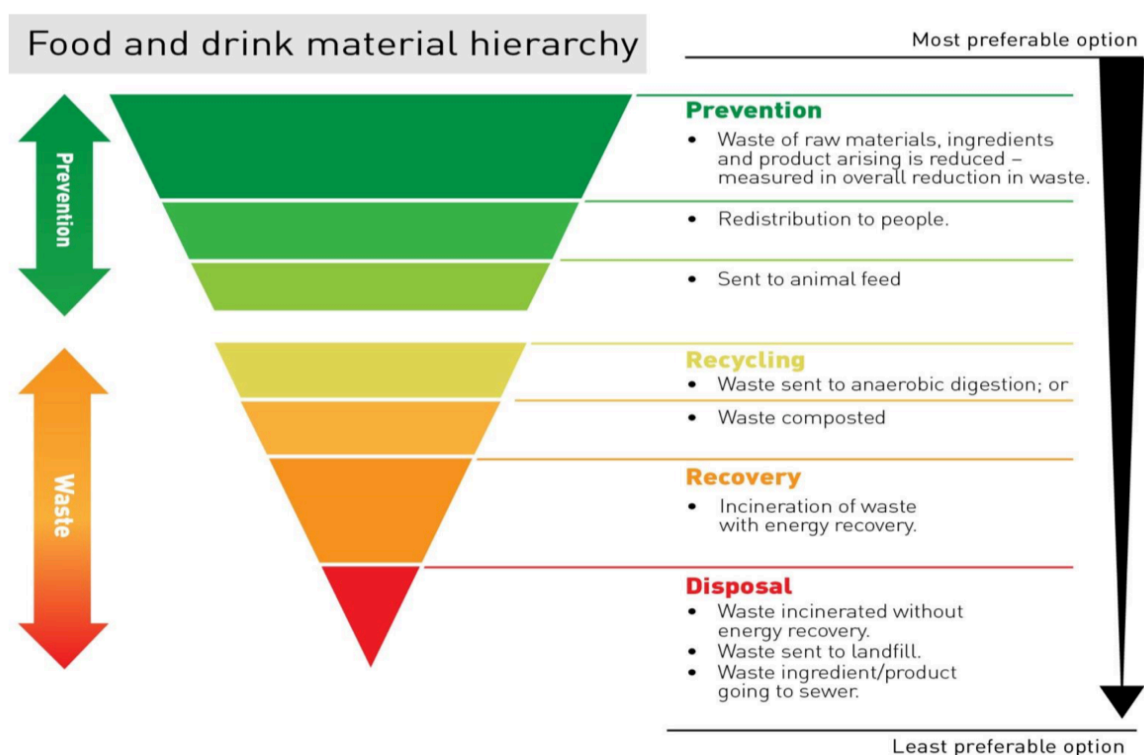


Figure 2: WRAP Food and Drink material hierarchy (2018).

Food waste valorisation measures, like energy recovery, have limited possibilities to fully recover the resources spent on food production. Food waste prevention through minimisation of food surplus and avoidable food waste is therefore preferable. The second most desirable option involves redistribution of food to people affected by poverty, followed by using it for animal feed, further process it into biofuel, bio compost, energy and lastly, disposal. The food waste hierarchy draws an important distinction between food surplus, which can be redistributed and eaten, and food waste, which is food that is degraded for purposes other than human consumption (FAO, 2014). This study focuses on food waste prevention.

2.2 Where does food waste occur?

The total amount of food wasted along the FSC is about the same in industrialised and developing countries, but the distribution differs. While food losses at the early stages of the FSC are a main issue in developing countries, food surplus and food waste at the later stages dominate in industrialised countries, such as in Norway. It is therefore necessary to make a distinction between food *waste* and food *loss* when discussing food waste in different parts of the FSC (figure 3).



Figure 3: Food waste in different part of the food supply chain (Every Crumb Counts, 2018)

Food loss

Food loss refers to a decrease in nutritional value or mass of all food produced for human consumption. In developing countries, food loss is often caused by inefficiencies in the FSC, such as poor infrastructure, choices of crop production, and lack of technology and access to markets (FAO, 2014). Avoidable food losses represent a waste of resources and have direct and indirect impacts on the income of farmers and consumers.

In industrialised countries, food loss is often caused by overproduction or food surplus. Food surplus occurs when production exceeds demand, sometimes because farmers produce larger quantities than needed to ensure delivery of agreed quantities to retail. Food loss in industrialised countries is also a result of high standards set by food manufactures and the retail industry. Some produce never leaves the farm because it is rejected by supermarkets due to quality standards concerning shape, weight, size or colour.

Food waste

Food *waste* refer to alternative (non-food) use of safe and nutritious food produced for human consumption (FAO, 2014). In developing countries, most of the food waste occur at retail level, mainly due to lack of facilities and markets that provides right conditions for storage and sale of products. At the consumer level there are minimal amounts of food waste due to poverty. Families with low income often buy smaller amounts of food, which results in little food being discarded.

Food waste occurs at significantly larger quantities in industrialised countries. In retail, high quality standards among consumers is an important factor behind food waste. In addition, consumers expect a wide range of food products be available in shops, which leads to products reaching their “best before” date before getting sold. While several shops sell products close to their expiry date at reduced prices, the date labelling is still a major cause of food waste in the retail sector.

Sixty percent of food waste in industrialised countries occurs at the consumer level (European Commission , 2018). Consumer attitudes and behaviour greatly influence the amount of food waste, which makes the role of the consumer crucial in food waste prevention. Another important factor is that some consumers can afford to discard food. At the supermarket, consumers are offered large packages of food at the same price as smaller quantities. This often results in food being discarded. Likewise, many businesses in the hospitality and food service sector serve buffets at fixed prices, which encourage guests to fill their plates with more food than they are able to eat.

2.3 Food waste in the hospitalities and food service sector

A number of studies have examined food waste at different stages of the Norwegian FSC. The ForMat-project found that a total amount of 355 000 tonnes of food waste occurs in Norway per year (Stensgård & Hanssen, 2016). Most of the food waste occurs at the household level (61%), followed by the food industry (21%), retail (17%) and wholesale (1%). National food waste statistics from primary production and the hospitality sector, however, are still lacking.

The hospitality and food service sector, sometimes referred to as the Horeca-network (hotels, restaurants and catering), is a large sector covering canteens, hotels, cafés, and other private and public kitchens that serve food. Internationally, an increasing number of studies are documenting the quantities of food waste in the sector. A study of the European HaFS- sector found that food services generate 12% of the total food waste (Stenmark, et al., 2016). Another study of the EU estimated that 12 million tonnes of food waste per year occur from the European HaFS sector (Monier, et al., 2010), whereas 840 000 tonnes of food waste occur in the Nordic Countries per annual (Marthinsen, et al., 2012). A study of the food service in Finland found that about 20% of the food purchased and prepared in the sector ended up as waste (Silvennoinen, et al., 2012), whereas WRAP estimated that 13% of food that could have been eaten is thrown away (WRAP, 2018).

In Norway, it is estimated that the HaFS- sector generates between 80 000 and 176 500 tonnes of food waste per year (Arbeidsgruppen for tiltak, 2017). Furthermore, a case-study of the Norwegian Horeca- network found that food waste occurs in the preparation (36%), on the buffet (28%), as food scrap on plates (28%) and from storage (7%) (Møller & Stensgård, 2016). Further research and cooperation across sectors is needed to obtain detailed statistics of sources and quantities of food waste from the sector.

2.4 Causes of food waste

In order to develop effective measures to reduce food waste, it is important to identify its causes. In an extensive study of food waste across the EU, Monier, et al. (2010) identified key causes of food waste in large parts of the FSC. Figure 4 shows that logistics, labelling, planning and portion size are general causes of food waste in food services and restaurants. Moreover, it shows that psychographic factors such as awareness, knowledge and attitudes also are important causes.

	Manufacturing & Processing	Wholesale & Retail		Food Service and Restaurants			Households
		Distribution & Wholesale	Retail	Hospitality industry	Schools	Hospitals	
Awareness				●	●	●	●
Knowledge			●	●	●	●	●
Attitudes				●	●	●	●
Preferences					●	●	●
Portion size			●	●	●	●	●
Planning				●	●	●	●
Storage		●	●				●
Socio-economic factors							●
Labelling			●	●	●		●
Packaging	●	●	●				●
Handling		●	●				
Stock management		●	●				
Logistics	●			●	●	●	
Product quality requirements	●		●				
Technical malfunctions	●						

Figure 4: Key causes of food waste in different sectors. (Taken from the report by Monier, et al. (2010)).

A general lack of awareness of the scale of food waste and the benefits that comes from reducing it, is an underlying problem in many parts of the food service and restaurant sector. Many people do not think about what they throw away, and wasteful behaviours with regard to food waste can be entirely unconscious. Furthermore, the low market value of food compared to other products contribute to an undervaluation of food resources. The consumer perception of food as rapidly disposable results in food being wasted needlessly. Measures to influence food waste behaviour and attitudes among consumers are as important as prevention strategies related to waste resistant products and packaging. Moreover, food waste prevention measures that influence behaviour could have the potential of reducing consumer related food waste at different parts of the FSC.

2.5 Measures to influence behaviour

The authorities use three main types of measures to influence human behaviour (NOU, 1995). These measures are implemented at different levels and have different strengths. The most powerful measures are juridical, including laws, rules and regulations. The second most powerful category is economic measures, which are used to influence actors when deciding what is economically beneficial to do. Examples include environmental taxes, quotas and fees to moderate environmental harmful practices, or grants or subsidies to support activities in favour of the environment. The final group of measures is administrative, and involve information, agreements and motivation campaigns.

These measures are generally cheaper and easier to implement than economic and juridical measures. Figure 5 shows the different levels of measures used to influence behaviour.

