Østfoldforskning

Matvett
TA VARE PÅ MATEN

Rapport SUSTAINABLEINNOVATION

Authors:	Aina Elstad Stensgård, Kjersti Prestrud, Ole Jørgen Hanssen and Pieter Callewaert

Report No.:	OR.28.18
ISBN:	978-82-7520-787-4

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Report on Key Figures 2015-2017

Report No.:	OR.28.18	**ISBN No.:**	978-82-7520-787-4	**Report Type:**	
		ISBN No.:	978-82-7520-787-4	Commissioned report	
		ISSN No.:	0803-6659		

Title of Report:

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Project No.:	1890	**Project Title:**	Food Waste in Norway Report on Key Figures 2016
Awarding Authorities:		**Contact Person:**	
Matvett AS		Anne-Grete Haugen	

Thematic Words:	**Accessibility:**	**No. of Pages incl. Appendix:**
• Food waste • Greenhouse gas emissions • Value chain	Open	72

Approved by:
Date: 10.10.2018

Project Manager	Research Manager
	
Aina Elstad Stensgård	Hanne Lerche Raadal

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Summary

About the report
In June 2017, the Norwegian government and the entire food industry signed a sector agreement on reduced food waste. The purpose of the agreement is to halve food waste in Norway by 2030, in line with the UN Sustainable Development Goal 12.3; the target will be achieved by a 15% reduction in 2020 and a 30% reduction in 2025, where 2015 represents the baseline. The parties to the agreement are obliged to report on developments in amounts and composition of food waste. The figures and trends for the food industry are documented in this report.

Food waste statistics
The results show that in 2017 about 385 000 tons of edible food were wasted in the stages of the value chain included in the survey[1] (Figure 1-1). This corresponds to roughly 73 kg per capita per year, a financial loss of NOK 22 billion and 1.3 million CO2 equivalents per year.

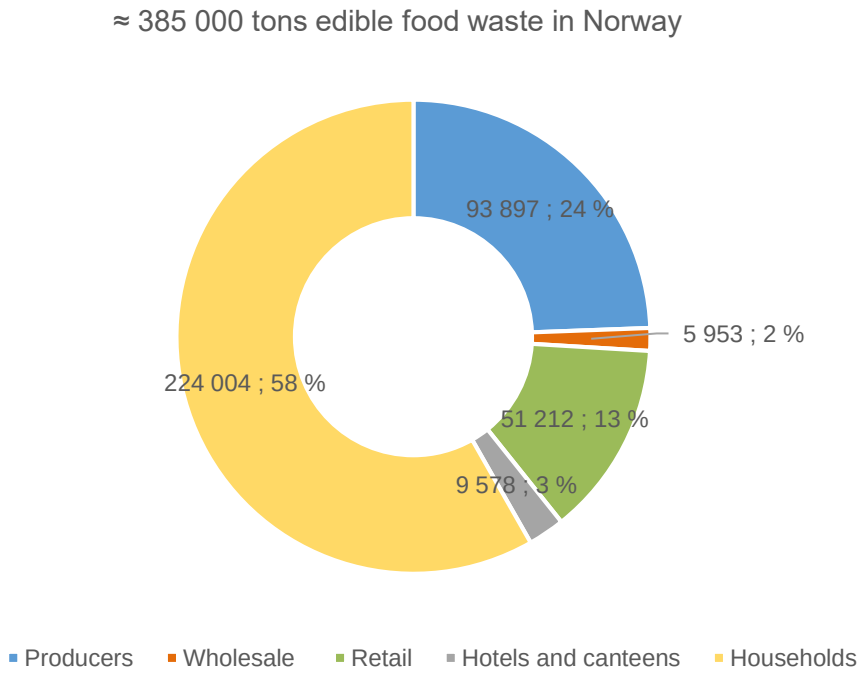

Figure 1-1 Estimated total amount of food waste in Norway by stage of the value chain

Food waste levels may seem to be higher than in previous reports, but this is because the figures for 2017 now for the first time include food waste data from mills and flour producers, breweries, and hotels and employee cafeterias.

Households account for over half of food waste (58%), followed by producers (24%), retailers (13%), hotels and employee cafeterias (estimated at 3%) and wholesalers (2%). It should be noted that actual food waste levels from households and producers are higher, since liquids discarded via drains are not included for households, unlike the other stages in the value chain, and the fishing industry has not been included under producers.

[1] The stages of the value chain included in the survey are food producers (excluding seafood), wholesalers, retailers, hotels and employee cafeterias, and households (excluding food discarded via household drains).

At the household stage, leftovers from meals and baked goods predominate in the food waste figures, while wholesalers waste most fresh fruit and vegetables. At the retail stage, fresh baked goods and fresh fruit and vegetables are the most important groups, while food waste is more evenly distributed between product groups in the production stage.

Developments in the food industry

From 2015 to 2017, food waste in the food industry (retailers, wholesalers and producers, except for the fishing industry) was reduced by 22 000 tons, corresponding to a reduction of 4.8 kg per capita or 13% (Figure 1-2). This comes on top of the reduction of 14% achieved by the industry between 2010 and 2015 in the ForMat project. In the same period, households reduced food waste by 11%. This represented a total reduction of 12%.

The fact that the food industry reduced food waste by 13% from 2015 to 2017 indicates that the industry is well on track to reach the first interim target of 15% reduction by the year 2020.

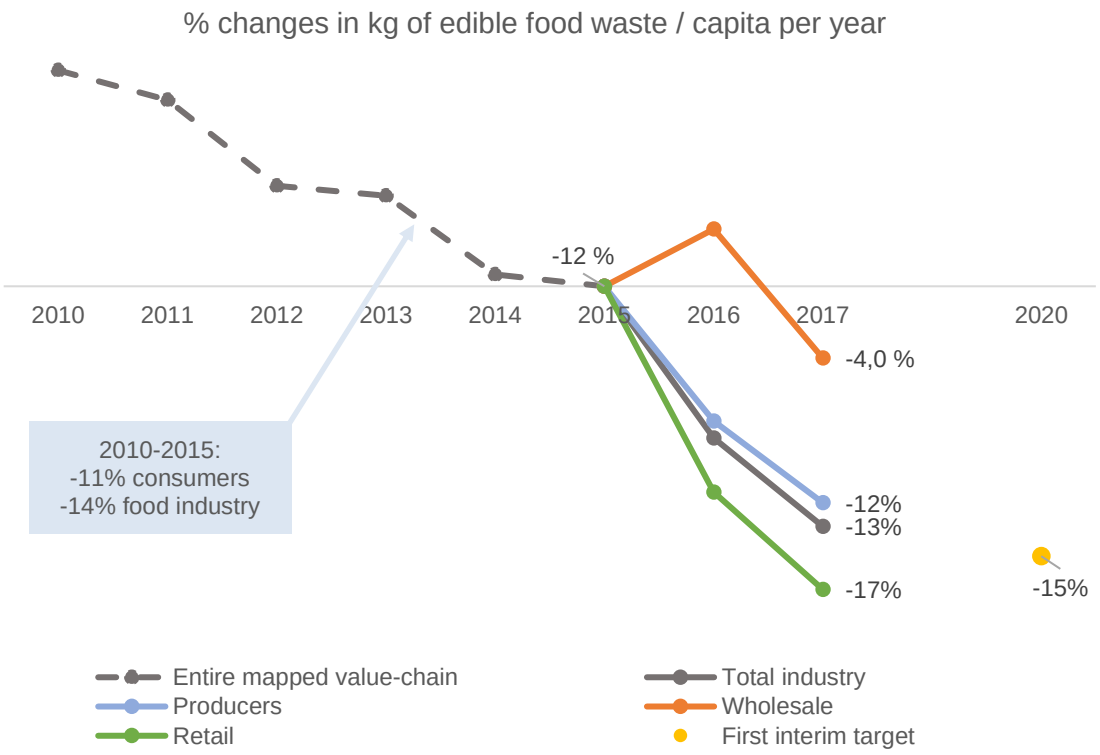

Figure 1-2 **Percentage changes in kg of food waste per capita per year by stage of the value chain**

Greenhouse gas emissions and financial losses associated with food waste in the industry were also reduced during the same period, by 10% and 8% respectively. This is the first time that financial losses and the carbon footprint have been reduced in step with food waste; this is because food waste now also shows a clear downward trend for relatively expensive and environmentally unfriendly foods such as meat and dairy products.

The decline in waste at the retail stage is largely linked to systematic price reductions for goods with a short shelf life, internal product flow procedures (purchasing) and competence development (knowledge of food waste, including the food waste toolkit and raw materials).

In the food industry in general, the reduction is related to improved forecasting and cooperation across the value chain, as well as production planning and internal procedures. Further important measures have been the use of alternative sales channels and the donation of food that cannot be sold at normal prices.

Consumers

The food industry also has a key responsibility for food waste that occurs in the homes of consumers; for this reason, Ostfold Research conducts annual consumer surveys on behalf of Matvett to learn more about the factors affecting food waste habits in Norwegian households.

The 2018 consumer surveys show that significantly fewer people reported having discarded food because it was past its expiry date in 2018 than in previous years. This is especially evident for sliced meat and yoghurt/sour cream.

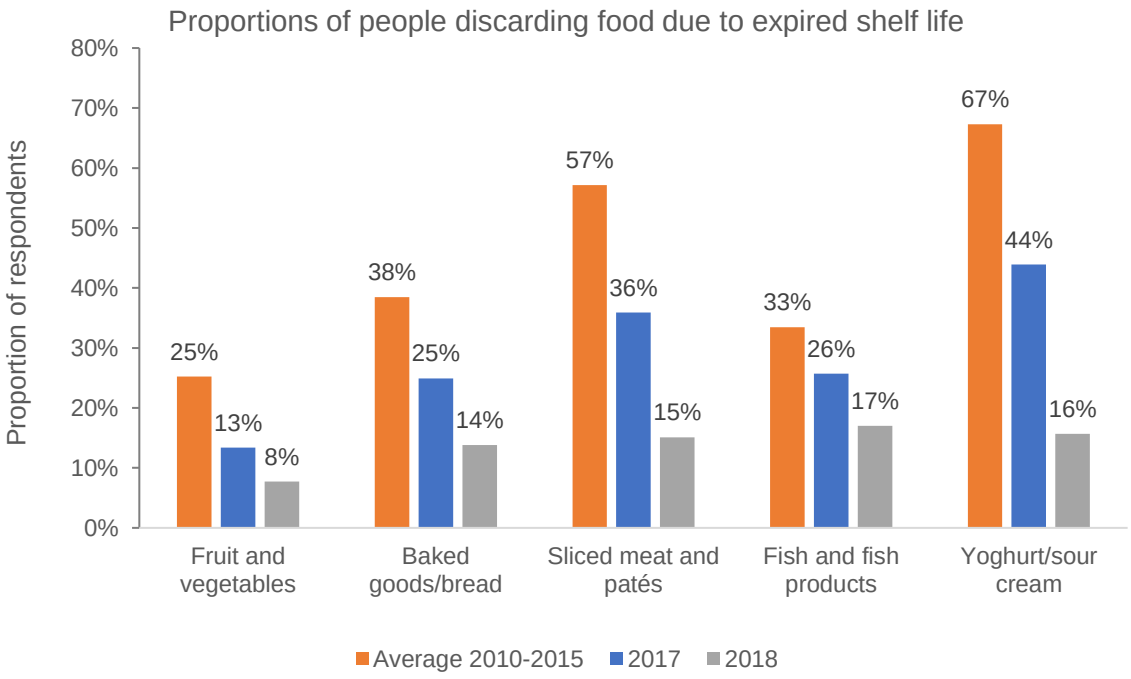

Figure 1-3 **Trends in percentages of respondents discarding food because it was past its expiry date for different product groups, average figures for 2010 to 2015, and figures for 2017 and 2018**

This positive trend is probably due to the efforts in the industry to provide additional labelling such as “not bad after”, “often good after” and “look, smell and taste”, where communication around this has increased awareness of the meaning of the "best before" stamp, which is primarily a guarantee of quality.

There are still four types of food that consumers report discarding more than others: leftovers from meals, fruit, vegetables and fresh baked goods. The percentage stating that they have thrown away these types is increasing, and several other attitude and behaviour indicators also show a negative trend. It is unclear whether this is due to increased food waste or increased consumer awareness.

The surveys also show that the following indicators lead to lower food waste:

- More time available (fewer children under 18 and/or not employed)
- Using a shopping list
- Shopping infrequently
- Concern about the environment

In addition, we see that income levels have some effect on food waste; high income is associated with more frequent food waste than lower income, but this association is not as strong as in the indicators above.
The price of food is also a factor in food waste, and, as shown in previous reports, older people (65+) throw away the least food. Now the figures also show that women report discarding food less often than men.

1 Introduction

1.1 Food Waste Efforts in Norway

Work on mapping food waste in Norway started with the ForMat project (2010-2015), a collaborative effort that covered large parts of the value chain of the Norwegian food and beverage sector. The aim of the project was a 25% reduction in food waste in Norway by the end of 2015, compared with 2010.

The ForMat project was run by the company Matvett AS and led by a steering committee with representatives from the Food and Drink section of the Confederation of Norwegian Enterprise (NHO), the Norwegian Grocery Sector's Environmental Forum (DMF), the Grocery Producers of Norway (DLF) and the Norwegian Packaging Association (NOK), while the Ministry of Agriculture and Food and the Environment Agency, on behalf of the Ministry of Climate and Environment, participated as observers.

An important part of the project was a survey of amounts and composition of food waste from producers, wholesalers, retailers and households for the period 2010-2015. In addition, the environmental and economic impacts of food waste were documented. The final project report showed that food waste in the four stages of the value chain declined by 12%, measured in kg per capita, from 2010 to 2015. Greenhouse gas emissions associated with food waste fell by 3%, while costs associated with food waste increased by 1.5% (financial losses related to discarded food).

The ForMat project also developed a common methodological basis for measuring food waste in the four stages of the value chain. This methodology, together with the results of the survey, forms the basis for future mapping of food waste throughout the value chain by the parties involved in the sector agreement on food waste, and has been summarised in the final report.

This report provides information on quantities, environmental impacts and costs associated with food waste by producers, retailers and wholesalers, as well as consumer studies on causes and attitudes related to household food waste. This is the second report in the series. New this year is a section on the catering sector based on the three-year project "KuttMatsvinn2020".

1.2 Sector Agreement on Food Waste

Norway has committed itself to fulfilling the UN Sustainable Development Goals, and one of these goals (12.3) is to halve food waste by retailers and consumers, measured in kg per capita, and reduce waste in production and the supply chain by 2030.

In June 2017, the Norwegian government and the entire food industry signed a sector agreement on reducing food waste. The purpose of the agreement is to halve food waste in Norway by 2030, in line with the UN Sustainable Development Goal 12.3, but with the additional objective of achieving the target with a 15% reduction in 2020 and a 30% reduction in 2025, where 2015 represents the baseline. The parties to the agreement from the food industry are also committed to quantifying the extent and composition of their food waste and reporting on this annually.

In addition to the sector agreement, individual companies have signed a declaration of affiliation whereby they agree to the goals of the agreement and commit themselves to mapping and reporting their food waste and working to implement anti-waste measures internally and in networks with others. As a result of this declaration and the sector agreement, the number of companies sharing waste data has more than doubled since the end of the ForMat project.

To date, 79 leading companies in the seafood industry and among food producers, retailers and caterers have signed this declaration of affiliation.

This is the second report on self-reporting in the food industry; it begins with an overall view of food waste in Norway, where all stages of the value chain were mapped, followed by detailed results and trends for food producers, retailers and wholesalers, as well as preliminary key figures for the hotel and catering sector (only hotels and employee cafeterias). Finally, the report presents the latest results from consumer studies on Norwegians' attitudes and behaviour related to food waste.

2 Methodology and Data Basis

2.1 Definition and Data Collection

The definition of food waste in the sector agreement formed the basis for the food waste survey and is similar to the definition used in the ForMat project:

"Food waste is defined as all useful parts of food produced for humans which are either discarded or removed from the food chain for other purposes than human food, from the time of slaughter or harvesting."

This definition thus includes only the wastage of edible parts of food (not inedible parts such as bones, pits, shells, etc.). Although animal feed is considered food waste, the parties should make optimal use of food waste, and using it to feed animals is therefore preferable to destroying it.

The basis for the survey of food waste in the food industry is the reporting of data on sales and waste by product group and cause by a selection of companies in the different stages of the value chain. For producers, the data is reported in tons, while for retailers and wholesalers, data is reported in economic terms and for the hotel and catering sector, data is reported both in economic terms and in grams per guest. The reason for this is that the recording of waste is part of the financial management system of wholesalers and retailers, while waste recording by producers is less integrated into the financial system (this generally only applies to parts of food waste, i.e. finished and returned products). In the hotel and catering industry, data is reported in grams per guest and in economic terms, since this is a complex sector with considerable variation in financial and waste recording systems.

The following key national figures have been calculated for all stages of the value chain:

- The total amount of food waste generated (in tons per year and kg per capita)
- Costs associated with food waste in terms of lost revenue (in billion NOK)
- Greenhouse gas emissions associated with the production, packaging and distribution of food that is discarded (in tons of CO2 equivalents)

The key figures are based on data collected in the reporting to Matvett by producers, wholesalers and retailers in 2017 under the sector agreement. To supplement the statistics, results for households (for the year 2016) and the catering industry are also shown, based on results from the report "Nasjonal beregning av mengde matsvinn på forbrukerleddet" (Calculations of Consumer Food Waste at the National Level) (Syversen et al. 2018) and the research project KuttMatsvinn2020 (Callewaert & Stensgård 2018).

The data have been scaled up to national figures based on the market share of the companies reporting, and have been adjusted for the edible portion according to data from the food composition table at matportalen.no

2.2 Division into Product Groups

Food waste that occurs in the various stages is divided into product groups in order to simplify the presentation of the statistics and calculate the economic and environmental impacts of food waste. The same division is used for the different stages of the value chain to ensure comparability across the value chain. Ten main groups have formed the basis of the surveys throughout the value chain; these are presented in Table 2-1.

Table 2-1 Overview of the division into product groups used in the surveys

Main Groups	Product Groups	Explanations
1. Frozen food	Frozen fruit/vegetables/berries/potatoes, ready-made food, ice cream/desserts, meat, fish, baked goods, etc.	
2. Fresh fruit and vegetables	Unprocessed fruit/vegetables/berries/potatoes	
	Processed fruit/vegetables/berries/potatoes	Pre-cut salads/vegetables, etc.
3. Bread and baked goods	Bread (fresh)	
	Baked goods (fresh)	Buns, rolls, cakes, pastries, etc.
4. Fresh ready-made food and delicatessen items	Ready-made and prepared food (not frozen)	Ready-to-eat meals/salads, fried/grilled meat/fish, sous vide food, etc.
	Chilled toppings for open sandwiches	Salads, sliced meat, pâtés, etc.
	Sausages	
	Open sandwiches/filled rolls/wraps	
	Prepared meat	Minced meat, raw burgers, etc.
5. Meat/poultry/other animals	Unprepared meat	Fresh pieces of beef, lamb, pork, poultry, other meat (reindeer meat, horse, etc.)
6. Fresh fish and seafood	Prepared fish	
	Unprepared fish	
	Prepared shellfish	
	Unprepared shellfish	
7. Eggs	Eggs	
8.1 Liquid dairy products	Cream	
	Soft cheese products	
	Dairy derivatives/by-products	
	Milk	
	Yoghurt	
	Other dairy-based products	
8.2 Solid dairy products	Cheese	
	Butter	
9. Durable goods	Flour, grains, cereals and baking ingredients	
	Dressings, oils, ketchup	
	Nuts/seeds/dried fruit and berries	Rice, pasta, noodles, tinned meals, packets of soup, etc.
	Dry foods for meals	
	Sweet/tinned toppings open sandwiches	Jam, chocolate spreads, tinned fish, etc.
	Snacks	
	Sweets/desserts/chocolate	
10. Beverages	Non-alcoholic drinks	Bottled water/juice/soft drinks, etc.
	Alcoholic drinks	Beer, cider, wine, spirits

2.3 Surveys of the Stages of the Value Chain

2.3.1 The Production Stage

Changes in the sample
Major changes have been made in the survey of food producers and therefore also in the data which form the basis for this report. The signing of the sector agreement in June 2017 and the declaration of affiliation, which is signed on an ongoing basis, have led to an increase in the number of producers providing food waste data from 15 companies in 2016 to 24 in 2017.

Although some of the new companies have been able to provide historical data, the increase in the number of companies in the sample from 2016 to 2017 has resulted in a break in the timeline. This break is further reinforced by the fact that some of the companies that have shared data since 2010 have improved their data base by introducing new and better measurement procedures and including a larger share of their business in the reporting. This means that the old time series (2010 to 2016) for these companies can no longer be compared to their surveys in 2017. However, the figures for 2017 are more correct.

Of the 24 companies that have shared data in 2017, 11 have data that are comparable back to 2015 (the start of the sector agreement) and eight of these also have comparable data back to 2010 (the start of the ForMat project). The 24 companies represent a broad selection of production facilities and cover about 35% of the total sales of Norwegian food producers. The sample is considered to be representative of several product groups in economic terms.

