Food Waste in Norway
Report on Key Figures
2015-2018

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Food Waste in Norway

Report on Key Figures 2015-2018

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Summary

About the report

In June 2017, the Norwegian government and the entire food industry signed a sector agreement on food waste reduction. 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.

Trends in food waste

From 2015 to 2018, food waste by retailers, wholesalers and producers (excluding the fishing industry) was reduced by 16 000 tons, which corresponds to a reduction of 3.8 kg per capita or 12% (Figure 1-1). This comes in addition to the reduction of 14% achieved by the industry from 2010 to 2015 in the ForMat Project.

The fact that the food industry reduced food waste by 12% from 2015 to 2018 indicates that the industry is on track to reach the first interim target of 15% reduction by the year 2020.
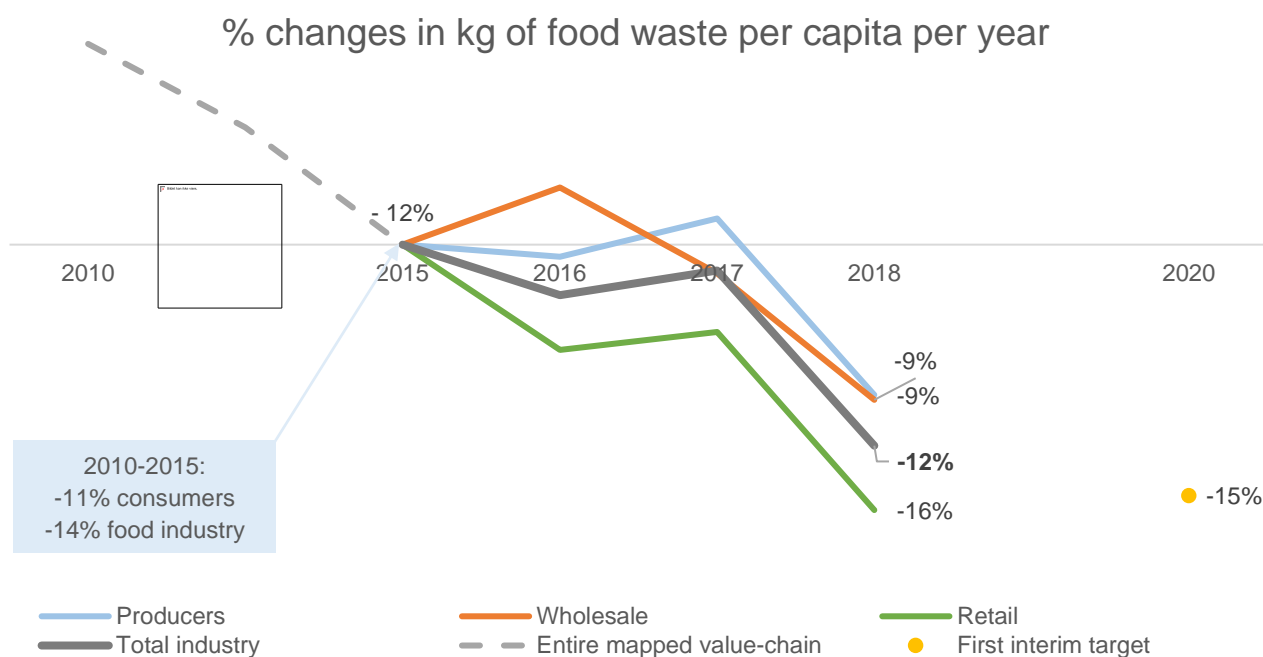

Figure 1-1   Percentage changes in kg of food waste per capita per year by stage of the value chain

Greenhouse gas emissions and financial losses associated with food waste in the industry were also reduced during the same period, by 2% and 12% respectively.

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).

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

Total amounts of food waste in 2018

Food waste has also been identified for households (except for waste discarded via drains) (Syversen et al. 2018), and for hotels, employee cafeterias and convenience stores (Callewaert et al. 2019), but the trends in these stages of the value chain are unknown at present.

Including all the stages of the value chain studied, we have calculated that at least 390 000 tons of edible food were discarded in Norway in 2018[1] (Figure 1-2). This corresponds to about 74 kg per capita per year, a financial loss of 22.3 billion NOK and 1.3 million CO2 equivalents annually.

Note that although food waste in this year's report may appear to have increased or decreased in some stages of the value chain compared to previous publications, these are not real changes. This year's report cannot be compared with previous reports, as a new sector has been included (convenience stores) and the methodology and data basis have changed. However, the changes from previous reports are not very large and the distribution between consumers and the food industry is unchanged from last year's report.

This report presents updated calculations for the entire period 2015-2018. For trends from 2010 to 2015, the final report from the ForMat project is still applicable (Stensgård & Hanssen 2016)

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[1] The stages of the value chain included in the survey were food producers (except for the seafood industry, which SINTEF is studying), wholesalers, retailers, hotels, employee cafeterias and convenience stores (restaurants, cafes and the public sector are currently being studied in the KuttMatsvinn2020 project), in addition to households (except for food discarded via drains).
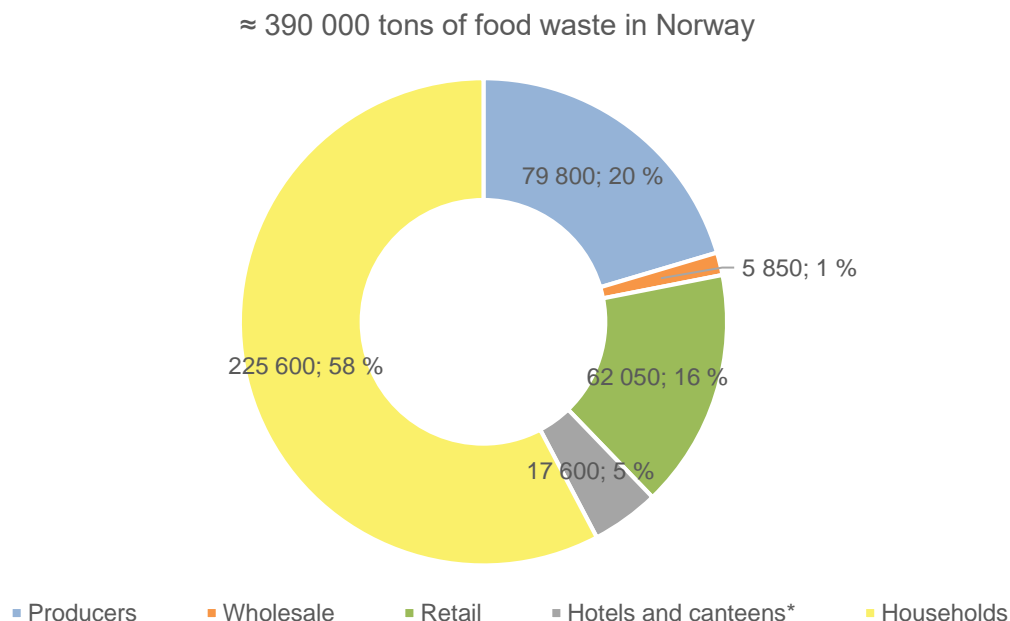
≈ 390 000 tons of food waste in Norway

79 800; 20 %

5 850; 1 %

62 050; 16 %

225 600; 58 %

17 600; 5 %

- Producers - Wholesale - Retail - Hotels and canteens* - Households

Figure 1-2   **Estimated total amounts of food waste in Norway by stage in the value chain**

Households account for more than half of food waste (58%), followed by producers (20%), retailers (16%), hotels, employee cafeterias and convenience stores (estimated at 5%) and the wholesale sector (1%). It should be noted that actual food waste levels from households and producers are higher, since liquid food discarded via drains is not included for households, unlike the other stages in the value chain, and the fishing industry has not been included under producers (currently being studied by SINTEF).

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, but here beverages, meat and fruit and vegetables are among the largest groups.

Consumer Surveys

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 2019 consumer survey shows relatively small changes from previous years in the number of product groups discarded. The proportion of respondents who reported having thrown away pan leftovers from the fridge and fresh vegetables in the past week increased from 2018, while for fresh fruit, pan leftovers directly from meals and fresh baked goods, the figures were slightly down on last year. The average for the remaining product groups has remained stable at around 11% since 2015. The main reason for food waste in this year's survey was that food was left in the fridge or cupboards, which indicates challenges in knowing what food there is in the house before buying new food.

Once again this year, surveys were conducted for four different consumer groups, focusing on whether available time and income have an effect on consumers' food waste. The results revealed that available time is more closely associated with high food waste in households than income.

New questions for respondents this year were related to their knowledge of food storage and what kinds of food can be eaten. Generally, a high proportion state that they know how to store and freeze food. However, more information is needed on what kinds of food can be eaten if part of the food is mouldy or damaged, especially among younger respondents.

Respondents were also asked about measures taken by the food industry with the aim of reducing food waste in households. Most respondents felt that the measures that had reduced waste in their household were extra information on date labels, increased shelf life, opening and closing mechanisms on packaging and information about a product's shelf life and storage after it has been opened.

Future prospects

Although the food industry as a whole is well placed to reach the first interim target in the sector agreement (-15% by 2020), the report also shows that the industry must work in an intensive and goal-oriented manner to meet the targets in the agreement, as these intensify from a 15% reduction in 2020 to a 30% reduction in 2025 and a 50% reduction in 2030.

Figure 1-3 shows how, in order to achieve the targets in the sector agreement, total food waste by producers, wholesalers, retailers and households must decrease from the current level of 71 kg per capita (excluding convenience stores, hotels and employee cafeterias) to 63 kg in 2020, 52 kg in 2025 and 37 kg in 2030.
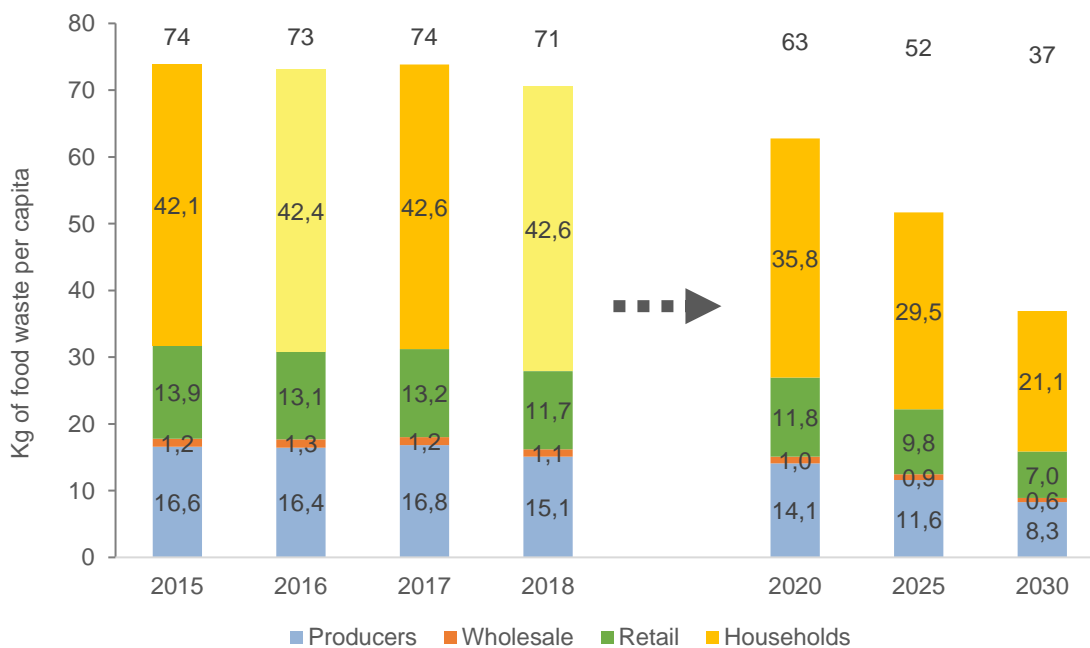

Figure 1-3   Trends in kg of food waste per capita towards the year 2030

In order to achieve the change shown in the figure, food waste efforts must focus on the large-volume product groups across the value chain, namely fruit and vegetables and bread/baked goods. For the food industry as a whole, there is a need for increased collaboration between companies and across the value chain in order to achieve better forecasts, lower quality requirements and improved alternative uses of products with reduced quality/shelf life. In addition, the food industry must work actively to increase consumer acceptance of food that is currently considered non-marketable.

There is little to suggest that consumer food waste is on the decrease. This indicates that the food industry, in collaboration with the government, has important work ahead to reduce food waste by consumers, in addition to reducing their own food waste. This responsibility cannot be left to consumers themselves.

The food industry should continue to focus on measures such as correct date labelling including supplementary information, better packaging (such as improved opening/closing mechanisms) to increase shelf life and information on storage and uses of its products. A further important point is to determine how the industry can facilitate easier planning of purchases coupled with better knowledge by consumers of the contents of their fridges and food cupboards. In addition, the industry must try to develop measures to alleviate consumers' time pressure, which apparently leads to significant food waste.

The government should focus on enhancing knowledge of food waste in schools and kindergartens, since children and young people appear to have large knowledge gaps about food in general and resource use. A greater focus on the quality of raw materials, on using different senses and on how to keep and store food in food and health classes at lower levels and in food science education at higher levels can help to reduce food discard by future generations.

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 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 (https://www.matvett.no/uploads/documents/ForMat-rapport-2016.-Sluttrapport.pdf).

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 third report in the series and it includes a section on the catering sector based on the three-year project "KuttMatsvinn2020". Note that this year's report includes an updated basis for data and methodology, which means that previous reports are dated and cannot be compared with this year's report. This report presents updated calculations for the entire period 2015-2018. For trends from 2010 to 2015, the final report from the ForMat project is still applicable (Stensgård & Hanssen 2016).

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 increased more than fivefold since the end of the ForMat project.

To date, 93 leading companies in the seafood industry and among food producers, retailers and caterers have signed this declaration of affiliation.

This report presents an overall view of total food waste, trends for the food waste surveyed in Norway and detailed results and trends for food producers, retailers and wholesalers, as well as preliminary key figures for the hotel and catering sector (including, hotels, employee cafeterias and convenience stores). Finally, the report presents the latest results from consumer surveys of Norwegians' attitudes and behaviour related to food waste.

2 Methodology and Data Basis

This chapter summarises the key aspects of the methodology and data basis for this report. Detailed descriptions are to be found in Appendix 1: Appendix 1 Methodology and Data Basis.

2.1 Definition

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 as food waste, the parties should make optimal use of food waste, and using it to feed animals is therefore preferable to destroying it.

2.2 Data Collection

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. These are primarily companies in the ForMat project and companies that have signed the declaration of affiliation.

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

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 et al. 2019).

2.2.1 The Production Stage

The basis for the survey of food waste by producers is the reporting of data on waste and amounts produced (in tons) by product group by a selection of companies. The companies have also reported on data quality, how food waste is used (animal feed, biogas, incineration), measures implemented, and how much food waste they have reduced by selling food at low prices, donating food, etc.

The 31 companies represent a broad selection of production facilities and cover about 45% of the total sales of Norwegian food producers (with the exception of the fishing industry). 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.

Of the 31 companies that have provided data, five have stated that they have not reported total food waste figures, since they have not established good methods for measuring/recording parts of food waste (such as food waste falling onto the floor during production). The extent of the missing waste is uncertain and differs between companies. The missing data applies to flour/grains/cereals etc., beverages, nuts/seeds/dried fruit, sausages and frozen vegetables/fruits/berries. The companies are working to establish statistics for the missing food waste, and hopefully these will be in place for next year's reporting.

As mentioned, efforts are ongoing to map food waste in primary production, which will also involve determining the boundary between what is considered as the primary stage and what is viewed as the production stage. Until now, companies' NACE codes have been used to determine which part of the value chain they belong to, but this approach will probably not be used in next year's report as the ongoing survey of primary production has identified several disadvantages of this methodology. This suggests that the amount of food waste by producers will be sharply revised in next year's report, as food waste that is currently considered as part of the production stage will be included in the primary stage. This adjustment may also lead to changes in figures for kg per capita, financial losses and greenhouse gas emissions for the production stage.

2.2.2 The Wholesale and Retail Stages

The basis for the survey of food waste by wholesalers and retailers is the reporting of data on waste and sales (in NOK) by product group and cause by a selection of companies in these two stages of the value chain. The reason why the data basis for these two stages is in economic terms is that the recording of waste is part of the financial management system of wholesalers and retailers.

2.2.3 Hotels, Employee Cafeterias and Convenience Stores

The research project KuttMatsvinn2020 has identified food waste occurring in hotels, convenience stores and employee cafeterias. There are also ongoing efforts to map food waste in the public sector (nursing homes, schools, kindergartens, hospitals, etc.) and in restaurants and cafes. Several catering outlets within these segments are well underway with mapping and prevention work, but unfortunately too few companies have started this work to enable the calculation of national statistics for these sectors.

For hotels, employee cafeterias and convenience stores, data are reported both in grams per guest and in economic terms, as this is a complex sector with large variations in financial systems and recording of food waste.

To date, around 2000 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

2.3 Consumer Surveys

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 use the Norstat web panels (electronic questionnaires), and a sample of 1000 respondents representative of Norwegian consumers. Studies have been conducted annually from 2010 to 2015 and from 2017 to 2019. In addition to the responses to the questionnaire itself, data are 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.