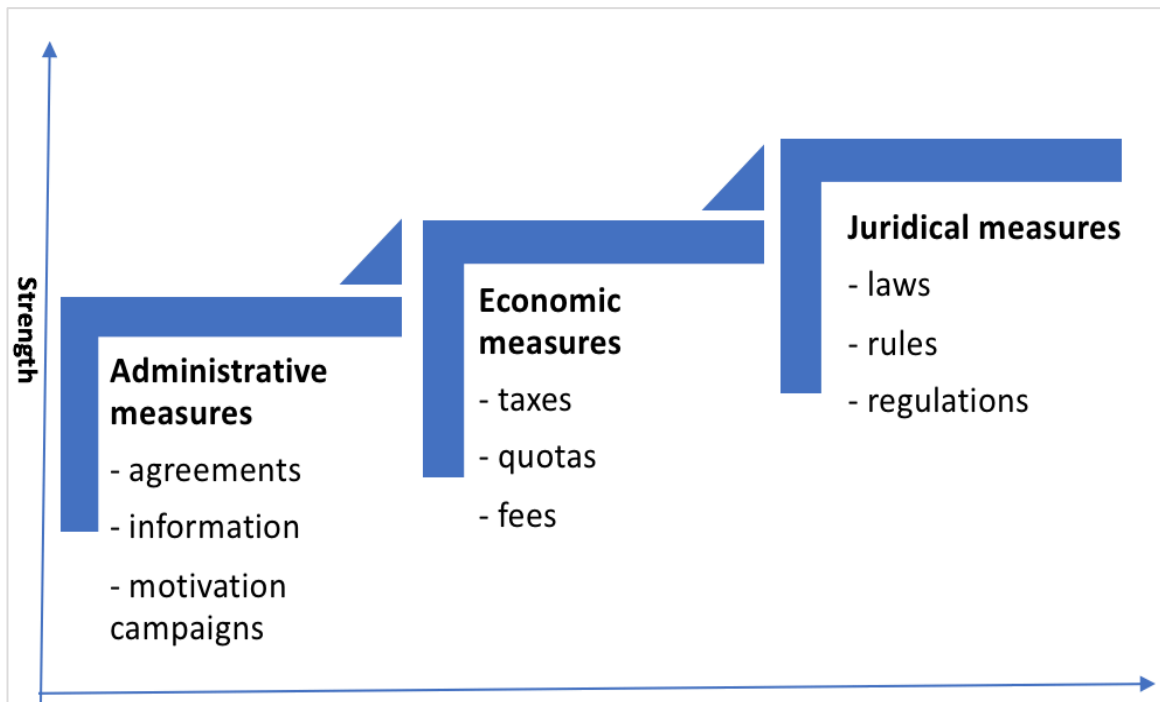


Figure 5: The three levels of measures to influence behaviour

In the context of environmental impact, behaviour can be defined as personal habits or conscious efforts to reduce impacts on the planet (Monroe, 1999). Research on behavioural economics demonstrates that people are influenced by information in memory and relevant information in the environment. Information and communication have been recognised as efficient means to educate the population on environmental issues and to maintain motivation and good practices among the population (Raadal, et al., 2016). Initiatives to draw public awareness to the extent of the problem, combined with knowledge about food waste prevention techniques, can therefore be highly effective.

Considering the potential benefits of food waste education, this study aims to quantify the impact of raising food waste awareness in a canteen.

3 Methods

The following chapter will present the research methods used in this study, including the data collection process and data analysis.

The goal of this exploratory study is to investigate the extent of which information can be used as a measure to prevent food waste in a canteen. The study was undertaken in a private workplace canteen at the Nortura factory, located in Tønsberg, Vestfold. To support the validity of this study, three different methods were combined. Participant observation was used prior to and during the study. Food waste quantification was used to track food waste generation from the kitchen and the canteen; both before, during and after the information campaign. The quantification was supplemented with two rounds of questionnaires, one before and one during the information campaign. This allowed for the documentation of the effects of information on canteen guests. The research methods were complemented with conversations with canteen guests and kitchen staff, in order to get a deeper insight into their experiences of the information campaign in the canteen.

The following figure gives an overview of the study period, including methods and implementation of the intervention.

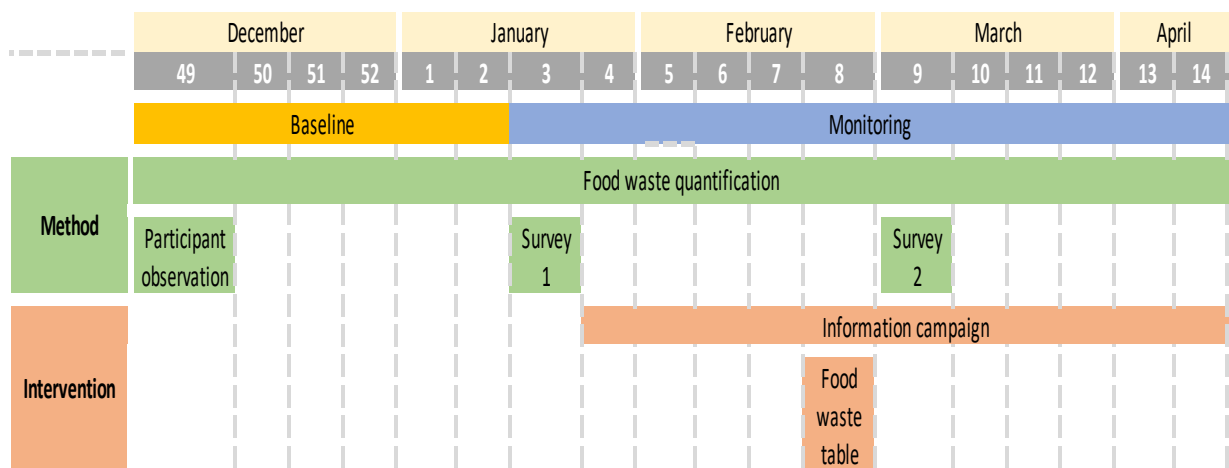


Figure 6: Study timeline.

3.1 Selection of study site

The motivations for selecting the Nortura canteen as a case study were based on these criteria:

- The canteen has separate bins for organic waste, i.e. food waste, and mixed waste, making the quantification process less problematic than if the study were to be conducted in a canteen which did not sort waste.
- The canteen has a buffet. The findings from this study could thus be relevant for other parts of the hospitality sector, such as hotels and restaurants.
- The canteen guests have various occupations and represent a heterogeneous group of people, despite the fact that all work in the same industry. This allows for an analysis of how different approaches used in the information campaign affect guests differently.
- It is a relatively large canteen, serving between 550 and 700 meals per day, providing more statistical significance to the results. In addition, the large food production means any positive changes on food waste reduction would have a larger impact than in a smaller canteen.
- Nortura is a big company with 5700 employees distributed among 33 factories around Norway. If this project will contribute to reduce food waste in one of their canteens, it might be implemented it in other canteens.

3.2 Preparations

I collected the data over a period of 18 weeks, from December 4, 2017 to April 6, 2018. The department manager of the operating service was the main contact person and gave permission to conduct the study.

Before data collection began, I did some initial work. Through participant observation, I observed the canteen, buffet, guests, and staff. This allowed documentation of current practises, as well as a strategy development for the research study.

Several factors were identified that made this canteen suitable for the study; it was always busy with guests, and the buffet had a large variety of foods, including salad, soups, warm dishes, bread, toppings, baguettes and cakes. The selection of food made the canteen comparable with a breakfast buffet at a hotel. I observed some empty plates, but I could also see the improvement potential in terms of reducing food scraps from being discarded.

In addition to give me insight into the canteen, the participant observation enabled me to talk to canteen guests and kitchen staff. Consequently, this helped me to find suitable approaches for implementing information in the canteen. The figures below provide an overview of the canteen (Figure 7) and the buffet (Figure 8).



Figure 7: The studied canteen.



Figure 8: A section of the buffet.

3.3 Data Collection

3.3.1 Food waste quantification

Actively quantifying the amount of food waste is recognised as an effective measure to prevent food waste from occurring (Tostivint, et al., 2016; WRAP, 2018). At the start of the study, the initial quantity of food waste was measured and used to set a baseline for the level of food waste at Nortura. The guidelines for food waste quantification proposed by the EU FUSIONS project, which is described in their “Food Waste Quantification Manual,” were followed. The manual provides practical guidelines on the quantification of food waste at different stages of the supply chain, including the hospitality sector (Tostivint, et al., 2016).

Time, resources, budget and level of access to physical amounts of food waste were considered in the selection of a quantification method. Since budget constraints did not allow the use of a smart weight to document and analyse the waste, direct weighing was utilised. This approach involved a manual scale to determine weight of samples or total fractions of waste. Direct weighing allowed for kitchen and canteen waste bags to be measured separately, which distinguished between food waste from preparation, and food scraps and leftovers from the buffet.

Due to limited time and resources, it was not distinguished between avoidable and unavoidable food waste in the quantification. Avoidable food waste are edible parts of food that ends up as waste, whereas unavoidable food waste is inedible parts of food, such as bones, seeds and peel.

The kitchen staff were responsible for weighing and registering the food waste and did not have the time and resources to go through the organic waste bin to collect avoidable food waste. Furthermore, the evaluation of food waste is assessed subjectively, as people’s perceptions on whether food is edible or not varies to a large extent. Distinguishing between avoidable and unavoidable food in the quantification would thus lead to uncertainty in the data base. Figure 9 illustrates what was quantified in this study; avoidable and unavoidable parts of food waste.

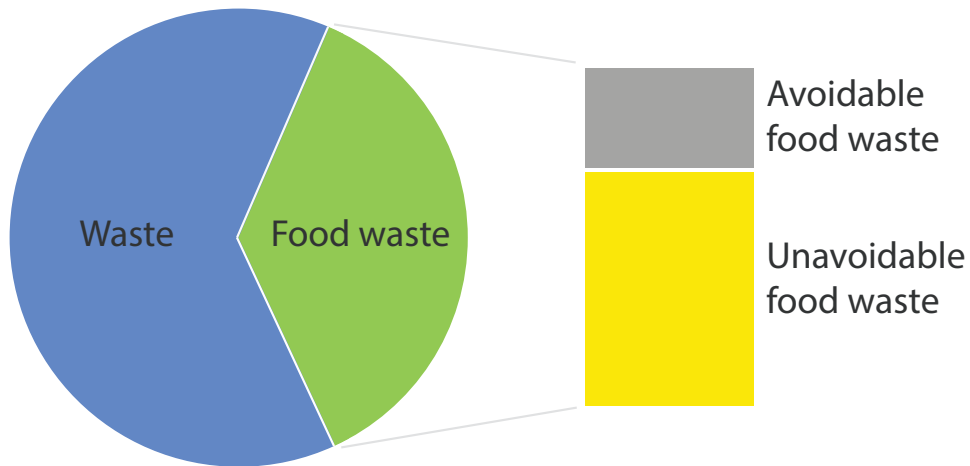


Figure 9: Food waste quantified in this study.

Registration

A station weighing and registering the food waste was installed. The kitchen staff were responsible for managing the weighing and registration throughout the quantification period. Before the quantification began, the registration was explained in depth to the kitchen staff. They were provided information on how to record the data during the baseline and monitoring periods, and with weighing scales (Kg) and a spread sheet for registering the food waste (Figure 10). The staff was asked to weigh and register bags of food waste from the canteen and the kitchen separately, allowing for the sources of food waste to be tracked.

The registration of food waste was carried out on a daily basis over a period of 18 weeks, from December 2017 to April 2018. In the spread sheet, the kitchen staff logged the weighted food, in addition to factors that could influence the amount of food waste, such as buffets at fixed prices or guests after opening hours. The data and the comments from the kitchen staff were entered into a spreadsheet in Excel on a regular basis. Data sheets and feedback were collected from the staff every third week. At this time the staff would also be updated on trends and changes in food waste levels.