Note that the fishing industry is not included in this report, as food waste from the seafood sector is being studied in a separate project run by the research organisation SINTEF on behalf of the Norwegian Seafood Federation.

Changes in reporting procedures
In addition to the increase in the sample, the reporting format has also changed. Previously, food producers reported tons of food produced and tons of food wasted. Any data relating to the handling of food waste, causes and preventative measures were only reported to varying degrees.

In the spring of 2018, Ostfold Research partnered with Matvett to launch a new reporting portal for food waste; this simplifies reporting and data collection, using a digital platform. The new reporting format enables the collection of a broader set of data; these include causes of food waste, measures implemented and utilisation of food that has become waste, thus fulfilling the reporting criteria of the sector agreement on food waste.

A new food waste guideline for producers
In addition to the new reporting portal, a new guideline was drawn up to help producers to map their food waste. The guideline was prepared in collaboration with food producers; various companies provided input in a joint workshop. The purpose of the guideline is to give producers a tool to map and report food waste in accordance with the sector agreement, and to ensure a common methodological basis to enable comparability across companies and the value chain. The guideline is based on experience from ForMat, KuttMatsvinn2020 and internationally recognised

methods of mapping food waste by producers (FUSIONS, Wrap and the FLW Protocol), and is a compilation of existing knowledge on food waste mapping.

Calculation method

Despite major changes in the data base, the method of calculating food waste by producers is unchanged in this year's report. Data at the product group level is shown as the percentage of food waste from production, and has been calculated by dividing the reported amount of food waste from raw material, production and finished product by the total quantity of goods produced.

The tonnage of food waste in the production stage has been calculated by multiplying the production volume by the percentage of waste recorded by the reporting companies by product group and year. In the case of product groups that are presumably not represented by any of the companies in the sample, tons of food waste are calculated by multiplying the weighted average of the percentage of food waste for all product groups in a particular year (in total) by the total quantity produced in these groups. In this report, these product groups are referred to as "others".

Compared to previous reports, this year's report covers a larger share of the food industry, as the brewery industry and mills and flour producers have now been included. This also means that the calculated amount of food waste by producers is greater than in previously published reports; in addition, the trend is not the same as the sample has changed.

Note that all the time series for producers (including the tonnage calculations) are only based on data from the 11 companies with comparable data from 2015. This is to ensure that the trend in calculated food waste is correct and not due to changes in the sample/data base.

Data for the annual production volumes of each product group are taken from Statistics Norway's Table 10455 "Solgt produksjon av varer for store foretak i industri, etter 8-sifret Prodcomkode" (Sold Production of Goods for Large Industrial Companies, by 8-digit Prodcom Code), and include confidential data. The production statistics in terms of amounts of waste are of varying quality; therefore, to correct for missing data and sources of error in the statistics, the costs for each product group and year (NOK per kg) were calculated; these were then combined with production statistics expressed as sales value in order to calculate annual production.

When calculating tonnage of food waste from Norwegian producers, the percentage of waste for the various product groups has been adjusted for waste associated with major incidents or extraordinary operations, so that abnormal fluctuations in a company's food waste are evened out.

Note that the seafood industry is not included in this report.

2.3.2 The Wholesale Stage

Changes in the data base
Improved data bases in companies have not only led to changes in the data from producers, but also in data from wholesalers. One company has made major improvements in its data collection method, resulting in new food waste data for 2016-2017. Since these figures are not comparable with the period 2010-2015, this company has been removed from the data basis, and the figures in this year's report therefore differ from those of previous reports.

The data for wholesalers cover a large proportion of Norwegian wholesale companies, and only to a minor extent product groups distributed directly from producer to retailer.

Calculation method
Data from wholesalers are expressed in economic terms, so to calculate the amount of food waste in tons at the wholesale stage, the key figures in terms of NOK per kg have been used to convert from economic value to tonnage. The key figures were collected in 2010 and have been CPI-adjusted for the years 2011-2017.

Market share in the retail sector for the wholesalers reporting to the project has been used as the upscaling factor.

2.3.3 The Retail Stage

Changes in the data base
As for producers and wholesalers, improved data bases in companies have also led to changes in the data base for retailers.

One of the retail chains identified an error in the figures, which was reported to the project, and revised food waste data have therefore been supplied for 2015-2017. Unfortunately, it has not been possible to obtain corrected data for the time series previous to this period; as a result, there is also a break in the timeline in the retail stage.

Calculation method
Three retail chains have provided data. The stores are a representative cross-section of retail outlets in Norway, with regard to geographical region, population density, and stores with or without fresh food sections. As for wholesalers, the data from the retail sector are expressed in economic terms, so to calculate the amount of food waste in tons at the retail stage, the key figures in terms of NOK per kg have been used to convert from economic value to tonnage.

The stores included have been scaled up to the national level on the basis of the market share of the chains for each year during the period. For market share that is not categorised ("Other"), the average amount of food waste in the stores has been used.

2.3.4 Hotels and Employee Cafeterias

Food waste mapping
The research project KuttMatsvinn2020 is currently involved in mapping food waste in hotels and employee cafeterias. The three-year research project is funded by the “Bionær Programme” (Sustainable Innovation in Food and Bio-based Industries) of the Research Council of Norway. It is a sectoral partnership with the goal of reducing food waste by 20 percent by 2020 and, in the longer term, reaching the UN Sustainable Development Goal 12.3. Matvett is the project owner and Ostfold Research manages the project. The partners are the Bama Group, Compass Group, ISS Facility Services, NorgesGruppen, Scandic Hotels, Nordic Choice Hotels, the Norwegian Hospitality Association, IntoLife, Mepex, Fredrikstad Town Council and Østfold County Council. Nofima, Ostfold Research, Luke (Finland) and RISE (Sweden) will be involved in the research. The results from the project will be included in next year's report.

In parallel with the research project, a sectoral project with the same name was also initiated. At present, about 1700 catering outlets are involved in this project, where the main focus areas are the measurement of food waste, employee competence development and the implementation of anti-waste measures. NorgesGruppen and ASKO initiated the sectoral project, which is managed by Matvett. Further information about the project can be found here: http://www.matvett.no/bransje/kutt-matsvinn-2020

Data basis
Data for 2017 from hotels and employee cafeterias has mainly been reported as the total amount of edible and inedible food waste, the number of guests and sales figures. A few hotels/employee cafeterias have reported amounts of edible food waste only. Data for hotels and employee cafeterias are either obtained via digital tools for the recording of food waste, with or without smart scales, data from refuse collectors (tons of food waste), or via manual weighing and recording of food waste in Excel or similar. The use of different data collection methods and recording tools may lead to different understandings of what to include in the data basis, which may therefore involve some uncertain factors. The data base for hotels and employee cafeterias covers waste in the entire chain: storage, food preparation, buffets and plate leftovers/wastage by guests.
For the hotel industry, a total of 125 catering establishments from three chains have reported data. These account for about 25% of sales in the hotel industry. The sample for employee cafeterias consists of 38 cafeterias and restaurants; these make up almost 1% of sales in staff cafeterias. Note that the results for this sector are therefore very unreliable.

Calculation method
For each catering outlet in the hotel and the staff catering sector, the amount of total (edible and inedible) food waste in kg has been divided by the sales in NOK for the relevant period. Subsequently, kg of total food waste divided by sales in NOK has been calculated for each chain as a weighted average for catering outlets (weighted by sales). Finally, the amount of food waste has been converted into edible food waste using a key figure for the proportion of edible food waste in total food waste based on waste sample analyses from seven catering establishments. Note that this conversion is not very reliable as the sample is very small. The sample has then been scaled up to national statistics based on the relative market share of the chains in 2017.

2.4 Consumer Surveys

Data basis
Every year, Matvett collaborates with Ostfold Research on surveys to determine the types of food consumers have discarded, reasons for discarding food, and their behaviour and attitudes related to planning, purchasing, meals, packaging, date stamps, etc.

The studies used the Norstat web panels (electronic questionnaires), and a sample of 1000 respondents representative of Norwegian consumers. Studies were conducted annually from 2010 to 2015 and in 2017 and 2018. In addition to the responses to the questionnaire itself, data were collected on age, gender, place of residence, education, social status, number of persons in the household and household income, to enable the responses to be considered in relation to various socio-demographic factors.

From 2010 to 2015, the annual consumer surveys were divided into two separate surveys, one of which focused on consumer food waste habits, while the other focused on consumer attitudes and behaviour. From 2017, the two surveys were merged to provide a better basis for understanding the relationship between food habits, attitudes and behaviour.

The questions asked in the 2018 survey are largely the same as in 2017, but with the addition of some new questions. One new question was about what kinds of food were often discarded after meals, as meal leftovers account for most food waste at the consumer stage.

Calculation method
The data and results were processed in several stages prior to analysis. A distinction was made between high-cost and low-cost food groups based on an average price per kg of NOK 65. All product groups with a higher price than the average were classified as high-cost (expensive) foods, while those with prices below the average were classified as low-cost (cheap) foods. Frozen food, fresh ready-made food, sliced meat, fish/fish products, meat for main meals, cheese and biscuits were categorised as high-cost products. Fruit, vegetables, baked goods, snacks, eggs, milk/cream, yoghurt/sour cream, dry goods and dressings were categorised as low-cost products.

Statistical analysis
New this year is an analysis of four different consumer profiles where respondents are categorised according to income, place of residence, age and family situation. The aim is to determine whether food discard and behaviour and attitudes related to food waste can be linked to different types/characteristics of consumers. Consumer profiles are defined based on relatively distinct characteristics, and can thus be clearly distinguished from one another. An analysis of the four consumer profiles was conducted for respondents in the studies in both 2017 and 2018; the four profiles were thus extracted from a total of 2007 respondents. The distribution of respondents to the different consumer profiles is presented in Table 5-3.

Selection for the four profiles was defined on the basis of two main indicators: available time and total household income. The time indicator was not measured directly, but determined on the basis of the total number of children and adults in the household and whether or not the adults are in full-time employment. It is assumed that households with several children under 18 relative to the total

number of people in the household, where the adults work full-time or are single parents, have busy lives and little time available. On the other hand, it is believed that pensioners and people on benefits without children have plenty of time available. The total household income indicator was based on the income level of the respondents.

The consumer profiles were mainly analysed using chi-square tests. These are statistical analyses that enable comparison of different levels of two variables in order to test for any relationships between the variables. The four consumer profiles were compared with different categorised variables, such as “number of product groups discarded”.

Chi-square tests were also performed for individual socio-demographic characteristics to explore whether certain characteristics were associated with the number of product groups discarded. Finally, the same analysis was used to compare different years to reveal possible significant differences in behaviour and attitudes in 2010, 2014 and 2018.

2.5 Carbon Footprint

The environmental analysis was limited to one indicator, namely greenhouse gas emissions; these were calculated using life cycle analysis (LCA) methodology in accordance with ISO 14040/44 and the European Commission JRC (2010, 2011).

It is important to note that the prevention of food waste can have a positive effect on many other environmental indicators (e.g. acidification, eutrophication, photochemical oxidation and emissions of NOx and particulates) and on resource use (such as the use of water, primary energy and phosphorus).

Greenhouse gas emissions were estimated on the basis of the amount and composition of food waste from the various stages of the value chain in Norway, and calculated by multiplying tonnages of food waste for the relevant product groups and stages by the corresponding emission factors.

Figure 2-1 shows which activities were included and excluded in the carbon footprint of food waste.

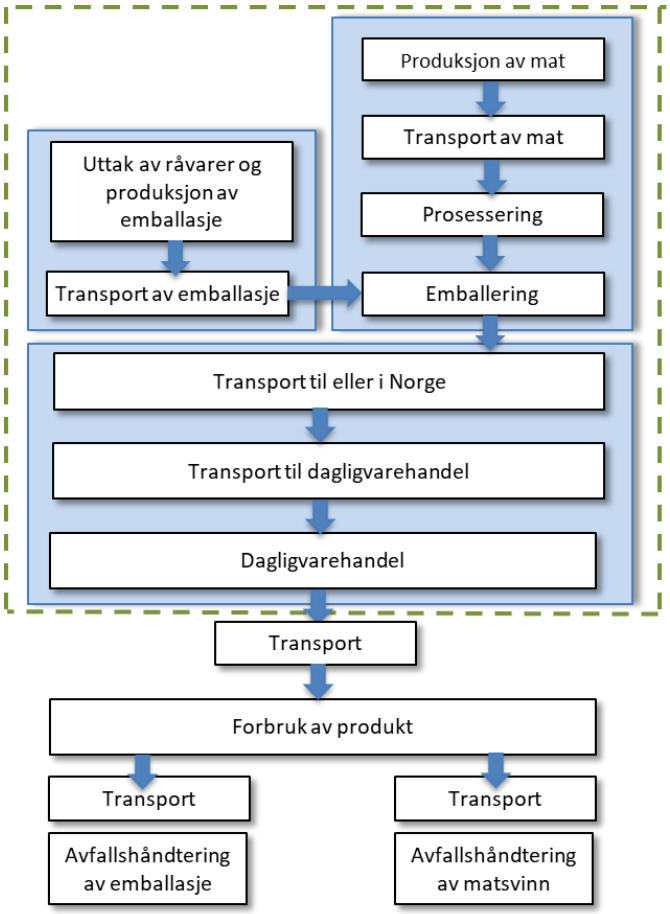

Figure 2-1 System boundary (green broken line) and activities included in the carbon footprint of food waste

The calculation of the carbon footprint includes all greenhouse gases associated with the production, transport and packaging of food. Emissions associated with waste management of packaging and food waste are not included. The emission factors are calculated in the LCA tool SimaPro and are based on data from the literature, international databases (Ecoinvent 3.3, Agri-footprint and AGRIBALYSE v1.3) and the Ostfold Research database, which has been developed during a number of previous projects. All greenhouse gas emissions are included (methane, nitrous oxide and carbon dioxide emissions are converted to CO2 equivalents).

2.6 Financial Loss

Financial loss associated with food waste has been calculated for the individual stages and in total for the value chain. Financial loss only includes the market value of the food discarded, not costs associated with food preparation or waste management.

For wholesalers and retailers, the calculation of financial loss is relatively simple, since waste is recorded in economic terms. Calculations in these stages were therefore made by totalling the economic value of the waste and then scaling up using the same methodology as for the calculation of tonnage (wholesalers' market share in the retail sector and retailers' market share in the retail chains).

Since data from producers are measured in tons, financial loss related to food waste was calculated in terms of key figures (NOK per kg) for each product group. These figures were multiplied by the key national figures for tons of food waste calculated for producers. The key figures used for conversion at the production stage are the same as those used to convert waste in economic terms to waste in tons at the retail and wholesale stages. These figures are net prices obtained from retail outlets, and are therefore relatively reliable for conversion at the retail and wholesale stages. For producers, these figures will be somewhat overestimated, since mark-ups will add value throughout the value chain.

Since the division into product groups at the production and wholesale stages is somewhat less detailed than at the retail stage (data at the level of product type), the product mix used for calculating waste by retailers (as a percentage) has also been used as the basis for calculating waste at the other stages. This is a simplification, as the composition of food waste within the various product groups is hardly the same at the different stages. But since there are no more detailed data on the composition of food waste at the non-retail stages, this is the best approach. This approach has also been used for calculating greenhouse gas emissions associated with food waste.

All values have been converted to 2015 NOK values to ensure comparability over time.

3 Results from the Survey

3.1 Tons of Food Waste by Stage in the Value Chain

This section gives a brief summary of the total amount of food waste for all parts of the food value chain included in the survey.

Figure 3-1 shows estimates of food waste in Norway by stage in the value chain. The figures for households are from the report “Nasjonal beregning av mengde matsvinn på forbrukerleddet” (Calculations of Consumer Food Waste at the National Level) and apply to 2016, while those for the hotel and catering sector are based on preliminary results from the research project KuttMatsvinn2020 and only include hotels and employee cafeterias.

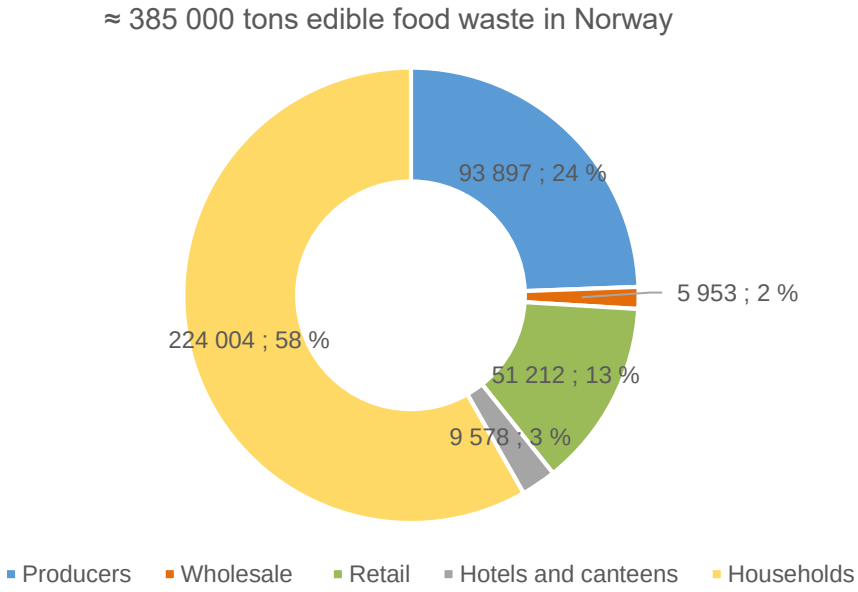

Figure 3-1 Estimated total amounts of food waste in Norway by stage in the value chain

The figure shows that the total amount of food waste in Norway is estimated at 385 000 tons annually, corresponding to about 73 kg per capita per year (this excludes food waste discarded via household drains and in the fishing industry and primary production). Food waste represents an economic loss of NOK 22 billion and 1.3 million CO2 equivalents per year. Households account for more than half of food waste (58%), followed by producers (24%), retailers (13%), hotels and employee cafeterias (estimated at 3 %) and the wholesale sector (2 %). Note that the figures for hotels and staff cafeterias are only a general estimate, since several segments of the catering sector are not included.

In the case of producers and wholesalers, estimated amounts of food waste are somewhat higher in this year’s report than in previous reports. This is due to the improved data base (more companies) and the fact that the brewery industry and mills and flour producers are now included in the data base. The results for the retail sector are the most reliable figures, as the data for this stage of the value chain are of good quality.

3.2 Overall Trends

This section gives a brief summary of overall trends in amounts of food waste and associated economic loss and greenhouse gas emissions for the three stages of the food value chain from 2015 to 2017.

For a more detailed description of developments from 2010 to 2015, see the final report from the ForMat project (Stensgård & Hanssen, 2016).

3.2.1 Trends in Amounts of Food Waste

Figure 3-2 shows the percentage change in kg of food waste per capita from 2015 to 2017 for each of the three stages of the value chain and in total, compared with the first interim target of the sector agreement (a 15% reduction by 2020), together with changes from 2010 to 2015 as documented in the final report of the ForMat project. The percentage change is shown relative to the base year in the sector agreement (2015), which is set at 0%.

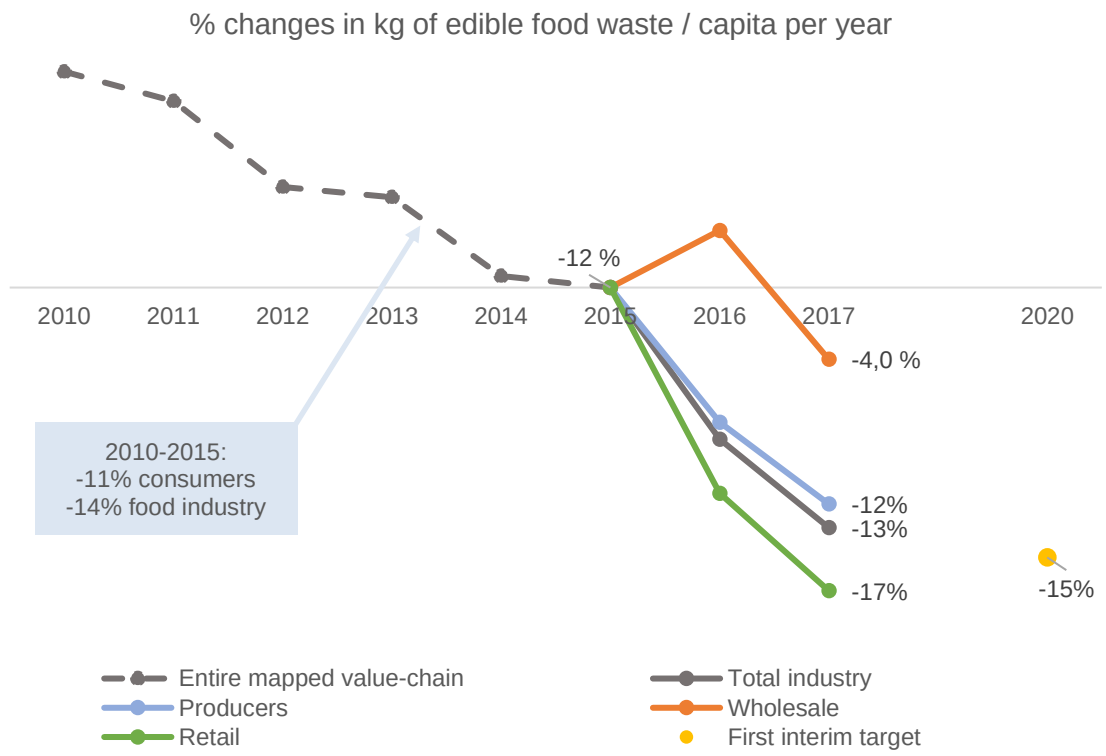

Figure 3-2 Percentage change in kg of food waste per capita and year by stage in the value chain

The final report from the ForMat project showed that food waste in the industry as a whole was reduced by 14% from 2010 to 2015, measured in kg per capita (the broken line).