The questions asked in the 2019 survey are quite similar to those in 2018, but the form has been expanded to include questions about how liquid food waste is discarded (via drains or waste containers), what food industry measures consumers think help them to discard less food, what consumers think they know about looking after food, and whether they throw away more food as a result of buying food at reduced prices or via apps such as Too Good To Go or using food boxes/online purchases.

2.4 Carbon Footprint

The environmental analysis has been 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).

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.

2.5   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.

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

3   Results of the Survey

3.1   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 2018.
For a more detailed description of developments from 2010 to 2015, see the final report from the ForMat project (Stensgård & Hanssen, 2016).

Figure 3-1 shows the percentage change in kg of food waste per capita from 2015 to 2018 in total and for each of the three stages of the value chain, 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%.
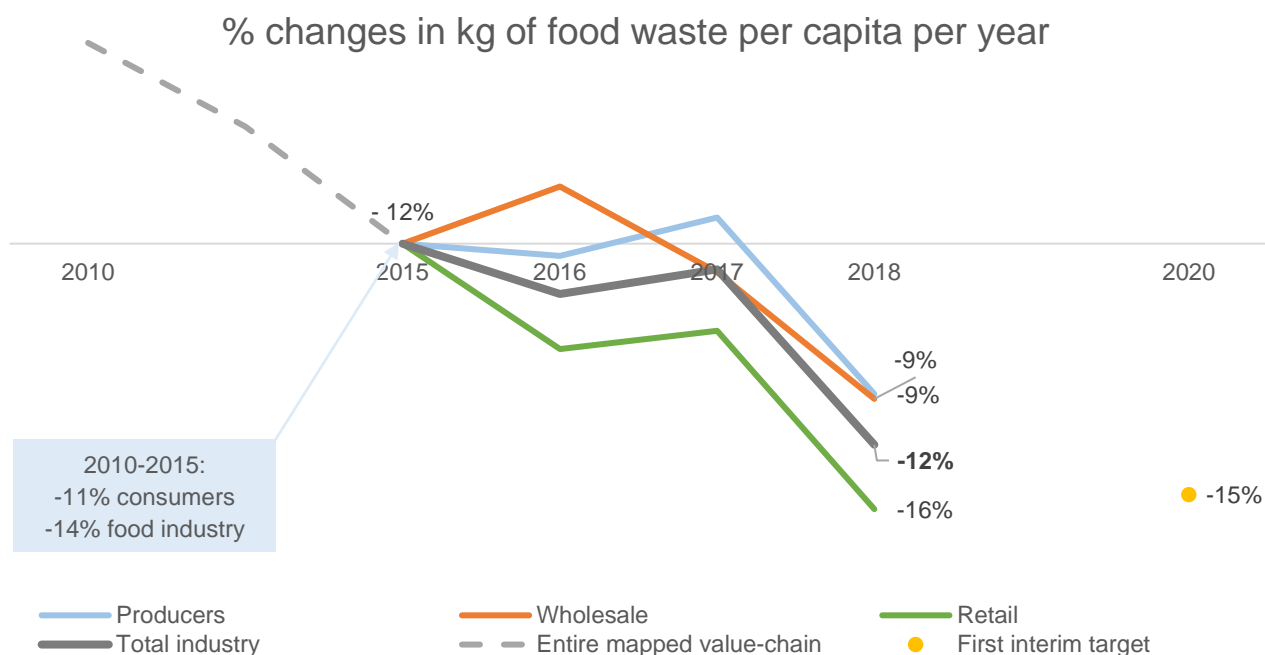
Figure 3-1   Percentage change in kg of food waste per capita and year by stage in the value chain

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 12% (grey line from 2015 to 2018). Note that the data for 2010-2015 are not directly comparable with the data sets for 2015-2018, 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 (16% reduction). Food producers and wholesalers are farthest behind the goal with a 9% reduction, and must implement measures to meet the first target of the agreement.

3.2 Tons of Food Waste by Stage in the Value Chain

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

Figure 3-2 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 catering sector are based on preliminary results from the research project KuttMatsvinn2020 and only include hotels, employee cafeterias and convenience stores.

≈ 390 000 tons of food waste in Norway

79 800; 20 %
5 850; 1 %
62 050; 16 %
17 600; 5 %
225 600; 58 %

■ Producers   ■ Wholesale   ■ Retail   ■ Hotels and canteens*   ■ Households
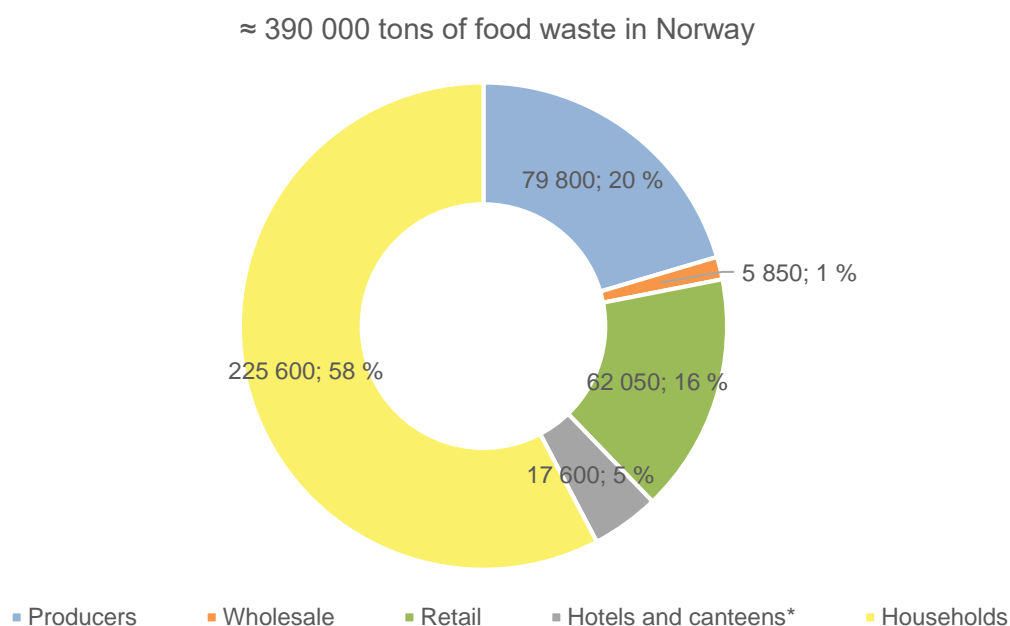
Figure 3-2   Estimated total amounts of food waste in Norway by stage in the value chain

The figure shows that the total amount of food waste in Norway is estimated at around 390 000 tons annually, corresponding to 74 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 22.3 billion and 1.3 million CO2 equivalents per year. Households account for more than half of food waste (58%), followed by producers (20%), retailers (16%), hotels, employee cafeterias and convenience stores (estimated at 5%) and the wholesale sector (1%). Note that the figures for hotels, employee cafeterias and convenience stores are only a general estimate, since several segments of the catering sector are not included.

The observant reader will notice that estimated amounts of food waste are higher or lower in this year's report than in previous reports for some of the links in the value chain. This is due to an improved data base (see the methodology section in Appendix 1 for a more detailed description).

Figure 3-3 shows changes in <u>tons of food waste</u> 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.
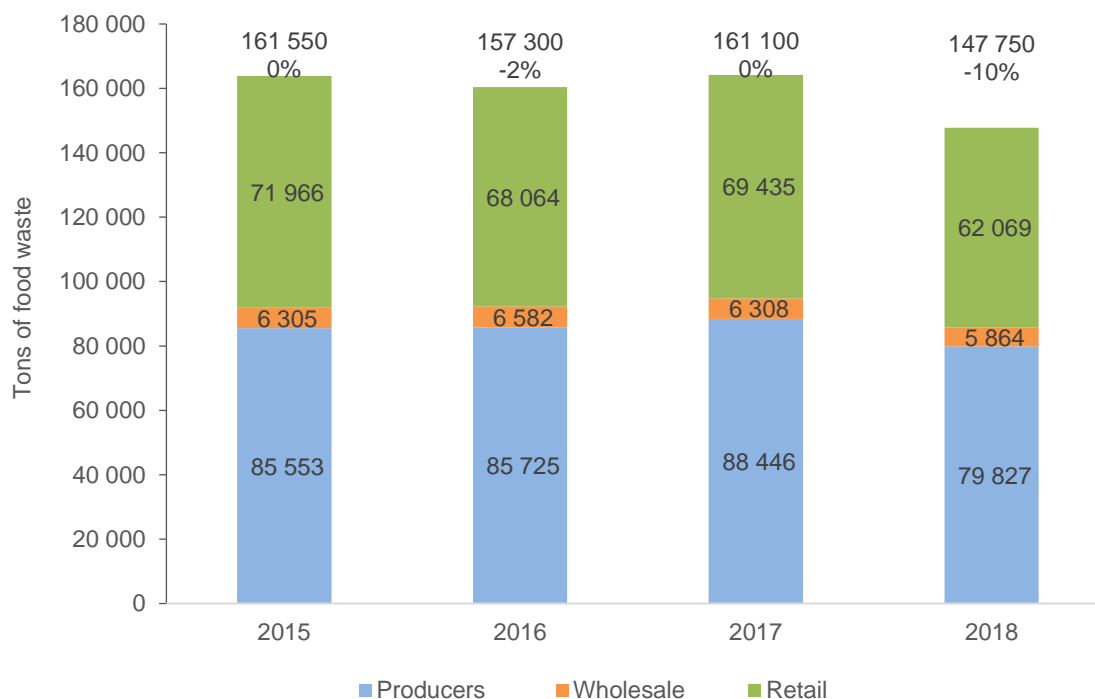
Figure 3-3   Changes in tons of food waste by stage in the value chain 2015-2018

The figure shows that the total amount of food waste in the three stages was reduced from 161 500 tons in 2015 to 147 800 tons in 2018. This is a reduction of 13 800 tons or 10%. The reduction is thus somewhat lower measured in tons than in kg per capita, due to an increase in the population from 2015 to 2018.

For the different stages of the value chain, the changes in tons of food waste from 2015 to 2018 were as follows (note that this is a percentage change in tons, not in kilograms per capita):
- Producers -7%
- Wholesalers -7%
- Retailers -14%

3.2.1   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.
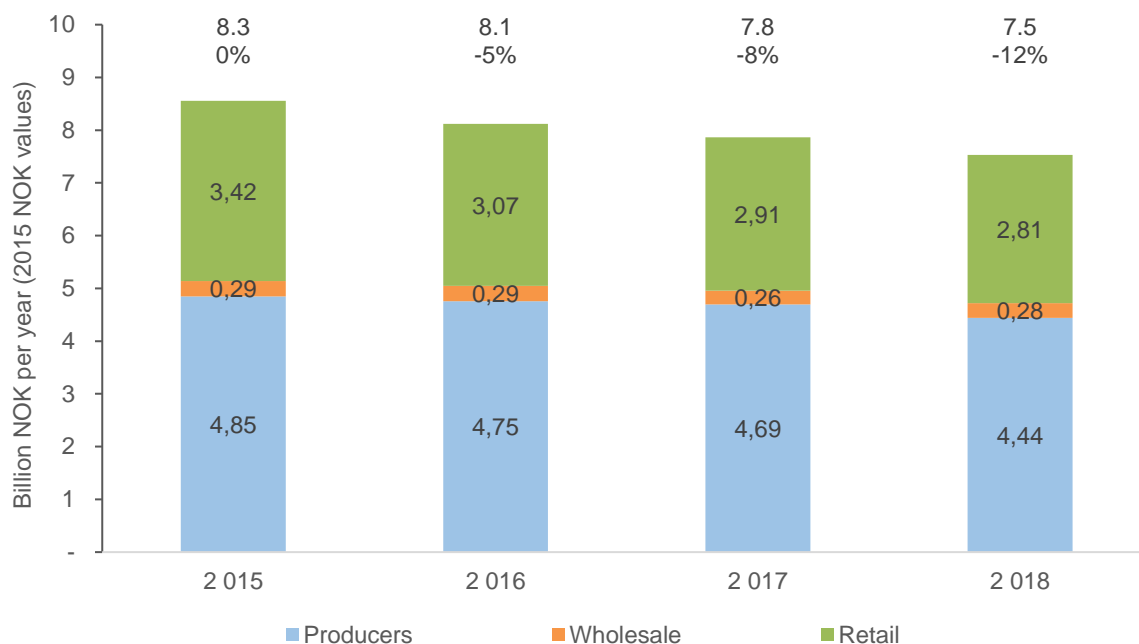
Figure 3-4   Financial loss (in billion NOK) linked to food waste by stage of the value chain from 2015 to 2018.

The figure shows that financial losses associated with food waste in the three stages of the food value chain were reduced from NOK 8.3 billion in 2015 to NOK 7.5 billion in 2018, in 2015 NOK values. This is a reduction of NOK 0.8 billion or 12%.

For the different stages of the value chain, the changes in financial loss related to food waste from 2015 to 2018 were as follows:

- Producers -8%
- Wholesalers -4%
- Retailers -18%

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.

3.2.2 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 and waste management of food and packaging are not included.
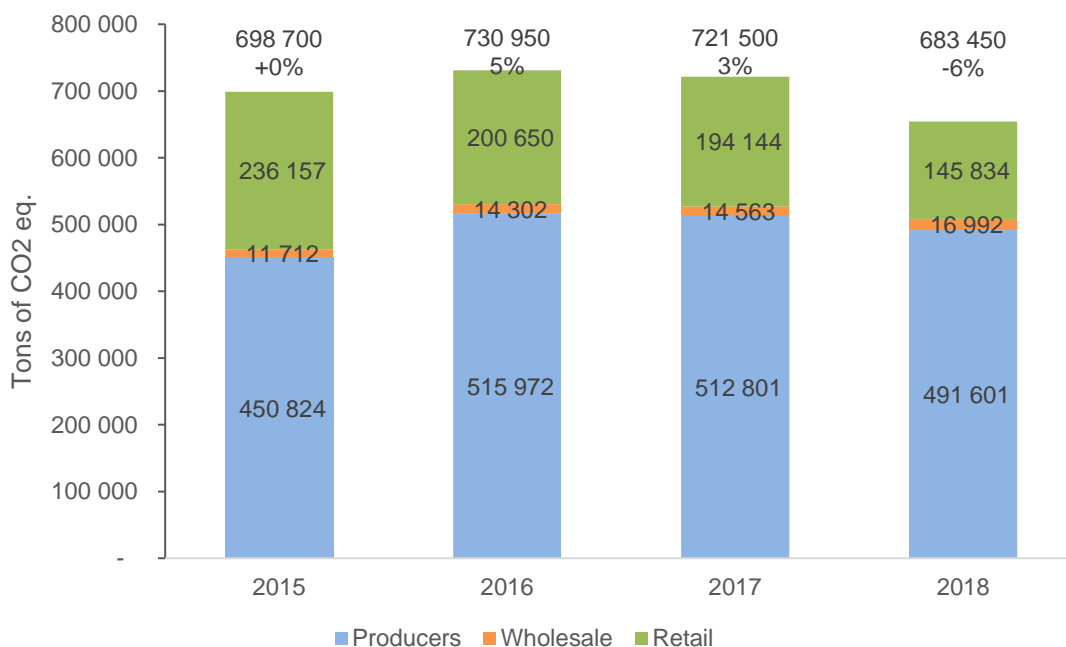
Figure 3-5   Tons of CO2 eq. linked to food waste by stage of the value chain from 2015 to 2018

The figure shows that the environmental impact of food waste in the industry as a whole decreased from 698 000 tons of CO2 equivalents to 683 000 tons, which is a reduction of 15 000 tons, or 2%.

Of the three stages of the value chain, retailers have reduced the carbon footprint of food waste the most. For the three stages, the changes from 2015 to 2018 were as follows:
- Producers +9%
- Wholesalers +45%
- Retailers -26%

Greenhouse gas emissions related to food waste by producers and wholesalers have increased. This is because food waste was reduced for items with a relatively low carbon footprint, while waste increased for items with a relatively high carbon footprint, such as meat products.

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 2018 in tons and percentages of amounts produced, and describes causes, anti-waste measures and use of resources.

Figure 4-1 shows the calculated composition of product groups involved in food waste by producers in 2015-2018.