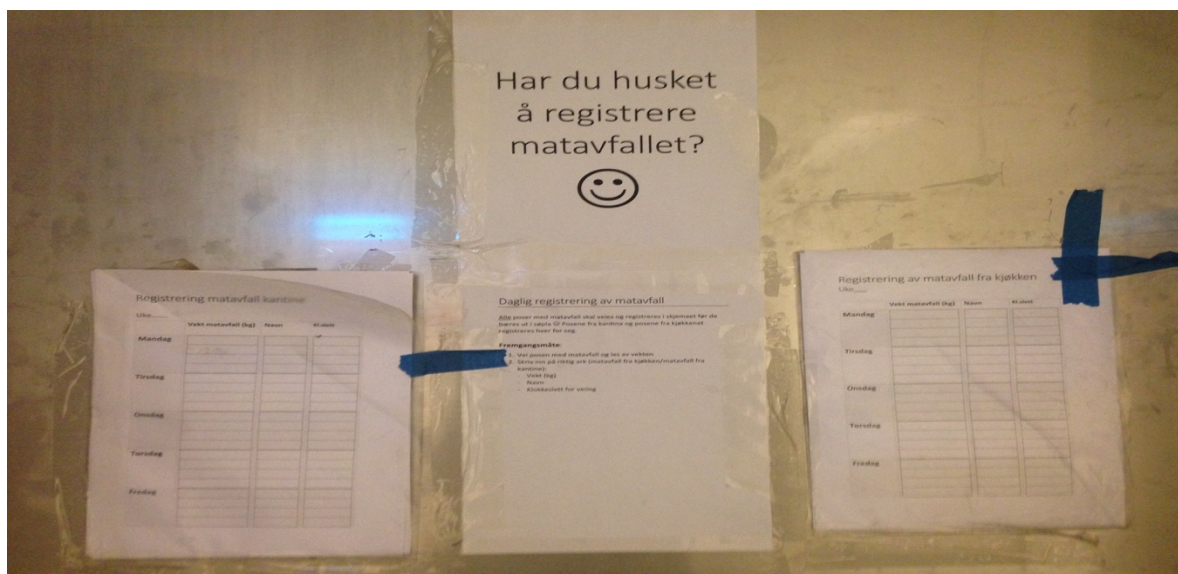


Figure 10: Sheet for registering food waste

Baseline period and monitoring period

The first 6 weeks were used to set a baseline of the current amount food waste. The following 12 weeks were used as a monitoring period to identify changes in the food waste levels related to the information campaign. The change in average food waste levels per week from the baseline period to the monitoring period were later used to calculate the decrease in food waste in relation to the information campaign.

The change in food waste levels was calculated as follows:

$$(\text{Average amount of food waste per week} / \text{weeks in the baseline period}) - (\text{average amount of food waste} / \text{weeks in the monitoring period}) = \text{change in food waste levels}$$

Number of portions served

In addition to quantifying the amount of food waste, the number of portions served was registered. The number of portions served per day was based on transactions at checkout. This was later used to calculate grams of food waste per portion served.

3.3.2 Information campaign

The aim of this study is to investigate the use of information as a measure to prevent food waste in a canteen. Hence, an information campaign was implemented between the baseline period and the monitoring period. The information campaign was mainly directed towards

canteen guests and consisted of different approaches to inform and encourage food waste reduction.

The following approaches were used:

- posters with information about food waste
- small notes on the buffet
- “table-talker”/small signs on each table in the canteen
- a PowerPoint slide-show at the information screen in the canteen
- daily communication of food waste levels
- food waste table

The posters were placed on the walls in the canteen, as well as on information boards by the entrance. The posters presented facts about food waste, information about the “food waste campaign” and photographs; all communicated in a friendly tone. The notes were placed on the buffet to communicate messages to canteen guests when they were serving themselves food. The notes included messages such as “Please serve yourself as many times as you like, but do not waste food,” “Food is valuable” and “It requires 15 000 litres of water to produce 1kg meat” (Figure 11). The table talkers mostly relied on facts and images intended to provide guests with knowledge and motivation to reduce food waste (Figure 12).



Figure 11: Communication towards canteen guests using notes on the buffet.



Figure 12: Signs on each table in the canteen.

The registrations of the food waste from the canteen was communicated to the guests on a daily basis, which allowed guests to follow the food waste trends (Figure 13).

In addition to the approaches mentioned above, an event was organized in the canteen during week 8. A small in-depth analysis of the organic waste was published to show canteen guests the amount of food waste that had been generated during the first opening hour of the canteen (Figure 14). Edible and inedible parts of food were separated on two plates and placed on a table by the entrance of the canteen. This allowed guests to see the amount and composition of food waste. The food waste table also allowed guests to see the difference between avoidable and unavoidable food waste.

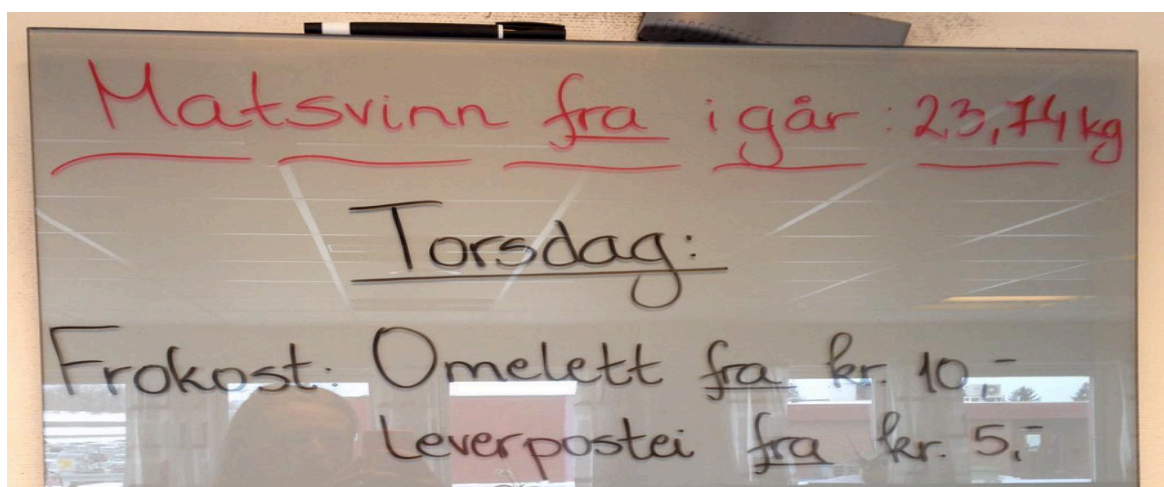


Figure 13: Daily communication of results from weighing on the information board in the canteen.



Figure 14: Demonstration of avoidable and unavoidable parts of food waste in the canteen. The food displayed was collected from the food waste bin only 45 minutes after the canteen opened that day.

3.3.3 Surveys

Surveys were used to document attitudes and opinions about the information campaign. A survey is a time and resource efficient research method, which makes it possible to see how information about food waste impacted canteen guests. Two rounds of surveys were conducted; one before the information campaign in January, and one during the information campaign in March (the surveys can be found in Appendices 1 and 2).

The surveys consisted of close-ended questions with a set of ordered answers, and ordinal-scale question where respondents were asked to decide where they fitted along a scale continuum. Respondents were also asked to fill out questions on nominal scales, such as gender and age group.

The purpose of the first survey was to document the current level of awareness on food waste among canteen guests. Paper surveys were distributed directly to guests who were eating in the canteen, allowing guests to ask for clarifications, if needed. All respondents got a numbered ticket as a thank you for their participation, and two numbers were picked to receive a prize. This encouraged guests to fill out the surveys and increased participation. The second round of surveys was completed in the same manner. The purpose of distributing a second survey was to see if the project had made the guests more aware of food waste in the canteen, as well as in other areas, such as in their households.

Selection of participants

The only criteria in the selection of respondents for the surveys was that they were canteen guests. Therefore, random probability sampling was used as the sampling method. This allowed for a representative sample of a chosen population to be obtained by distributing the survey directly to guests in the canteen. Surveys were handed out during the busiest hours, between 10 a.m. and 2 p.m. in order to reach as many guests as possible. The majority of the employees have a lunch break two times a day. The distribution of surveys over a timespan of 4 hours ensured that I did not distribute it to the same guests twice.

A sample size of 110 respondents was used, representing about 20% of the employee population that conclusions would be made about based on the study results. This was an appropriate number considering that all respondents were in the target population, i.e. canteen guests. Furthermore, it was an achievable sample size within the timeframe of the study.

3.4 Data analysis

To identify the major and most relevant findings from the food waste quantification and the surveys, Excel was used to interpret the data. The next sections summarise the process of the data analysis.

3.4.1 Food waste quantification

To summarise the results from the food waste quantification, registration sheets were transcribed into Excel. This allowed for the data to be gathered in one file and for the results to be presented visually through graphs and diagrams. Line graphs were used to illustrate food waste trends throughout the registration period and bar charts were used to visualise numerical proportions of food waste from the kitchen and canteen.

Calculating food waste per serving

To calculate grams of food waste per serving, the daily transactions were used as a reference for the number of servings per day. The amount of food waste was divided by number of transactions to calculate it into kilograms of food waste per person. Then, this was multiplied to find grams of food waste per person. Figure 15 shows each step of the calculation.

Key indicators:

Food waste per serving= X

Number of guests= Y

Kg of food waste= Z

Amount of food waste per serving: $Z / Y = X$

Figure 15: Each step of calculating food waste per portion served.

Calculating economic costs of food waste

The following figures provide the basis in the calculation of economic costs of food waste in the canteen. These are obtained from research carried out by Ostfold Research on behalf of the KuttMatsvinn2020-project.

- NOK 100/kg of food waste: includes all costs associated with transport, purchase, preparation, and waste management.
- NOK 50.44/kg food waste: the price of purchasing the ingredients only.

Calculating environmental effects of food waste

The following figure provides the basis in the calculation of CO₂-equivalents associated with food waste. The figure is based on estimations of CO₂-equivalents associated with food waste from canteens, which also are carried out by Ostfold Research.

- 2.37 kg CO₂- equivalents per kg food waste

3.4.2 Surveys

An Excel spreadsheet was used to analyse the two questionnaires. Alternatives were coded with numbers in the rows (horizontal cells) and the correspondents were numbered in columns. Finally, the questionnaire responses were entered using predetermined numbers. This spreadsheet was then used to create pie charts and diagrams to present the data visually. Figure 16 shows how the two surveys were analysed in a spreadsheet in Excel.

	A	B	C	D	E	F	G	H
1								
2		1	2	3.1	3.2	3.3	3.4	3.5
3	1	6	1	2	1	2	2	1
4	2	6	1	2	1	2	2	1
5	3	6	1	2	1	2	2	2
6	4	6	2	2	1	2	1	1
7	5	6	3	2	1	2	2	1
8	6	6	1	1	1	2	1	1
9	7	6	1	2	2	2	2	1
10	8	6	1	2	2	1	2	2
11	9	6	1	2	1	2	1	2

Figure 16: Spreadsheet in Excel where the data from the surveys were analysed.

4 Results

This section will first present the major findings from the food waste quantification, followed by the results of the survey. Finally, the main findings will be represented pointwise in Table 5.