Since the end of the ForMat project, food waste in the industry has been reduced by a further 13% (grey line from 2015 to 2017). Note that the data for 2010-2015 are not directly comparable with the data sets for 2015-2017, due to changes in the sample and improved data.

The figure suggests that the food industry is well on its way to reaching the first interim target in the sector agreement of a 15% reduction by 2020 (indicated by a yellow dot). The retail trade has already reached this goal (17% reduction), and food producers, with a 12% reduction, are also on course to reach it. The wholesale sector, which showed an increase in food waste from 2015 to 2016, is farthest behind the goal with only a 4% reduction, and must implement actions to meet the first target of the agreement.

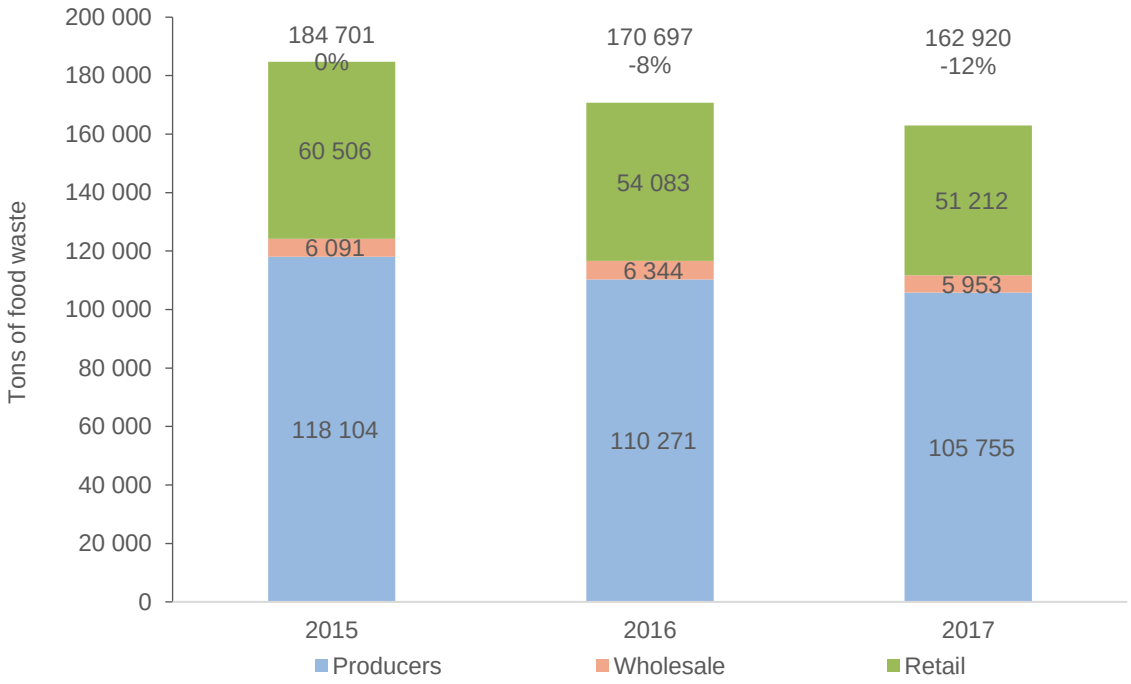

Figure 3-3 shows changes in tons of food waste for the three stages of the value chain. The percentages above the bars indicate the total tonnage of food waste for the three stages combined and the percentage change from 2015.

Note that the figure for producers in

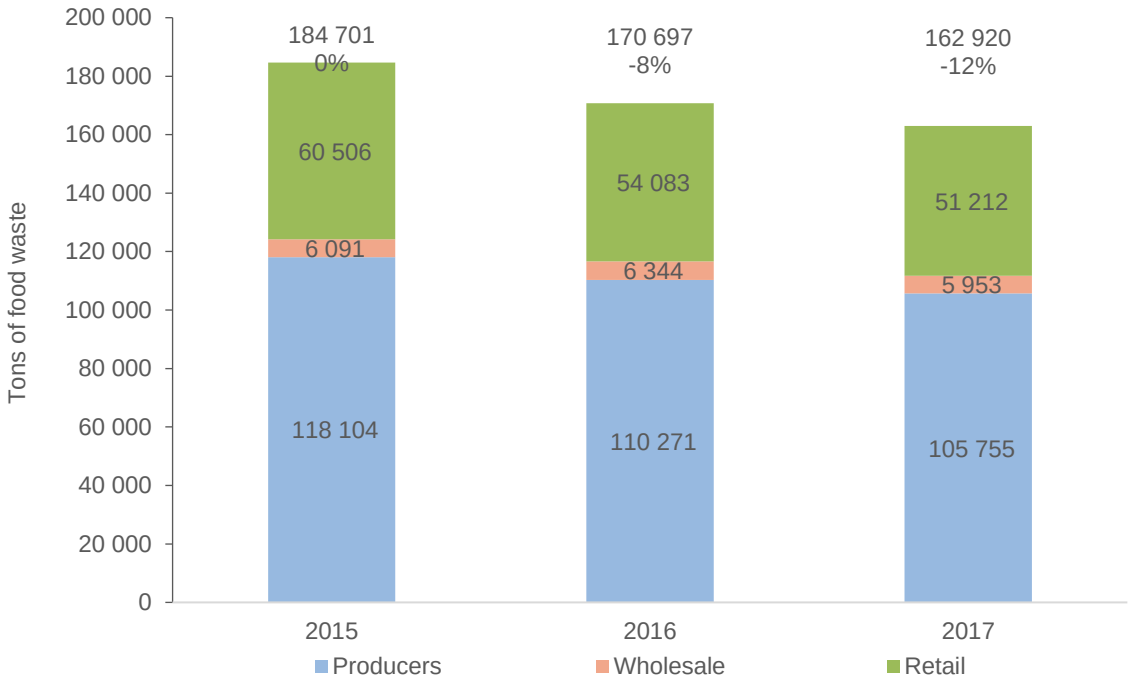

Figure 3-3 is higher than in Figure 3-1, since this chapter is based on the sample of companies (11) with comparable data back to 2015, while Figure 3-1 is based on data from all companies (24) reporting data for 2017. The figure for 2017 in Figure 3-1 is the most correct and representative estimate for producers in 2017, while

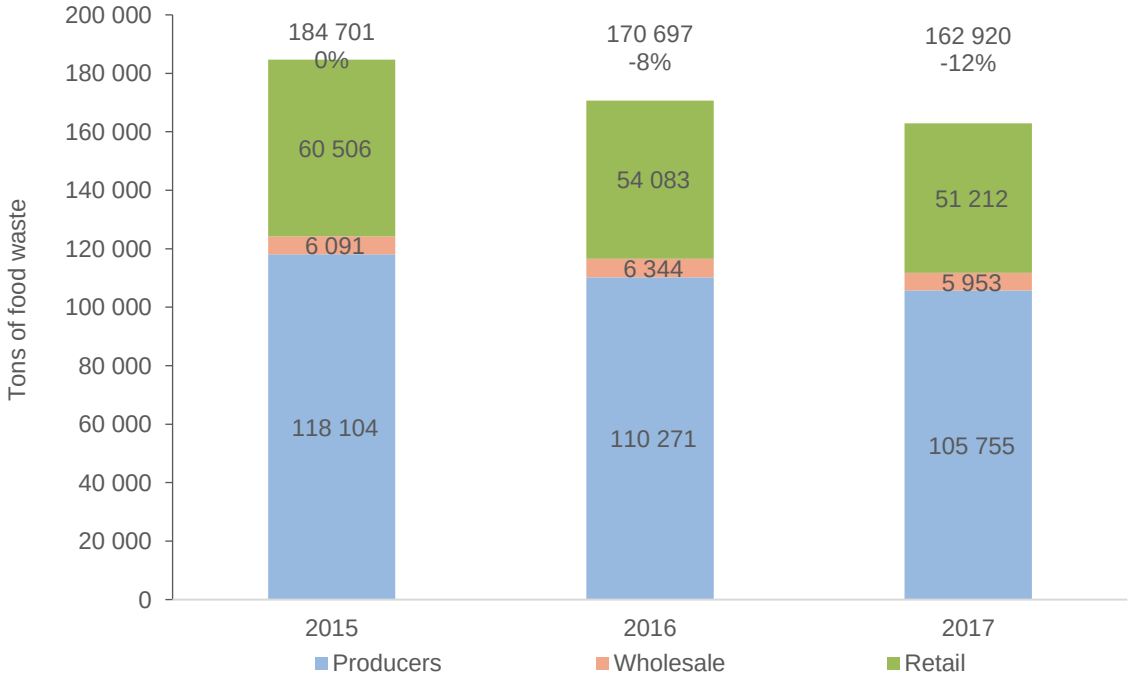

Figure 3-3 shows the best estimate for the trend. The lower calculation for 2017 in Figure 3-1 is due to a more detailed data base for that year.

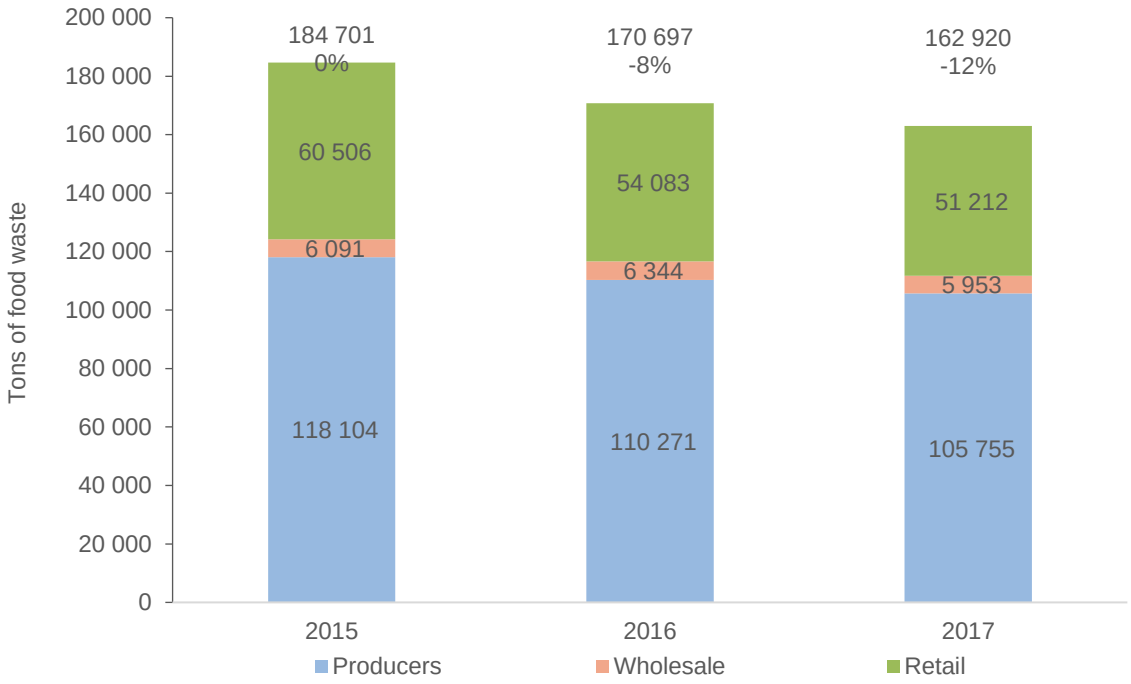

Figure 3-3 Changes in tons of food waste by stage in the value chain 2015-2017

The figure shows that the total amount of food waste in the three stages was reduced from 185 000 tons in 2015 to 163 000 tons in 2017. This is a reduction of 22 000 tons or 12%. The reduction is thus somewhat lower measured in tons than in kg per capita, due to an increase in the population from 2015 to 2017.
Table 3-1 shows changes in tons of food waste, by stage of the value chain and in total, from 2015 to 2017.

Table 3-1 Changes in food waste (in tons and kg per capita) from 2015 to 2017

Stage of value chain	Changes in tons of food waste (2015-2017)	Changes in tons in percentages (2015-2017)	Changes in kg per capita (2015-2017)	Changes in kg per capita in percentages (2015-2017)
Producers	-12 349	-10%	-2.75	-12%
Wholesalers	-138	-2%	-0.05	-4%
Retailers	-9 293	-15%	-1.97	-17%
Total	**-21 781**	**-12% (average)**	**-4.8 kg per capita**	**-13% (average)**

3.2.2 Financial Loss Linked to Food Waste

Figure 3-4 shows historical changes in financial loss associated with food waste for the three stages of the value chain. The percentages above the bars indicate the total financial loss (in billion NOK) for the three stages combined and the percentage change from 2015 for the year in question.

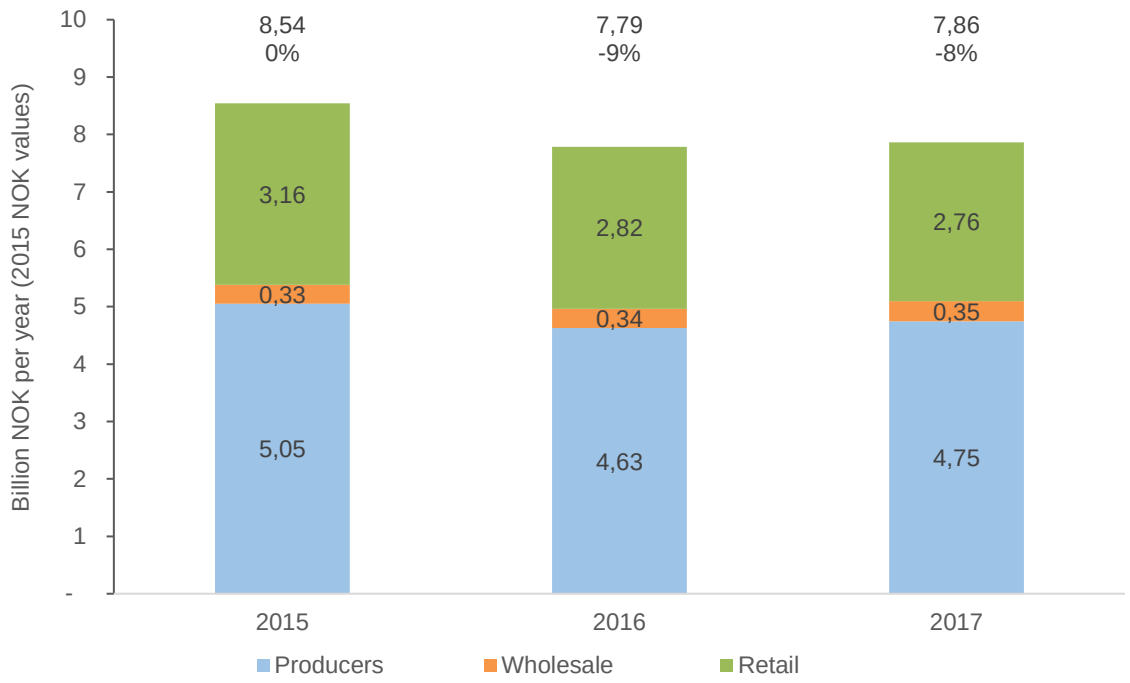

Figure 3-4 Financial loss (in billion NOK) linked to food waste by stage of the value chain from 2015 to 2017

The figure shows that financial losses associated with food waste in the three stages of the food value chain were reduced from NOK 8.54 billion in 2015 to NOK 7.86 billion in 2017, in 2015 NOK values. This is a reduction of NOK 0.68 billion or 8%.

The retail trade accounts for most of the reduction (NOK 0.40 billion), having reduced its financial losses by 13%, while producers show a reduction of NOK 0.31 billion or 6%. The wholesale sector, on the other hand, has increased its economic loss by NOK 0.03 billion, or 8%.

The final report from the ForMat project showed that financial losses associated with food waste in the food industry as a whole remained relatively stable during the period 2010 to 2015, with only a slight reduction of 1.2% despite the fact that food waste was simultaneously reduced by 9%. This is because food waste decreased for cheaper items and increased for more expensive ones.

Figure 3-4 shows that the industry is finally decreasing its waste of the more expensive foods. This is especially true of retailers, where the introduction of systematic price reductions at the end of 2015 led to a significant reduction in food waste for e.g. meat products and fresh ready-made food.

3.2.3 Greenhouse Gas Emissions Linked to Food Waste

Figure 3-5 shows historical changes in tons of CO2 equivalents linked to the production, packaging and transport of food wasted in the three stages of the value chain.
The percentages above the bars indicate the total greenhouse gas emissions linked to food waste in the three stages combined and the percentage change from 2015 for the year in question.

Note that the calculations only include emissions until the product reaches the retail outlet. This means that emissions related to transport from store to home, food preparation, waste management and packaging are not included.

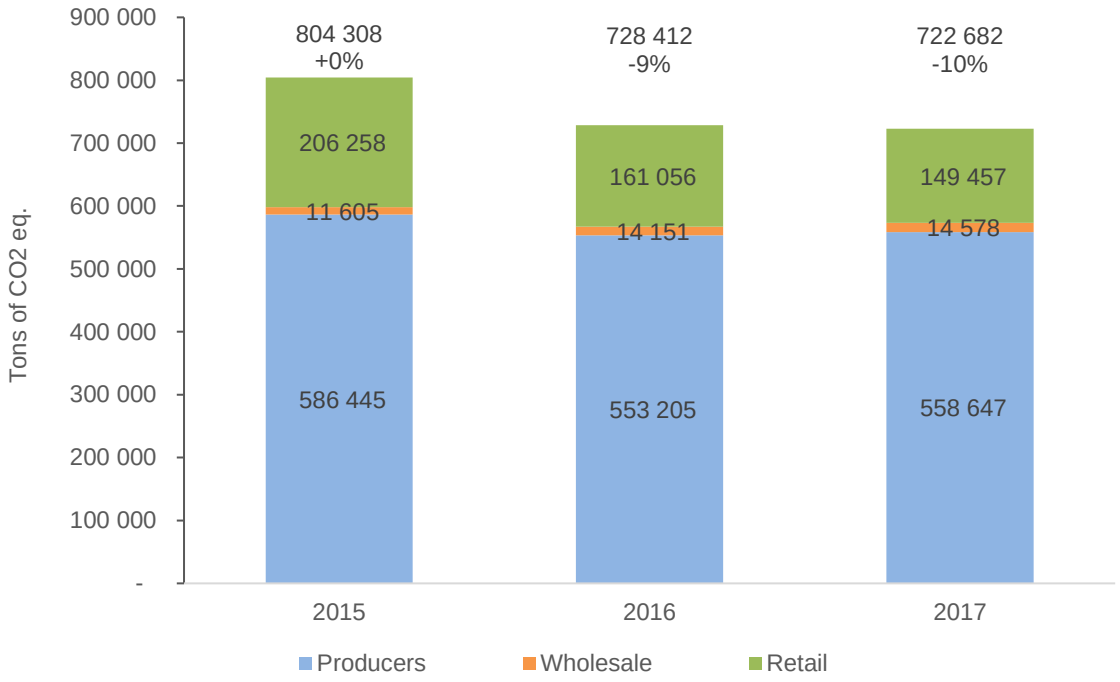

Figure 3-5 Tons of CO2 eq. linked to food waste by stage of the value chain from 2015 to 2017

The figure shows that the environmental impact of food waste in the industry as a whole decreased from 804 000 tons of CO2 equivalents to 723 000 tons, which is a reduction of 82 000 tons, or 10%. Of the three stages of the value chain, retailers have reduced the carbon footprint of food waste the most, at 57 000 tons of CO2 equivalents, or 28%. Producers have reduced the carbon footprint by 28 000 tons (5%); however, the wholesale sector shows an increase of almost 3000 tons, or 26%.

Between 2010 and 2015, greenhouse gas emissions related to food waste in the industry as a whole were reduced by 12%; most of the reduction was related to reduced waste of dairy products, meat and frozen ready-made food by producers. During the same period, the carbon footprint of food waste in the retail and wholesale sectors remained unchanged, even though retailers reduced their food waste considerably. As with the financial loss, this is because food waste was reduced for items with a relatively low carbon footprint, while waste increased for items with a relatively high climate footprint. It is thus a positive sign that this trend has been reversed among retailers and it is to be hoped that wholesalers will follow suit.