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.
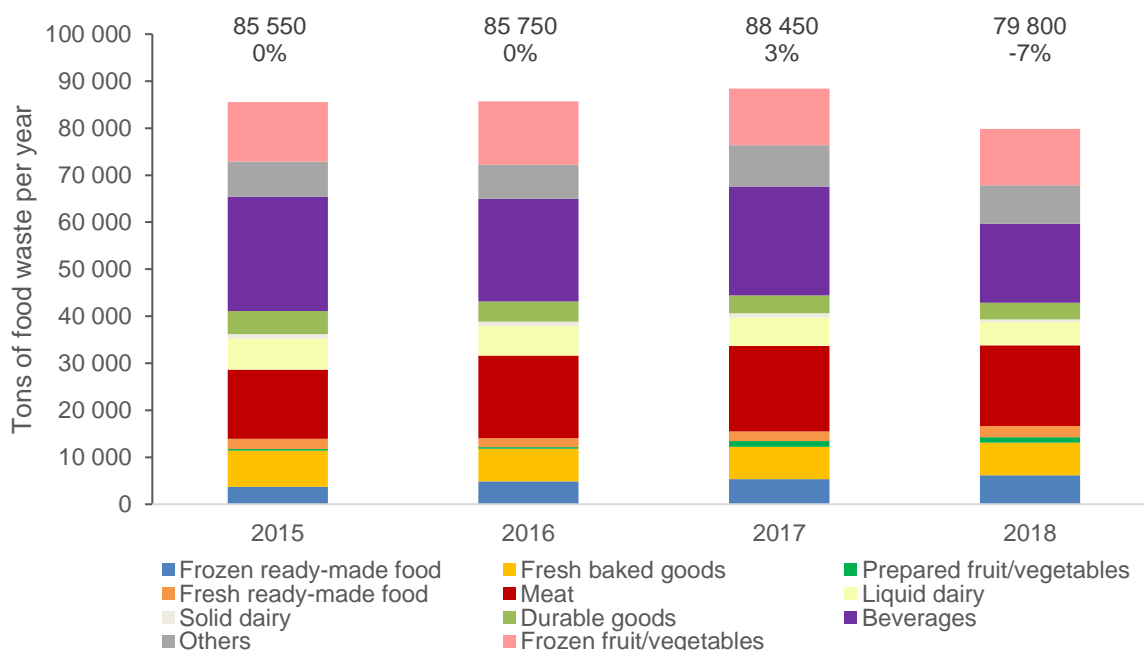
Figure 4-1   Changes in tons of food waste by producers 2015-2018

Note that the calculations of amounts of food waste at the production stage are unreliable, since there is considerable uncertainty about production volumes and percentages of food waste for some product groups, particularly beverages and "others".

The figure reveals considerable waste of beverages, meat, fruit and vegetables and fresh baked goods by food producers. The reason for waste of beverages is that relatively large quantities of

beverages are produced in Norway, which gives a high amount of waste in tons despite a low percentage of waste (about 2%). It should be noted, however, that for some beverage manufacturers, only waste from the finished product is included, not raw material and production waste, as this is challenging to measure. The waste percentage for this group is therefore probably higher. Baked goods and meat also have a low percentage of waste (2-3%) but high production volumes. The opposite applies to fruit and vegetables, however; this is a product group with a relatively high waste percentage (about 16%) and a low production volume.

As mentioned in the methodology section, amounts of food waste by producers will probably be sharply revised in next year's report, as food waste that is now considered to belong to the production stage will be seen as part of the primary stage. This applies mainly to fruit, vegetables and meat. This adjustment may also lead to changes in figures for kg per capita, financial loss and greenhouse gas emissions for the production stage.

In addition to tons of food waste per product group, food waste is also calculated as percentages of the quantity produced. Results in percentages of quantities produced are more reliable than those expressed in tons of food waste, since the figures are not based on production statistics. The fact box below shows the results as percentages.

As mentioned in the methodology section, 5 of the 31 companies that have provided data have stated that they have not reported total food waste figures due to lack of methods of measuring/recording parts of food waste (such as food waste falling onto the floor during production). The missing data applies to flour/grains/cereals etc., beverages, nuts/seeds/dried fruit, sausages and frozen vegetables/fruits/berries. This means that food waste for these product groups is not entirely comparable to the other groups.

Fact Box 4-1   Summary of figures for producers in 2015 and 2018, and trends 2015-2018.

Product groups with the *most* waste as a percentage of production (in tons) in 2018 were:
1) Frozen vegetables/fruit/berries (16.0%)
2) Prepared fruit/vegetables (12.5%)
3) Frozen ready-made foods (7.0%)

Product groups with the *least* waste as a percentage of production (in tons) in 2018 were:
1) Eggs (0.0%)
2) Flour, cereals, grains, etc. (0.2%)
3) Butter/margarine (0.3%)

Product group	% waste 2015	% waste 2018	Change in % waste 2015-2018
Frozen ready-made foods	5.3%	7.0%	23%
Frozen desserts	4.8%	5.6%	14%
Frozen vegetables/fruit/berries	18.3%	16.0%	-14%
Prepared fruit/vegetables	15.6%	12.6%	-24%
Fresh baked goods	2.5%	2.2%	-14%
Ready-to-eat meals and refrigerated toppings	2.7%	2.6%	-4%
Sausages	0.6%	0.4%	-48%
Sliced meat and pâtés	1.4%	4.6%	69%
Red meat and venison	2.4%	2.0%	-18%
Poultry	3.1%	3.1%	0%
Prepared meat	0.6%	1.3%	53%
Eggs	0.0%	0.0%	0%
Liquid dairy products	1.2%	0.9%	-27%
Cheese	0.7%	0.4%	-58%
Butter/margarine	0.5%	0.3%	-34%
Flour, grains, cereals, etc.	0.3%	0.2%	-33%
Dressings, etc.	4.2%	2.0%	-109%
Nuts/seeds/dried fruit	1.9%	2.1%	12%
Dry bread (crispbread)	1.3%	5.7%	76%
Sweet and tinned spreads	0.8%	0.5%	-72%
Confectionery, etc.	3.2%	3.3%	2%
Snacks	2.8%	4.1%	33%
Dry foods for meals	5.8%	1.5%	-291%
Beverages	2.3%	1.9%	-22%

Figure 4-2 shows food waste as a percentage of annual production in tons from 2015 to 2018 and is a summary of the figures in the fact box, in addition to the years between 2015 and 2018. The percentages marked represent the waste for the various product groups in 2018 and the broken line shows the weighted average for waste in 2018.
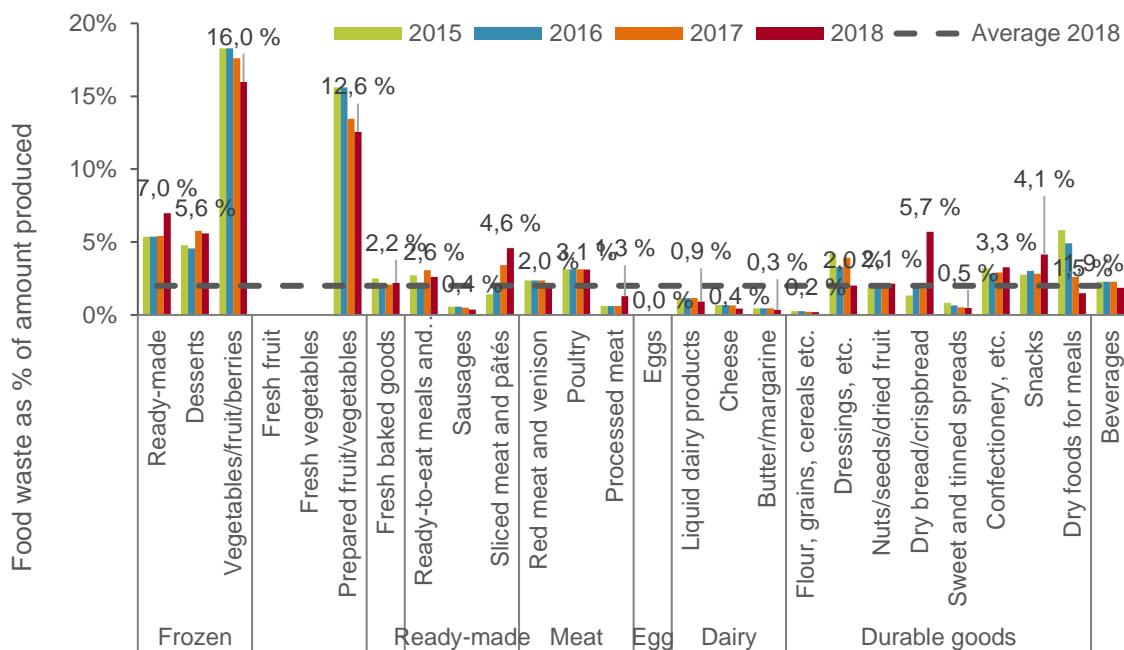
Figure 4-2   **Trends in waste from 11 producers 2015-2018 as a percentage of production**

The figure shows that total food waste by producers amounted to 2.0% in 2018. From 2015 to 2018, the proportion of food waste in the total quantity produced decreased from 2.2%, which corresponds to a reduction of about 69%.

The figure shows that food waste as a percentage of the total amount of food produced varies considerably between product groups. In general, we see that fruit and vegetables have a relatively high percentage of waste, primarily because of sorting due to quality requirements. For frozen ready-made foods and dry bread (crispbread), we see a sharp increase in the percentage of food waste from 2017 to 2018. This is due to the introduction of new production lines and the launch of new products. This is therefore probably a temporary increase which will hopefully be reduced in 2019.

The figure also shows that eggs have 0% waste. This is partly because blood eggs and similar are rejected at the primary stage and partly because eggs that are broken or cannot be resold as eggs are utilised in other food production instead of being discarded.

4.1.2 Causes

Table 4-1 shows the causes of food waste by product group, as provided by the companies involved.

Table 4-1   **Causes of food waste for various product groups at the production stage**

Product group	Cause
Frozen vegetables/fruit/berries	Raw material quality (rotting, etc.), start or reorganisation of production
Frozen desserts	Start and end of production, technical faults/disruptions during production, waste of raw materials in connection with minimum orders, finished product past storage date, forecasting errors, damage/rejection of finished product
Prepared fruit/vegetables	Raw material quality, start or reorganisation of production
Bread	Slicing of bread, technical faults/disruptions during production and returns of finished product
Ready-to-eat meals	Raw material quality, faulty production, technical faults/disruptions during production, forecasting errors
Prepared meat and sausages	Planning errors, production accidents, forecasting errors, technical faults/disruptions during production and unused portions of meat from bones and carcass
Fresh meat	Planning errors, production accidents, forecasting errors, technical faults/disruptions during production, unused portions of meat from bones and carcass, cleaning, past storage date of raw material and finished product
Dairy products	Quality of raw material and finished product, technical faults/disruptions during production
Flour, grains, cereals, etc.	Quality of raw material and finished product, technical faults/disruptions during production, breakage, past storage date, use in test laboratory
Nuts/seeds/dried fruit	Raw material quality, rejected during packing, technical faults/disruptions during production
Snacks	Quality of raw material and finished product, technical faults/disruptions during production, rejected during packing
Sweet and tinned spreads	Raw material quality and cleaning of production facility
Beverages	Past storage date of finished product, quality of finished product, technical faults/disruptions during production, cleaning of production facility

This table shows that quality of raw material and finished product, faults/disruptions during production and expired storage date of finished products are important causes common to a number of product groups. Other recurrent causes of food waste are production accidents and forecasting errors.

Faults, disruptions and accidents during production are complex causes and may require an investment in new equipment/machinery, a focus on internal procedures and training or a combination of the two. These causes have the advantage that the company itself can make efforts to decrease this kind of food waste by implementing various measures. By contrast, raw material quality, expired storage of the finished product, forecasting errors and to some extent the quality of the finished product are causes that run across the value chain, thus requiring collaboration between the primary, production, wholesale and catering stages. Note that finished product quality may also be related to faulty production, packaging or similar, which indicates that this food waste could also be dealt with internally in some cases.

In many cases, the quality of raw material and finished product is linked to quality requirements later in the value chain, at the retail or the consumer stage. To reduce this food waste, quality requirements at the retail/catering stage could be eased, which could then affect the consumer's requirements, so long as the reason for the change in quality was adequately communicated. For some raw materials, this might be difficult, if the company is struggling to find a market with its existing products/sales channels. In such cases, producers should consider alternative utilization of the raw material, e.g. through new processing or as a new product. It should also be noted that waste due to raw material quality may involve rotting food and other damage that prevent the use of the raw material in production. In such cases, it is important for food producers to work with the primary stage to identify possible measures to solve the problem.

4.1.3   Anti-Food Waste Measures Implemented

Food producers were also asked about the measures they have taken to reduce their own food waste and food waste in other stages of the value chain.

Figure 4-3 shows the percentage of the 31 companies that have implemented measures to reduce their own food waste or food waste in the other links in the value chain.
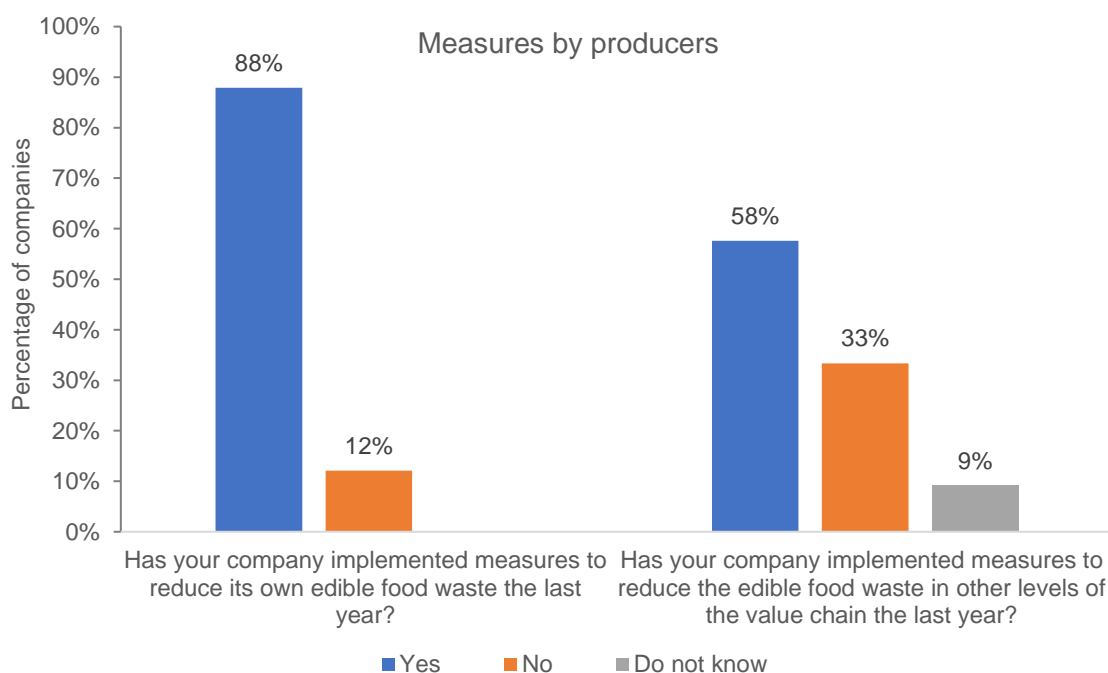
Figure 4-3   Percentages of companies that have implemented measures to reduce their own food waste or food waste in other links in the value chain

The figure shows that a significant proportion of companies (88%) have implemented measures to reduce their own food waste, while 58% have implemented measures to reduce food waste in other parts of the value chain. Last year, about the same proportion of companies (87%) reported having taken steps to reduce their <u>own</u> food waste, while the figure was only 43% for food waste

elsewhere in the value chain. It is a positive sign that more and more companies are implementing measures to reduce food waste in other stages of the value chain, since this should be an important focus area going forward to ensure that e.g. consumers reduce their food waste.

Companies were also asked which measures they had implemented. Figure 4-4 shows the percentages of the 31 companies that reported having implemented various measures to reduce their own food waste.

Internal measures by producers

Measure	Percentage
Optimisation of the production process	76%
Optimisation of planning/storage management systems	69%
Food donation	55%
Optimisation of packaging/packaging process	52%
Sale of food via alternative sales channels	48%
Changes in the product portfolio/product composition	31%
Further processing of food in their own products	28%
Changes in product specifications	21%
Optimisation/adjustment of transport	17%
Further processing of food for new products in other companies	10%
Other	7%

Percentage of companies

Figure 4-4   Percentages of companies reporting having implemented various measures to reduce their own food waste

The figure shows that optimisation of the production process (76%) and optimisation of planning/storage management systems (69%) are the two most frequently used measures by food producers to reduce their own food waste. These measures, in addition to food donation (55%) and the sale of food via alternative sales channels (48%) appear to be useful in relation to food waste linked to several of the causes presented in Section 4.1.2, namely start/reorganisation of production, technical faults/disruptions during production, finished product past storage date and forecasting errors.

Some companies also reported having implemented measures that can be linked to the quality of raw material or finished product, including further processing of food in their own products (28%), changes in product specifications (21%) and further processing of food for new products in other companies (10%).