4.1 Food waste quantification

In total, 4207 kg of food waste was registered during the 18-week study period. Most food waste occurred as leftovers or food scraps from the canteen (2335 kg), but considerable amounts occurred from preparation in the kitchen as well (1872 kg). It is important to note that these measurements include both avoidable and unavoidable food waste.

Figure 17 shows the amount of food waste from the canteen and the kitchen throughout the quantification period. Food waste levels were relatively high during the first weeks compared to the following weeks. It is important to note that during week 51 and 12, holiday parties (pay for a buffet and eat as much as you like) were organised for Christmas and Easter celebrations.

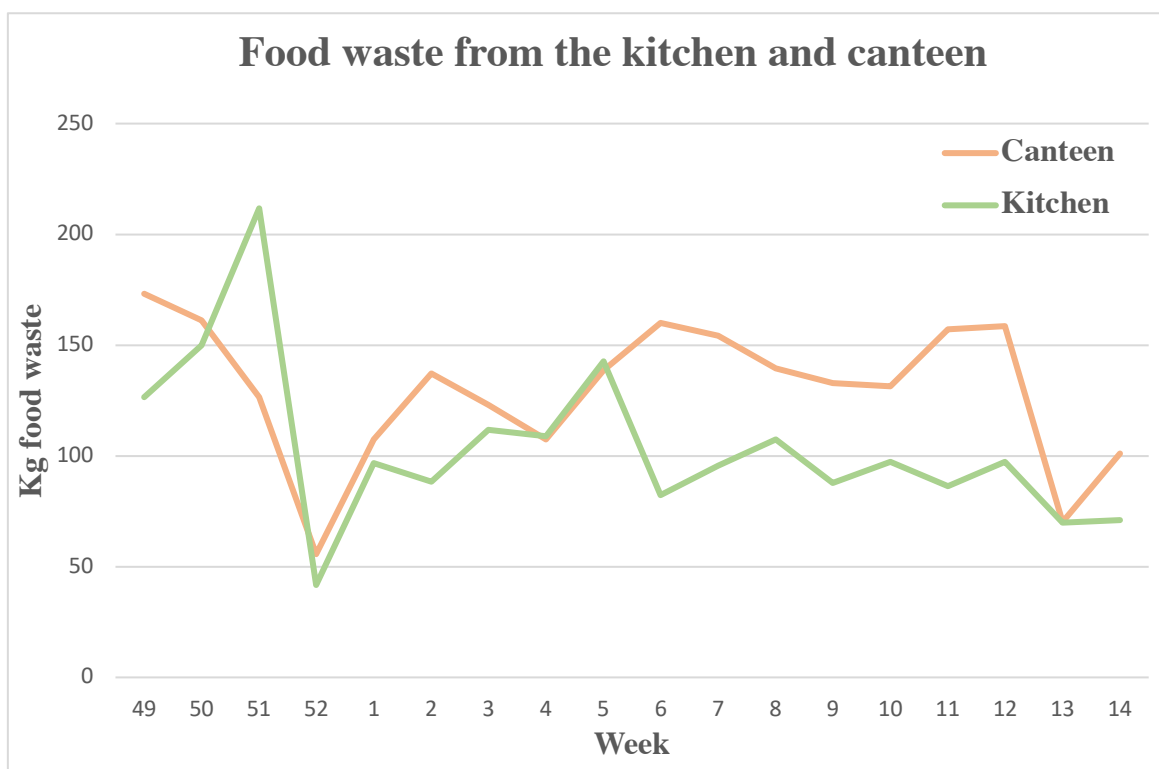


Figure 17: Food waste from the kitchen and the canteen throughout the study.

4.1.1 Food waste per serving

The amount of food waste should be seen in relation to the number of servings. There were 52,077 portions served throughout the study. The number of servings per week was stable during the study period, with a decrease in weeks 52 and 13 due to Christmas and Easter holidays, respectively (Figure 18).

When food waste from all processes was included, an average of 79g food waste occurred per portion served during the study period. The amount of food waste per portion varied between 66g at the lowest level (week 9) and 109g per portion at its peak (week 13). When food waste from preparation in the kitchen was excluded, the food waste from the canteen alone amounted to 44g per portion served in average.

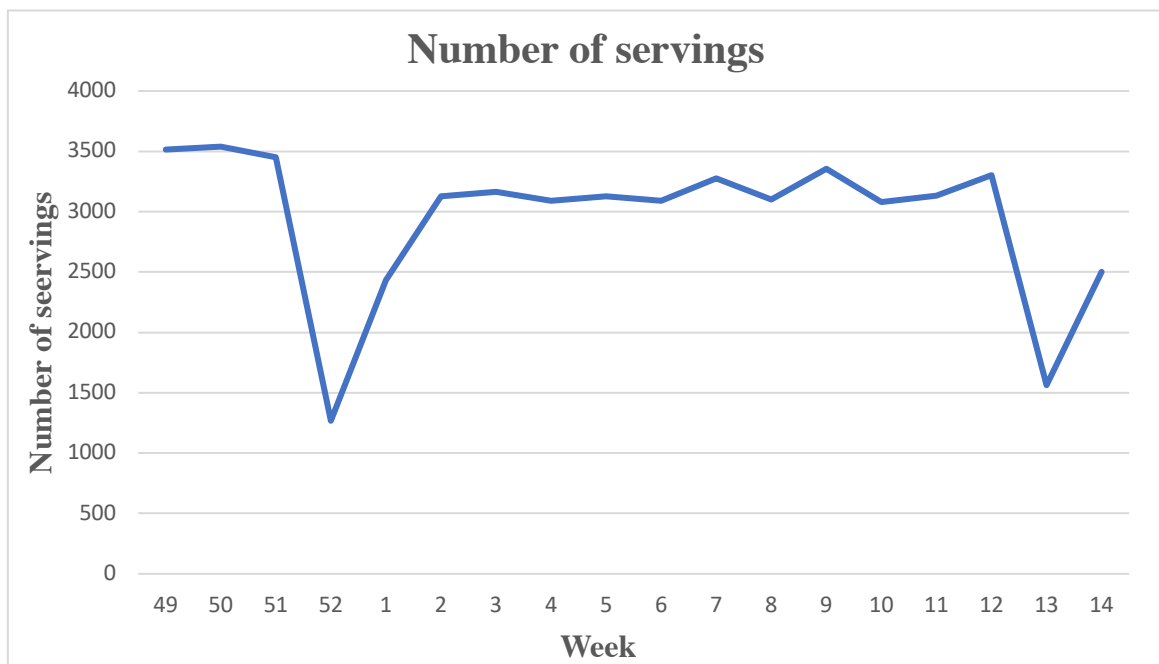


Figure 18: The number of portions served per week throughout the study.

4.1.2 Food waste in the kitchen

The food waste from the kitchen largely consisted of unavoidable food waste, such as trimmings, peels and bones. Most of the food was prepared from scratch at the kitchen, which resulted in higher levels of food waste than if it was partly prepared elsewhere. The food waste from the kitchen also contained avoidable food waste, such as leftovers, food scraps from preparation, and food waste from storage.

The amount of food waste was relatively stable throughout the study period, despite a higher amount of food waste during the first weeks (Figure 19). The notable upsurge in amount of food waste in week 51 was likely related to the Christmas buffet. The Easter buffet in week 12, however, did not result in higher food waste levels than normal.



Figure 19: Food waste (kg) registered in the kitchen throughout the 18 weeks of quantification.

4.1.3 Food waste in the canteen

The food waste from the canteen largely consisted of food scraps from guests and leftovers from the buffet. Dishes such as stews, soups, porridge, baguettes and salads are the primary foods served in the canteen, which results in the weighed food containing a low quantity of unavoidable food waste. This is because the unavoidable food waste, i.e. the inedible parts of the food, already were removed during preparation in the kitchen. About 10 kg coffee grounds was registered as food waste from the canteen every day. The kitchen staff also expressed that napkins and other non-food items, which accidentally were thrown in the food waste bin, sometimes were weighed as food waste. Likewise, other non-food items that belong in the food waste bin, such as tea bags, were also included in the weight.

There were great variations in the amount of food waste (Figure 20). During the first week, i.e. week 49, there was substantially more food waste than the following weeks. This is

probably because food linked to the Christmas season are heavier as it contains more unavoidable food waste than many other types of food. The Christmas buffet that caused high levels of food waste in the kitchen did not cause any particular rise in the amount of food waste from the canteen. The Easter buffet in week 12, however, resulted in high food waste levels compared to other weeks, despite the fact that it was arranged during the information campaign. There was also a noticeably high level of food waste in week 6, which cannot be explained by any sort of celebration or event.

Figure 20 shows that there also were weeks with reduced amounts of food waste. When weeks with fewer servings related to holiday are excluded, the week the information campaign was implemented (week 4) had the lowest amount of food waste. It is also worth noting that the amount of food waste decreased after both of the surveys. After the first decrease, in week 3 and 4, the food waste levels increased the following week. After the second decrease, in week 9, it took two weeks before the food waste levels increased again.

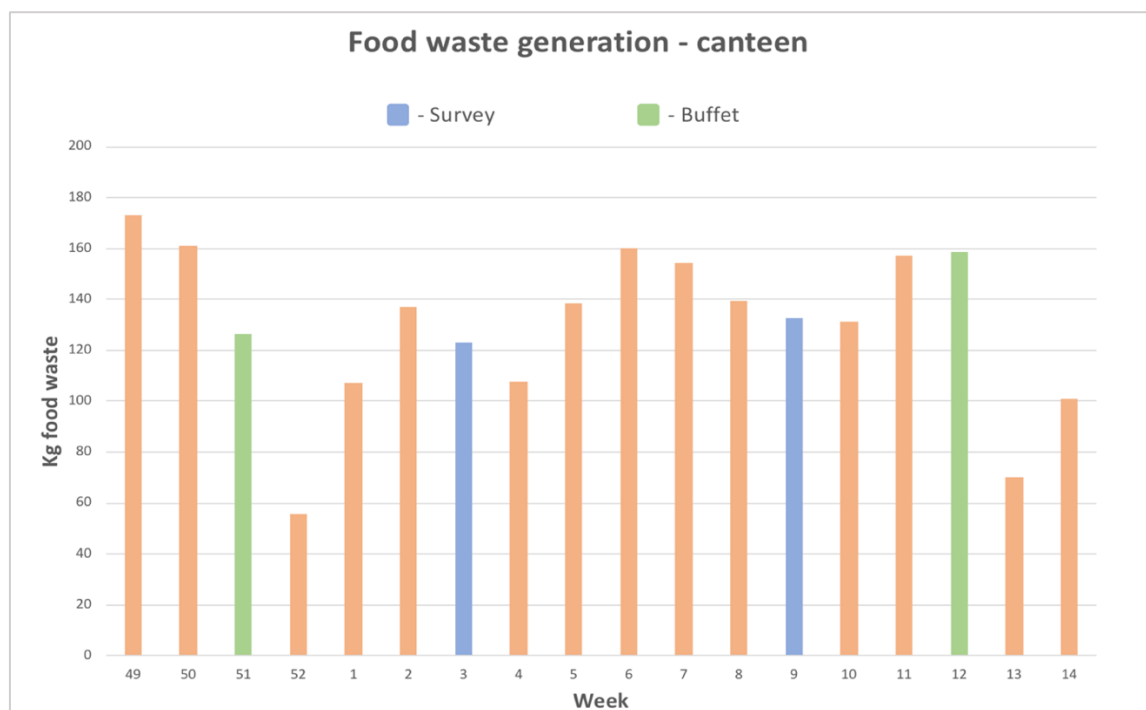


Figure 20: Food waste generated in the canteen throughout the quantification period of 18 weeks.