3.3 Trends by Stage in the Value Chain and Product Group

3.3.1 Producers

Figure 3-6 shows the calculated composition of product groups involved in food waste by producers in 2015-2017, where national statistics are based on companies with comparable food waste data (basis for

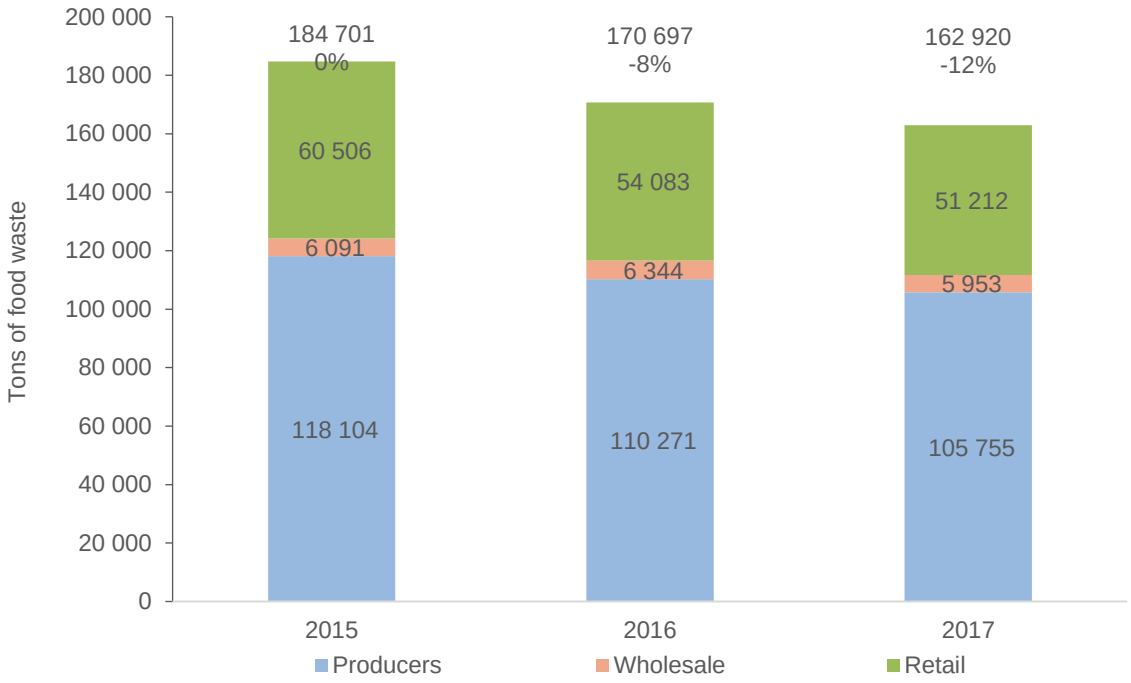

Figure 3-3), and the calculated composition for 2017 only, where the national statistics are based on all companies who provided data for 2017 (basis for Figure 3-1).

Note that the product group “others” is a large group containing various product groups not thought to be represented by any of the companies in the sample. Tons of food waste for these products have been calculated by multiplying the weighted average of the percentage of total waste for all product groups in the relevant year by the total amount produced of the products in question.

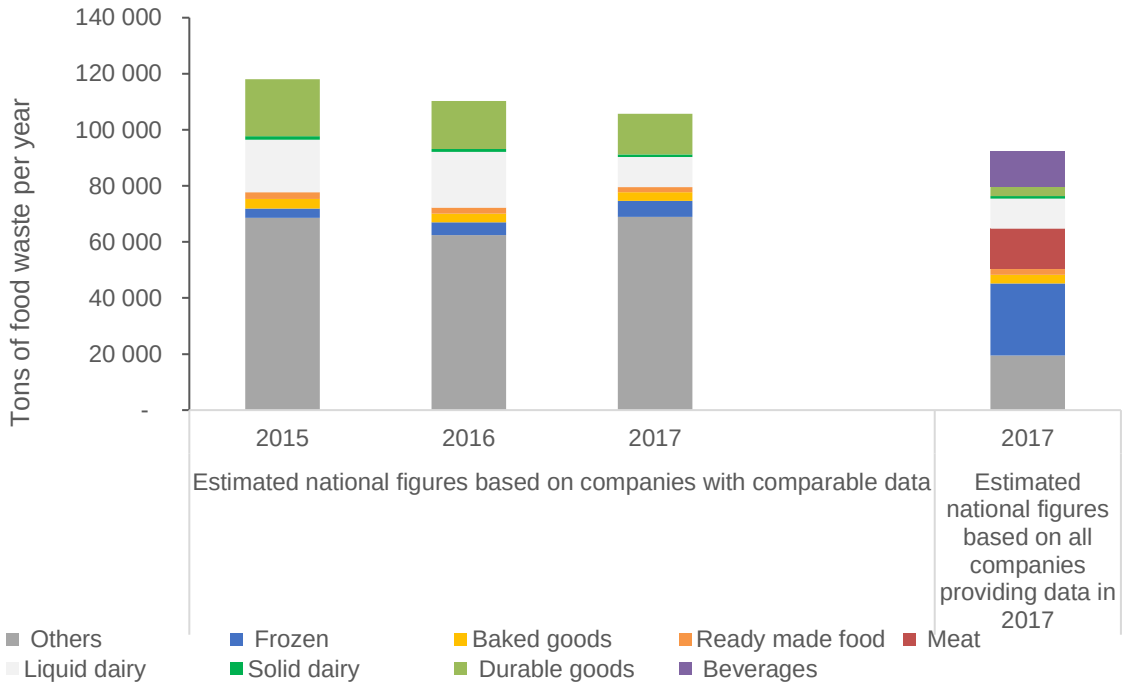

Figure 3-6 **Changes in tons of food waste by producers 2015-2017 (based on companies with comparable data and scaled up to national figures) and total amounts of food waste by producers in 2017 (all companies providing data in 2017, scaled up to national figures), distributed by product group**

The figure shows that “others” make up a large proportion of the total amount of food waste in the 2015-2017 figures. This indicates that the calculated amount of food waste by producers is unreliable for those years, since “others” is a large mixture of various products without specific waste data. On the other hand, estimated total food waste in 2017 for all companies shows that “others” constitute a small proportion. This is because producers of frozen fruit and vegetables, meat, beverages, and mills and flour producers, were included in 2017.
The main reason why estimated national figures based on food waste data from all companies are lower than the figures for companies with comparable data in 2017 is that several of the product groups previously included in “others” turned out to have lower percentages of waste than average.

In addition to “others”, durable goods and frozen foods also make up a large proportion of food waste. The main reason for the large proportion of frozen foods is that the production of frozen vegetables involves considerable waste (see further description in 4.1). Durable goods constitute a large proportion because this is a large product group in terms of production, including a wide variety of foods (e.g. confectionery, snacks, flour, cereals and tinned and sweet spreads).

3.3.2 Wholesalers

Figure 3-8 shows the composition of product groups involved in food waste by wholesalers for 2015-2017.

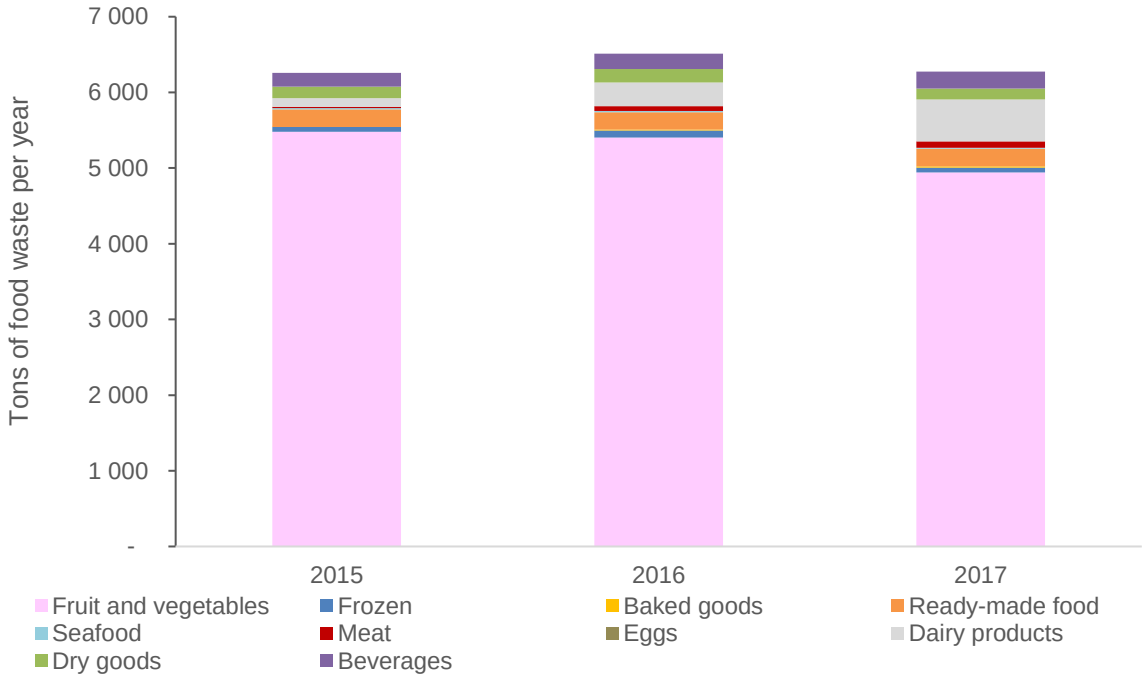

Figure 3-7 Changes in tons of food waste by wholesalers for 2015-2017 by product group

The figure shows that fresh fruit and vegetables make up most of the food waste. This product group is susceptible to damage during transport and storage and has a short shelf life, which may explain why it predominates in the statistics.

Note that the composition of product groups at the wholesale level is very unreliable.

3.3.3 Retailers

Figure 3-8 shows the composition of product groups involved in food waste by retailers for 2015-2017.

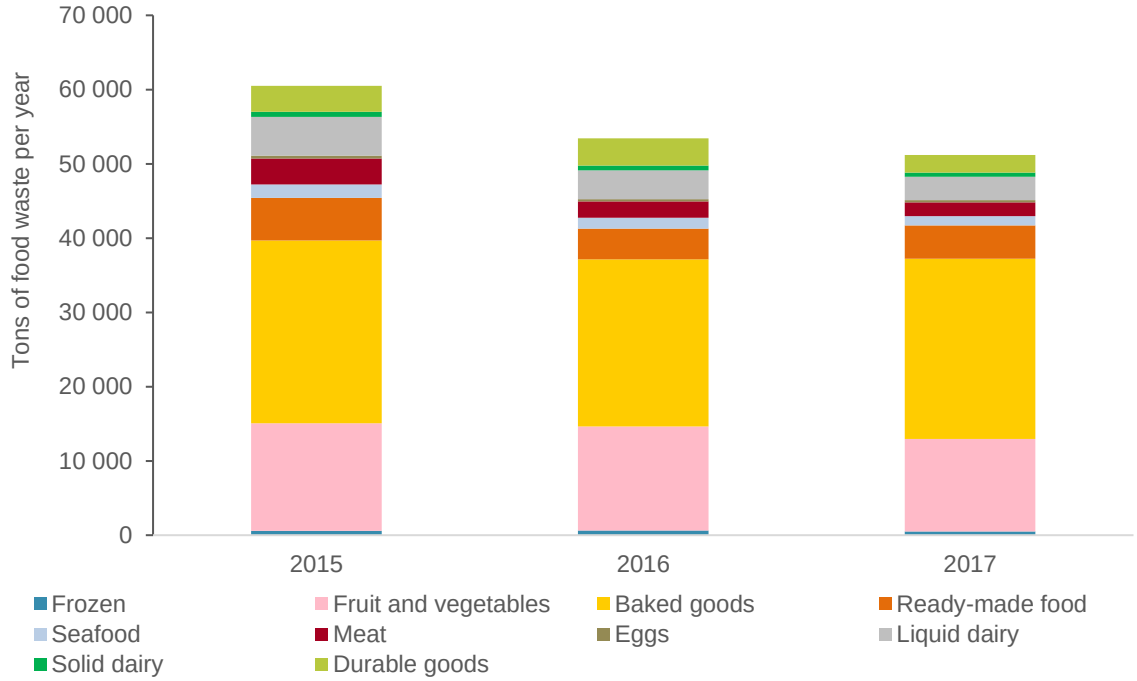

Figure 3-8 Changes in tons of food waste by retailers for 2015-2017 by product group

The figure shows that fresh baked goods account for most of retail food waste, followed by fresh fruit and vegetables. These two groups have a short shelf life and high quality requirements, which may explain why they predominate.

The figure also shows that in order to reach the target of a 50% reduction in food waste by 2030 (as stated in the sector agreement and the UN Sustainable Development Goal), retailers should focus their future efforts on fresh baked goods and fruit and vegetables.

4 Detailed Results

4.1 Producers

4.1.1 Trends by Product Group

This section shows trends in food waste by product group for producers from 2015 to 2017 in percentages of amounts produced, and describes causes, anti-waste measures and use of resources.

Food waste varied between product groups: frozen ready-made food, ice cream and frozen desserts, and baked goods, nuts, seeds, etc. had the highest proportion of waste, while sweet and tinned spreads, solid dairy products and fresh baked goods had the lowest.

Nine out of fifteen product groups showed a reduction in waste, while six showed an increase.

Fact Box 4-1 Summary of figures for producers in 2015 and 2017, and trends from 2015 to 2017.

Product groups with the *most* waste as a percentage of production (in tons) in 2017 were:

1) Frozen ready-made food (6.5%)
2) Ice cream and frozen desserts (5.7%)
3) Baked goods, nuts, seeds, etc. (4.4%)

Product groups with the *least* waste as a percentage of production (in tons) in 2017 were:

1) Sweet and tinned spreads (0.2%)
2) Solid dairy products (1.0%)
3) Fresh baked goods (1.0%)

Product group	% waste 2015	% waste 2017	Change in % waste 2015-2017
Frozen ready-made food	6.3%	6.5%	+3%
Frozen desserts	3.7%	5.7%	+55%
Fresh baked goods	1.2%	1.0%	-20%
Ready-to-eat meals and refrigerated toppings	2.8%	3.1%	+9%
Sausages	0.8%	0.2%	-77%
Sliced meat and pâtés	1.4%	3.4%	+141%
Dairy products	3.3%	2.1%	-38%
Cheese	1.3%	1.0%	-21%
Flour, grains, cereals and baking ingredients	5.7%	4.4%	-23%
Dressings, etc.	4.2%	3.9%	-7%
Thin crispbread	1.3%	1.8%	+34%
Sweet and tinned spreads	0.5%	0.2%	-63%
Confectionery, chocolate and desserts	3.5%	3.1%	-11%
Snacks	2.6%	2.6%	+2%
Dry foods for meals	7.3%	3.4%	-53%

Figure 4-1 shows food waste as a percentage of annual production in tons from 2015 to 2017 for de 11 companies with comparable data from 2015 (the first year of the sector agreement), which forms the basis for calculations of trends in food waste by producers (

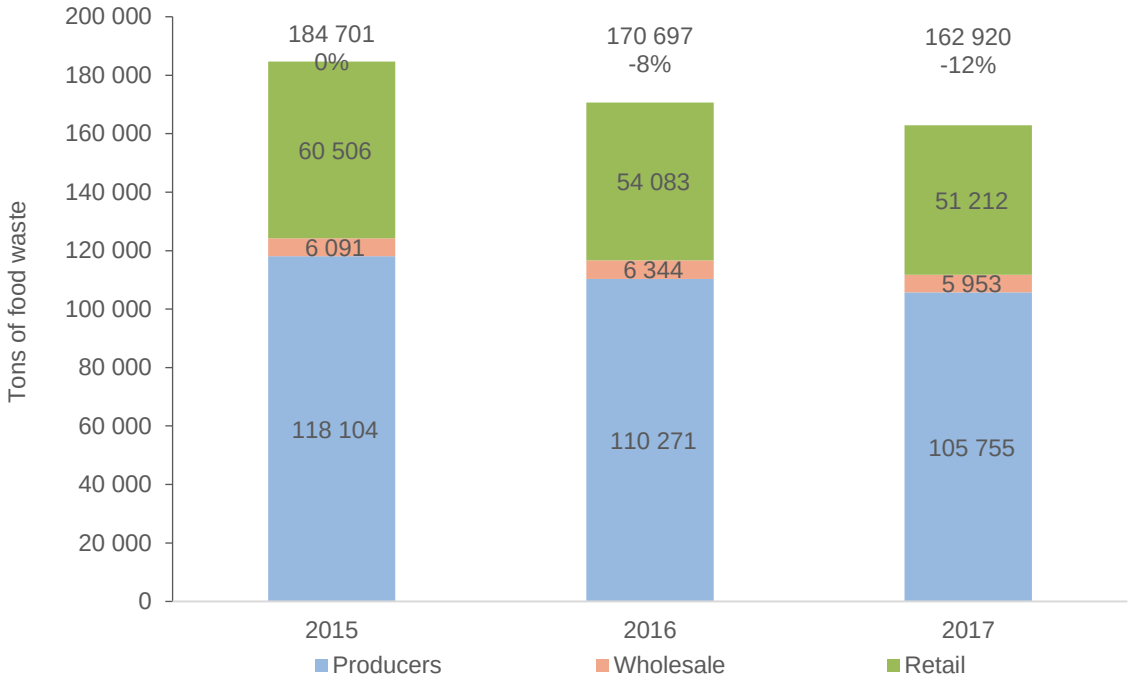

Figure 3-3). The percentages marked represent the waste for the various product groups in 2017 and the broken line shows the weighted average for waste in 2017.

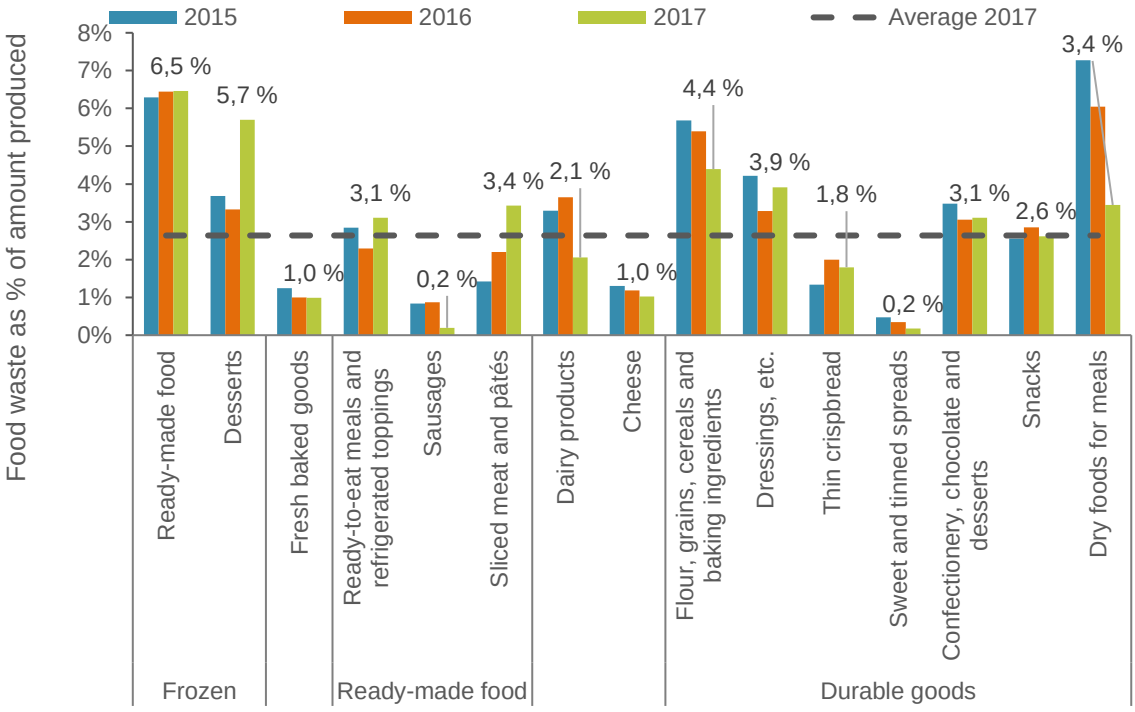

Figure 4-1 Trends in waste from 11 producers 2015-2017 as a percentage of production

This figure is intended to show trends in the proportion of food waste per product group that were used for scaling up to national trends in food waste by producers. Note that not all product groups are included in this figure, as several groups, such as meat, beverages and frozen vegetables, lack complete time series from 2015 to 2017.

The figure shows that total food waste by producers amounted to 2.6% in 2017 for the 11 companies with comparable data. From 2015 to 2017, the proportion of food waste in the total quantity produced decreased from 3.2%, which corresponds to a reduction of about 16%.

During this period, food waste has been reduced the most for sweet and tinned spreads (-63%), followed by dry foods for meals (-53%), sausages (-49%), dairy products (-38%), baked goods, Flour, grains, cereals and baking ingrediens (-23%), cheese (-21%), fresh baked goods (-20%), confectionery and desserts (-11%) and dressings, sauces, oils and margarine (-7%).