Figure 4-5 shows the percentages of the 31 companies that reported having implemented various measures to reduce food waste elsewhere in the value chain.
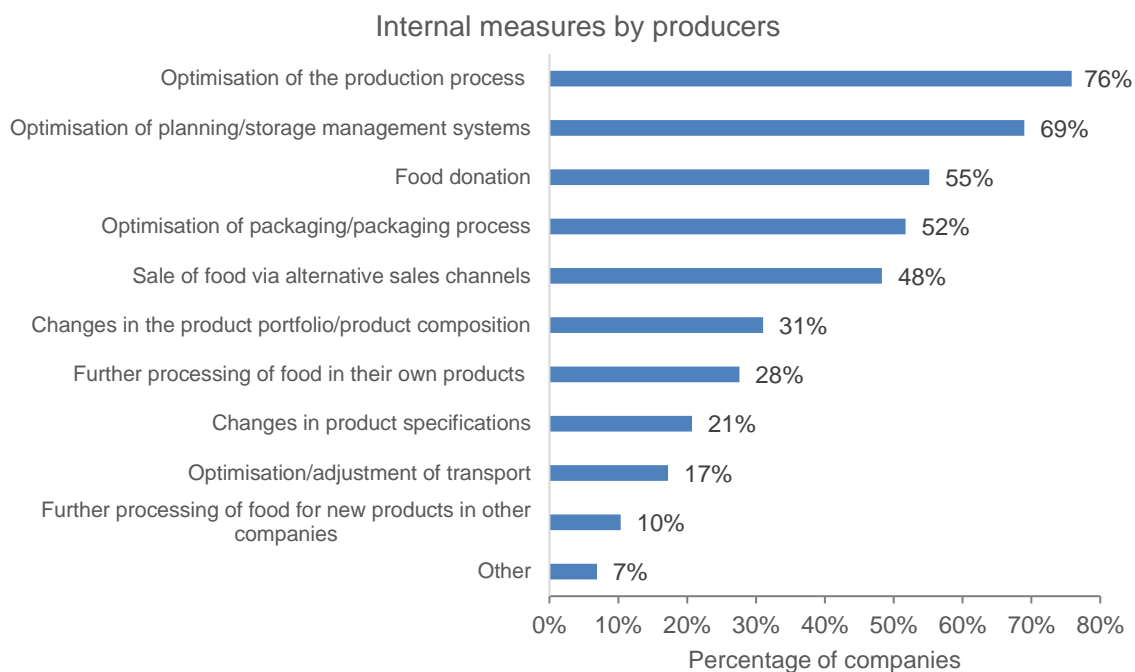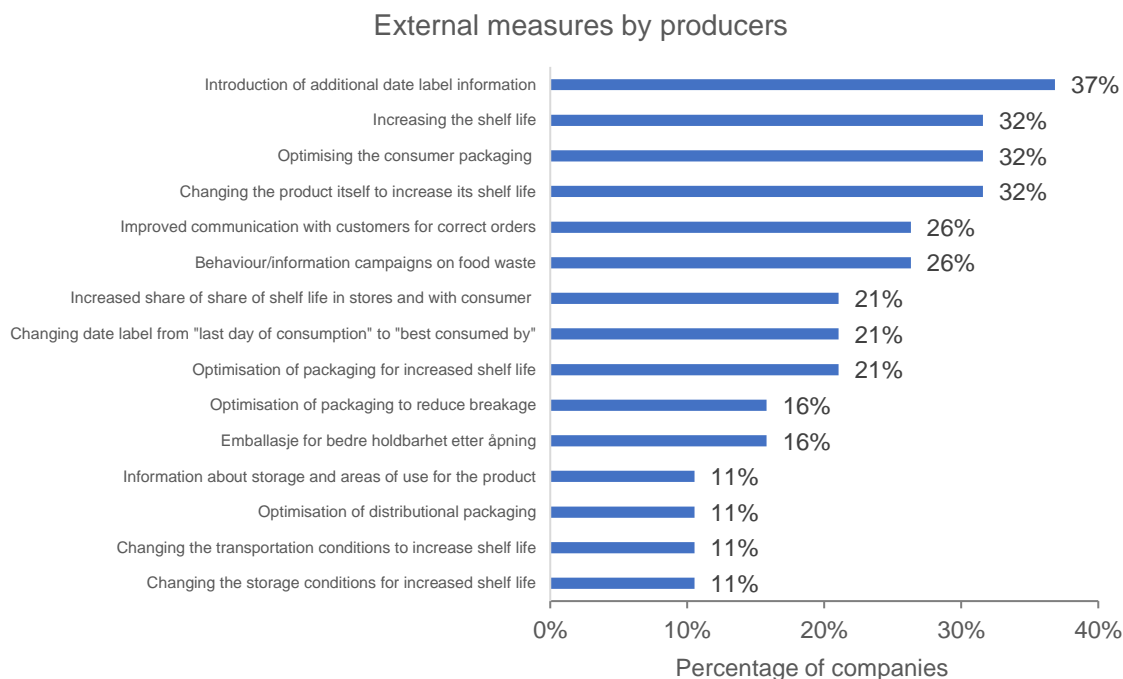
External measures by producers

Measure	Percentage
Introduction of additional date label information	37%
Increasing the shelf life	32%
Optimising the consumer packaging	32%
Changing the product itself to increase its shelf life	32%
Improved communication with customers for correct orders	26%
Behaviour/information campaigns on food waste	26%
Increased share of share of shelf life in stores and with consumer	21%
Changing date label from "last day of consumption" to "best consumed by"	21%
Optimisation of packaging for increased shelf life	21%
Optimisation of packaging to reduce breakage	16%
Emballasje for bedre holdbarhet etter åpning	16%
Information about storage and areas of use for the product	11%
Optimisation of distributional packaging	11%
Changing the transportation conditions to increase shelf life	11%
Changing the storage conditions for increased shelf life	11%

Percentage of companies

Figure 4-5   **Percentages of companies reporting having implemented various measures to reduce food waste elsewhere in the value chain**

The figure shows that the introduction of additional information on date labels is the most frequently implemented measure (37%), followed by increasing the shelf life, optimising the consumer packaging and changing the product itself to increase its shelf life (all 32%). These are all measures aimed at the consumer and they also indicate that producers are aware of the challenges associated with downstream food waste, since "past its expiry date" has long been one of the main causes of food waste by consumers (Stensgård et al. 2018).

4.1.4   Food Waste Management

Figure 4-6 shows the proportion of food that companies have avoided wasting by using it as an input factor in other food production (15%), selling it at a reduced price (30%) or donating/redistributing it (2%). This makes up 47% of the food not sold at full price. The proportion of food allotted to alternative management was 53%; most of this was animal feed (43%), followed by biogas (7%) and incineration (4%).
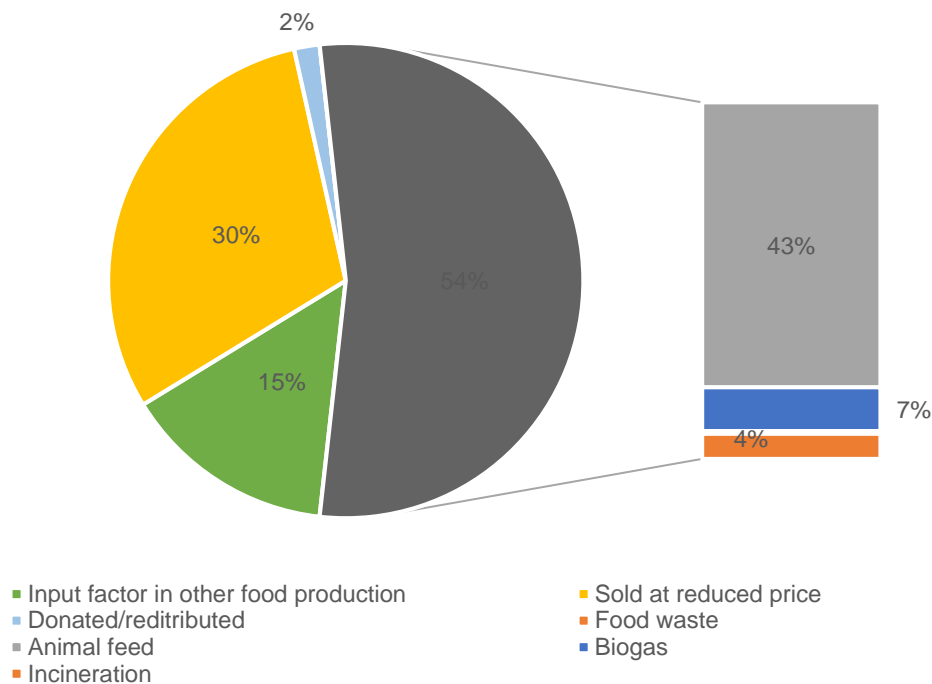
Figure 4-6 includes pie chart showing: 2% (Donated/redistributed), 30% (Sold at reduced price), 15% (Input factor in other food production), 54% (Animal feed combined portion), with expanded bar showing 43% (Animal feed), 7% (Biogas), 4% (Incineration).

Legend:
- Input factor in other food production
- Donated/reditributed
- Animal feed
- Incineration
- Sold at reduced price
- Food waste
- Biogas

Figure 4-6   Proportions of food and food waste by management method and resource use

In last year's report, the proportion of food waste (the orange field) amounted to 75%, which may indicate that companies have become better at using alternative reduction measures. It is a positive development that so much food is sold at a reduced price and used as an input factor in other food production, but the figure also suggests that there may be a great potential for increasing the proportion of food donated/redistributed at the expense of food that currently ends up as food waste (animal feed, biogas and incineration).
One challenge here is that it is often more profitable for companies to use food as animal feed, since they can then be paid for the 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 2018 in tons and percentages of sales, and causes of wholesale food waste.

Figure 4-7 shows the composition of product groups involved in food waste by wholesalers for 2015-2018.
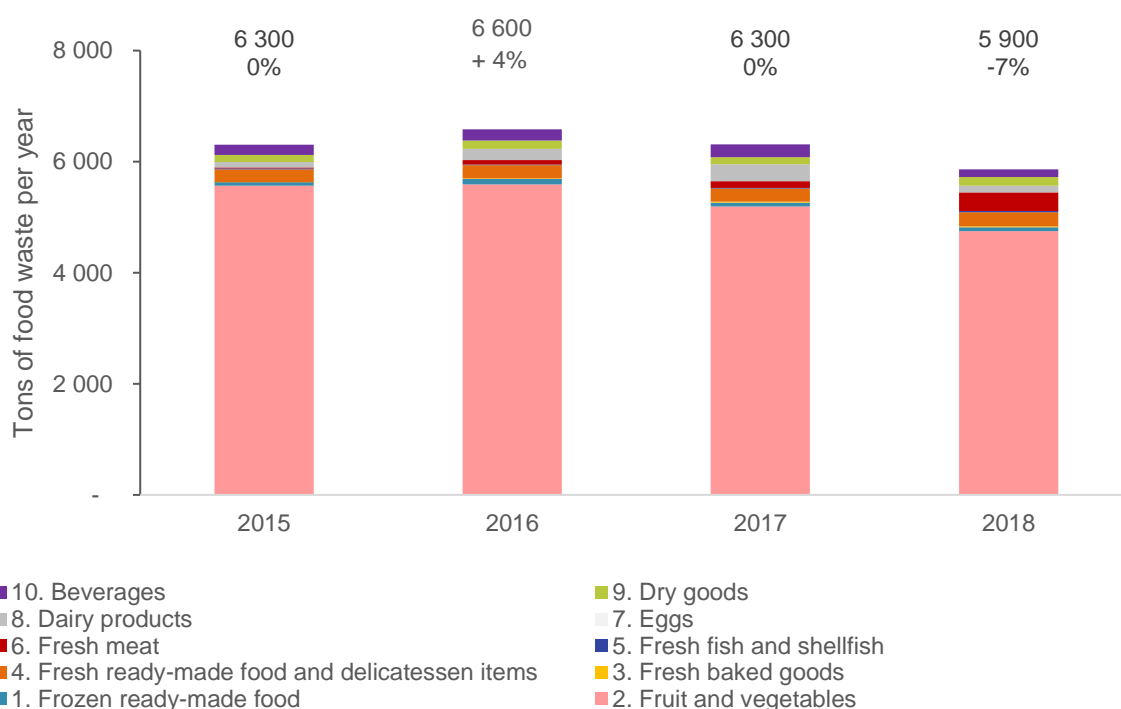

Figure 4-7   Changes in tons of food waste by wholesalers for 2015-2018 by product group

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.

In addition to tons of food waste per product group, food waste is also calculated as percentages of sales. The fact box below shows the results as percentages.

Fact Box 4-2   Summary of figures for wholesalers in 2015 and 2018, and trends from 2015 to 2018.

Product groups with the *most* waste as a percentage of sales were:
1)   Fresh fruit and vegetables (0.41%)
2)   Fish and shellfish (0.21%)
3)   Fresh ready-made food (0.21%)

Product groups with the *least* waste as a percentage of sales were:
1)   Dry goods (0.02%)
2)   Beverages (0.02%)
3)   Frozen food (0.02%)

Product group	% waste 2015	% waste 2018	Change in % waste 2015-2018
Frozen food	0.02%	0.02%	+4%
Fresh fruit and vegetables	0.47%	0.41%	-13%
Baked goods	0.01%	0.04%	198%
Fresh ready-made food and delicatessen items	0.16%	0.21%	+33%
Fish and shellfish	0.18%	0.21%	+17%
Meat	0.01%	0.16%	+1151%
Dairy products	0.04%	0.13%	+242%
Dry goods	0.02%	0.02%	+2%
Beverages	0.02%	0.02%	-27%

Figure 4-8 shows wholesale food waste as a percentage of sales from 2015 to 2018 for all companies reporting to the project. The percentages marked represent the waste for the various product groups in 2018 and the broken line shows the weighted average for food waste in 2018.
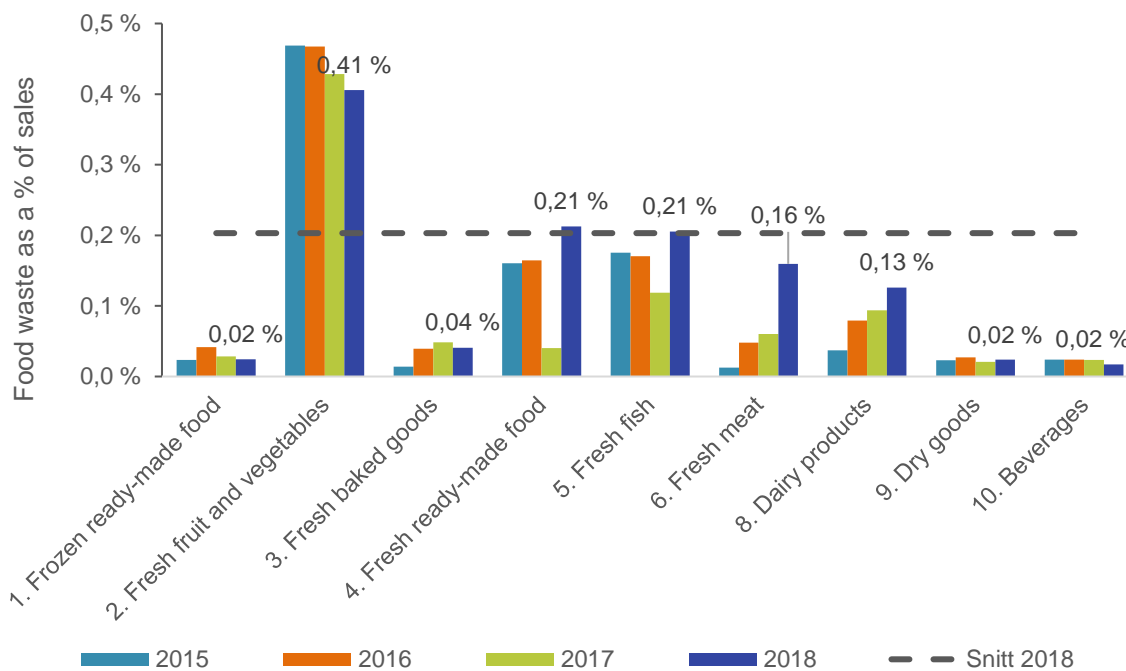
Figure 4-8   Trends in wholesale food waste as percentages of sales from 2015 to 2018

The figure shows that wholesale food waste as a percentage of sales was about 0.2% overall in 2018. From 2015 to 2018, food waste as a percentage of sales decreased by 8%, but as the figure shows, food waste as a percentage of sales increased significantly from 2017 to 2018 for fresh ready-made food, fresh fish, fresh meat and dairy products. This trend is negative because these product groups are relatively expensive and environmentally unfriendly. The increase is primarily due to the establishment of a new central storage facility in 2018 for refrigerated products, which involved changes in product flow, system development, competence building and the implementation of new procedures. Preliminary figures for 2019 indicate that food waste will be considerably lower.

4.2.2 Causes

Figure 4-9 shows causes of wholesale food waste in 2017 and 2018
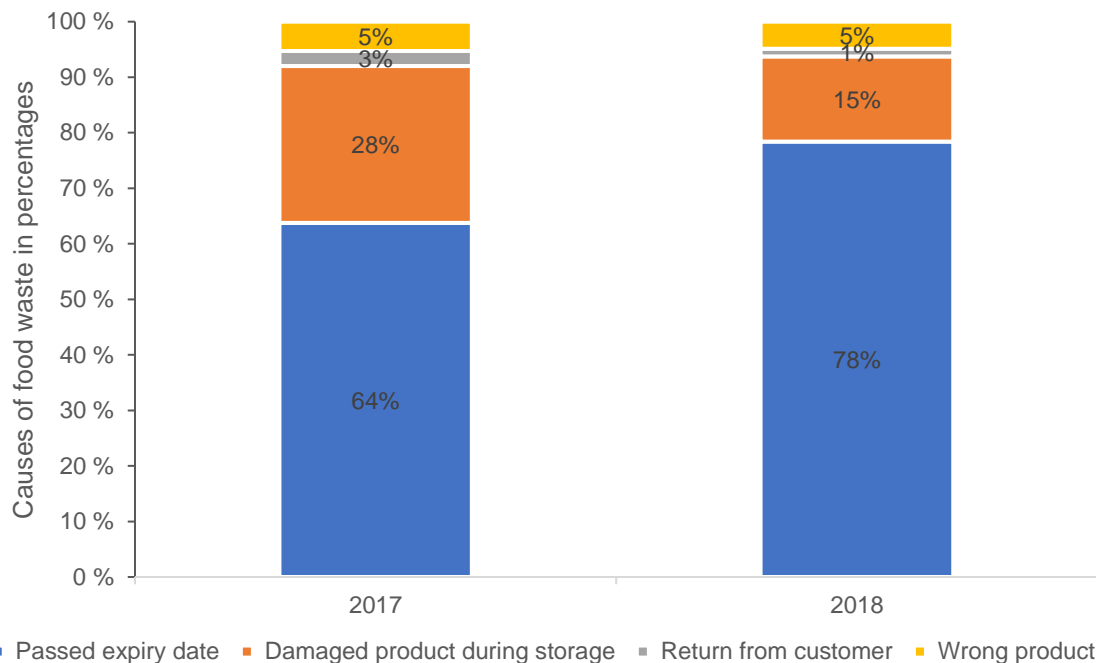

Figure 4-9   Causes of wholesale food waste in 2017 and 2018

The figure shows that most food waste at the wholesale level is related to food being past its expiry date (64-78%) or damaged during storage (15-28%), while defective items and those returned by customers account for a smaller proportion.