4.1.4 Economic cost of food waste

Food waste to the monetary equivalent of NOK 420 700 was disposed throughout the 18-week period. This equals a food waste cost of NOK 4676 per day throughout the study period. These expenditures include total costs associated with preparation in the kitchen and

waste management, as well as costs related to procurement of ingredients. The economic cost associated with wastage of ingredients alone was NOK 212 201 throughout the 18 weeks, which equals food waste worth a monetary cost of NOK 2358 per day.

The overall costs related to the 1872 kg of food waste that occurred from the kitchen was NOK 187 000. This equals food waste worth NOK 94 000 if only accounting for costs related to purchasing the ingredients. In the canteen, food waste to the monetary equivalent of NOK 233 500 was disposed throughout the study period. This equals food waste worth NOK 118 000 when accounting for money spent on ingredients only.

4.1.5 Environmental effects of food waste

Food waste to the equivalent of 9.97 tonnes CO₂-equivalents was disposed during the study period. The estimation of CO₂- equivalents associated with the food waste includes emissions linked to different stages of the life-cycle of the food, such as transportation, preparation and waste management. The food disposed from the kitchen alone equated 4.4 tonnes worth of CO₂- equivalents, whereas the total food waste from the canteen amounted for 5.5 tonnes of CO₂- equivalents.

4.1.6 Food waste before and after the information campaign

The baseline level of food waste was calculated to 144kg per week in the canteen and 133kg per week in the kitchen based on the first six first weeks of the study. Through the 12-week period of monitoring, there was an average amount of 138kg and 101kg food waste per week from the canteen and the kitchen, respectively. This equates an average reduction in food waste levels by 4.8% in the canteen and a 24% reduction in the kitchen.

Economic savings

The average cost of food waste per week associated with food waste from the kitchen during the baseline period was NOK 13 380. The 24% reduction in the average amount of food waste per week resulted in an economic saving by NOK 3211 per week. Savings associated with the cost of ingredients alone accounted for an average of NOK 1634 per week. Overall, food waste equivalent to a monetary cost of NOK 38 532 was reduced from the kitchen during the information campaign.

In the canteen, the total cost of food waste during the baseline period was calculated to NOK 14 490 per week. In the monitoring period, after the implementation of the information campaign, the cost was reduced to NOK 13 790 per week. This means that the canteen saved food waste equivalent to the monetary cost NOK of 700 per week, which amounts for a total saving of NOK 8 400 throughout the study.

Environmental savings

An average amount of food waste equal to 317kg of CO₂-equivalents was disposed in the baseline period. In the monitoring period, the kitchen disposed food waste equivalent to 240kg, which means an average saving of 77kg CO₂- equivalents per week. The reduction in the amount of food waste after the implementation of the information campaign amounted to an overall saving by 921kg CO₂- equivalents from the kitchen.

The 4.5% reduction in the amount of food waste resulted in a decrease from an average amount of food waste equivalent to 343kg CO₂ per week in the baseline period, to an average of CO₂- equivalent of 326.82 kg in the monitoring period. This means an average saving of 16kg per week, or an overall reduction of almost 2 tonnes CO₂- equivalents.

4.2 Survey

4.2.1 Survey 1 – before the information campaign

The majority of the respondents recognised food waste as a social issue (Table 1). When eating in the canteen, almost all guests deliberately served themselves with a portion of food that they thought they would be able to eat. The majority of the respondents also reported that they served themselves more than once rather than taking too much food when eating at a buffet. Furthermore, almost all of the respondents agreed or strongly agreed that they knew the different date labels.

However, there were also responses that designated a lack of awareness about food waste among guests in the studied canteen. A few did not see food waste as a problem in Norway as we produced enough food, and some of the respondents thought it was reasonable to waste food as long as it was used for producing compost or biofuel. Twenty percent of the respondents did not reflect on food waste when discarding food from their plates.

Table 1: Responses to the first survey.

First survey	Agree	Disagree
I consider food waste as a social issue	87%	13%
I deliberately serve myself with a portion of food I think I will be able to eat	95%	5%
I serve myself more than once, rather than taking too much food when eating on a buffet	94%	6%
I know the different date labels (best before/use by)	95%	5%
I do not see food waste as a problem in Norway, because we produce enough food in Norway	8%	92%
It is reasonable to waste food as long as it is used for producing compost or biofuel	25%	75%
I do not reflect on food waste when I waste food	20%	80%

Causes of food waste in the canteen

The main cause of food waste in the canteen guests serving themselves more food than they were able to eat. This happened despite the fact that 95% of the survey respondents said that they deliberately served themselves with a portion of food that they thought they were able to eat. Therefore, it is reasonable to conclude that there is a difference between what people say they do and their actual actions. The high amount of food waste at the buffet demonstrates that canteen guests actually served themselves with more food than they were able to eat, despite that they indicated otherwise in the survey.

Some respondents identified the low price of food in the canteen as an important factor behind food waste. As most of the food in the canteen was sold at fixed prices independently of how much food the guests served themselves, it often resulted in unnecessary amounts of food being discarded. The low price could thus explain why people served themselves with more food than they were able to eat.

Some guests also identified the size of the pre-made portions as a cause of food waste. They expressed that they sometimes could not finish because the portions were too big. Guests suggested that food waste would be reduced if the portions of premade plates of food were halved and sold at half the price.

In addition, canteen guests expressed that they often ended up to waste food when it contained ingredients that they did not like. For example, guests disagreed on whether premade baguette sandwiches should or should not include lettuce. The lettuce was sometimes discarded because some canteen guests preferred not to eat salad. The same happened with meat in the mixed salads because some guests preferred not to eat the meat. Individual perceptions were therefore important determinants of food waste in the studied canteen.

Causes of food in the household

There were various causes behind food waste in households (Table 2). Regarding food waste habits in general, more than half of the respondents agreed or strongly agreed that food passed its best-before date was a general reason behind food waste in their households. Furthermore, 55% agreed or strongly agreed that preparing too much food for dinner was a reason for discarding food, while 49% expressed that they served themselves with excessive portions and ended up wasting the food scraps afterwards. Food purchasing habits also contributed to food waste, as more than half of the respondents agreed or strongly agreed that they ended up wasting food because they procured unnecessary amounts of each food type.

Table 2: General causes behind food waste in the household.

General causes of food waste in the household

Purchasing too much food	56%
Food scraps from plates	49%
Preparing too much food for dinner	55%
Best-before date	65%

4.2.2 Survey 2 – during the information campaign

The second survey revealed that the information campaign contributed to raise awareness about food waste among the majority of respondents (72%). Most of the respondents indicated that they had learned about food waste and the consequences of wasting food (Table 3), and the majority had discussed food waste during their lunch break. In addition, almost all agreed that the project had contributed to create an understanding of the importance of reducing food waste.

Table 3: Responses to the second survey.

Second survey	Agree	Disagree
I have learned about food waste and the consequences of wasting food	72%	28%
I have discussed food waste during the lunch break	87%	13%
The project has contributed to create an understanding of the importance of reducing food waste	91%	9%

Side- effects of the information campaign

The information campaign in the canteen contributed to raise guests’ awareness about food waste in settings other than the canteen (Table 4). Almost all reported that they were more conscious about not wasting food in their households after the information campaign, whereas the majority implied that the information campaign had facilitated them to eat food passed its “best before” date. Nearly half the respondents agreed that the project had contributed to make them more conscious about the amount of food they bought when purchasing food, while more than half indicated that they saved leftovers.

Table 4: Responses to the second survey

Second survey	Agree	Disagree
I am more aware about food waste in settings other than the canteen	82%	18%
I think more about food waste in my household after the information campaign	58%	42%
The campaign has facilitated me to eat food passed its “best before” date	74%	26%
The information campaign has made me more conscious about the amount of food I buy when purchasing food	49%	51%
The project has contributed to make me save leftovers if we prepare too much dinner in my household	59%	41%

Approaches of information towards canteen guests

The table-talkers stood out as most effective among respondents. They expressed that the signs on the tables constantly reminded them about food waste, and that it was a good way to make people talk about it. It also came forth during conversations with canteen workers that they often observed guests reading the signs, or groups of guests discussing food waste. Some of the canteen guests expressed that they would feel guilty about wasting food after reading the signs. One of the respondents also said that as guests were generally more aware of food waste, he felt ashamed when others saw that he discarded food scraps he could not finish. This showed that the information signs influenced the canteen guests' awareness of food waste.

The food waste table garnered the attention of the majority of canteen guests. Almost all canteen guests that entered the canteen stopped to look at the food waste table. Some were shocked that perfectly edible food had ended up in the waste bin. Others said that the plates displaying edible and inedible parts of food made it easier for them to understand the difference between the two. There was significant discussion about the food waste table during the following lunch break.

The food waste quantification facilitated the kitchen and canteen staff to keep track of food waste generation. They said that it was an eye-opening experience to see the large amounts of food that ended up in the waste daily. Furthermore, they were motivated by the daily communication towards guests. They said that they noticed engagement among canteen guests after they started the daily communication of the weighed food waste. Canteen guests asked questions about the weighing, and several guests presented their empty plates before putting it into the dish-washer to demonstrate that they did not waste edible food.

4.3 Summary of results

Table 5 present the main results, which will provide the basis for the discussion.

Table 5: Summary of main results.

Summary of results

Total amount of food waste

An amount of 4207kg food waste occurred during the study. This amounts to the monetary equivalent of NOK 420 000 or 9.97 tonnes CO₂- equivalents.

Savings

The average food waste level from the kitchen was reduced by 24%, while the average food waste level from the canteen was reduced by 4.8%. This equals reduction of food waste equivalent to the monetary cost of more than 200 000 NOK, or to the environmental impact of 1.1 tonnes CO₂- equivalents. The periodical reductions of food waste were short-term.

Motivation among the kitchen staff

The amount of food waste from the kitchen was higher during the first week of the study compared to the following weeks. The kitchen staff was motivated to cut food waste during the food waste quantification.

Short-term effect of information

The information had a short-term effect on the amount of food waste. The food waste levels decreased shortly after the surveys and after the implementation of the information campaign. Food waste levels increased in the period in between.

Side-effects of the information campaign

There are potential positive side- effects associated with the information campaign in the canteen. The majority of the canteen guests had been thinking about food waste in settings other than in the canteen.

Different approaches of communicating information

The table-talkers was the most effective approach to raise canteen guests' awareness about food waste. However, the food waste table also caught the attention of many canteen guests.