The product groups showing increased waste are ready-made food (+3%), ice cream and frozen desserts (+55%), fresh ready-made food (+9%), sliced meat and pâtés (+183%), biscuits (+34%) and snacks (+2%). The increase for sliced meat and pâtés was partly due to replacement of equipment and quality errors. In the case of ice cream and frozen desserts, the increase was due to technical problems, rebuilding and the launch of a new product. The final report from the ForMat project showed a similar jump in the food waste figures for ice cream and frozen desserts in 2013, which was rapidly reduced to “normal” levels in 2014. That temporary increase was also related to challenges with new products (Stensgård & Hanssen 2016), which suggests that the increase in 2017 for this product group will also be temporary.

4.1.2 Food Waste by Product Group and Causes in 2017

As mentioned above, only 11 out of the 24 companies have comparable data for the period 2015 to 2017, and have therefore been included in the time series. Figure 4-2 shows food waste as a percentage of production for all the 24 companies reporting in 2017, and forms the basis for the estimate of food waste by producers (Figure 3-1).

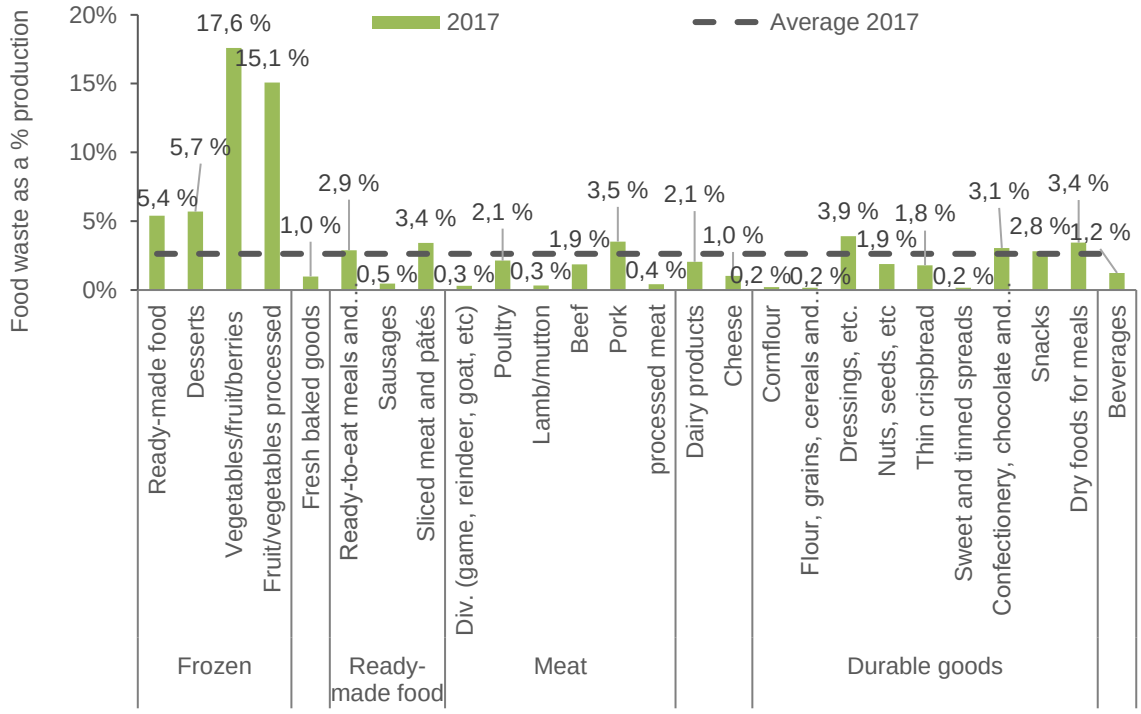

Figure 4-2 Food waste as percentages of amounts produced by 24 food producers in 2017

This figure shows some additional product groups to those in Figure 4-1, including frozen vegetables/fruit/berries, fresh meat and beverages. Note that the proportions of food waste for the product groups included in Figure 4-1 are not necessarily at the same levels in this figure, as several companies have reported on the same product groups.

For all product groups, the mapping is more or less complete and includes all food waste that arises from raw material, processing/production, packaging and finished products. The only incomplete product groups are liquid dairy products, confectionery/desserts and beverages. For liquid dairy products, data related to changeovers between production and cleaning is lacking, while for confectionery/desserts, not all finished products have been mapped and for beverages, only finished products have been mapped. Companies are constantly working to improve their data, but for companies that have only recently begun to study their waste, it often takes some time to prepare and implement data collection procedures for all stages of their processes.

The figure also shows that total food waste in 2017 for the 24 companies amounted to 2.6% of the quantity produced, which happens to be equal to the food waste figure for the 11 companies with a complete time series from 2015.

Frozen vegetables/fruit/berries have a notably high proportion of waste, corresponding to 17.6% (the average is 2.5%). This is partly due to strict quality requirements and a lack of alternative utilisation of rejected raw materials, and partly because raw materials come directly from farms, which means that the food waste that usually occurs in packing facilities moves up the value chain.

The main causes of food waste by producers are:

- Shelf life

- Distribution of shelf life between stages of the value chain
- Quality requirements
- Production errors
- Starting and stopping production
- Changing product lines

In general, many food producers report that time to expiration/shelf life is an important cause of waste, in that manufactured and packaged goods often do not meet requirements for the distribution of shelf life between the various stages of the value chain. Shelf life is defined by the Norwegian standard STAND001, which states that an overall objective is that manufactured goods should be dated with the consumer in mind. If the expiration limits in the table are slightly exceeded, those involved should aim for solutions that lead to the lowest possible food waste.

A short shelf life may be symptomatic, meaning that there are one or more root causes of products failing to meet the expiration requirements. For example, some companies report overproduction and variation in sales as causes of waste, which may be possible root causes of the discard of products due too short expiration time. Shelf life may also be a systematic cause, meaning that the requirement for distribution of shelf life or the actual date marking is the challenge. Food producers are currently making effort to rectify this.

Other important causes of food waste among producers are quality requirements, production errors, starting production, cleaning and changing of product lines.

4.1.3 Measures Implemented and Food Waste Management

Of the 24 reporting companies, 20 state that they implemented internal food waste reduction measures during 2017, while 10 of them report having implemented measures to reduce food waste in other stages of the value chain.

In terms of internal food waste reduction measures, many companies report an increased internal focus on food waste and/or staff training in food waste prevention. Since many of the companies (13) are new to food waste mapping, several have also reported the start of mapping or improved methods/procedures as separate food waste reduction measures.

Other internal food waste measures implemented in 2017 were:

- Better forecasting and cooperation on the exchange of data between the stages of the value chain (can also reduce food waste in the other stages)
- Measures to improve predictability of quantities and timing (production planning)
- Investment in technology to reduce food waste in production, packing, etc.
- Agreements with alternative sales channels and increased sales of goods that do not meet date labelling requirements
- Redistribution/donation of products that do not meet date labelling requirements
- Increased focus on, or requirements for, raw material quality (may shift food waste to an earlier stage of the value chain)
- Optimisation of storage conditions
- Repackaging of poorly packaged goods

Anti-food waste measures in other stages of the value chain in 2017 were:

- New types of packaging and packaging in smaller units.
- Measures to influence consumers' views on date stamps

Several food producers have used additional labelling on goods labelled "best before". In March, many players in the food industry agreed on "often good after" as additional wording to describe shelf life. This measure will help raise awareness among both consumers and food industry employees that "best before" is only a description of quality and that the item can be sold and consumed after the expiry date if the quality is good; the measure also encourages consumers to use their senses more to determine the quality of foods.

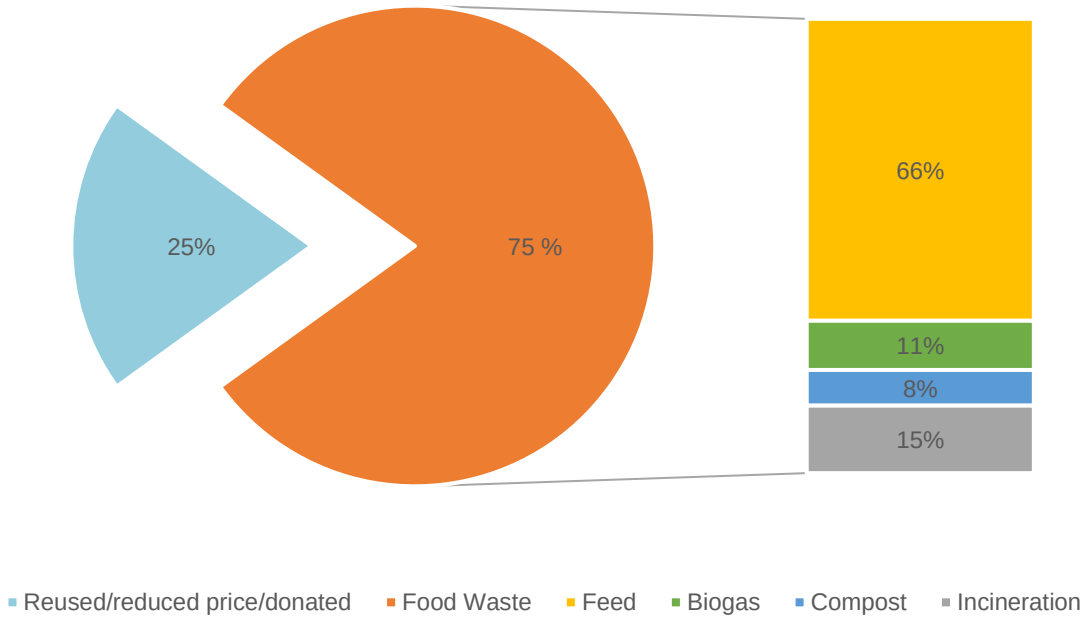

Figure 4-3 shows the proportion of food that companies have avoided wasting by either using it as an input factor in other food production, selling it at a reduced price or donating/redistributing it (25% in total), and the proportion of food allotted to alternative management (75%), divided into animal feed, biogas, compost and combustion.

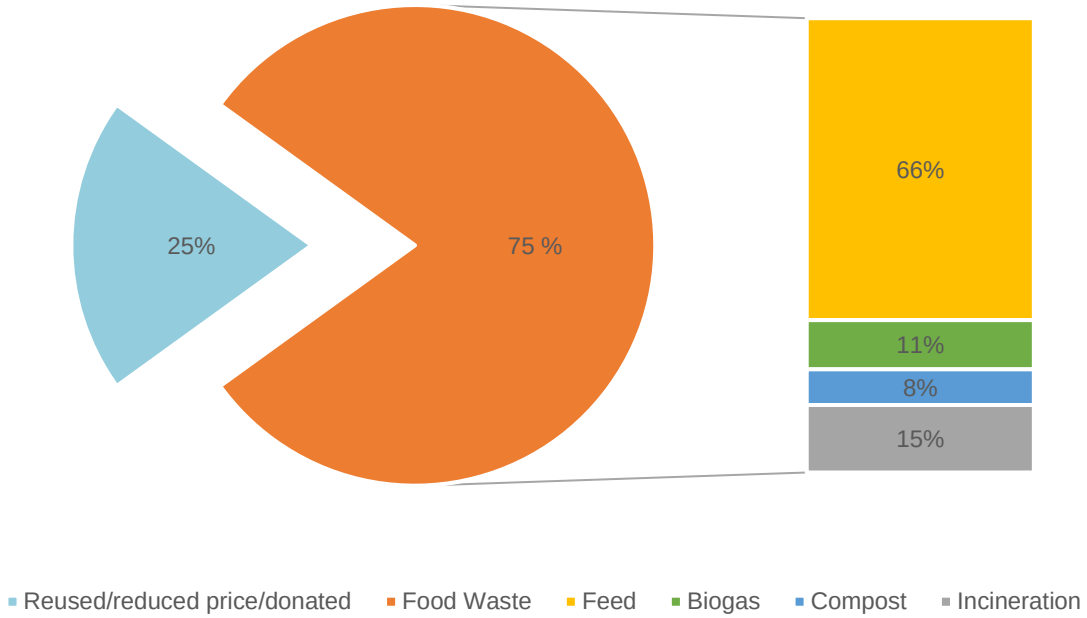

Figure 4-3 Proportions of food donated/sold at reduced prices and alternative uses of food waste

The figure shows that 25% of the food that companies could not sell at full price was used in other food production, donated or sold at a reduced price (alternative sales channels), while the remaining 75% ended up as food waste. 66% of this food waste was used as animal feed, 11% as biogas and 8% as compost. 15% of the food waste was sent for combustion. Although it is always best to avoid food waste, it is also important to utilise the food waste that does occur as efficiently as possible. It is therefore gratifying that about two-thirds of food waste from producers is used as animal feed.

The proportion of food that was not discarded is probably somewhat larger, as several companies reported redistributing food in 2017, but could not give precise figures. Of the non-discarded food for which the companies had data, most (76%) was used in other food production, 22% was sold at reduced prices, while 1% was redistributed. There would thus seem to be a potential for increased redistribution and increased *recording* of redistributed food.

4.2 Wholesalers

4.2.1 Trends by Product Group

This section shows trends in food waste by product group for wholesalers from 2015 to 2017 in percentages of sales, and causes of wholesale food waste.

Food waste varied between product groups: fresh fruit and vegetables, fish and shellfish and dairy products had the highest proportion of waste, while dry goods, beverages and frozen food had the lowest.

Six out of nine product groups showed a reduction in waste, while three showed an increase.

Fact Box 4-2 Summary of figures for wholesalers in 2015 and 2017, and trends from 2015 to 2017

Product groups with the *most* waste as a percentage of sales were:

1) Fresh fruit and vegetables (0.43%)
2) Fish and shellfish (0.12%)
3) Dairy products (0.09%)

Product groups with the *least* waste as a percentage of sales were:

1) Dry goods (0.02%)
2) Beverages (0.02%)
3) Frozen food (0.03%)

Product group	% waste 2015	% waste 2017	Change in % waste 2015-2017
Frozen food	0.02%	0.03%	+17%
Fresh fruit and vegetables	0.47%	0.43%	-10%
Baked goods	0.01%	0.05%	+72%
Fresh ready-made food and delicatessen items	0.16%	0.04%	-300%
Fish and shellfish	0.18%	0.12%	-48%
Meat	0.01%	0.06%	+79%
Dairy products	0.04%	0.09%	-61%
Dry goods	0.02%	0.02%	-12%
Beverages	0.02%	0.02%	0%

Figure 4-4 shows wholesale food waste as a percentage of sales from 2015 to 2017 for all companies reporting to the project. The percentages marked represent the waste for the various product groups in 2017 and the broken line shows the weighted average for food waste in 2017.

Figure 4-4 Trends in wholesale food waste as percentages of sales from 2015 to 2017

The figure shows that wholesale food waste as a percentage of sales was about 0.23% overall in 2017. From 2015 to 2017, food waste as a percentage of sales decreased by 3%.

The product group with the greatest proportion of food waste is fresh fruit and vegetables. This group generally has high wastage in all stages of the value chain, which is related to its particular characteristics (shorter shelf life). Fruit and vegetables are also particularly susceptible to impact damage and other quality deterioration during transport and storage.

The figure shows that food waste in relation to sales decreased considerably from 2016 to 2017 in the case of fresh ready-made food and delicatessen items, while baked goods, meat and dairy products increased throughout the period. It is worth noting that the figures for the wholesale stage are unreliable, and trends for product groups may therefore be incorrect.

4.2.2 Causes

Figure 4-5 shows causes of wholesale food waste in 2017.

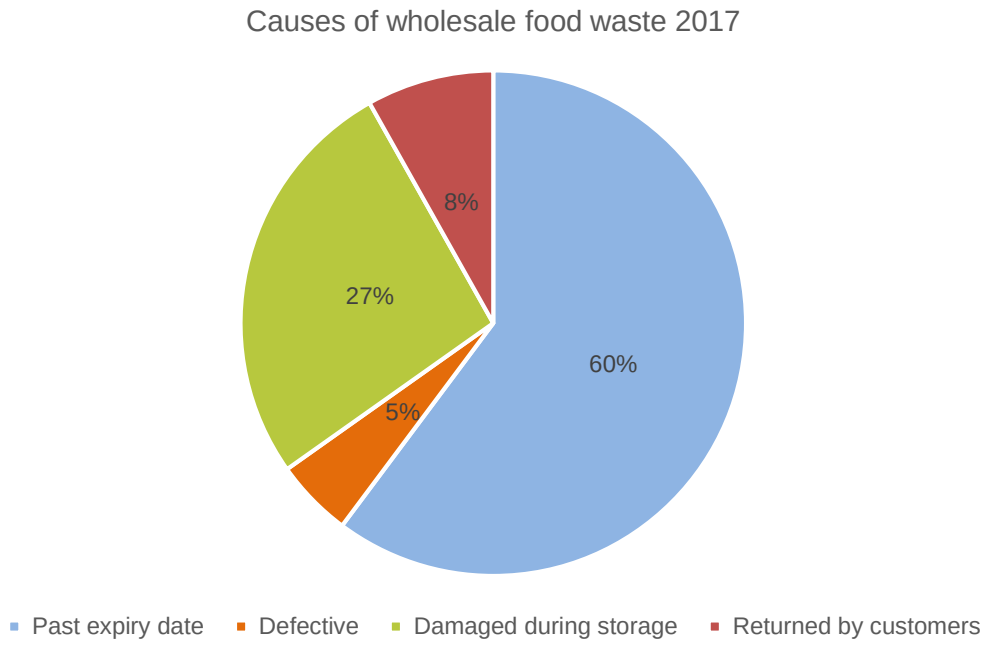

Figure 4-5 Wholesale food waste in 2017 according to reason for disposal

The figure shows that most food waste at the wholesale level is related to food past its expiry date (60%) or damaged during storage (27%), while defective items and those returned by customers account for a smaller proportion (5% and 8% respectively).

Note that estimated food waste by wholesalers is very low at only 0.23% of total sales; therefore, although much of the waste is due to food being past its expiry date, this is still a very modest proportion of all food sold.

4.3 Retailers

4.3.1 Trends by Product Group

This section shows trends in retail food waste for selected product groups from 2015 to 2017 in percentages of sales, and describes causes and anti-food waste measures.

Thirteen of fifteen product groups showed a reduction in food waste, while two showed an increase (baked goods and fresh vegetables). However, these latter two groups are large in volume, which means that price reductions, donations and innovative solutions for utilising fresh fruit and vegetables and baked goods at the retail level will be important focus areas in the future.

Fact Box 4-3 Summary of retail figures for selected product groups in 2015 and 2017, and trends from 2015 to 2017

Product groups with the *most* waste as a percentage of sales were:

1) Fresh baked goods (10.2%)
2) Fresh vegetables (4.5%)
3) Fresh fish (4.4%)

Product groups with the *least* waste as a percentage of sales were:

1) Frozen ready-made food (0.2%)
2) Dry goods (0.5%)
3) Fresh eggs (0.6%)

Product group	% waste 2015	% waste 2017	Change in % waste 2015-2017
Frozen ready-made food	0.3%	0.2%	-25%
Fresh fruit	4.5%	4.2%	-5%
Fresh vegetables	4.2%	4.5%	+8%
Fresh potatoes	2.3%	2.0%	-11%
Fresh baked goods	10.0%	10.2%	+2%
Fresh ready-made food	4.8%	3.7%	-23%
Sausages	3.3%	2.5%	-26%
Sliced meat and pâtés	2.2%	1.6%	-28%
Fresh fish	6.5%	4.4%	-33%
Fresh meat	4.9%	3.3%	-34%
Minced meat	2.2%	1.4%	-34%
Fresh eggs	0.7%	0.6%	-13%
Milk products	1.1%	0.8%	-29%
Cheese	1.0%	0.9%	-10%
Dry goods	0.9%	0.5%	-40%

The table shows that for the selected product groups, food waste as a percentage of sales decreased by 16% from 2015 to 2017. Note that this section only considers a selection of product groups. For retail trends as a whole, see Chapter 3. These particular groups have been selected

because of their high waste and/or high volume, which means that the average waste in the retail sector is lower.

In general, foods with a short shelf life, such as fresh fish and fresh ready-made food, have a high proportion of food waste in relation to sales. This also applies to food with a short shelf life but without a date stamp, i.e. fresh baked goods and fresh fruit and vegetables. Goods with a long shelf life such as frozen ready-made food and dry goods generally have very little waste.

Figure 4-6 shows changes in retail food waste as a percentage of sales for selected product groups from 2015 to 2017.