The figure shows that the proportion discarded due to the expiry date has increased sharply from 2017 to 2018. This is closely related to the increase in food waste for fresh ready-made food, fresh fish, fresh meat and dairy products shown in Section 4.1.1, and is, as mentioned, a temporary increase due to the new central storage facility for refrigerated products.

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 2018 in tons and percentages of sales, and describes causes and anti-food waste measures.

Figure 4-10 shows the composition of product groups involved in food waste by retailers for 2015-2018.
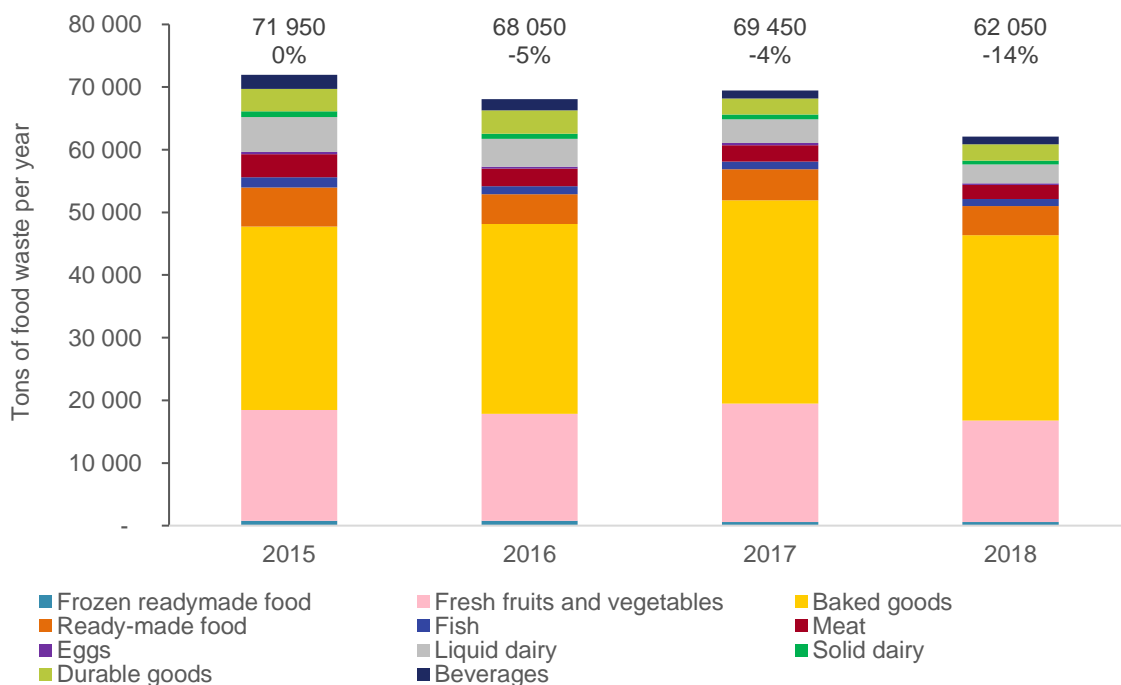

Figure 4-10   Changes in tons of food waste by retailers for 2015-2018 by product group

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 retail trade has reduced food waste by 14%, measured in tons, from 2015 to 2018.

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.

In addition to tons of food waste per product group, food waste is also calculated as percentages of sales. The fact box below shows the results as percentages.

Fact Box 4-3 Summary of retail figures for selected product groups in 2015 and 2018, and trends from 2015 to 2018

Product groups with the *most* waste as a percentage of sales were:
1) Fresh baked goods (8.8%)
2) Fresh fish (4.2%)
3) Fresh fruit (3.5%)

Product groups with the *least* waste as a percentage of sales were:
1) Beverages (0.1%)
2) Frozen ready-made foods (0.3%)
3) Fresh eggs (0.4%)

| Product group	% waste 2015	% waste 2018	Chang in % waste 2015-2018
Frozen ready-made foods	0.5%	0.3%	-36%
Fresh fruit	4.0%	3.5%	-13%
Fresh vegetables	3.8%	3.3%	-13%
Fresh baked goods	8.4%	8.8%	+5%
Fresh ready-made food	4.1%	2.4%	-43%
Sausages	3.7%	1.6%	-57%
Sliced meat and pâtés	2.3%	1.2%	-47%
Fresh fish	6.0%	4.2%	-30%
Fresh meat	5.2%	2.6%	-49%
Minced meat	3.1%	1.0%	-66%
Fresh eggs	1.1%	0.4%	-60%
Milk products	1.0%	0.5%	-49%
Cheese	1.0%	0.7%	-31%
Dry goods	0.9%	0.5%	-41%
Beverages	0.3%	0.1%	-62%
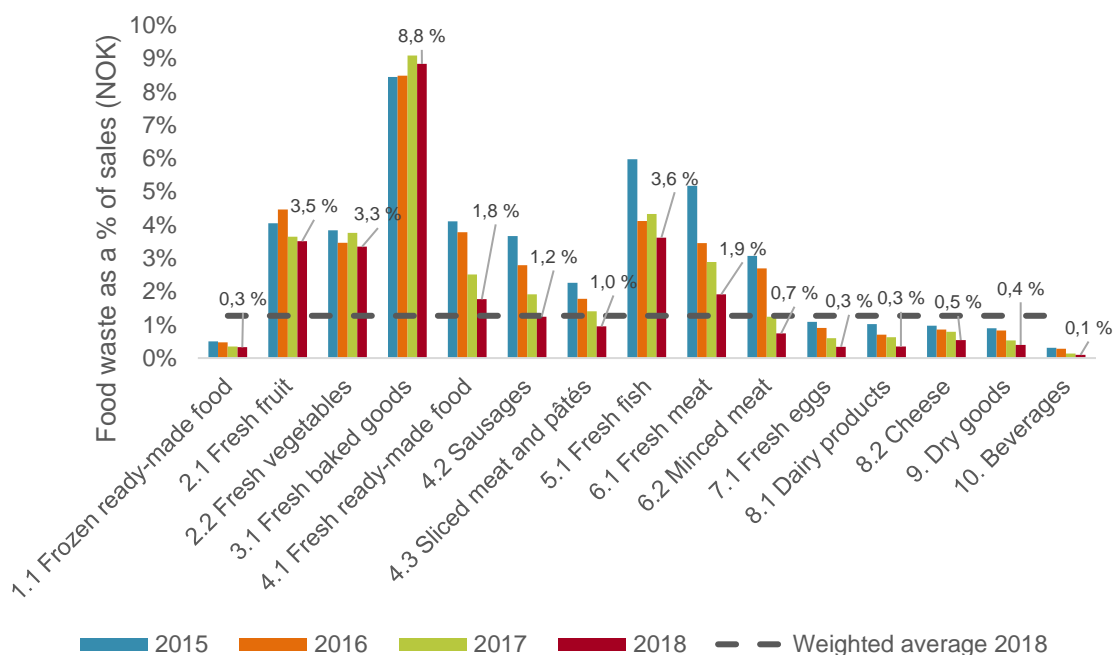
Figure 4-11 shows changes in retail food waste as a percentage of sales for selected product groups from 2015 to 2018.
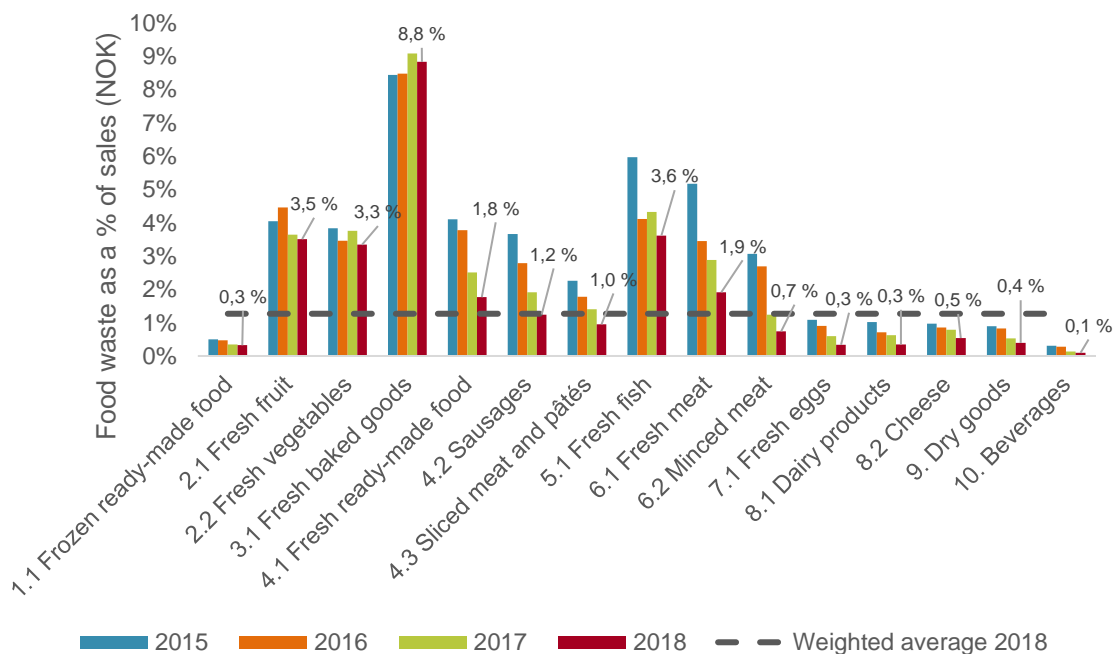

Figure 4-11   **Changes in retail food waste as a percentage of sales from 2015 to 2018**

The figure and fact box show that food waste as a percentage of sales is greatest for fresh baked goods. This is probably closely related to the return schemes for bread and bakery products in the retail sector, where several stores have free return of unsold baked goods. Combined with the fact that bread is regarded as a destination product, this means that stores have little incentive to reduce this food waste. Fortunately, efforts are now being made to revise some of these return schemes, which should help to reduce wastage of bread/baked goods.

Although food waste has not been reduced for the largest product groups in the retail trade (fruit/vegetables and bread/baked goods), the figure shows that retailers have achieved large reductions in waste for the other groups, including some with traditionally somewhat high wastage such as fresh ready-made food, sausages, sliced meat, fresh fish, fresh meat and processed meat. This is largely due to reduced prices, but probably also an increased focus on ordering procedures and forecasting. This development is very positive in terms of carbon footprint and costs associated with food waste, as the reduction has been achieved for relatively expensive and environmentally unfriendly products.

4.3.2 Causes

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.

A short shelf life may be symptomatic, meaning that there are one or more root causes of products being past their expiry date in stores. Some of the root causes are as follows:

- Sub-optimal storage/display of products: This applies, for example, to fruit and vegetables that are kept cool and dark until displayed in stores. Here, several stores have good procedures of either limiting light exposure by covering the products or refrigerating them overnight, but for some fruits and vegetables that need dark and cool storage, current display methods lead to reduced quality and thus a shorter shelf life.
- Excessive product range: Some stores attract customers with a large product range. If the range in a store is greater than the demand/need, so that product rotation is inadequate, more products will pass their expiry date.
- Destination products with a short shelf life: Fresh bread is a so-called "destination product" in the retail sector, i.e. a product that has a decisive influence on whether customers choose to shop in a particular store. The idea is that if a store cannot offer a satisfactory selection of fresh bread throughout its opening hours, customers will choose another store. This is particularly problematic as many Norwegians consider bread as a fresh item, and this, in combination with the large selection, means that large quantities of bread are discarded just after closing time (i.e. collected early the next morning to be sent for animal feed).
- Variations in sales are also an important root cause of food passing its expiry date. Despite good planning tools, it is challenging for stores to order the right amount of goods as sales vary greatly in the course of a week.

As mentioned, 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 in certain stores.

Unfortunately, this has not reduced waste significantly in these groups, but the effect might be greater if it was introduced in more stores.

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.

4.3.3 Measures Implemented

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 special offers 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 (discounts on fruit and vegetables separated out from packs).
- 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, convenience stores 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, employee cafeterias and convenience stores. Figure 4-12 shows estimated total food waste in the parts of the catering sector studied in 2018. The parts of the sector not included in the survey are shown with question marks.
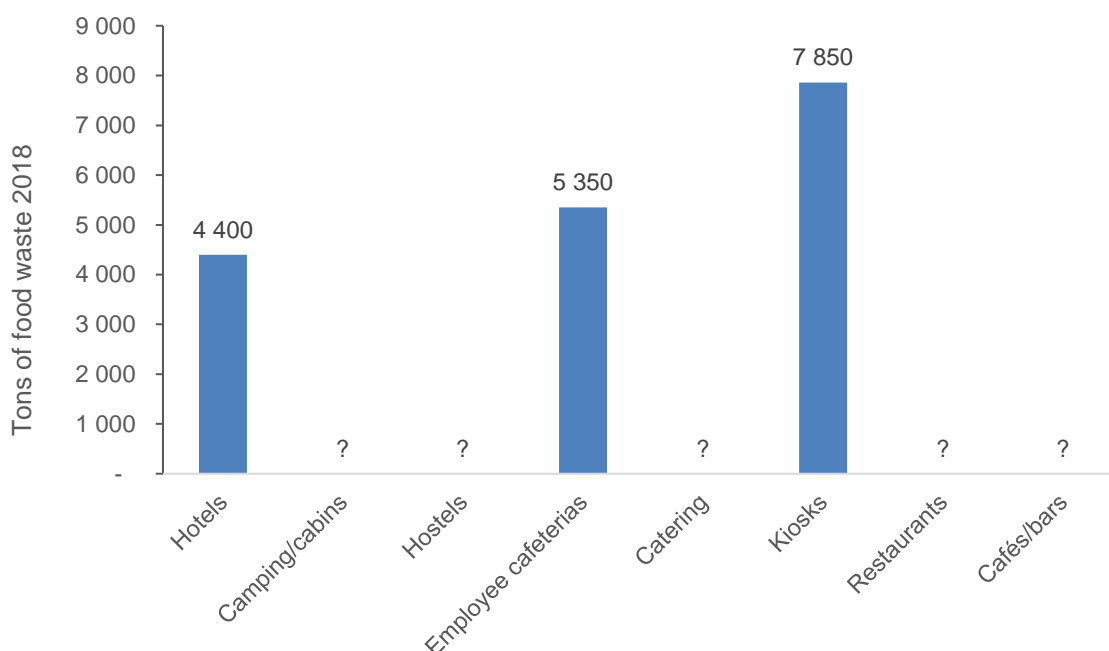

Figure 4-12   Estimate of tons of food waste in the parts of the catering sector studied

The figure shows an estimate of food waste in hotels, employee cafeterias and convenience stores; these three segments accounted for about 17 600 tons of food waste in 2018. Two-thirds of the food waste studied comes from buffets and from guests' plates. Mixed dishes, fruit and vegetables and baked goods have the most waste.

Note that there are ongoing efforts to map food waste in several links in the value chain not shown in the figure above, such as the public sector (nursing homes, schools, kindergartens, hospitals, etc.) and restaurants and cafes. Several catering outlets within these segments are well underway with mapping and prevention work, but unfortunately too few companies have started this work to enable the calculation of national statistics for these sectors.