Several factors influence the food waste quantification

There were many factors that influenced the amount of food waste during the study. These cause uncertainties in the data.

5 Discussion

5.1 Information campaign and food waste

The results show that the information campaign had an effect on food waste. In the canteen, the food waste decreased during the week of the survey, and continued to decrease during the duration of the information campaign. In the following weeks, however, the food waste increased. A similar decrease occurred when the food waste table was displayed. In the weeks between these two periods, however, the food waste increased. Therefore, the information resulted in a short-term decrease in food waste from the canteen.

The short-term decrease in food waste might have been related to the *novelty* of the information campaign. The majority of the canteen guests ate in the canteen every day. Therefore, both the surveys and the information campaign quickly caught their attention. Most of the canteen guests read the information signs and wanted to participate in the surveys. Furthermore, the canteen staff noticed an increased interest by the recycling station, many canteen guests asked questions about food waste quantification. The information campaign resulted in several discussions about food waste around the lunch tables, as well as a short-term decrease in food waste generation by canteen guests. The food waste increased after the information campaign had been running for one week, and continued to increase until the food waste table was displayed. This shows that innovative and varying information targeted at guests helped to reduce food waste, and thus indicates that novelty is an important factor.

The two periods of decreased food waste are slightly different. While the amount of food waste decreased immediately after the first survey and continued to drop the week the information campaign was implemented, it increased the following week. In the second period of decrease, however, the amount of food waste did not decrease as significantly, but the period lasted for one more week. This implies that the information towards canteen guests had a stronger impact the second time. This could be a result of the spacing effect.

The spacing effect is the phenomenon whereby information repeated at separate points in time is better remembered than the same amount of information massed together (Sisti, et al., 2007). This phenomenon has been extensively studied in psychology and has a wide scope of application. A study of effects of temporal spacing between advertising exposures found that the likelihood of a product's purchase increased if its ads are spread out rather

than bunched together (Sahni, 2015). Although advertisements and information campaigns are not fully comparable, the spacing effect supports the observations in this study. The combination of spotting the table-talkers every day for 4 weeks before seeing the food waste table displayed in the canteen, might have resulted in the information about food waste being retained more effectively. Presenting information over spaced intervals is thus an effective approach to influence canteen guests over time.

This study is too short to capture the long-term effect of information, but it would be interesting to investigate if, following a third intervention, the decrease would have lasted even longer. The decrease in food waste from Norwegian households by 11% from 2011-2015, which was documented through the ForMat-Project, was likely related to information campaigns and other prevention measures implemented during the study period. If the same occurs in the studied canteen, it is possible that the short-term effects would have turned into larger reductions of food waste over time.

The amount of food waste from the kitchen was also affected by the information campaign. The periods of decreased food waste occurred at the same time as those in the canteen. The amount of food waste in the kitchen was higher during the beginning of the study than in the following weeks. As stated in the results, it becomes clear that the kitchen staff was motivated to discard less food when they were made aware of the large masses of food ending up as waste. Several of the canteen workers were also motivated by the daily communication of results during the weighing period. Therefore, the decrease in food waste from the kitchen about three weeks into the study implies that practical involvement could also be an impacting factor in reducing food waste. As a result, the food waste from the kitchen decreased as the involvement and motivation among the kitchen staff increased.

The benefit of practical involvement of the staff to reduce food waste has also been identified in previous studies. A study from Germany found that a participatory approach can be used to raise awareness on the topic of food waste to improve employee commitment and responsibility (Strotman, et al., 2017). Moreover, the study found that the participatory concept contributed to reduce food waste and enhanced the resource efficiency of the food industry. Another study, of buffet servings at a hotel in the U.K., also found that greater staff engagement contributed to reduced food waste (WRAP, 2017). This, along with the findings

of this study, shows that a participatory approach to create commitment and motivation among the kitchen staff is effective in reducing food waste.

To additionally highlight the importance of practical involvement, the decrease in food waste from the kitchen demonstrates the likely positive effects of using different approaches of information to reduce food waste. People have different learning styles. The theory of learning perspectives could therefore be advantageous to have in mind when developing measures to prevent food waste. While most of the canteen guests found the “table- talkers” most effective, other guests were motivated by the food waste table that presented it visually. A third group of people, i.e. the kitchen staff, were influenced by the practical involvement of registering and communicating food waste. A combination of various approaches was therefore valuable to reduce food waste.

A study conducted on behalf of the Norwegian Agency of Environment (Miljødirektoratet) had similar findings. This study analysed measures of increasing support in recycling of plastic and organic waste in households. This study suggests that information campaigns should communicate a message that appeals to the population in general (Raadal, et al., 2016). Furthermore, the information campaigns should be conducted on a regular basis and communicated through different channels in order to reach as many segments of the population as possible. Even though increased participation in recycling systems is not directly linked to food waste prevention, they both require behavioural change among the population in order to be achieved. A combination of different approaches of information, which should be implemented on a regular basis, could therefore result in larger reductions in food waste levels compared to the use of one single approach.

Despite the canteen guests reporting that the information campaign had made them aware of food waste, there were still large amounts of food waste occurring from the canteen. This indicates that increased awareness about food waste does not automatically result in reduced amounts of food waste. Studies have shown that the provision of knowledge and supportive attitudes alone have been consistently shown to have little effect on changing behaviour (McKenzie-Mohr, 2000). Therefore, it is possible that the amount of food waste in the canteen could be further reduced in combination with other measures, such as a fee for wasting food.

However, if canteen guests are exposed to information over time, food waste prevention have the potential of becoming a social norm. The canteen guests who said that they felt bad about discarding leftovers from their plates demonstrated that the acceptability of wasting food already was decreasing during the study. According to a study of prevention of food waste in the hospitality sector, 11% of actors in the sector said that making avoidable food waste not social acceptable was an important part of their work on reducing food waste. If the information campaign continues to decrease the acceptability of discarding edible food, its effect on the amount of food waste might be larger over time.

The long-term effect of awareness campaigns can be exemplified by the change in smoking rates among the Norwegian population. In 2003, one out of four Norwegians, or 26%, aged between 16-74 years smoked on a daily basis (SSB, 2004). This has changed to 11% in 2018 (SSB, 2018), and is largely a result of changed attitudes due to increased awareness of its negative health effects. A period of 15 years is not long when seen in a bigger perspective. This means that a behavioural change among the canteen guests can be achievable if exposed to information over time.

5.2 Benefits of the information campaign in the studied canteen

As presented in Chapter 2, administrative measures are cheaper and easier to implement than economic and juridical measures. As there were minor costs and time requirements related to the implementation of the information in the canteen, the benefit-cost ratio of the information campaign was very high. In addition to reduce costs associated with purchasing and preparing food in the kitchen, reducing food waste contributes to less environmental impacts in terms of production, transportation and processing, reduced emissions of climate gases, and less wastage of natural resources. It also results in lower renovation costs, as most actors in the industry pay per tonnes they waste. In a study of cost-benefit ratios of taking actions to reduce food loss and waste in 42 hotels across 15 countries, they found that for every \$1 invested in food waste reduction, half the sites realised a return of \$5 or more (Clowes, et al., 2018). The implementation of an information campaign can therefore be considered a good investment relative to its costs.

To my knowledge, there are very few Norwegian studies which specifically examine costs and effects associated with information campaigns in canteens. However, there is an available study of costs related to national information campaigns to increase recycling rates of organic waste (food waste). In 2016, Raadal et al. estimated the information campaign to cost NOK 741 per increase in tonnes recycled waste. Given the economic and environmental benefits associated with increased recycling rates, the costs are outweighed by these benefits.

In the studied canteen, a total amount of food waste to the monetary equivalent of NOK 420 700 was quantified during the study. This demonstrates that there were significant economic costs related to food waste in the studied canteen. However, the results also show that there is money to save by focusing on information and communication towards canteen guests. Food waste equivalent to NOK 46 932 was reduced throughout the 12-week monitoring period. In one year, this adds up to a reduction in the amount of food waste to a monetary equivalent of approximately NOK 200 000. Communication and information can thus lead to large monetary savings over time.

These predictions, however, must be considered cautiously. The general estimation of NOK 100/kg food waste might have been higher than the actual cost per kilo of food waste in the studied canteen. This is because salaries and costs related to preparation and waste management vary greatly with type of serving place and location. The total cost of 1kg food waste from a restaurant, for example, might be higher than that in a canteen due to higher salaries and higher costs of purchasing ingredients. The estimated cost of NOK 50.44 per kg of food waste, which is based on the expense of purchasing the ingredients, possibly gives a more accurate estimate with regards to the food waste in the studied canteen. When salaries and charges of waste management are included, the cost per kg food waste probably is somewhere in between NOK 55.44/kg and NOK 100/kg. However, the estimated costs in the results give an indication of the monetary savings associated with the implementation of the information campaign in the canteen.

The reduction of food waste in terms of CO₂-equivalents showed that information towards canteen guests also had environmental effects. During the 12-week monitoring period, there was a reduction of food waste from the kitchen and canteen equivalent to 1.1 tonnes of CO₂. Over a year, this reduction adds up to a total saving of 4.8 tonnes of CO₂-equivalents, which is more than the annual emissions associated with the life of an average world citizen.

Further implementations of information campaigns in canteens can therefore lead to significant reductions in food waste generation, contributing towards the SDG number 13: Climate actions.

In Chapter 2, I explain how considerable emissions of GHGs are linked to food production. A reduction in the amount of food waste from the HaFS- sector can thus lead to reductions in GHGs from Norwegian agriculture. Furthermore, it will lead to lower emissions at later stages of the FSC, associated with transportation, processing, storage, preparation, and waste management. As about 50% of the food consumed in Norway is produced within the country, a reduction of food waste from the Norwegian HaFS- sector will also contribute to reduced emissions associated with production and transportation of food imported from other countries. A reduction in food waste levels as a result of information campaigns can thus contribute to national goals in terms of reducing emissions of GHGs.

In addition to having short-term effects on food waste generation in the canteen, this study also revealed that the information campaign affected guests' awareness of food waste in other settings, such as in their own household. That guests reported that they were more conscious about food waste when they were eating dinner at home, or when they were grocery shopping, imply that the information campaign has potential unexpected effects on food waste generation in other parts of the FSC.

In this study, almost half the respondents agreed that they served themselves with excessively large portions and ended up wasting the food scraps afterwards. This was also documented in a study of Norwegian households (Stensgård & Hanssen, 2018), which also found that food-scraps and leftovers from dinner is a major source of food waste in the household. If respondents have become more conscious of food waste in their own households, this source may also be reduced as a result of the information campaign.

It would be interesting to investigate further if canteen guests actually are more aware about food waste in their households, and if they *do* save leftovers from dinner as a result of an information campaign regarding food waste. If that is so, the effects of the information campaign may be more extensive than they appear in the food waste quantification. In this study, however, the main focus has been on the effect of information on food waste generation in the canteen, which means that these questions go beyond the boundaries of

this study. Yet, these findings demonstrate that the information campaign may have positive unintended side-effects, which should be taken into account when considering the effectiveness of information campaigns as a food waste prevention measure.