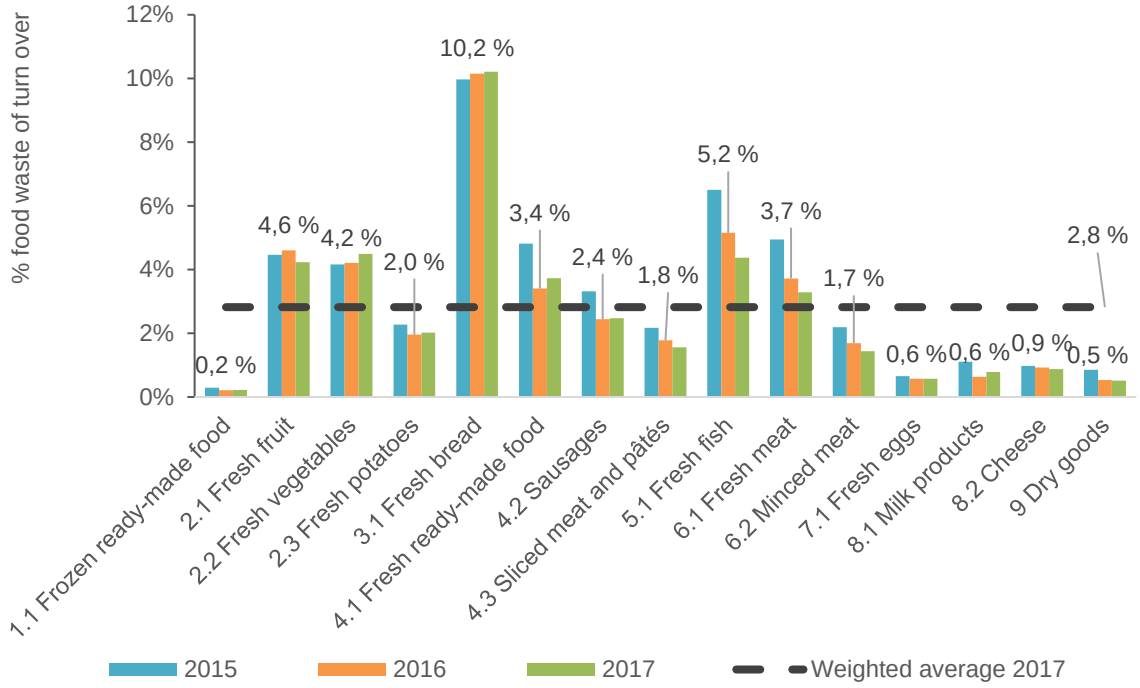

Figure 4-6 Changes in retail food waste as a percentage of sales from 2015 to 2017

The figure shows that average retail food waste for the selected product groups was 2.8% of sales (broken line). The product groups with above average waste were fresh fruit and vegetables, fresh baked goods, fresh ready-made food, fish and meat. These are generally products with a short shelf life, while goods with a long shelf life such as dry goods, frozen ready-made food, eggs and cheese have considerably lower waste than the average for the selected product groups.

4.3.2 Causes of Waste and Anti-Waste Measures Implemented

Much of food waste in the retail sector is food that has expired. This is to be expected, since the retail trade is one of the last stages of the value chain.

As shown in this chapter and in Figure 3-8, waste of fresh fruit and vegetables and fresh baked goods is a major challenge for retailers. One waste reduction initiative that proved to be effective at the retail level was the introduction of systematic price reductions on goods with a short remaining shelf life. This measure was mainly used for foods with a date stamp, but in 2016 some chains also introduced price reductions on fruit and vegetables and bread and baked goods. Figure 4-7 shows the trend in amounts of fruit and vegetables and fresh bread sold at reduced prices in one retail chain from 2015 to 2017.

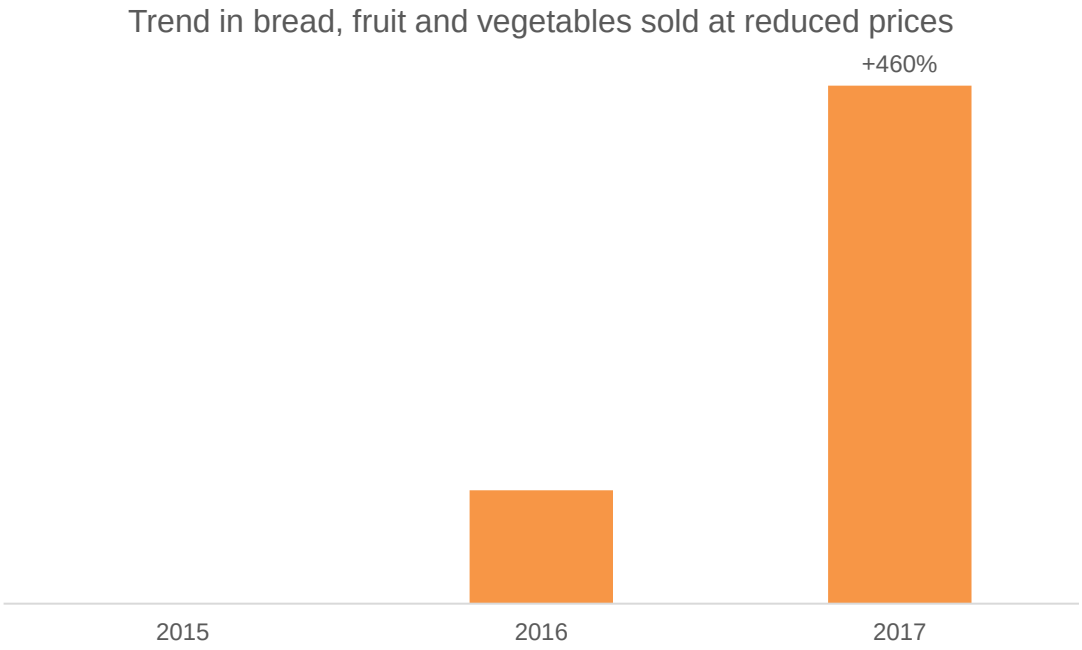

Figure 4-7 Trend in amounts of bread, fruit and vegetables sold at reduced prices in stores

The figure shows that amounts of fruit, vegetables and fresh bread sold at reduced prices have increased more than fivefold from 2016 (when the reductions were introduced) to 2017 in the retail chain in question. The full effect of this measure has not yet been seen in the retail trade in general (Figure 3-8 and Figure 4-6), since it has not been implemented in all chains and stores, but it is to be hoped that this initiative will take off in 2018.

Work is in progress to introduce more detailed food waste codes in the retail sector, which will make it easier to determine how much of what is recorded as food waste actually is food waste. Some food sold at reduced prices or donated is currently recorded as waste in certain stores. The proportion of stores with separate codes for donations and price reductions is increasing; hopefully, it will be possible to include this in reporting from retailers next year, as is already the case with wholesalers and producers.

In addition to price reductions and donations, several of the stores have implemented other measures for food waste ***prevention***, such as:

- Efforts to improve procedures and product flow
- Local adaptations of product range in stores
- In-house training and competence development (knowledge of food waste, including the food waste toolkit and raw materials).
- Internal studies of food waste using KPIs
- Focus on everyday procedures related to campaigns and expiry date checks
- Strong tape to repair broken packaging on goods that can be used

The following measures have been implemented for food waste ***reduction***:

- Price reductions on goods with a short remaining shelf life
- Price reductions on fresh fruit and vegetables and fresh baked goods.
- Relocation of fruit and vegetables.
- Sale of small fresh baked goods at reduced prices 30 minutes before closing time
- Use of large-volume goods with a short shelf life in internal production.
- Cooperation with the anti-food waste campaign “Too Good To Go”.
- Donation of food

In addition to the above efforts at food waste prevention and reduction, various measures have been implemented aimed at consumers and other stages of the value chain, such as the sale of “ugly” vegetables and fruit and information and attitude-changing campaigns (see Stensgård and Hanssen 2016).

4.4 The Hotel and Catering Sector

Efforts to prevent and reduce food waste in the hospitality industry have been organised in a new project called KuttMatsvinn2020. The aim of the project is to involve as many operators in the hospitality industry as possible (hotels, restaurants, employee cafeterias, catering services and the public sector) who will attempt to reduce their food waste by 20 percent by the year 2020. A research project is running parallel to this, focusing on surveys of food waste in catering establishments and overall for the sector.

The research project KuttMatsvinn2020 has provided food waste figures for hotels and employee cafeterias.

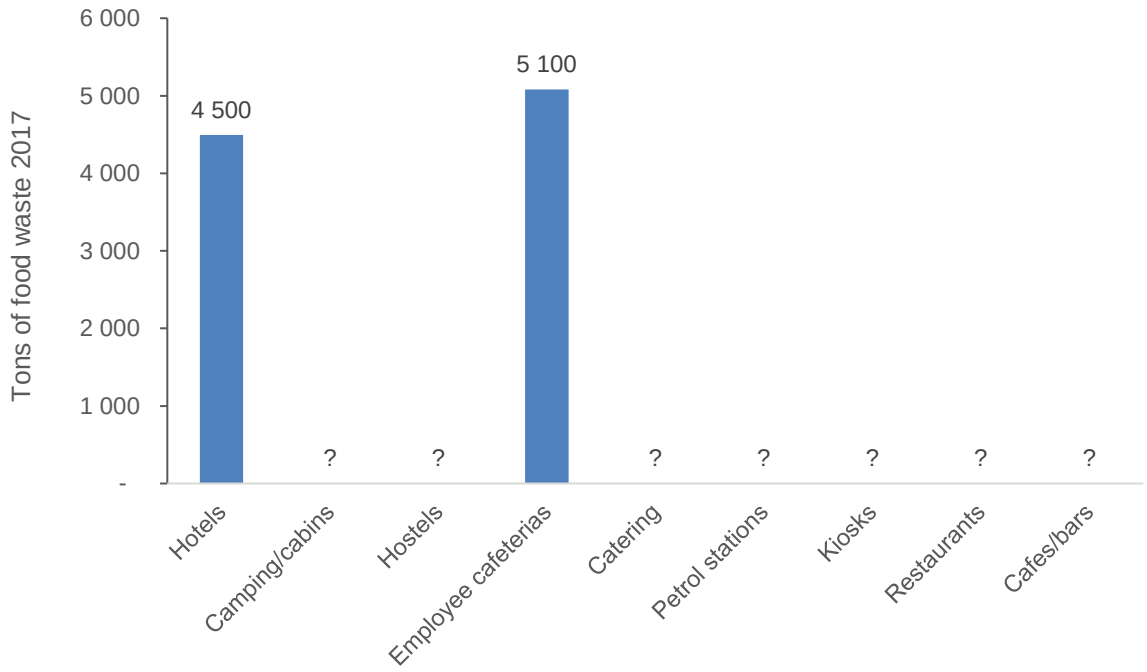

Figure 4-8 shows estimated total food waste in the parts of the hotel and catering sector studied in 2017. The parts of the sector not included in the survey are shown with question marks.

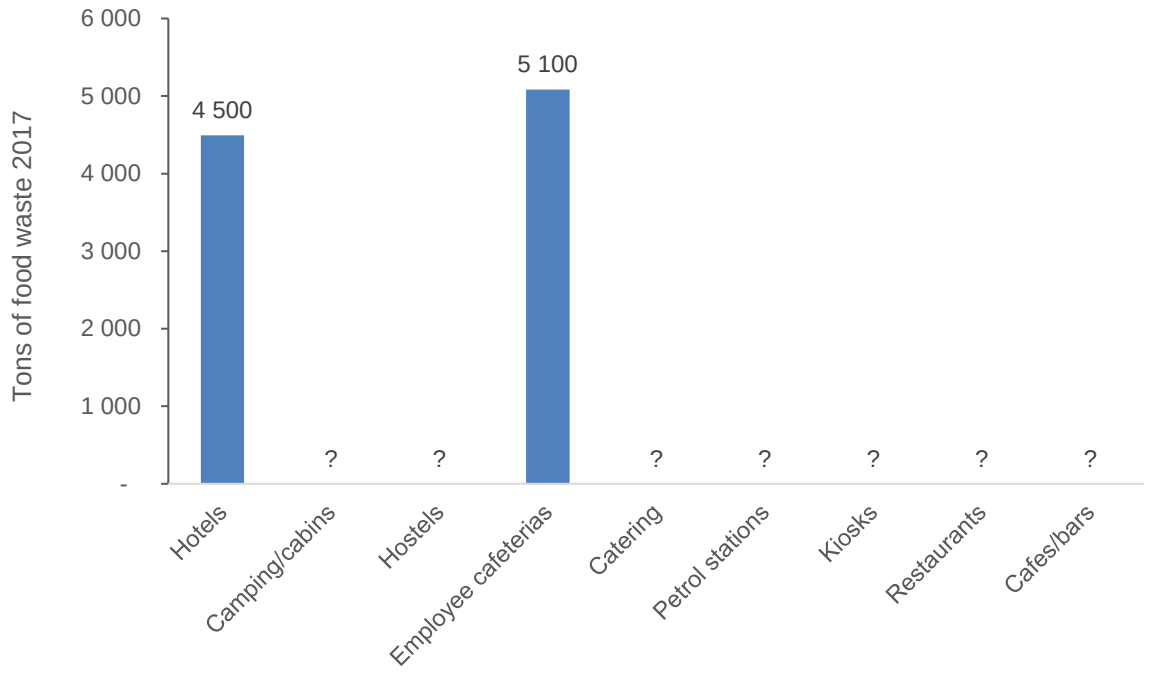

Figure 4-8 Estimate of tons of food waste in parts of the hotel and catering sector

The figure shows an estimate of food waste in hotels and employee cafeterias; these two segments accounted for about 9600 tons of food waste in 2017. Note that the figures are somewhat unreliable.

A survey of food waste occurring in kiosks, petrol stations, restaurants, cafes/bars and catering took place in late 2018 in the sectoral research project KuttMatsvinn.

5 Consumer Studies

5.1 What kinds of food are we throwing away?

Trends in the proportion of respondents who report having recently thrown away different product groups for the years 2010 to 2018 are presented in Figure 5-1.

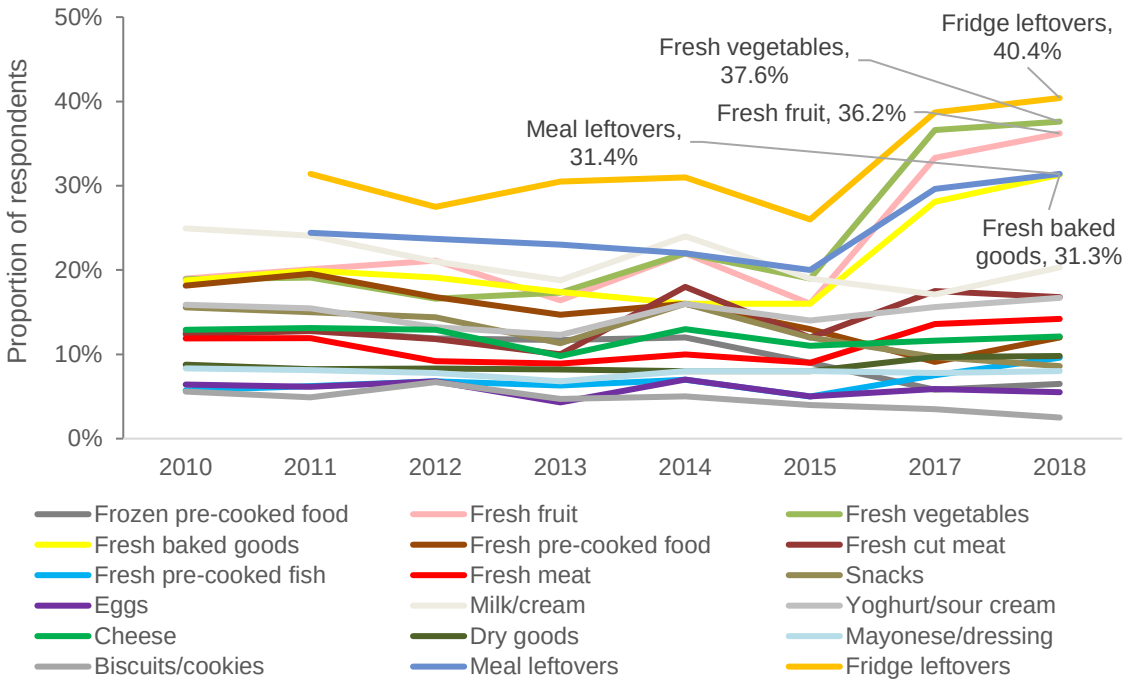

Figure 5-1 Proportion of consumers reporting having thrown away different types of food in the past week 2010-2018

The figure shows that five product groups had much greater waste in 2017 and 2018, namely fridge leftovers (40.4%), fresh vegetables (37.6%), fresh fruit (36.2%), meal leftovers (31.4%) and fresh baked goods (31.3%). The proportion of respondents who reported having discarded these groups increased markedly from 2015 to 2017, but it is uncertain whether this was a real increase in food waste by Norwegian consumers or whether the increase was due to greater awareness among consumers of what kinds of food they are actually throwing away, which would mean that this part of the graph is more consistent with actual behaviour.

Waste sample analyses conducted in 2011, 2015 and 2017 have not revealed any increase in the amount of food waste per capita (Stensgård and Hanssen 2015; Syversen et al. 2018), which may indicate that the increase shown in Figure 5-1 is not a real increase. At the same time, the data basis for the waste sample analyses has improved significantly during the period; the 2017 results are therefore not directly comparable with those from 2011 and 2015. It is therefore impossible to confirm or deny whether the increase for the above product groups is real, based on the existing time series for waste sample analyses.

A further complicating factor is that the questions were somewhat differently worded in 2017 and 2018 compared to 2010-2015, which might also explain the increase for these product groups. Another possible explanatory variable for the increase is that when the ForMat project was concluded in 2016 and the final report published, there was an increase in press releases and consumer interest in food waste issues. As the results of the consumer surveys for 2017 and 2018 (the years after the launch of the final report) are more consistent with those of waste sample analyses, including the composition of the waste (Stensgård and Hanssen 2016; Syversen et al. 2018), this may indicate that consumers have become more aware of what they actually throw away, which would make the 2017 and 2018 results more in line with reality than in previous years. If this is true, it may also explain why the marked increase we saw from 2015 to 2017 has levelled off somewhat in 2018.

Considering that so many respondents (78%) reported having recently thrown away fridge and meal leftovers, and that “pan and plate leftovers” are the largest group in the waste sample analyses (Syversen et al. 2018), the survey was expanded this year to include a question on what the leftovers consisted of.

Figure 5-2 shows the composition of fridge and meal leftovers, based on the question: “What types of food does your household most often throw away as leftovers from meals?”.

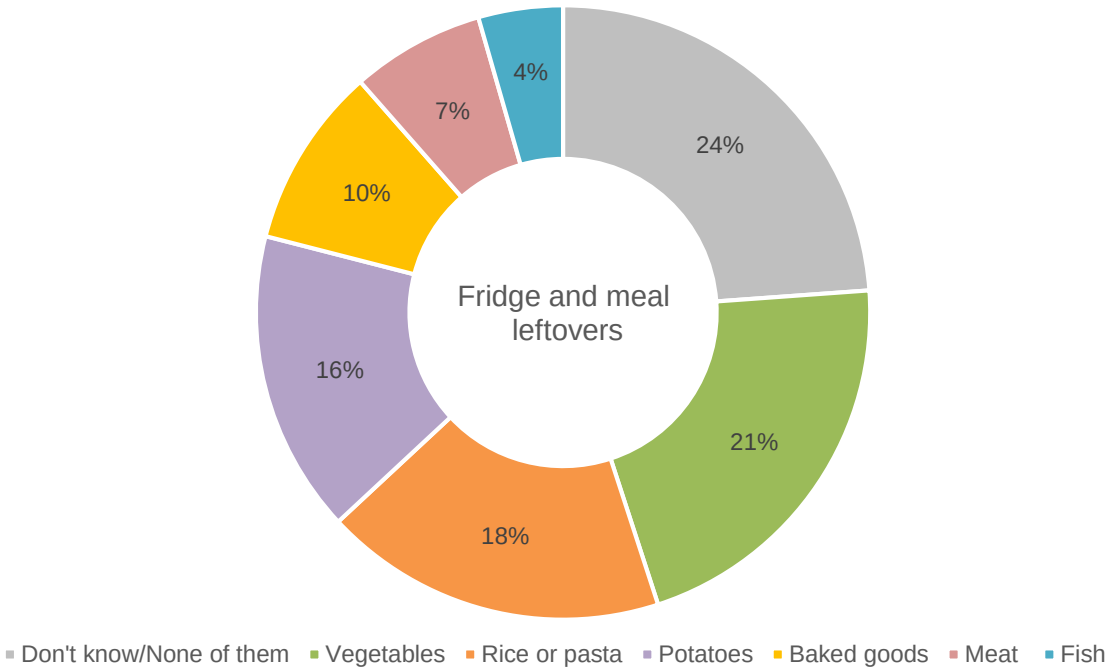

Figure 5-2 Types of food most often discarded as fridge and meal leftovers (2018)

Among the alternatives, most respondents mentioned vegetables (21%), rice or pasta (18%) and potatoes (15%). These foods are not usually considered as the main components of the meal and are also relatively inexpensive. Further, 9.5% most often threw away baked goods, 7% meat, while only 4.5% stated that fish was the most usual kind of meal leftover discarded.

Almost a quarter (24%) of respondents stated that they did not know what types of leftovers they normally threw away, or that they did not usually dispose of any of the alternatives given. This may be because many people are unaware of what they throw away, because the respondents often throw away mixed dishes/combinations of the groups mentioned, or because food groups not mentioned are often discarded after meals.