5 Consumer Surveys

5.1 What kinds of food are we throwing away the most?

Trends in the proportion of respondents who report having recently thrown away different product groups for the years 2010 to 2019 are presented in Figure 5-1. To provide a clearer overall picture, the figure has been simplified compared to previous years, showing the five most important groups separately and the remaining groups as a weighted average.
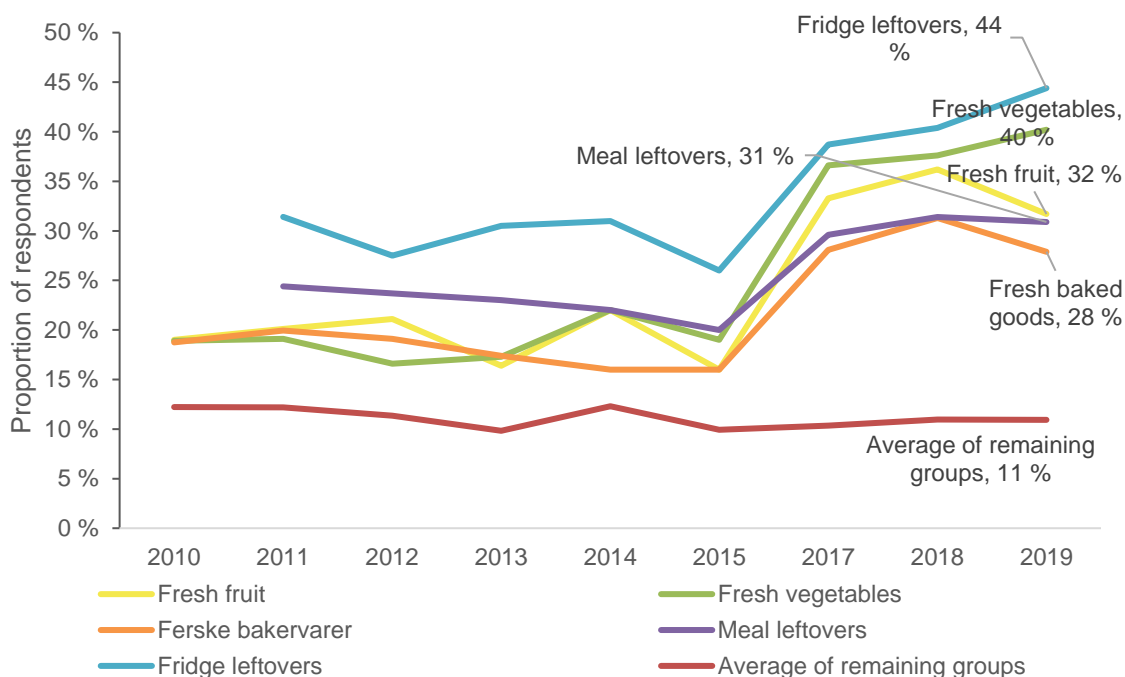

Figure 5-1   **Proportion of consumers reporting having thrown away different types of food in the past week 2010-2019**

The figure shows that five groups had much greater waste in 2017 and 2018 than the remaining groups, namely fridge leftovers, fresh vegetables, fresh fruit, meal leftovers and fresh baked goods. 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.

From 2018 to 2019, fresh fruit and fresh baked goods have decreased significantly, while fridge leftovers and fresh vegetables have increased somewhat over the past year. For the weighted average of the remaining groups, we see that the proportion of consumers reporting this has levelled out in recent years, and declined somewhat from 2010 to 2019.

Table 5-1 shows the waste frequency for all 20 food groups in 2019, as well as the total change from 2015 to 2019. Percentage changes in red indicate a negative trend (increased food waste) since the survey started, while green indicates a positive trend in the same period.

Table 5-1   **Percentages of consumers reporting having thrown away different types of food in the past week (2015-2019)**

Food group	2019	Change 2015-2019
Fridge leftovers	44%	71%
Fresh vegetables	40%	112%
Fresh fruit	32%	98%
Meal leftovers	31%	55%
Fresh baked goods	28%	74%
Sliced meat for open sandwiches	18%	53%
Milk/cream	18%	-4%
Yoghurt/sour cream	16%	16%
Cheese	14%	28%
Fresh meat	12%	28%
Mayonnaise/dressings	11%	41%
Fresh ready-made food	10%	-20%
Fresh ready-made fish meals	10%	104%
Dry goods	9%	11%
Snacks	8%	-32%
Frozen ready-made food	7%	-24%
Eggs	5%	-4%
Biscuits	3%	-18%

Waste sample analyses conducted in 2011, 2015 and 2016 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 2016 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 2017-2019 compared to 2010-2015, which might also explain the increase for these groups.

Another possible explanatory variable for the increase from 2015 to 2017 is that the ForMat project was concluded in 2016 and in connection with the publication of the final report there was an increase in press releases and consumer interest in food waste issues. As the results of the consumer surveys for 2017-2019 (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 the past two years.

Considering that so many respondents (75%) 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 last 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?".
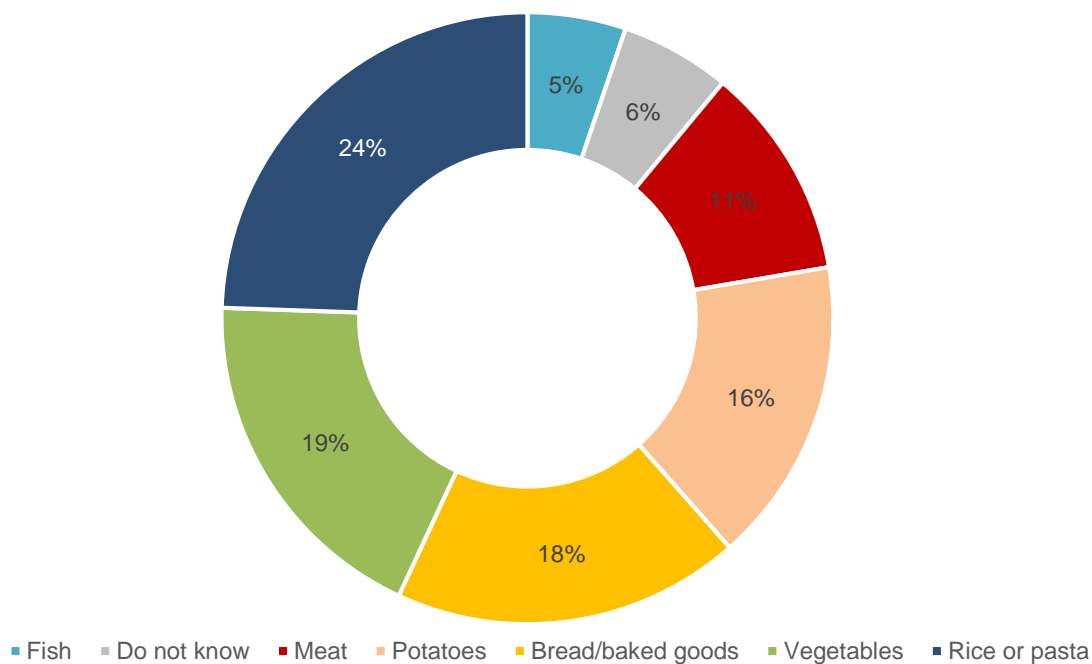

Figure 5-2   Types of food most often discarded as fridge and meal leftovers (2019)

Among the alternatives, most respondents mentioned rice or pasta, vegetables and bread/baked goods, i.e. foods are not usually considered as the main components of the meal.

5.2   Why are we throwing away edible food?

The reasons for discarding selected product groups are shown in Figure 5-3, presented as a weighted average of eight groups (yoghurt/sour cream, cheese, vegetables, fruit, baked goods, fish/fish products, sliced meat and milk/cream). The question on food waste behaviour was expanded from previous surveys to include more possible causes, which means that the results cannot be directly compared with results from previous years.
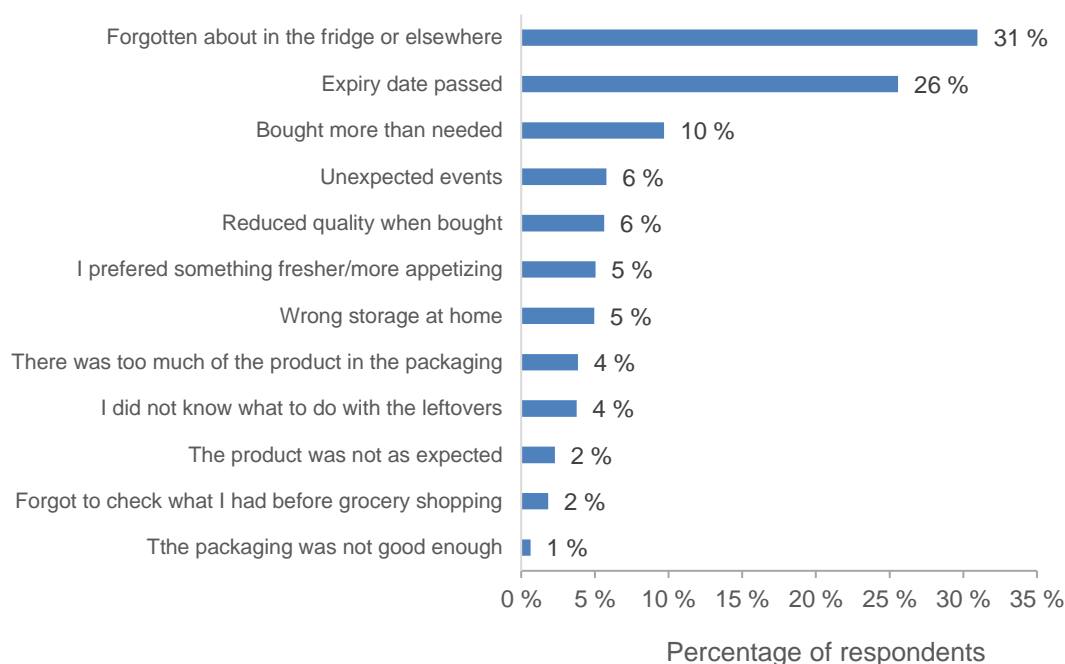

Figure showing a horizontal bar chart:

- Forgotten about in the fridge or elsewhere — 31 %
- Expiry date passed — 26 %
- Bought more than needed — 10 %
- Unexpected events — 6 %
- Reduced quality when bought — 6 %
- I preferred something fresher/more appetizing — 5 %
- Wrong storage at home — 5 %
- There was too much of the product in the packaging — 4 %
- I did not know what to do with the leftovers — 4 %
- The product was not as expected — 2 %
- Forgot to check what I had before grocery shopping — 2 %
- Tthe packaging was not good enough — 1 %

Percentage of respondents

Figure 5-3   Main reason for discarding eight different types of food, weighted average (2019)

The results of the survey indicate that the greatest challenge for consumers is to keep track of the food in their fridge/cupboards and to use it up before buying more food.

Despite a higher number of response options than in previous years, the most important reason for food waste among the selected product groups is still "forgotten about it in the fridge or elsewhere". Furthermore, about a quarter of respondents stated that the expiry date was the main reason for discarding food. This year there was a much larger proportion of respondents giving this as a reason than in 2018. Packaging-related reasons were generally of little importance this year as in previous surveys.

5.3 Who typically throws away food?

5.3.1 Typical Attitudes and Behaviour Influencing Food Waste Habits

Statistical analyses have been conducted to explore possible relationships between different behaviour patterns and attitudes and the number of product groups discarded in households. The results of these analyses are presented in Table 5-2.

Table 5-2   Relationships between attitudes/behaviour and number of product groups discarded

Characteristics	Results
I always know how much to buy	Reduces food waste
I am often tempted to buy too large/too many items	Increases food waste
I take smaller portions rather than having to throw away leftovers	Reduces food waste
I often try out new foods and then throw them away because I didn't like the taste	Increases food waste
I often throw away poor-quality food and choose fresher food instead	Increases food waste
There is little environmental impact of the food thrown away in my household, and this does little to limit my food waste	Increases food waste
I try to have as eco-friendly a lifestyle as possible	Reduces food waste

5.3.2 Typical Consumer Characteristics Influencing Food Waste

Table 5-3 shows various socio-demographic characteristics with a significant correlation with the number of product groups discarded.

Table 5-3   Socio-demographic characteristics with a significant correlation with the number of foods discarded

Characteristics	Results
Age	The youngest age groups (below 40 years) generally discard more product groups that the oldest groups (60+)
Gender	More men than women discard only 0-1 products, while more women than men discard only 2-6 products.
Everyday situation	Pensioners, people on leave from work and others who stay at home report discarding less food than employed people.
Number of people/under 18s in the household	Fewer people or fewer under 18s in the household means less food waste

Both this year and last year, pensioners and non-employed people reported throwing away fewer food groups than people in employment.

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 under 18s 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 considerably higher 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 and size of town/village where respondents live show no association with the number of products discarded in this analysis.

5.3.3 Four Consumer Profiles and their Food Waste Habits

Both this year and last year, analyses were conducted of four different consumer profiles, where respondents were categorised according to income, age and family situation. This was done for the first time last year in order to gain insight into whether food waste and associated behaviour could be linked to different types/characteristics of consumers.

The respondents who fitted into one of the four consumer profiles were distributed accordingly, as seen in Table 5-4. The table 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 main criteria of number of people in the household, number of under 18s in the household, income and age group. Of a total of 3013 respondents in 2017, 2018 and 2019, 1210 respondents belonged to one of the consumer profiles, i.e. about 40% of all respondents in the three years.

Table 5-4   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	≥1 child	>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	43	383	179	605

As the basis for comparing the food waste behaviour of the four consumer profiles, seven product groups were selected: 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 (Figure 5-1), in addition to fish and meat because they are more expensive foods. It could be interesting to explore any potential difference between the food waste habits of the consumer profiles for these two foods, since income was used as one of the main criteria. The results are shown in Figure 5-4.
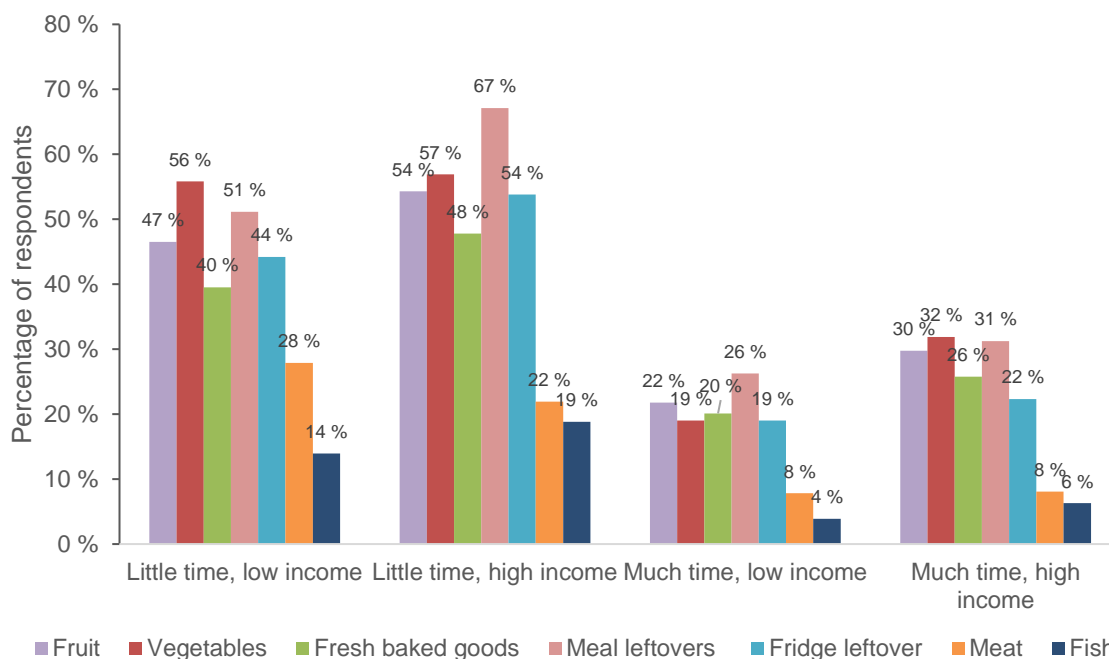

Figure 5-4   Percentages of respondents reporting having discarded seven product groups in the past week by consumer profile

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 that throws away least of all seven product groups.

Figure 5-4 reveals a clear difference between the two profiles with little time and the two with plenty of time; this suggests that the time factor is important for the amount of food wasted. By contrast, there is less difference between low and high income, which suggests that finances are a less important factor than time in relation to food waste, even for relatively expensive foods such as meat and fish.

Table 5-5 shows the results of statistical tests for the four consumer profiles.

Table 5-5   Comparison of the four consumer profiles

Food waste habits	Elaboration
Good idea of how much food needs to be bought for the household	Profile 2 (little time/high income) has a poorer idea of this than the other groups. Profile 3 (plenty of time/low income) has the largest proportion who say they have a good idea of this.

Always eat up leftovers from meals	Profile 3 (plenty of time/low income) and Profile 4 (plenty of time/high income) have the largest proportions who always eat up meal leftovers. Profile 2 (little time/high income) has a greater proportion than Profile 1 (little time/low income). It is rather surprising that people with less money are not better at using up their leftovers than those with a higher income.
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 proportions who take smaller portions to prevent food waste. The lowest proportion is in Profile 1 (little time/low income).
Always throw away food past its expiry date (labelled as either "use by" or "best before")	Profiles 3 and 4 (plenty of time) do this less than Profiles 1 and 2 (little time).
Often have to buy too much food because of too large items.	This is less of a problem for Profile 2 (little time/high income) than for the other three profiles.
Often tempted to buy too large/too many food items in stores.	This is much more common among respondents in Profile 1 (little time/low income) than in the other profiles. It rarely occurs in Profile 4 (plenty of time/high income).

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.