5.3 Methods discussion

Although this study focuses on reducing avoidable food waste, the 4.2 tonnes that was quantified included both avoidable and unavoidable food waste. As specified in Chapter 3, this was because distinguishing between edible and inedible food in the quantification could have led to uncertainties in the data base, because the evaluation of food waste is assessed subjectively. Research on food waste in the Norwegian hospitality sector suggest that about 60-70% of the total food waste in canteens is avoidable food waste, i.e. food that could have been eaten (Callewaert, 2018). Furthermore, research from WRAP suggests that out of the total amount of food purchased in the Horeca- network, 82% is consumed and 18% is discarded. The 18% of food that is discarded consist of 5% unavoidable and 13% avoidable food waste (WRAP, 2018). If applied to this study, 72% (13/18), or about 3 tonnes, of the quantified food waste was avoidable.

The uncertainties associated with the amount of avoidable food waste in the total food waste contribute to weaken manual food waste quantification as a method to investigate food waste over time. A digital scale that provides in-depth information of food waste composition, source, and quantity would probably contribute to eliminate many of the uncertainties that occurred during the study. As mentioned in Chapter 3, however, it can be valuable to include both avoidable and unavoidable parts of food to evaluate the overall effect of information on food waste. Therefore, the data obtained by using a manual weight approach provided valuable information about the overall impact of information on food waste generation. In addition, the manual approach was a time and resource efficient method in the sense that it required minimal time and resources to implement in the daily routines of the kitchen staff. Furthermore, it makes the results from this study comparable to other studies as most of the existing studies include the total amount of food waste.

The food waste quantification shows that there were great variations in weekly food waste despite that the number of servings was relatively stable during the study period. This means

that the variations in the amount of food waste are caused factors other than the number of portion served. In the following section, I discuss these factors and their implications on the food waste quantification as a research method.

First, the type of food on the menu greatly influences the weight of the quantified food waste. When chicken or lamb ribs are on the menu, for example, there is more food waste than when porridge is served. This is because lamb and chicken have a higher percentage of unavoidable food waste, such as bones and skin. As the menu in the studied canteen varies from one day to the next, there will always be variations in the amount of food waste.

The type of food varies with the season. The high level of food waste in the first two weeks of the quantification, was possibly related to the Christmas season. The canteen served typical Christmas food, such as ribs, which contains unavoidable food waste. The total amount of food waste was thus probably higher close to Christmas than at other times of the year. According to the kitchen staff, higher amounts of unavoidable food waste were also, likely to occur in the barbeque season during summer. Furthermore, there are periods in which the level of food waste was lower than the average, such as in January, when guests ate a lot of salad. Such variations, however, occurred with the seasons throughout the year. Including these variations in the quantification therefore gave valuable information on total food waste generation throughout different seasons.

In addition to food, the canteen sold smaller meals, such as chocolate, yoghurt, pastilles and ice cream. This means that one serving could have been an ice cream, which rarely generates any food waste. The numerator (number of servings) in the equation was therefore artificially high compared to the denominator (amount of food waste). This implies that the amount of food waste per portion served in the canteen is likely to be higher than it appears in the results. This is also an important factor that must be taken into account when comparing food waste levels across the HaFS-sector. Food waste quantifications from different parts of the HaFS-sector show consistently lower levels of food waste in canteens (Mepex, 2017), and this could potentially have something to do with the discrepancies between the numerator and denominator in the fraction.

There were also some factors that affected the grams of food waste per portion served the other way around. For many, the Christmas season involved a higher intake of meat, which

in turn led to employees working night-shifts at Nortura. The meals that were served after opening- hours were not registered as servings, as the number of servings was based on transactions at checkout. The food waste that was generated during the night shifts therefore resulted in a higher amount of food waste per serving than it actually was the following day.

Other factors that might have influenced the food waste quantification:

- Canteen guests may have consumed and wasted food outside the canteen. Food waste generated outside the canteen was not included in this study. The amount of food waste may have been slightly higher than it appeared in the food waste quantification.
- Additionally, errors in the recycling occurred. Sometimes, food waste ended up in the mixed waste, or vice versa. This may influence the weight of the food.
- In the results, it also came forth that coffee grounds caused variations. The coffee grounds, which normally made up about 10kg per day, varied with the number of canteen guests. Despite the number of visitors being relatively stable throughout the study, occasionally there were more or fewer guests than normal. This affected the amount of coffee grounds in the waste, which in turn influenced the quantification.

The above uncertainties resulted in weekly food waste levels ranging from 65g per portion served, to 96g per portion served during the study period. A study from Sweden, which quantified food waste in municipal organisations, including schools, preschools and elderly homes, found a waste level ranging from 33g per portion served to 131g waste per portion served (Eriksson, et al., 2017). A similar study of two canteens in Oslo, found an average of 4.9g food waste per serving in the first canteen, and 12g in the second canteen (Mepex, 2017). The large variations in food waste levels within canteens indicate that many of the uncertainties discussed above occur naturally. There will always be different types of food, a different number of servings, seasonal changing and different types of canteens. This demonstrates the challenges associated with quantification of food waste in the HaFS-sector. Furthermore, it highlights the importance of using a consistent method. This means that the findings of this study should be seen in relation to these uncertainties; there will always be uncertainties when quantifying food waste.

5.4 Limitations of the study

It has to be acknowledged that as the findings of this study are based on research in one canteen, there are limitations in relation to the generalisability of the results. The effect and direction of the effect of information might have been different if other canteens.

While some statistics were used to compare the amount of food waste before and after the information campaign, no further statistical analysis were conducted to calculate if the short-term decreases in food waste were statistically significant. However, the focus of this study is on the effect of information on food waste generation, rather than analysing quantities of food waste. It was therefore sufficient to exclude statistical analyses from the study.

While providing valuable information of total food waste generation, including inedible parts of food caused uncertainties in the food waste quantification. However, as inedible parts of food are assessed subjectively, it would have caused more uncertainties to exclude them from the quantification.

The choice of study site may be perceived as a limitation. Employees at Nortura might be more concerned about food waste than people who work in a different sector. However, it can also be that they have a more relaxed relation to food waste. Canteen guests who work with food processing, for example, might be used to seeing food being lost or wasted as a result of high quantity standards and procedures. The choice of study site could thus be justified.

The chosen sample size of 110 respondents to the survey might have been too small to be able to draw a conclusion for the entire population of canteen guests. It is possible that the results would differ if another sample of the population had responded to the survey. However, the use of random sampling of a chosen population strengthens the reliability of the results from the survey.

The calculations of economic and environmental effects caused by the food waste in the studied canteen are based on general estimations and are thus not entirely dependable. The aim of this study, however, was to discuss potential benefits associated with the information campaign, rather than providing exact economic and environmental savings.

5.5 Further research

- To minimise limitations associated with conducting the study in one canteen only, future research should include more canteens to be able to compare findings.
- A similar study over a longer period could be conducted to capture long-term effects of information on the amount of food waste.
- Test the effect of each approach of information one by one.
- Investigate the effect of the information campaign in settings other than in the canteen. It would be interesting to investigate if canteen guests actually are more aware of food waste in their households, and if they *do* save leftovers from dinner as a result of the information campaign. To do that, in-home practices can be studied and documented before and after the information campaign.
- Study some general measures and some measures towards specific groups. Use control-groups to evaluate the effect of measures towards specific groups with the effects of general measures.

5.6 Further practice

- Use the same food waste quantification method to make future studies comparable
- Include more canteens in future studies to be able to compare the results
- Write down the menu in the canteen every week to keep track of the type of food. This will make it easier to account for large variations in the food waste quantification
- To limit uncertainties in the food waste quantification, further studies should exclude factors that cause uncertainties in the data, such as coffee grounds
- Program planners can use the findings from the study to develop effective measures to reduce food waste in canteens

5.7 Further recommendations to reduce food waste in the studied canteen

- Continue to weigh the food to keep up commitment and motivation among the kitchen staff
- Continue to communicate the weighed food to canteen guests to involve them

- Implement new approaches of communicating information towards canteen guests and change approach on a regular basis (remember the value of novelty and the spacing effect)
- Avoid buffet servings, or install a weight so guests pay for their food by weight
- Make a pricelist: canteens with a pricelist have shown to generate less food waste
- Let the guests decide whether they should add meat in the salad mix or not – there are increasing numbers of vegetarians
- Make food waste prevention one of the core values of the organisation! In that way, food waste prevention could become a natural part of the everyday-life
- Sell half portions to reduced price
- Reduce the variety of meals per day to reduce leftovers
- Join KuttMatsvinn2020

6 Conclusion

This study found that different approaches of communicating information towards guests resulted in periodic short-term decreases in the amount of food waste. Signs on each table, daily communication, visual presentation of a “food waste table” and informative posters were used in this study. The use of a variety of information communication approaches combined over time are suggested to further decrease the amount of food waste

Although the main focus of this study was to investigate the effect of information towards canteen guests, the study also found that practical involvement of the kitchen staff contributed in the reduction of food waste. Information as a participatory approach can thus be used to raise awareness of food waste to improve employee commitment, and thereby reduce food waste.

The high benefit-cost ratio of the information campaign found in this study suggests that the implementation of an information campaign is an efficient investment relative to its costs. In addition to a reduction in food costs, there were a substantial decrease in CO₂- equivalents related to the food waste reduction in the canteen. Although the economic and environmental impacts of the information campaign are based on estimates, the results show the benefits of reducing food waste.

In addition to economic and environmental benefits, this study suggests that information targeted towards canteen guests may potentially have effects on food waste generation in other parts of the FSC. It would be worthwhile to conduct further research in this regard.

Finally, this study suggests that further implementations of information campaigns in canteens can contribute towards national and international targets on food waste reduction and to lower negative impacts associated with food waste, such as: environmental degradation, emissions of greenhouse gases and unnecessary economic costs.

7 Reference list

Arbeidsgruppen for tiltak, 2017. *Rapport anbefalinger tiltak matsvinn*. [Internett]

Available at:

<https://www.regjeringen.no/contentassets/1c911e254aa0470692bc311789a8f1cd/rapport-anbefalinger-tiltak-matsvinn-17.02.17.pdf>

[Accessed 15 April 2018].

Callewaert, P., 2018. *Hvor mye matsvinn er det i serveringsbransjen?*. Oslo: s.n.

Casimir, J., 2014. *Food Waste at the School Level - a case study on a food waste reduction project within school restaurants in Uppsala, Sweden*, Uppsala : Uppsala University .

Clowes, A., Mitchell, P. & Hanson, C., 2018. *The Business Case for Reducing Food Loss and Waste: Hotels*, s.l.: Champions 12.3.

Eriksson, M. et al., 2017. Quantification of food waste in public catering services - A case study from a Swedish municipality. *ScienceDirect*, March, pp. 415-422.