As this was the first time consumers were asked about the composition of their leftovers, it is difficult to know how representative the distribution is and whether it agrees with reality. It will therefore be very interesting to see future trends in responses to this question.

5.2 Why do we throw away food?

The reasons for discarding selected product groups in 2018 are shown in Figure 5-3. The questions differed somewhat from those of previous surveys, which means that the 2018 results cannot be directly compared with results from previous years.

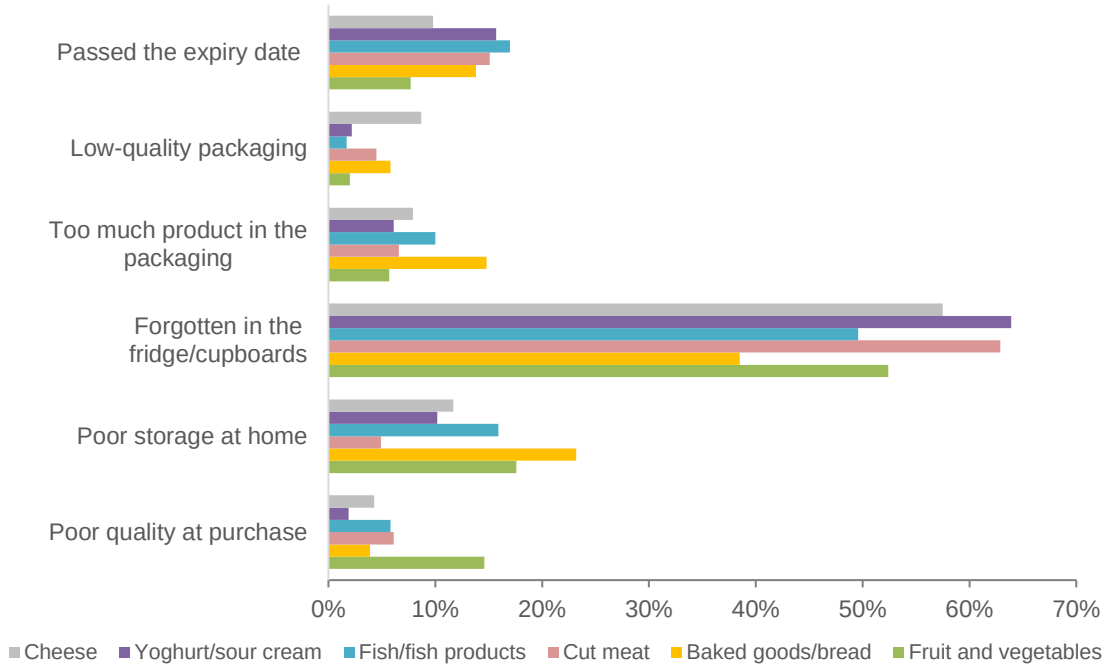

Figure 5-3 Main reason for discarding different types of food in 2018

Figure 5-3 shows that the most important reason for food waste in the selected product groups was “forgotten about it in the fridge/cupboard”; here, 38% (baked goods) to 64% (yoghurt/sour cream) of the respondents gave this as a reason. For fruit and vegetables and fresh baked goods, “poor storage at home” was the second most important reason for discard (18% and 23% respectively), a slight decrease on 2017. The causes revealed in this study indicate that the greatest challenge for consumers is to keep track of the food in their refrigerator and cupboards and use it up before buying more food.

Packaging-related reasons were generally of little importance, except for the size of packs, which was said to be too large for fresh baked goods (15%) and fish products (10%).

Compared with 2017 and the period 2010 to 2015, the most notable change in responses to this question is that far fewer people reported throwing away food because it was past its expiry date. In 2017 the figure was 13-43%, but in 2018 it was as low as 8-17%.

Figure 5-4 shows changes in the percentage of respondents stating that “past its expiry date” was their main reason for discarding the various product groups in the period 2010 to 2015 and in 2017 and 2018. Note that cheese is not included in the figure, as this food was not included in the years 2010-2015.

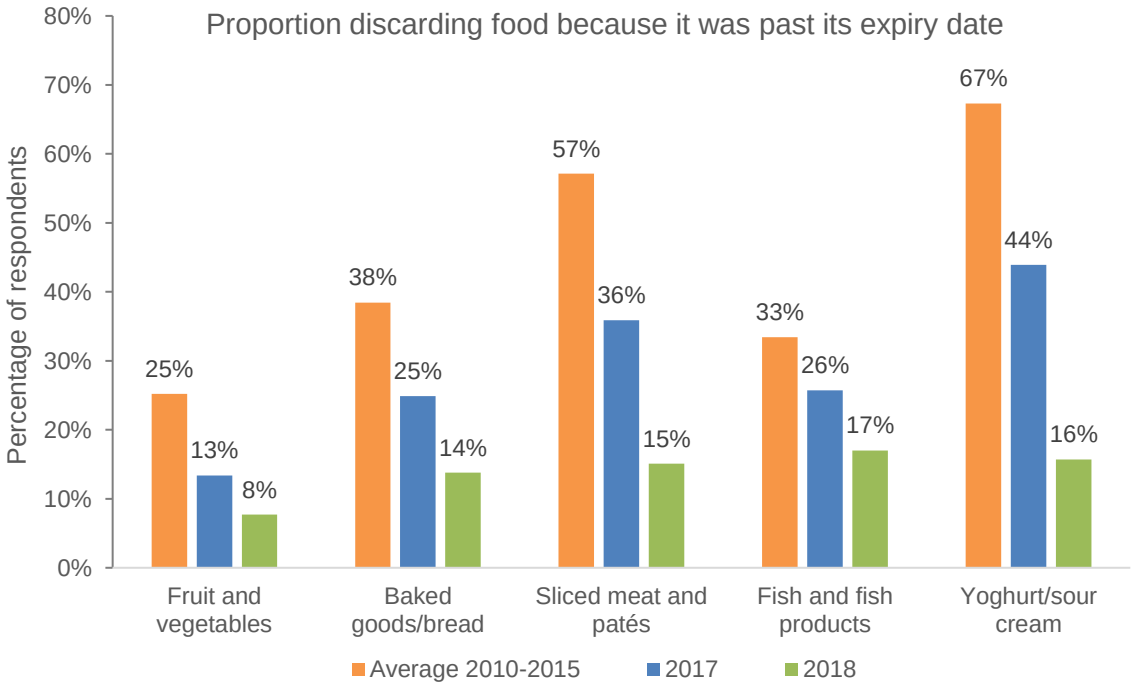

Figure 5-4 **Changes in the proportion of respondents stating that "past its expiry date" was the main reason for discarding various product groups, average 2010-2015, and 2017 and 2018.**

The figure shows that fewer and fewer consumers are disposing of food only because it is past its expiry date. The fact that fewer respondents are giving this as the main reason for throwing away food is a positive development, indicating that many years of work to change consumer attitudes to date stamps has yielded results. This trend is probably due to the food industry's efforts to introduce additional labelling such as "look, smell and taste", "often good after" and "not bad after".

For three of the product groups, however, more than 15% of respondents still state that the expiry date is the main cause. This applies to fish and fish products (17%), yoghurt/sour cream (16%) and sliced meat for open sandwiches (15%).

5.3 Who throws away food?

5.3.1 Typical Attitudes and Behaviour Influencing Food Waste

Chi-square tests (statistical analyses) were conducted to investigate possible associations between different behavioural patterns related to purchases and meals and the number of product groups discarded. The results of these tests are presented in Table 5-1, which also shows that all the correlations found in the analysis were weak.

Table 5-1 Chi-square tests of relationships between attitudes/behaviour and number of product groups discarded

Characteristics	Elaboration
Always use a shopping list*	Respondents who do not use a shopping list also report discarding more product groups.
Purchasing frequency*	Respondents who shop for food more than four times a week also report discarding more product groups.
How many days a week do you eat dinner at home?*	Those who often eat dinner at home report discarding more product groups than those who seldom eat dinner at home.
How many meals of open sandwiches do you eat at home each week?*	Those who eat the most meals of open sandwiches at home also report discarding fewer product groups.
Try to live as eco-friendly a lifestyle as possible*	Those reporting trying to live as eco-friendly a lifestyle as possible also report discarding fewer product groups.

*Weak significant correlation

This table shows a significant relationship between the statement “I always use a shopping list” and the number of product groups discarded. Respondents who say they always use a shopping list also report discarding less food than those who do not use a list. This suggests that the use of a shopping list leads to better planning and thus less food waste. However, there is no significant correlation between not using a shopping list and buying too much food.

With regard to purchasing frequency, there is also a slight significant correlation between shopping often and discarding food frequently. This suggests that fewer visits to the shops may lead to less food waste, probably because infrequent visits often involve better planning and are less likely to lead to impulse buying.

We also see a significant correlation between living as eco-friendly a lifestyle as possible and the number of product groups discarded, where those who report eco-friendliness also report discarding somewhat less food than those who do not say they aim at an eco-friendly lifestyle. This is perhaps to be expected, but on the other hand, we find no significant correlation between those who replied that they sort their waste for the sake of the environment and the number of product groups discarded. In other words, it is not clear that people who believe they are doing more for the environment throw away less or more food than other consumers.

New sentences/behaviour patterns added to the consumer study in 2018, such as “Do you use apps like ‘Too Good to Go’?”, “In our household we sort waste for the environment”, “We buy food in food boxes/online” or “We try to live as eco-friendly as possible”, show no significant relationship with the number of product groups discarded.

5.3.2 Typical Characteristics Influencing Food Waste

Table 5-2 shows various socio-demographic characteristics with a significant correlation with the number of product groups discarded.

Table 5-2 Socio-demographic characteristics with a significant correlation with the number of product groups discarded

Characteristics	Elaboration
Age*	Young people (<40) report discarding many products, while older people (>65) report discarding few products.
Gender*	More women report discarding 2-6 products, while more men report discarding 7-12 products.
Marital status*	More married/cohabiting couples with children report discarding a large number of products.
Income*	Respondents with the lowest income report discarding few products, while those with a relatively high income report discarding more products.
Everyday situation*	Pensioners generally discard little food. People in employment discard most products.
Number of children under 18 in the household*	Families with several children report discarding more than those with few or no children.

*Weak significant correlation

The table shows that there are more young consumers (under 40) who state that they throw away many product groups. By contrast, respondents over 65 most often report throwing away few product groups.

The gender statistics show no major differences between men and women, but the proportion of women reporting having discarded one or no product groups in the past week is somewhat higher than the figure for men. At the same time, a larger proportion of men than women reported having thrown away between seven and twelve different groups over the past week.

The table also shows that pensioners/people on leave generally state that they dispose of few product groups. This suggests that available time is an important factor affecting the number of foods discarded. This tendency is reinforced by the fact that the number of children under 18 in the household has the strongest correlation of all the socio-demographic factors with the number of product groups discarded. The proportion who report frequent food waste is clearly greatest for those who have two or more children under 18 in the household. This characteristic is discussed in more detail in the next section, as this is one of the main criteria for creating four different consumer profiles in terms of amounts of food discarded.

Geographical region, type of housing and size of town/village where respondents live are all socio-demographic characteristics that have no significant correlation with the number of products discarded.

5.3.3 Four Consumer Profiles and their Food Waste Habits

As mentioned in Chapter 0, this year is the first time analyses have been conducted of four different consumer profiles, where respondents have been categorised according to income, place of residence, age and family situation.
This is to gain insight into whether food waste and associated behaviour and attitudes can be linked to different types/characteristics of consumers.

Based on the criteria described in Chapter 0, the respondents who fitted into one of the four consumer profiles were distributed accordingly, as shown in Table 5-3.

The table below outlines the presumed characteristics of the consumer profiles, in order to give a clearer picture of the types of people belonging to the different groups, in addition to the four criteria. Of a total of 2007 respondents in 2017 and 2018, 674 respondents belong to one of the consumer profiles, i.e. about one-third of all respondents in the two years (33.58%).

Table 5-3 Characteristics of consumer profiles

Characteristics of consumer profiles	Profile 1 Low income and little available time	Profile 2 High income and little available time	Profile 3 Low income and much available time	Profile 4 High income and much available time
Characterisation of profile	Single parent	Working couple with children	Single, unemployed, no children	Working couple with adult children
Age	25-39 or 40-59	25-39 or 40-59	40-59 or 60+	40-59 or 60+
Number of persons in household	≥2 persons	≥4 persons	1-2 persons	2 persons
Number of children under 18 in household	≥1child	>2 children	0 children	0 children
Total household income	≤NOK 400 000	≥NOK 701 000	≤NOK 400 000	≥NOK 701 000
Marital status	Single with child(ren)	Married/cohabiting with children	Single with or without children	Married/cohabiting with adult children not living with them
Everyday situation	Full- or part-time work	Full- or part-time work	Disability benefits or pension	Full-time work or pension
Number of respondents	91	185	134	264

As the basis for comparing the food waste behaviour of the four consumer profiles, seven product groups were selected. Firstly, vegetables, fruit, fresh baked goods, leftovers from meals and leftovers from storage, which are the groups most respondents report having discarded in the past week. In addition, fish and meat were selected because they are more expensive foods, since it could be interesting to explore any potential difference between the food waste habits of the consumer profiles for these foods, since income was used as one of the main criteria.

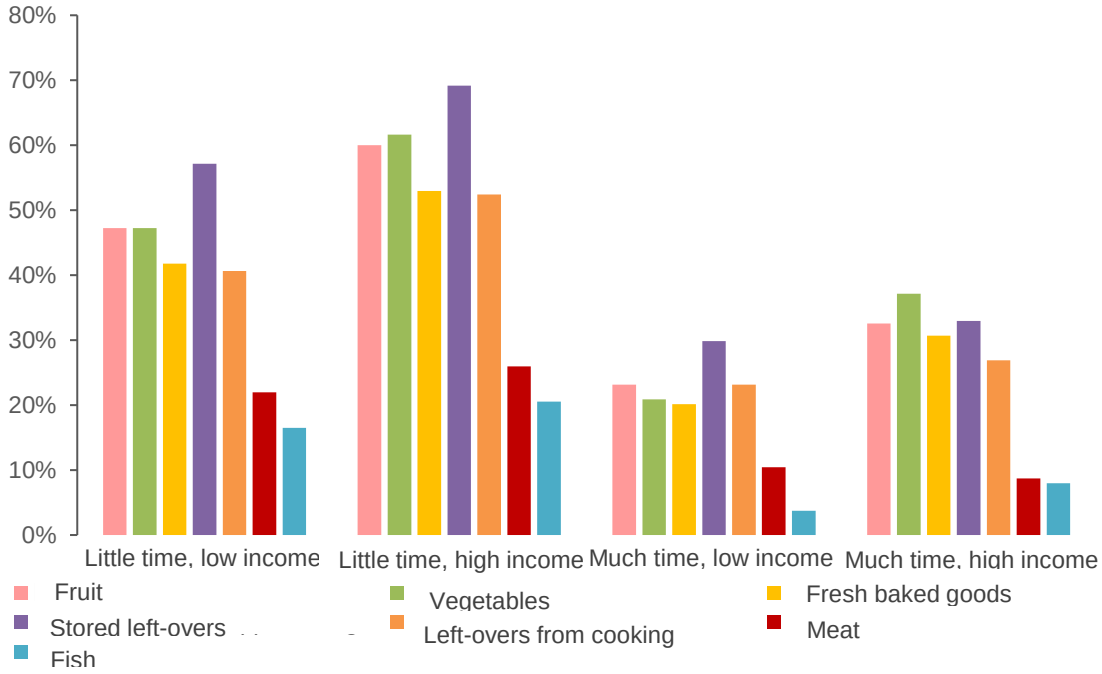

Figure 5-5 Proportions of respondents reporting having discarded seven product groups in the past week by consumer profile

Figure 5-5 shows a considerable difference between the profiles with little time and those with plenty of time; this suggests that the time factor is of great importance for the amount of food wasted. By contrast, there is little difference between low and high income, which suggests that finances are less important in relation to food waste, even for relatively expensive foods such as meat and fish.

The consumer profile with little time and high income reports discarding food most frequently, while those with low income and plenty of time are at the opposite end of the scale, being the profile who throw away least of all seven product groups.
Table 5-4 shows the results of chi-square tests for the four consumer profiles.

Table 5-4 Various food waste habits with a significant correlation with consumer profiles

Food waste habits	Elaboration
High-cost foods*	Profile 1 (little time/low income) and Profile 2 (little time/high income) report discarding the most. Little difference between Profile 3 (plenty of time/low income) and 4 (plenty of time/high income).
Low-cost foods*	Profile 2 (little time/high income) report discarding most, closely followed by Profile 1 (little time/low income). Profile 4 (plenty of time/high income) report having discarded more than Profile 3 (plenty of time/low income).
Good idea of how much food needs to be bought for the household*	Profile 3 (plenty of time/low income) has the largest proportion stating that they have a good idea of this, followed by Profile 4 (plenty of time/high income). Somewhat more respondents report having a good idea of this in Profile 1 (little time/low income) than in Profile 2 (little time/high income).
Always eat up leftovers from meals*	Profile 3 (plenty of time/low income) and Profile 4 (plenty of time/high income) have the highest proportion who always eat up leftovers from meals.
Use leftovers in exciting new dishes*	Profile 3 (plenty of time/low income) and Profile 4 (plenty of time/high income) use leftovers in new dishes the most. Profile 2 (little time/high income) use leftovers the least.
Take smaller portions rather than throwing away food*	Profile 3 (plenty of time/low income) and Profile 4 (plenty of time/high income) have the highest proportion who take smaller portions to prevent food waste. The lowest proportion is in Profile 1 (little time/low income).
Make too much food and throw away the leftovers*	Profile 2 (little time/high income) have the highest proportion reporting that they make too much food, closely followed by Profile 1 (little time/low income). The lowest proportion is in Profile 3 (plenty of time/low income).
Help themselves to too much food and throw away the leftovers*	By far the greatest proportion helping themselves to too much food is in Profile 2 (little time/high income). The lowest proportion is in Profile 4 (plenty of time/high income).
Food gets past its expiry date before it is eaten*	Profile 1 (little time/low income) has the highest proportion who state that food gets past its expiry date before it is eaten, followed by Profile 2 (little time/high income). Little difference between Profile 3 (plenty of time/low income) and Profile 4 (plenty of time/high income).

* Weak significant correlation

High- and low-cost foods were divided into different levels according to the number pf products reported discarded in the past week: 0-1, 2-3, 4-5 and 6 or more. For both high- and low-cost foods, there are significant differences between the four consumer profiles in the number of the 16 product groups discarded.

The results show that the consumer profiles with little time available, Profiles 1 and 2, are those which most often report having thrown away two or more high-cost product groups (33% for both profiles), while 67% state that they have discarded none or one of these groups. Of the two consumer profiles with plenty of time, Profiles 3 and 4, 84.3% and 88.3% respectively reported having disposed of none or one of the high-cost groups in the past week. This suggests that available time is the most important indicator in determining whether or not expensive foods are discarded.

Results for low-cost foods show the same trend: for these groups too, Profiles 1 and 2 throw away the most products; here, 38% and 44% respectively reported having discarded two or three of them in the past week, while 15% and 21% said they had thrown away four or five of these product groups. For the consumer profiles with plenty of time, Profiles 3 and 4, the numbers who discarded more than one group are lower (22% and 39% respectively for two or three low-cost groups, and 6% and 5% respectively for four or five low-cost groups).

In general, we see that all consumer profiles discard more of the cheaper foods than the more expensive foods, suggesting that the economic value of food affects food waste in households, despite income not being a significant factor. It is also important to realise that there are two more low-cost product groups than high-cost product groups, which may also affect the results.

Most of the relationships suggest that time rather than money determines how much food is discarded in Norwegian households. However, since Profile 3 (low income, much available time) generally shows a less wasteful behavioural pattern than Profile 4 (high income, much available time), it would seem that income is also an important factor in amounts of food discarded.

No significant correlation was seen between any consumer profile and frequency in use of a shopping list, suggesting that there is no consumer profile better at using a list than others. Another interesting result from the analysis of the consumer profiles is the significant difference between the groups with regard to the statement that they always throw food labelled “use by”, while there is no significant difference regarding food labelled “best before”. This may be because people have a broader understanding of what “best before” implies (and therefore more people are willing to test such food before deciding to throw it away), while people tend to be more dubious about “use by”.

5.4 Changes in Attitudes and Behaviour over Time

5.4.1 Developments from 2010-2015 to 2017 and 2018

Figure 5-6 shows results for planning of food purchases and mealtime behaviour as an average for the period 2010-2015, and for 2017 and 2018.

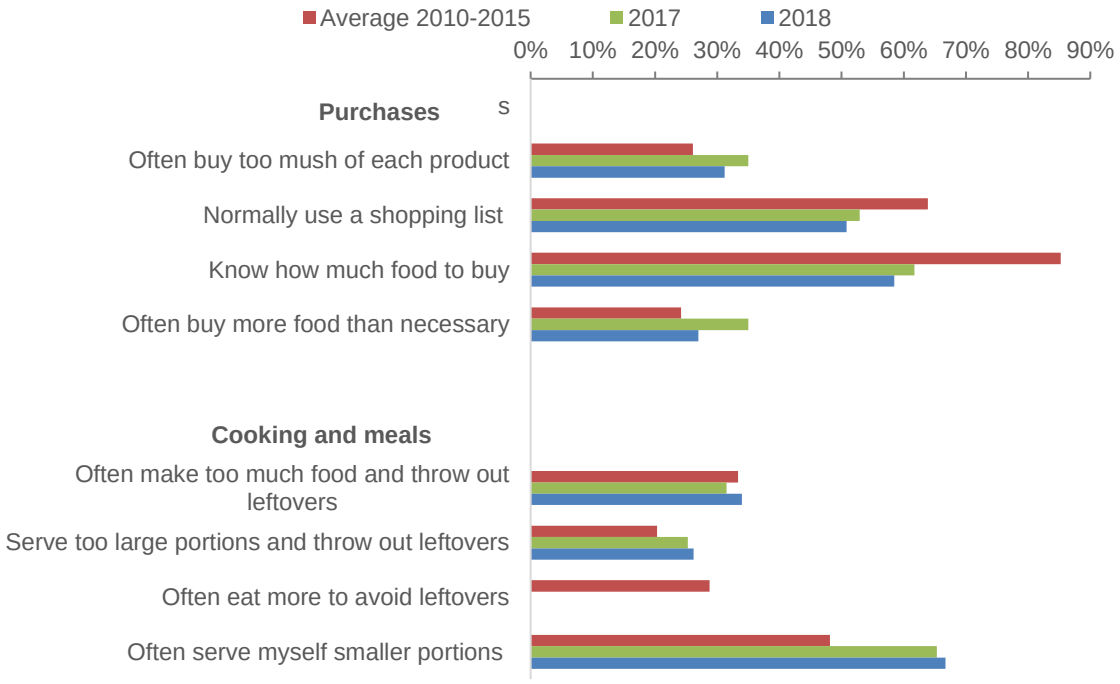

Figure 5-6 Consumer behaviour regarding planning of food purchases, cooking and meals: average data for 2010-2015, data for 2017 and 2018

In 2018, 27% stated that they often buy too much food, while 31% reported often buying too much of each product, which is a reduction from 35% for both questions in 2017. However, this is an increase from 2010-2015, when the corresponding averages were 26% and 24% (Figure 5-6).

Not only do more people now say that they buy too much food, there are also fewer who state that they know how much food they need when shopping (58% in 2018 compared to 85% for the period 2010-2015 and 62% in 2017) and that they always use a shopping list (51% in 2018 compared to 64% for 2010-2015 and 53% in 2017).

In other words, the figure shows a negative trend for all questions related to planning of food purchases; fewer plan their shopping or know how much they need, while more and more people say they buy too much food.

The questions on these issues were exactly the same in 2017 and 2018 as in previous years, so there are no methodological reasons for these notable changes. It may be that people now have a more realistic idea of their food waste than in previous studies, because the greater focus on food waste and discard has made people reflect more thoughtfully on their own behaviour. At the same

time, the demographic composition of the sample has shifted from 2010 to 2018 (time has passed and people have grown older), and in 2014, the consumer surveys showed that the age group 60 and over threw away least food (Stensgård and Hanssen 2015). In this year's survey, we see that the group that discards the least food has grown older, and now includes those over 65 years. This may indicate that the post-war generation that grew up in the 1950s and 1960s, which was the last generation that grew up in the "housewife era", is generally good at not wasting food. As this generation continues to make up an ever smaller proportion of the sample, the figures for the population as a whole will also deteriorate. It is therefore important to focus on making young people growing up today more aware of food waste as a problem and on helping them to learn more about raw materials and looking after food, to equip them better to prevent food waste than the generations between them and the baby boomers.

For the questions related to cooking and meals, the trend is also somewhat negative. Only 25% stated in 2018 that they help themselves to smaller portions to prevent food waste, compared to 48% for the period 2010-2015 and 65% in 2017 (Figure 5-6). In addition, rather more say that they take too large portions and throw away the leftovers (26% in 2018 compared to 20% for the entire period 2010-2015 and 25% in 2017).

The proportion of respondents who replied that they often make too much food and throw away the leftovers (31% in 2017, 33% in 2010-2015) was at about the same level in 2017 as in 2010-2015, but rose somewhat in 2018, to 34%.

Figure 5-7 shows the results for transport and storage of food, and opinions and behaviour related to packaging and date stamping, as an average for 2010-2015, and for 2017 and 2018.

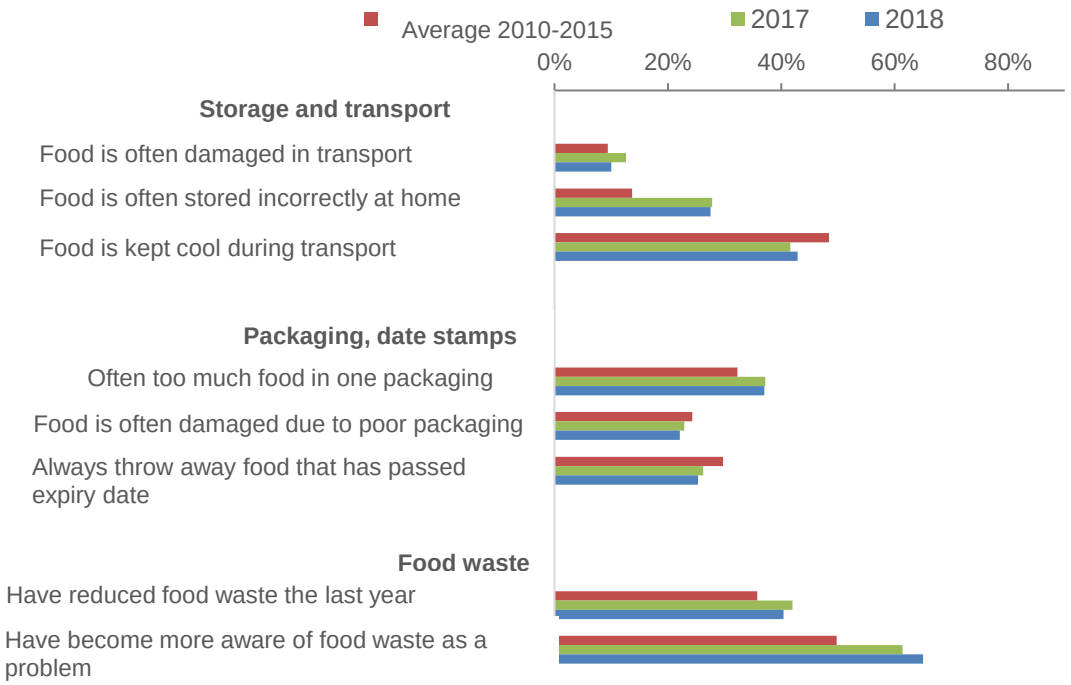

Figure 5-7 **Consumer behaviour related to transport and storage of food and opinions and behaviour related to packaging and date stamps: average data for 2010-2015, data for 2017 and 2018**

The figure shows that the proportion of consumers who state that food is often stored incorrectly at home almost doubled from 14% in 2010-2015 to 27% in 2018 and 28% in 2017 (Figure 5-7). The proportion reporting that food is often damaged in transport home from the store increased somewhat, from 9% in 2010-2015 to 13% in 2017. Now this figure has decreased again to a similar level to before, at 10% in 2018. This trend is consistent with the fact that a slightly higher proportion replied that food is kept cool during transport home in 2018 compared with 2017 (43% versus 42%).

With regard to packaging, 37% of respondents stated that there was often too much food in each pack (in both 2017 and 2018), which is an increase from the period 2010-2015 (32%). The proportion reporting that food was often damaged due to poor packaging has remained relatively stable, but was somewhat lower in 2018 (22%) than in both 2010-2015 (24%) and 2017 (23%).

Another positive feature of the 2018 survey was that the proportion who replied that they threw away food because it was past its expiry date decreased slightly from 30% in 2010-2015 and 26% in 2017 to 25% in 2018. This underpins the results in Figure 5-3, which show that “past its expiry date” is no longer one of the main causes of food being disposed of in households. In Figure 5-7, however, the figures for this question are not directly comparable, because in 2010-2015 a single question was asked regarding the two date labelling schemes, while in 2017 and 2018 a distinction was made between “best before” and “use by”. The results in Figure 5-7 apply to “use by” responses and are significantly higher than the average for both types of date labelling. We can therefore clearly see that the results for 2017 and 2018 show that consumers are good at distinguishing between the two labelling schemes, and that the trend of throwing away food only because it is past its expiry date is declining.

The proportion stating that they had reduced their own food waste in the past year in 2018 was 20%, which is a decrease from 42% in 2017 and 36% for the period 2010-2015. This appears somewhat inconsistent with the results for the question of whether the person has become more aware of food waste as a problem, where the figure increased from 50% in 2010-2015 to 61% in 2017 and again to 65% in 2018. In other words, more and more consumers have become more aware of the food waste problem, while fewer believe they have managed to reduce their own food waste.

5.4.2 Statistical Analysis of Trends over Time

Chi-square tests were performed to study the overall trends in responses from the start of the consumer surveys in 2010 until 2018 and at the midway stage in 2014. This only applies to trends for questions that were not adjusted during the period.

Table 5-5 Positive trends from 2010 to 2018

Causes and behaviour	Trend	Elaboration
The food is past its expiry date	Positive*	Fewer discard food only because of the date stamp.
The food is of poor quality when purchased	Positive*	Fewer state that poor product quality on purchase is an important reason for discarding food in their household.
We have reduced food waste in the past year	Positive*	Stable from 2011 to 2014, but large increase in those responding “Agree/Strongly agree” from 2014 to 2018.
We have become more aware of the amount of food waste in society	Positive*	More and more respond “Agree/Strongly Agree” that they have become more aware of food waste as a problem from 2010 to 2014 and to 2018.
Take smaller portions rather than throwing away food	Positive*	More “Agree/Strongly Agree” that they help themselves to smaller portions rather than throwing away food in 2018 than in 2010.

*Weak significant correlation

Table 5-5 shows that fewer and fewer people respond that “past its expiry date” is an important/very important reason for throwing away food in their household. This in clearly in line with Figure 5-3, which shows that the proportion of respondents stating that the expiry date was the main reason for food waste has decreased sharply since 2017. Similarly, fewer say that “the food is of poor quality when purchased” is an important/very important reason for discarding food in their household. This is probably due to the quality work in the food industry, where there has been a strong focus in recent years on ensuring that food remains of good quality until it reaches the consumer.

The statement “We have reduced food waste in our household in the past year” was added to the consumer survey in 2011, and from 2011 to 2014, the proportion agreeing or strongly agreeing remained stable. However, from 2014 to 2018, this proportion has increased significantly.

The positive trend in the responses on these issues shows that people have become more aware of food waste as a problem and that they think they are doing something to reduce amounts of food waste. We also see clearly that respondents have become less likely to throw away food only on the basis of the date stamp.

Table 5-6 sums up the negative trends which were significant between 2010, 2014 and 2018.

Table 5-6 Negative trends from 2010 to 2018

Causes and behaviour	Trend	Elaboration
Too much of the product in the pack, can't eat it all up	Negative*	More people find too much of the product in the pack to be a problem in 2018 than in 2010 and 2014.
Poor storage in the home leads to poorer food quality	Negative*	Almost twice as many in 2018 as in 2010 state that poor storage at home is an important/very important reason for discarding food in their household.
Use a shopping list	Negative*	Fewer "agree/strongly agree" that they always use a shopping list in 2018 than in 2010.
Usually know how much food to buy for the household	Negative*	Fewer state that they have a good idea of how much food to buy for their household.
Make sure food is stored properly between store and home	Negative*	Fewer "agree/strongly agree" that they ensure that they store their food properly between store and home in 2018, compared with 2010.

* Weak significant correlation

The results in Table 5-6 suggest that consumers have become somewhat worse at planning their food purchases (less use of a shopping list and a poorer idea of how much they need to buy for their household). More respondents in 2018 than in 2010 also replied that there is too much of the product in the pack, so that they are unable to eat it all before it goes bad. This suggests that the food industry must continue to work on product development in this area, despite launches of many solutions for smaller consumer packs in recent years, such as smaller loaves from Bakehuset and dinners for one from Kiwi.

Other possible causal relationships and behaviour patterns tested for changes from 2010 to 2014 and 2018 which did not show significant changes were "Poor packaging", "Food quality deteriorates during transport from store to home", "I get tempted to buy too much/too large packs" and "I make sure I store food properly at home".

6 Other Activities 2017

6.1 The AVARE Research Project

The AVARE research project is a SUSFOOD project, involving collaboration between research partners from Germany, Sweden, Finland and Norway on research questions related to food waste in the hospitality sector. The Norwegian activities are financed by the Research Council of Norway.

The project will measure food waste and analyse the effects of various anti-food waste measures. The measures will aim to prevent or reduce waste and be linked to organisation/planning and redistribution. They will be analysed in terms of amounts of food waste, environmental effects using LCA, social effects using social LCA and economic effects by estimating the utility value for the catering establishments concerned. There will also be technical experiments involving the use of food waste in bioprocesses to assess how the waste can be best utilised. Communication with various target groups is an important part of the project, and the last part of the project will include national workshops for participating catering establishments.

Five research partners are participating in the project: the University of Applied Science in Münster, Technische Universität Berlin, the Swedish University of Agricultural Sciences, the Finnish Natural Resources Institute and Ostfold Research in Norway.

6.2 Participation in the EU Platform on Food Losses and Food Waste

The European Commission agreed to create an EU platform for food waste to bring together key public and private actors from member states to collaborate on important food waste issues. The aims of the platform are to share experiences, develop joint anti-waste measures and help the EU to reach the UN Sustainable Development Goal of a 50% reduction in food waste by 2030.

Matvett was included in the group as part of a consortium with Ostfold Research. Three general meetings have been held, along with several meetings in working groups dealing with mapping, redistribution, date labelling and anti-food waste measures.
The reasons for including the Norwegian participants are that Norway has developed methodology and data for measuring food waste throughout the value chain that is unique in Europe, and also that Norway is more advanced than most other countries in organising food waste cooperation across the food value chain and with the government.

7 Summary, Discussion and Recommendations

7.1 Summary of the Main Findings

7.1.1 The Food Industry

This report shows that the food industry as a whole is well on the way to reaching the first interim target in the sector agreement of a 15% reduction in food waste by 2020. Waste has been reduced by 13% from 2015 to 2017, corresponding to a reduction of 4.8 kg per capita or 22 000 tons. This is in addition to the 14% reduction that the industry achieved between 2010 and 2015 in the ForMat project.

We also see a positive trend for greenhouse gas emissions and financial losses associated with food waste, where the carbon footprint has been reduced by 10%, and financial loss by 8%, during the same period. This is the first time that financial losses and the carbon footprint have been reduced in step with food waste; this is because food waste is now also decreasing for relatively expensive and environmentally unfriendly items such as meat and dairy products.

The reduction in food waste in the retail stage is mostly related to systematic price reductions on foods with a short shelf life, internal procedures to improve product flow (purchasing) and competence development (knowledge of food waste, including the food waste toolkit and raw materials), while at the production stage, the decrease is related to better forecasting, improved cooperation between the stages of the value chain and efforts to enhance production planning and internal routines. Donation of food that cannot be sold at the normal price has also been an important initiative for the food industry as a whole.

7.1.2 Consumers

The consumer studies conducted in 2018 have provided greater insight into behaviour, attitudes and habits related to food waste in Norwegian households than consumer surveys from previous years, because of several additional questions and statistical analysis of relationships between attitudes/behaviour and food waste. This year's consumer survey has also revealed a stable development since 2017, which indicates that the findings are consistent.

Among the positive trends, we find that consumers have generally become more aware of food waste as a problem and that fewer people throw away food only because it is past its expiry date. All of the correlations found are weakly to moderately significant; therefore, although these findings may represent the average for the Norwegian population, there are still large individual differences.

The analysis of consumer profiles shows that available time is a more important constraining factor than money in relation to food waste behaviour in Norwegian households. The results again show that young people (>40) discard more food than older people (<65), and new insights reveal that the use of shopping lists and low shopping frequency help to decrease food waste.

7.2 Discussion and Recommendations

Preventative food waste measures related to shelf life
The surveys show that shelf life is an important factor in food waste at the production, wholesale and retail stages.
As mentioned above, a short shelf life may be symptomatic, implying one or more root causes why foods do not meet the requirements of the industry standard (STAND) or reach their expiry date. For example, some companies report overproduction and variation in sales as causes of waste, which may be possible root causes of food being discarded because of its expiry date. Fluctuations in demand will always be a challenge, but increased co-operation in forecasting and campaigns across value chains can help to reduce this food waste. Shelf life can also be a system cause, which means that the greatest challenge may be requirements for distribution of shelf life across the value chain or the actual date labelling. Much work is being done on this in the food industry.

Food waste reduction measures related to shelf life
In addition to the prevention of food waste related to shelf life through cooperation between the stages of the value chain and correct date labelling, food waste that arises due to expiration issues can also be reduced through better utilisation. This applies to items that are suitable for sale via non-traditional sales channels or donation/redistribution (with some exceptions, such as soft and alcoholic drinks).

The continuous establishment of new food banks around the country can result in more efficient redistribution of food with a short shelf life from producers and wholesalers; hopefully, the food banks can help to solve the challenges of handling large quantities and of communication/logistics between local charities and the food industry. The increase in the number physical and online stores specialising in the sale of food with a short remaining shelf life should also help reduce this type of waste.

For retailers, local redistribution, in addition to existing measures such as price reductions, sales or information sharing via apps and the re-use of raw materials, can be an important means of reducing future food waste. Local redistribution has not been widespread in Norway due to a lack of information sharing, knowledge of food safety and systems to ensure this, necessary infrastructure, supportive legislation and funding or financial incentives (Hanssen et al. 2015). These are areas that have seen important positive developments in recent years, but there is still a potential for improving and increasing local redistribution.

Other causes of food waste in the industry and potential solutions
Other important reasons for food waste in the industry are poor quality (producers, wholesalers and retailers), production errors (producers) and damage (wholesalers and retailers). Food waste related to quality can be difficult to avoid if it is due to raw material quality (such as decay or factors in primary production), but much waste can probably be avoided through an increased focus on correct handling of the raw materials (harvesting, packing, transport and storage). Production errors and damage can also be limited by focusing on internal procedures, training and innovative solutions (such as the availability of strong tape in retail outlets to repair damaged packaging).

Finally, some food producers also state that food waste occurs in connection with starting production, cleaning and switching products. Such food waste largely depends on the company's production planning, internal procedures, knowledge of production processes and production equipment. For some companies, this food waste is very difficult to avoid and may require a huge investment in new equipment; however, certain companies have managed to significantly reduce this food waste during the period under study by optimising internal production plans. In other words, the potential for reduction of this type of food waste will vary between companies and product groups.

7.3 Efforts for the Future

Looking towards 2020 and eventually 2030, work must be concentrated on large-volume and environmentally unfriendly product groups. Examples of large-volume product groups in the entire value chain (including consumers) are fresh baked goods and fruit and vegetables. In order to achieve the target of cutting food waste by half, waste in these groups must be reduced considerably. The food industry should develop innovative solutions for storage, packaging and especially alternative marketing/display of the product groups (which are important sources of waste of bread and fruit/vegetables). Product development is also important (including longer shelf life), in addition to waste reduction measures such as processing food close to its expiry date or of reduced quality to make new products (e.g. stores selling self-produced smoothies from fruit and vegetables of reduced quality). There is also a need for major system changes in how we consumers relate to these product groups, as the demand for freshly baked bread is one important factor in food waste in baked goods at the retail and consumer levels. In order to achieve a possible system change, the industry must work together on common parameters.

The most environmentally unfriendly product groups are often also the most expensive groups, such as meat and meat-based products, dairy products, some seafood products and dry goods (e.g. coffee and spices). Limiting food waste in these groups will considerably reduce both costs and the environmental effect, despite the relatively small volume. For some of these items, part of the food waste at the producer and consumer stages can be reduced by limiting special offers (e.g. buy three, pay for two) and price wars that often lead to food waste in all parts of the value chain.

The food industry must continue efforts to reduce waste of food that is past its expiry date. Such waste can be prevented through better cooperation across the value chain, focusing on internal procedures, etc., and can also be reduced through donations and sales at reduced prices.

In addition, the industry should intensify its work on communication and product development (packaging solutions, planning tools, recipes, date labelling, etc.) aimed at food waste in the homes of consumers. This work should probably also be expanded to include new areas and more extensive system changes that can lead to real changes in attitudes and behaviour among the under 40s and children growing up today. After all, the consumer stage accounts for more than half of the food waste mapped, and is therefore crucial to achieving the goal of halving food waste by 2030.

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Østfoldforskning
SUSTAINABLEINNOVATION

Gamle Beddingvei 2B
N-1671 Kråkerøy
Telephone: +47 69 35 11 00
Fax: +47 69 34 24 94
firmapost@ostfoldforskning.no
www.ostfoldforskning.no