5.3.4 Consumer Handling of Food

This year, respondents were again asked about their knowledge of correct storage of food and the condition of food, and the results of these questions are presented in Figure 5-5.
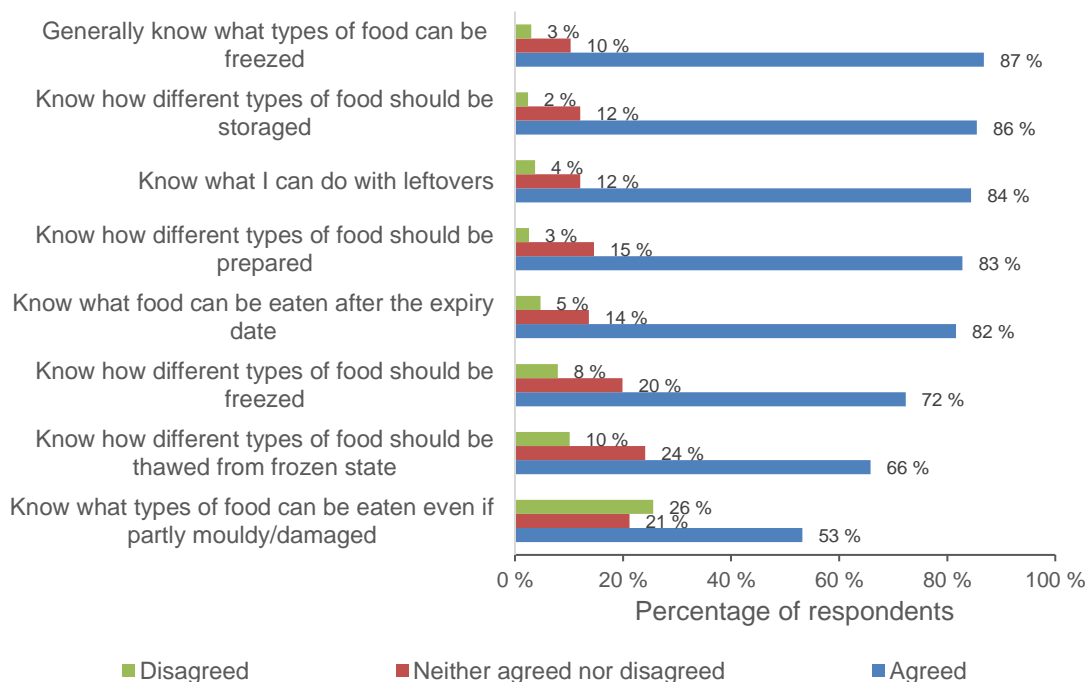

Figure 5-5   **Consumer knowledge of storage of food and the condition of food**

Consumers have good knowledge of correct storage and shelf life. One area that stands out is knowledge of what foods can be eaten even if parts of the food are mouldy or damaged, and even more people state that they know how different foods should be frozen and thawed, but the food industry should still make efforts to provide consumers with this information.

Statistical analyses were also performed, showing that for most of the questions presented in Figure 5-5, older respondents know much more than younger ones about storing food and what foods can be eaten despite having passed their expiry date or being mouldy or damaged in parts.

5.4   Consumer Knowledge of Anti-Food Waste Measures in the Industry

Offers that can change consumers' purchasing patterns were included in this year's consumer survey. Respondents were asked whether they had bought food that was reduced in price due to its short remaining shelf life, whether they had bought food online/using food boxes and whether they had used food waste reduction apps such as "Too Good to Go". The results of these questions are presented in Figure 5-6.
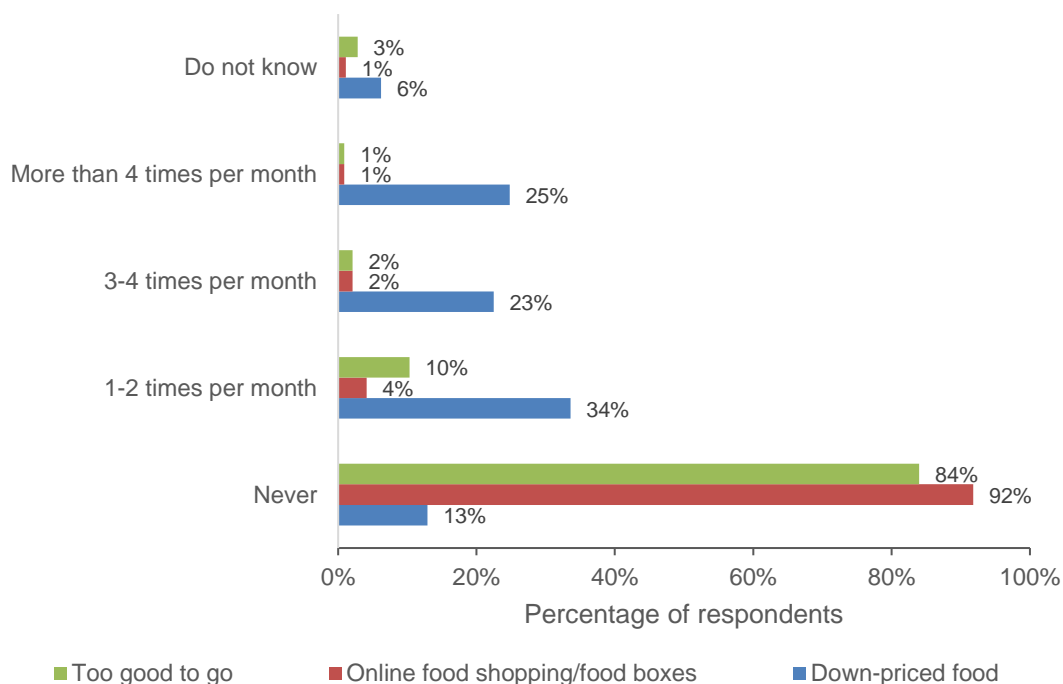

Figure 5-6   Frequency of respondents' use of various offers (2019)

Since such offers can make people buy more food than they need, respondents who had used the offers were also asked if they threw away more food as a result of using the offers. In Figure 5-7, the responses are given as "Yes", "No" and "Don't know" for each of the three offers.
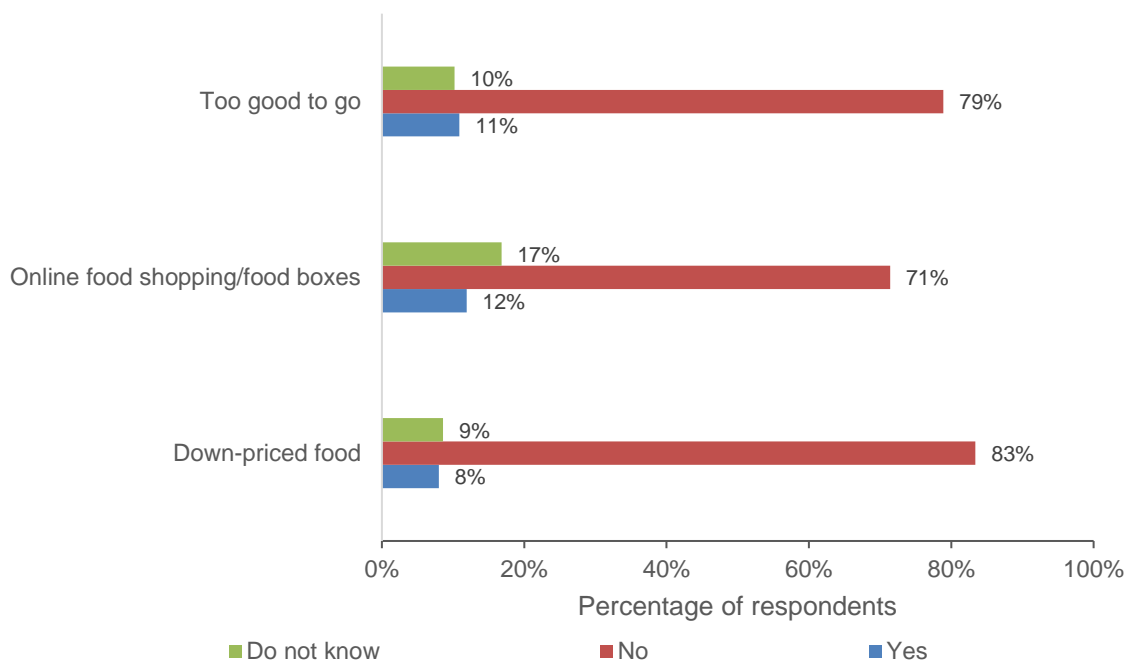
Figure 5-7 **Percentages of respondents discarding more food as a result of using various offers (2019)**

It is also interesting to investigate whether the measures introduced by the food industry to help consumers reduce their food waste have reached the consumers, and if so, to what extent they have led to a decrease in consumer food waste. The responses to the question "Do you know about the following measures?" are presented in Figure 5-8.
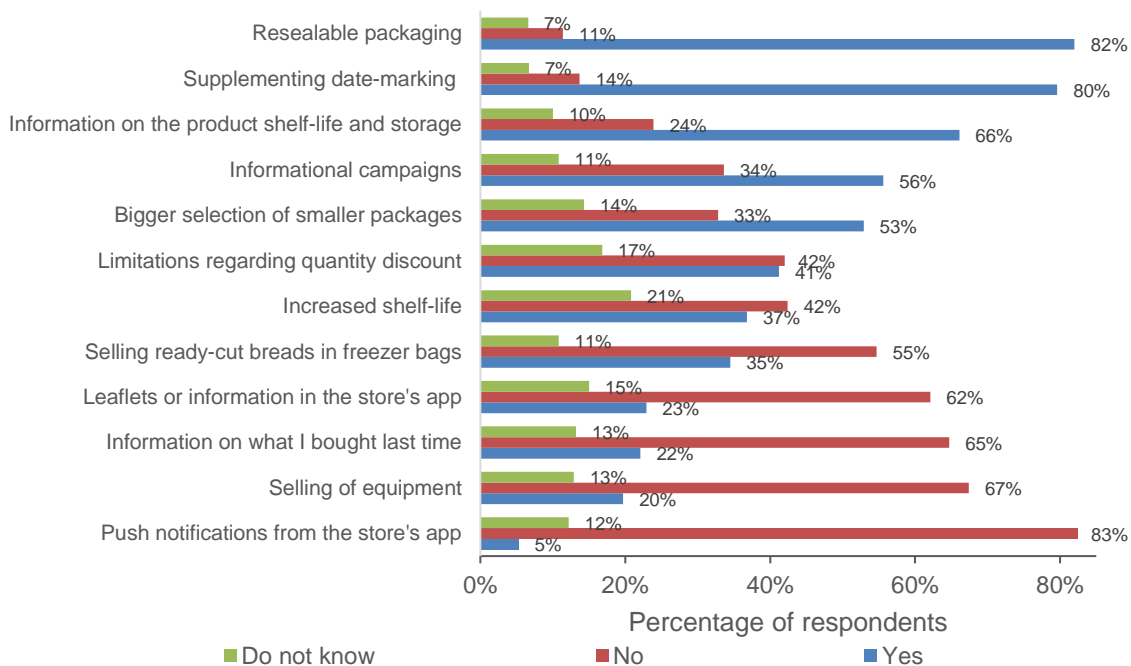

Figure 5-8 **Consumer knowledge of anti-food waste measures in the food industry (2019)**

The best known measures are opening/closing mechanisms on packaging, additional information on date labels and information on shelf life and storage after opening. Information about what consumers bought the last time they went shopping, the sale of equipment, and push notifications from the store app are less well-known measures. The results indicate that using apps from stores is not a widely used food waste measure.

Respondents who replied "Yes" to the question presented in Figure 5-8 were then asked, "Has this measure reduced your food waste?". The results from the responses to this question are presented in Figure 5-9.
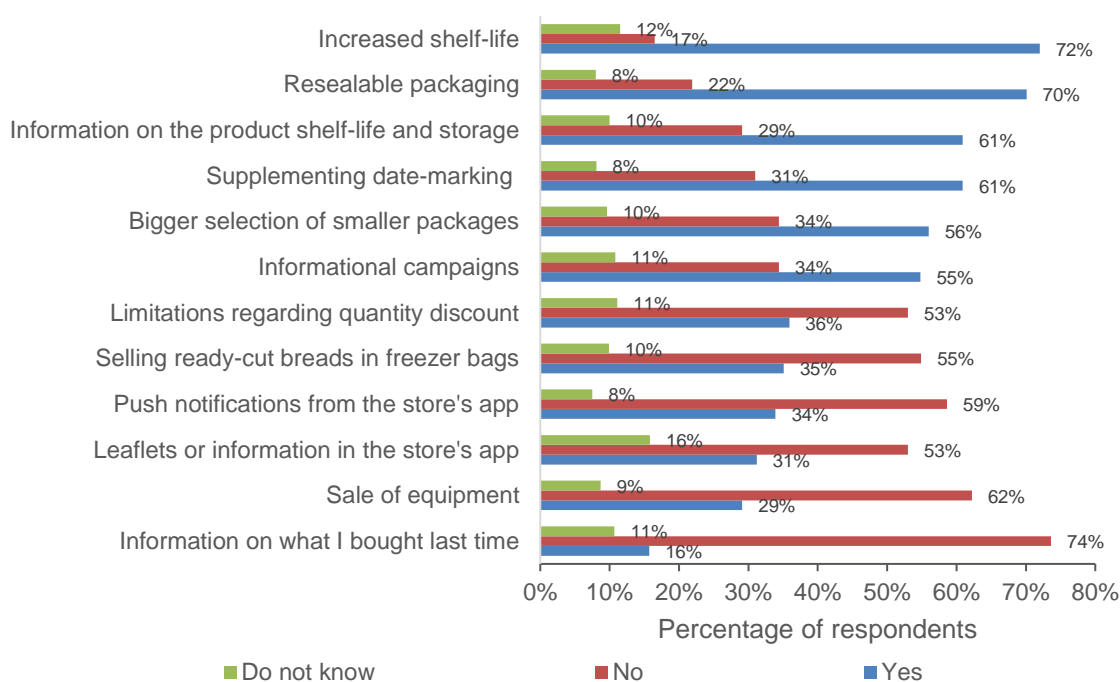

Figure 5-9   Respondents' answers to the question "Has this measure reduced your food waste?" (2019)

The measures that most people stated had reduced food waste in their household were longer shelf life, opening/closing mechanisms on packaging, information about shelf life and storage after opening, and additional information on date labels.

5.5 Changes in Attitudes and Behaviour over Time

5.5.1 Developments from 2017 to 2019

Figure 5-10 shows results for planning of food purchases and mealtime behaviour for the years 2017, 2018 and 2019.
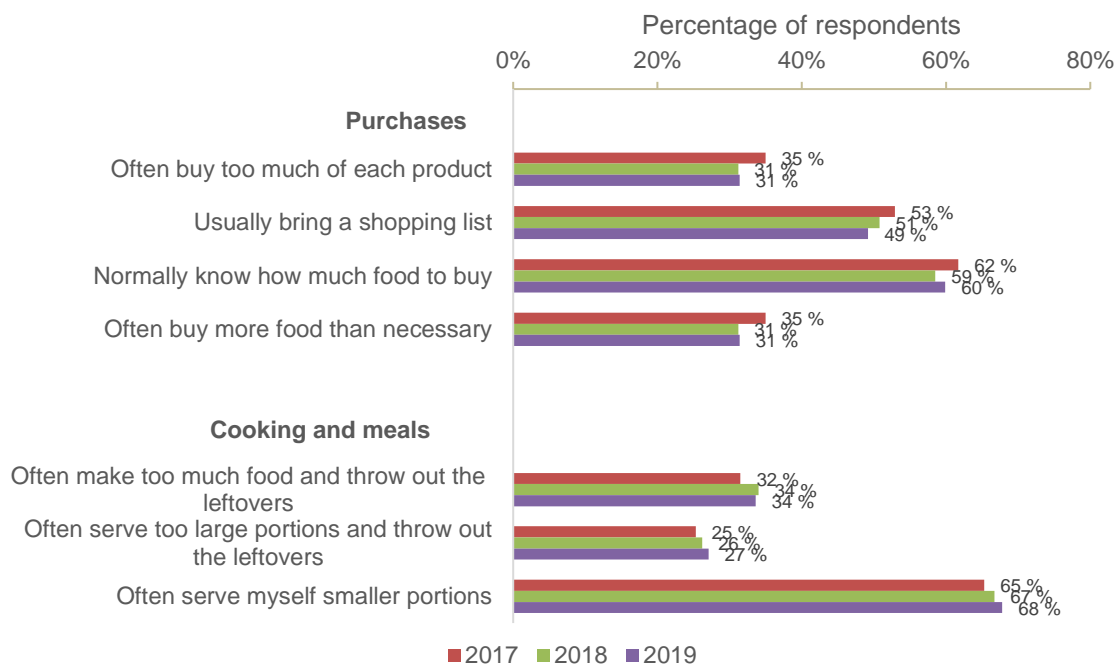

Figure 5-10   **Consumer behaviour regarding planning of food purchases, cooking and meals in 2017, 2018 and 2019.**

The figure shows no major changes in responses since 2017. These results support the assumption that there is actually little change in amounts of food waste from Norwegian households, as also shown by the analysis of the frequency of discarding food by consumers.

Also with regard to packaging, food discard and storage and transport, there are generally only minor changes from 2017 to 2018 and 2019. One exception is the relatively large increase in the proportion replying that food is kept cool during transport home. This may be due to the change in the wording on products from "store in a cool place" to "store correctly", which can be interpreted more broadly. Further, fewer respondents state that they have become more aware of food waste as a problem than in 2017 and 2018. This is probably because food waste is now a more established topic in society and the proportion of consumers who become more aware of it will naturally level off.

6 Discussion and Recommendations

6.1 Discussion and Recommendations

The need for greater cooperation
Last year's report showed that shelf life was an important cause of food waste by producers, retailers and wholesalers. In that connection it was pointed out that 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) with regard to shelf life, or pass their expiry date.

This year's analysis shows similar results for wholesalers and retailers, but indicates that several food producers suggest possible underlying root causes related to shelf life, such as overproduction and variation in sales. Furthermore, this year's report shows that much of the food waste by producers is also linked to customer requirements/quality requirements for both raw material and finished products.

Food waste related to the expiry date/reduced shelf life and customer requirements/quality requirements can generally be decreased through better cooperation and communication across the value chain. This includes cooperation on forecasting, special offers and distribution of shelf life between the stages of the value chain.

Although overproduction and variation in sales were two major causes of food waste by producers, the food waste measures reported by producers showed that only a small portion of surplus food was donated to charities or food banks. In this context, several companies have pointed out that price determines much of their food waste management and that more incentives to donate food are needed. Several companies find it more profitable to destroy food or send it to animal feed than to give it away because of fees to be paid if food is donated. The government, in collaboration with the food industry and Food Banks Norway, should look into the question of how to make it easier to donate food.

The food industry and the consumer
The analysis of measures taken by producers to reduce food waste in other parts of the value chain showed that relatively few companies (16% and 11% respectively) had implemented measures related to "better packaging for increased shelf life after opening" and "information on product storage and use". At the same time, consumer surveys showed that these were among the three most popular measures. This indicates a potential for food producers to help reduce consumer food waste through these measures.

The retail trade has seen very positive developments in food waste in terms of quantity, eco-friendliness and costs. This is largely due to reducing the prices of goods with a short shelf life. It is therefore very gratifying that this year's consumer survey shows that consumers are not discarding more food as a result of buying at reduced prices. In other words, this measure is working for the entire value chain.

6.2   Efforts for the Future

The results in this report show that the food industry as a whole is well placed to reach the first interim target in the sector agreement (-15% by 2020), since it has already achieved a reduction of 12% overall.
The retail stage has already reached the first interim target, but the wholesale and production stages have some way to go. The trend suggests that both producers and wholesalers must increase their efforts towards 2020 in order to reach the first interim target.

Figure 6-1 shows trends to date in food waste for producers, wholesalers, retailers and households, as well as how these must continue in 2020, 2025 and 2030 (the three target years of the sector agreement). Note that the trend for households from 2015 to 2018 is uncertain, as only two waste sample analyses were conducted during the period (2015 and 2017) and the two analyses are not comparable.
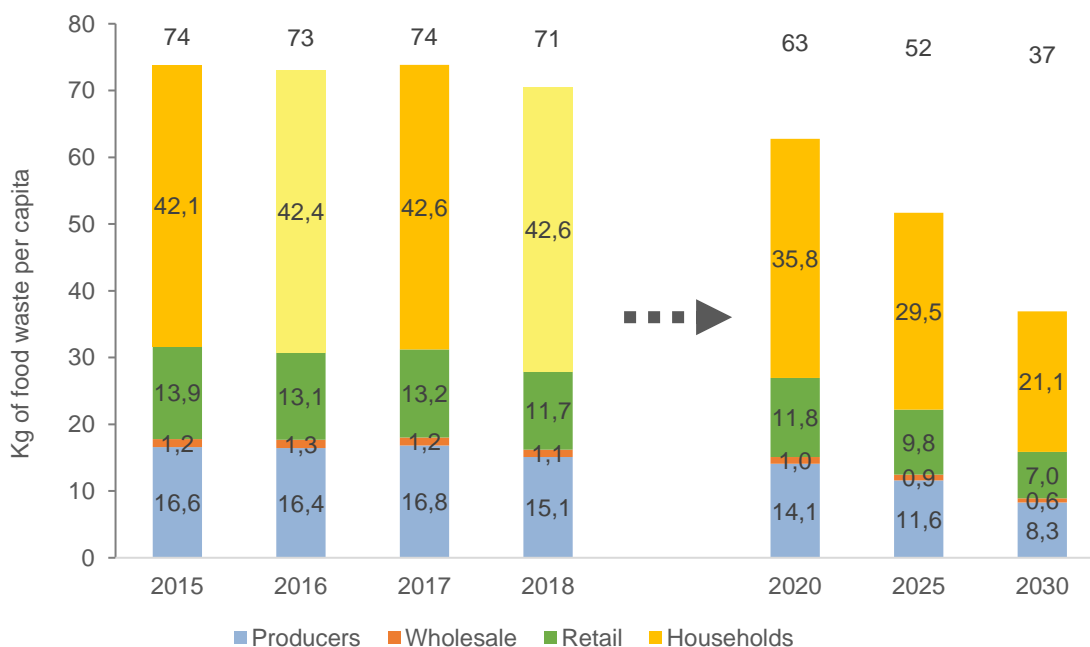

Figure 6-1   Trends in kg of food waste per capita towards 2030

The figure shows that in order to achieve the targets in the sector agreement, total food waste for the four links in the value chain must decrease from current levels of 71 kg per capita (note that convenience stores, hotels and employee cafeterias are not included here) to 63 kg in 2020, 52 kg in 2025 and 37 kg in 2030.

Since the targets of the sector agreement intensify from a 15% reduction in 2020 to 30% in 2025 and 50% in 2030, the food industry must work in an intensive and goal-oriented manner to meet the targets in the agreement, although it is well placed to reach the first interim target. 2020 is only a small step on the road, and much greater efforts will be needed from 2020 to 2030.

The report shows that the large-volume product groups across the value chain are fruit/vegetables and bread/baked goods. These must therefore be the future focus areas for the food industry. At the production stage, we see that the causes of food waste in these groups are related to the quality of raw material and finished product, reorganisation or disruptions in the production process and returns from customers. For wholesalers and retailers, much of the waste in these groups is linked to shelf life or quality. These causes indicate a need for increased cooperation across the value chain and between companies to improve forecasting, reduce quality requirements where possible and find alternative uses for foods with reduced quality/shelf life. In addition, the food industry must work hard to increase consumer acceptance of goods that are currently considered non-marketable.

Although no waste sample analyses have been conducted since 2017, the questionnaires in this year's report unfortunately do not indicate a positive trend in food waste frequency and attitudes at the consumer stage. This shows that the food industry, in collaboration with the government, has an important task ahead to reduce consumer food waste, in addition to reducing its own food waste. This responsibility cannot be left to consumers themselves; it requires efforts in schools, at the production and wholesale stages and especially in the retail and catering sectors, where consumers are in direct contact with the industry. Product and packaging design and product innovation at the production stage and avoiding special offers such as "buy three, pay for two" and other sales incentives at the retail stage are also important, since the food will end up in the consumer's home - either to be eaten or thrown in the rubbish bin.

The consumer surveys indicate that the food industry should continue to focus on measures such as additional information on date labels, better packaging to increase shelf life after opening and information on storage and use. The surveys also suggest that the industry should focus on how to help consumers improve their planning and knowledge of the food they have in their fridge and cupboards, in addition to addressing the time pressure that apparently leads to significant food waste.

The authorities should also target schools, as there is much to suggest poor general knowledge of food among children and adolescents. A greater focus on the quality of raw materials, on using different senses and on how to keep and store food in food and health classes can help to reduce food discard by future generations.

7   References

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Appendix 1 Methodology and Data Basis

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 CO_2 equivalents)

The key figures are based on data collected in the reporting to Matvett by producers, wholesalers and retailers in 2018 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 2019).

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

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 7-1.

Table 7-1   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-to-eat meals og prepared food (not frozen)	Ready-to-eat meals/salads, fried/grilled meat/fish, sous vide food, etc.
	Refrigerated toppings	Salads, sliced meat, pâtés, etc. for open sandwiches
	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 (venison, reindeer meat, horse meat, etc.)
6. Fresh fish and seafood	Prepared fish Unprepared fish Prepared shellfish Unprepared fish	
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 foods	Flour, grains, cereals and baking ingredients Dressings, oils, ketchup Nuts/seeds/dried fruit and berries	
	Dry foods for meals	Rice, pasta, noodles, tinned meals, packets of soup, etc.
	Sweet and tinned toppings for open sandwiches	Jam, chocolate spreads, tinned fish, etc.
	Snacks	

	Sweets/desserts/chocolate	
10. Beverages	Non-alcoholic drinks	Bottled water/juice/soft drinks/squashes, etc.
	Alcoholic drinks	Beer, cider, wine, spirits

Surveys of the Stages of the Value Chain

The Production Stage

The basis for the survey of food waste by producers is the reporting of data on waste and amounts produced (in tons) by product group by a selection of companies. The companies have also reported on data quality, how food waste is used (animal feed, biogas, incineration), measures implemented, and how much food waste they have reduced by selling food at low prices, donating food, etc.

The 31 companies represent a broad selection of production facilities and cover about 45% of the total sales of Norwegian food producers (with the exception of the fishing industry). 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.

Of the 31 companies that have provided data, five have stated that they have not reported total food waste figures, since they have not established good methods for measuring/recording parts of food waste (such as food waste falling onto the floor during production). The extent of the missing waste is uncertain and differs between companies. The missing data applies to flour/grains/cereals etc., beverages, nuts/seeds/dried fruit, sausages and frozen vegetables/fruits/berries. The companies are working to establish statistics for the missing food waste, and hopefully these will be in place for next year's reporting.

As mentioned, efforts are ongoing to map food waste in primary production, which also involves work on determining the boundary between what is considered as the primary stage and what is viewed as the production stage. Until now, companies' NACE codes have been used to determine the part of the value chain they belong to, but this approach will probably not be used in next year's report as the ongoing survey of primary production has identified several disadvantages of this methodology. This suggests that the amount of food waste by producers will be sharply revised in next year's report, as food waste that is currently considered as part of the production stage industry will be included in the primary stage. This adjustment may also lead to changes in figures for kg per capita, financial losses and greenhouse gas emissions for the production stage.

Changes in methodology from last year's report
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 and 31 in 2018.

Although some of the new companies have been able to provide historical data, the increase in the number of companies in the sample from 2015 to 2018 means that the data basis is not directly comparable between years. This discrepancy is further reinforced by the fact that some of the companies that have shared data since 2010 have improved their data basis 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 for these companies can no longer be compared to the surveys in more recent years.

In last year's report (Stensgård et al. 2018), this problem was solved by basing all time series for producers (including changes in kg per capita) solely on data from the few companies with comparable data from 2015. This was to ensure that the calculated food waste trend was correct and not due to changes in the sample/data base. However, there were two challenges involved in this methodology: despite data comparability, representativity was very poor (small sample size). Furthermore, the methodology resulted in two calculations of tonnage, one for changes from 2015 to 2017, based on the companies with comparable data, and one for 2017, based on all the companies that had provided data that year.

In this year's report, this methodology has therefore been revised. To ensure a comparable and maximally representative time series, for all new companies entering the data base after 2015, their production and waste volumes in their first reporting year are used for the previous years without waste data. This means that if Company A started reporting its food waste in 2017, it will be given the same waste percentage in 2015 and 2016 as it had in 2017. In this way, there will be no changes in waste for companies before they can provide real figures, and they thus have fewer years to implement the sector agreement. The same applies to companies that do not have comparable data because they have changed their data base or methodology.
This methodology ensures that the data are both comparable and representative. The disadvantage is that a large proportion of the data at the beginning of the period is not real data, but data for a later year. In addition, this means that the time series will be corrected backwards in time each time new companies provide data. The annual food waste reports will therefore not be comparable. Fortunately, the effect of this will diminish as the number of companies increases.

Reporting methods
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 in 2018 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.

The guideline can be downloaded here: https://www.matvett.no/uploads/documents/OR.10.18-Veileder-for-kartlEggsing-av-matsvinn-i-matindustrien.pdf

Calculation method

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 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".

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 was multiplied with the production volume from Statistics Norway.

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

The Wholesale and Retail Stages

The basis for the survey of food waste by wholesalers and retailers is the reporting of data on waste and sales (in NOK) by product group and cause by a selection of companies in these two stages of the value chain. The reason why the data basis for these two stages is in economic terms is that the recording of waste is part of the financial management system of wholesalers and retailers.

Changes in the data basis

Improved data bases in companies have not only led to changes in the data from producers, but also in data from wholesalers and retailers.

This year for the first time, one of the chains has expanded its data basis to include kg of food waste in addition to measuring waste in economic terms. This has meant that the previous prices per kg, based on consumer price index-adjusted key figures from 2011, that were used to convert waste figures in economic terms to quantities of waste, have now been replaced with more correct prices per kg. Previous waste calculations for wholesalers and retailers from 2015 to the present have therefore been corrected with new prices per kg. The calculations in this year's report thus differ somewhat from previous calculations for these stages of the value chain.

Samples

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.

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.

Calculation method

The data from the wholesale and retail sectors are expressed in economic terms, so to calculate the amount of food waste in tons, the key figures in terms of NOK per kg have been used to convert from economic value to tonnage. These are the key figures that have been updated this year.

The companies included have been scaled up to the national level on the basis of their market share for each year during the period.

Hotels, Employee Cafeterias and Convenience Stores

Food waste mapping
The research project KuttMatsvinn2020 is currently involved in mapping food waste in hotels, employee cafeterias and convenience stores.

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 is also being conducted. At present, about 2000 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 2018 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.

For the convenience store segment, data is reported in economic terms and is recorded by staff at the sales outlet using PLU codes or scanning barcodes as part of the financial management system. The data are recorded either when food is discarded, at the end of a shift or at closing time, or as part of year-end stocktaking. Food waste by convenience store customers is not included in the data for this segment as this is currently not recorded.

Since different chains and outlets have different point of sale systems and financial management systems, there is some variation in the degree of detail and quality of the waste data in the convenience store segment. Most chains have reported sales and waste for different product groups, while some have only reported total sales and waste. Outlets have not been able to distinguish between financial loss and food waste, which means that food donated or sold at reduced prices is included in the food waste calculations for this segment.

For the convenience store segment, three chains have provided data. Their outlets represent about 50% of convenience stores and covers petrol stations and other small stores throughout Norway. Convenience stores in this report are listed in the Nielsen Norway Register of Convenience Stores (Nielsen Norges Servicehandelsregister).

Calculation method
For each catering outlet in the hotel and employee cafeteria 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 small. The sample has then been scaled up to national statistics based on the relative market share of the chains in 2018.

For convenience stores, the data basis is expressed in economic terms; therefore, in order to calculate the amount of food waste in tons that occurs in this sector, key figures in the form of NOK per kg) have been used to convert food waste from economic value to tonnage. The sample has been scaled up to the national level based on the market share of each chain in 2018.

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 2017-2019. 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 2019 survey are quite similar to those in 2018, but the form was expanded to include questions about how liquid food waste is discarded (via drains or waste containers), what food industry measures consumers think help them to discard less food, what consumers think they know about looking after food, and whether they throw away more food as a result of buying food at reduced prices or via apps such as Too Good To Go or using food boxes/online purchases.

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
An analysis has been conducted 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. The consumer profiles have been 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 2017, 2018 and 2019; 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 5-4.

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 were in full-time employment. It is assumed that people in 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.

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.

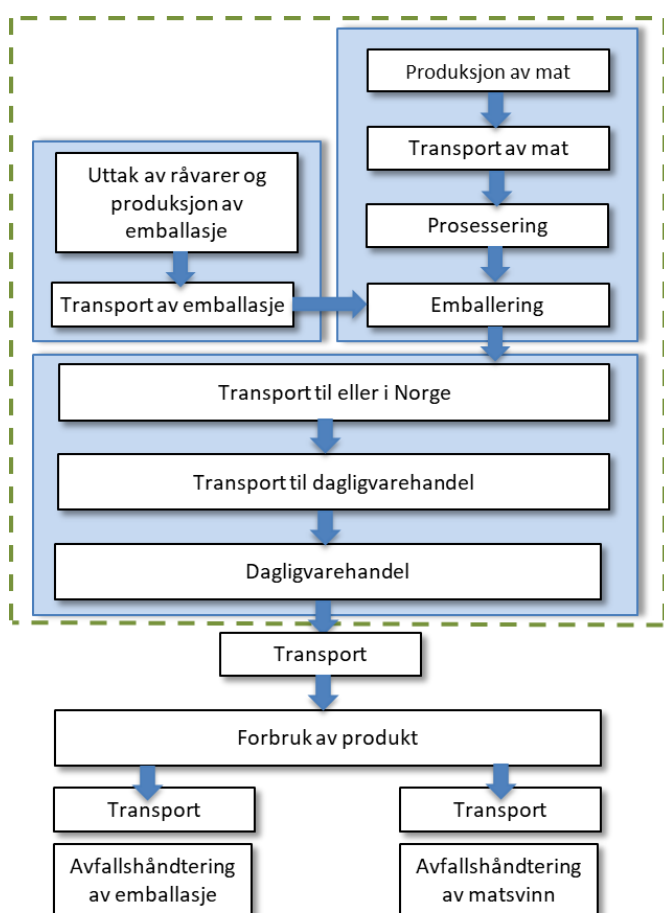Figure 7-1 shows which activities were included and excluded in the carbon footprint of food waste.

Figure 7-1 **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).

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.