European Commission , 2018. *Food*. [Internet]

Available at: https://ec.europa.eu/food/safety/food_waste/eu_actions_en

European Commission, 2015. [Internet]

Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614>

[Accessed 10 April 2018].

Every Crumb Counts , 2018. *Every Crumb Counts*. [Internet]

Available at: <http://everycrumbcounts.eu>

[Accessed 11 February 2018].

FAO, 2013. *Food wastage footprint: Impacts on natural resources (Summary Report)*, s.l.: FAO.

- FAO, 2014. *Food losses and waste in the context of sustainable food systems*, Rome: HLPE Report.
- FAO, 2014. *Food wastage footprint - Full-cost accounting*, s.l.: FAO.
- FAO, I. U. W. W., 2017. *The State of Food Security and Nutrition in the World 2017. Building resilience for peace and food security*, Rome: FAO.
- Foley, J. et al., 2011. Solutions for a cultivated planet. *Nature*, Issue 478, pp. 337-342.
- Godfray, C. et al., 2010. Food Security: The Challenge of Feeding 9 Billion People. *Science*, 12 February, pp. 812-818.
- IPCC, 2014. *UN IPCC Fifth Assessment Report*, s.l.: UN IPCC.
- Marthinsen, J. et al., 2012. *Prevention on food waste in restaurants, hotels, canteens and catering*, Copenhagen : Nordic Council of Ministers .
- Møller, H. & Stensgård, A., 2016. *Karlegging av matavfall i Horeca-nettverket (Sodexo, Nordic Choice Hotels og BAMA)*, s.l.: Østfoldforskning.
- McKenzie-Mohr, D., 2000. Promoting Sustainable Behavior: An Introduction to Community-Based Social Marketing. *Journal of Social Issues*, 56(3), pp. 543-554.
- Mepex, 2017. *Kutt matsvinn2020 - Status og videre arbeid*. Oslo.
- Miljøverndepartementet, 2013. *Fra Avfall til Ressurs - Avfallsstrategi*, s.l.: Regjeringen.no.
- Monier, V. et al., 2010. *PREPARATORY STUDY ON FOOD WASTE ACROSS EU27*, s.l.: Bio Intelligence Service.
- Monroe, M. C., 1999. *What Works: A Guide to Environmental Education and Communication Projects for Practitioners and Donors*. 1 ed. s.l.:New Society Publisher .

NOU, 1995. *NOU 1995: 4 - Virkemidler i miljøpolitikken*, Oslo: Statens forvaltningstjeneste - Statens trykning.

Raadal, H. L., Stensgård, A. E., Lyng, K.-A. & Hanssen, O. J., 2016. *Vurdering av virkemidler for økt utsortering av våtorganisk avfall og plastemballasje*, Fredrikstad : Østfoldforskning.

Raadal, H. L., Stensgård, A. E., Lyng, K.-A. & Hanssen, O. J., 2016. *Vurdering av virkemidler for økt utsortering av våtorganisk avfall og plastemballasje*, s.l.: Østfoldforskning.

Regjeringen, 2016. *Avtale om å redusere matsvinn*. [Internett]
Available at: <https://www.regjeringen.no/no/aktuelt/avtale-om-a-redusere-matsvinn/id2558931/>

Sahni, N. S., 2015. Effect of temporal spacing between advertising exposures: Evidence from online field experiments. *Quantitative Marketing and Economic*, 13(3), pp. 203-247.

Silvennoinen, K. et al., 2012. *Food waste volume and composition in the finnish supply chain: special focus on food service sector..* Venice: CISA Publisher.

Sisti, H., Glass, A. & Shors, T., 2007. Neurogenesis and the spacing effect: Learning over time enhances memory and the survival of new neurons. *Learning & Memory*, 14(5), pp. 368-375.

SSB, 2004. *Statistics Norway*. [Internet]
Available at: <https://www.ssb.no/helse/statistikker/royk/arkiv/2004-02-02>
[Accessed 1 May 2018].

SSB, 2018. *Statistics Norway*. [Internett]
Available at: <https://www.ssb.no/helse/statistikker/royk/aar>
[Accessed 1 May 2018].

Stenmark, Å., Jensen, C., Quedsted, T. & Moates, G., 2016. *Estimates of European food waste levels* , s.l.: FUSIONS.

Stensgård, A. E. & Hanssen, O. J., 2016. *Matsvinn i Norge 2010-2015* , s.l.: Østfoldforskning.

Stensgård, A. E. & Hanssen, O. J., 2018. *Matsvinn i Norge* , s.l.: Østfoldforskning .

Strotman, C. et al., 2017. A Participatory Approach to Minimizing Food Waste in the Food Industry - A manual for Managers. *Sustainability* , 9(1), p. 66.

Tostivint, C. et al., 2016. *Food waste quantification manual to monitor food waste amounts and progression*, Paris: European Commission.

World Food Programme , 2013. *World Food Programme*. [Internet]

Available at: <http://www.wfp.org/stories/10-things-you-need-know-about-hunger-2013>

WRAP, 2017. *Taking action on waste; resources for hospitality and food service chefs and support staff*. [Internet]

Available at:

<http://www.wrap.org.uk/sites/files/wrap/Taking%20Action%20on%20Waste%20Resources%20for%20Hospitality%20and%20Food%20Service%20Chefs%20and%20Support%20Staff.pdf>

[Accessed 7 Mai 2018].

WRAP, 2018. *Taking action on waste: The business case*. [Internet]

Available at:

<http://www.wrap.org.uk/sites/files/wrap/Taking%20action%20on%20waste%3B%20the%20business%20case%20for%20hospitality%20and%20food%20service.pdf>

[Accessed 20 April 2018].

8 Appendices

8.1 Survey 1

Undersøkelse om matsvinn

Denne undersøkelsen skal brukes til å kartlegge holdninger rundt matsvinn i forbindelse med en masteroppgave. Tusen takk for at du tar deg tid til å svare! Undersøkelsen er anonym, og vil kun bli brukt til forskningsformål.

***Matsvinn** er definert som mat som kunne blitt spist av mennesker, men som av en eller annen grunn ikke blir det. Matsvinn er ikke det samme som matavfall (ikke-spiselige deler, som avskjær, frø osv. fra mat).*

1. Hvor ofte spiser du vanligvis i kantina?

- Hver dag
- Fire ganger i uka
- Tre ganger i uka
- To ganger i uka
- Én gang i uka
- Mindre enn én gang i uka

2. Hvor ofte legger du igjen spiselig mat på tallerkenen når du spiser i kantina?

- Hver dag
- Fire ganger i uka
- Tre ganger i uka
- To ganger i uka
- Én gang i uka
- Mindre enn én gang i uka

3. Kryss av for om du er enig eller uenig i følgende påstander om grunner til matkasting når du spiser her i kantina:

	Enig	Uenig
Jeg tar til meg mer mat enn jeg orker å spise		
Jeg legger igjen mat jeg ikke liker		
Maten er så billig at det ikke spiller noen rolle om jeg ikke spiser opp alt		
Jeg tenker ikke over det når jeg ikke spiser opp		
Jeg legger igjen maten jeg ikke tåler		
Jeg har ikke noen mulighet til å ta den med meg		
Jeg tar bevisst til meg mat med tanke på at jeg skal spise opp		

Når det er buffet går jeg heller flere ganger enn å ta til meg en for stor porsjon		
--	--	--

4. I hvilken grad er du enig/uenig i følgende påstander om mat generelt?

	Meget enig	Enig	Uenig	Helt uenig
Jeg bruker som oftest handleliste når jeg handler				
Jeg er nøye med å oppbevare maten riktig				
Matsvinn er ikke noe problem i Norge siden vi produserer nok mat				
Jeg kjenner godt til forskjellen mellom ulike datomerkinger (Siste forbruksdato og Best før)				
Jeg synes matsvinn generelt er et samfunnsproblem				
Det er helt greit å kaste mat så lenge det går til kompost eller biogass				
Jeg blir ofte fristet til å kjøpe for store/mange enheter av matvarer i butikkene				
Jeg kaster alltid mat som er gått ut på dato				
Vi lager ofte for mye mat til middag				
Jeg forsyner meg heller med mindre porsjoner enn å kaste rester jeg ikke klarer å spise opp				

5. Hvor viktig anser du følgende faktorer som generell årsak til at mat blir kastet i din husholdning?

	Meget viktig	Ganske viktig	Ganske uviktig	Helt uviktig
Produktet har gått ut på dato før vi rekker å spise det				
Vi lager ofte for mye mat og kaster restene i grytene etterpå				
Det er dårlig emballasje slik at produktet blir fort ødelagt				
Vi forsyner oss ofte med for store porsjoner og kaster alle tallerkenrester etter måltidene				
Vi kjøper ofte inn unødvendig mye av hvert produkt				

6. Kryss av for din aldersgruppe:

20-30

31-40

41-50

51-60

61 +

7. Kryss av for kjønn:

Kvinne

Mann

Tusen takk for deltakelsen! 😊

8.2 Survey 2

Undersøkelse om matsvinn

1. Synes du «matsvinnprosjektet» i kantina har bidratt til å øke din generelle bevissthet rundt matsvinn?

Ja

Nei

2. Kryss av for om du er enig eller uenig i at matsvinnprosjektet i kantina har bidratt til:

	Enig	Uenig
Å skape en større forståelse rundt viktigheten av å redusere matsvinn		
At du/dere har diskutert matsvinn i lunsjpausen på jobb		
At du forsyner deg med porsjoner med tanke på at du skal spise opp		
At du har lært noe om matsvinn og konsekvenser av å kaste mat		
At du tenker over matsvinn i andre settinger enn når du spiser her i kantina		

3. Hvilke av tiltakene har hatt størst effekt på deg i forhold til å gjøre deg bevisst på matsvinn? Nummerer fra 1 - 6, der nr.1 er tiltaket som har hatt størst effekt

Daglig kommunikasjon av vekten på matavfallet på infotavler	
Informasjonsplakater i kantine og på infotavler	
Informasjonen på infoskjermene	
De små skiltene på buffeten / ved maten	
Skiltene på bordene («table-talkers»)	
Matkastebordet som viste matavfall og matsvinn	
Spørreundersøkelsene	

**4. Kryss av for om du er enig eller uenig i utsagnene om matsvinn i husholdningen.
Har matsvinnprosjektet i kantina bidratt til at du:**

	Enig	Uenig
Tar vare på rester om du har laget for mye middag		
Er mer bevisst på å ikke kaste mat på hjemmebane		
Er bevisst på hvor mye du handler inn når du handler mat		
Kan spise mat som har passert «best før» dato		
Tar til deg porsjoner du spiser opp		
Er mer obs på å ikke kaste mat generelt sett		

5. Kommentarer, forslag og innspill i forhold til å redusere matsvinn i kantina tas i mot med et stort takk! Noter her:

6. Kryss av for din aldersgruppe:

- 20-30
- 31-40
- 41-50
- 51-60
- 61 +

9. Kryss av for kjønn:

- Kvinne
- Mann

Tusen takk for deltakelsen! 😊



Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitenskapelige universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway