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Food Waste in Norway

Report on Key Figures 2016

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Summary

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; the target will be achieved by a 15% reduction in 2020 and a 30% reduction in 2025, where 2015 represents the baseline. In September 2017, 42 leading companies in the food manufacturing, retail and catering industries signed a declaration of affiliation in which they agreed to the objectives of the sector agreement and committed themselves to surveying and providing data on their own food waste and to take steps to reduce waste in their own company and in networks with others.

This report is a summary of reporting from the food industry. Food waste from the catering sector is not included in this report, but will be included in the next report.

The results from the survey show that food waste in the three stages of the food industry value chain (producers, retailers and wholesalers) was reduced by about 23 000 tons, or 15%, from 2010 to 2016. This is the equivalent of a reduction of 6.68 kg per capita, or 21%. Greenhouse gas emissions and financial losses associated with food waste in the industry also declined in the same period, by 11% and 6% respectively.

From 2015 to 2016, food waste in the food industry was reduced by 1.1 kg per capita, or 4% (kg per capita is the measure used in the sector agreement and the UN Sustainable Development Goal). This corresponds to a reduction of 4 500 tons. During this period, food waste from retailers and wholesalers declined, but increased for producers.
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The increase in the amount of food waste by manufacturers is due to several factors, one of which is that production in the Norwegian food industry increased from 2015 to 2016 (+ 6% (Statistics Norway 2017)). Further causes were increased complexity in the product range and changes in the logistics system. Logistics challenges are assumed to be temporary, but the complexity challenges require increased cooperation throughout the value chain.

The decline in the retail sector is largely due to discounts on items with a short remaining shelf life. These discounts have also led to a significant reduction in greenhouse gas emissions and financial losses associated with food waste in the retail sector, as food waste was mainly reduced for relatively expensive and environmentally unfriendly products. The causes of the decline in the wholesale sector are unknown, but will be further studied in 2018.

1 Introduction

1.1 Food Waste Statistics in Norway

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

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

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

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.

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.

June 2017 saw the signing of the Norwegian sector agreement between the government and the food sector on food waste reduction. The agreement aims to reduce food waste in Norway in line with the sustainable development goal, but with a further target: to cut food waste by half for the entire value chain. The reduction by half is to be achieved through interim targets of 15% reduction by 2020 and 30% reduction by 2025, compared to the 2015 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 that commits them to surveying, reporting and reducing their food waste. As a result of this declaration and the sector agreement, the number of companies sharing waste

data has more than doubled since the end of the ForMat project. This improves the database considerably.

The definition of food waste used in the sector agreement and in this report 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.). Other definitions used include the inedible parts (see Section 3.5). 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.

This report provides information on quantities, environmental impacts and costs associated with food waste by producers, retailers and wholesalers.

Household food waste is studied in a separate project for the Norwegian Environment Agency, which is responsible for this part of the food chain under the sector agreement, and household food waste is therefore not included in this report. Avfall Norge, Mepex, Ostfold Research and Statistics Norway are conducting this project for the Environment Agency. The consumer studies performed by Matvett and Ostfold Research, which started in 2010, are continued in this report in a new and improved version, providing new information on the extent and causes of food discard by consumers. A more extensive report on this is planned for 2018.

2 Methodology and Data Basis

2.1 Definition and Data Collection

As mentioned above, the definition of food waste in the sector agreement forms the basis for this survey of food waste.

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.

Food waste that occurs in the various stages is divided into product groups in order to calculate the economic and environmental impacts of food waste. The same division is used for producers, wholesalers, retailers and consumers to ensure comparability across the value chain.

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

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

The key figures are based on data collected in the reporting to Matvett by producers, wholesalers and retailers in 2016 under the sector agreement.

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

2.2 Surveys of the Stages of the Value Chain

2.2.1 The Production Stage

Among food producers, 15 companies have provided data for 2016, and 11 of these have provided data every year since 2010. The companies represent a wide range of production facilities and cover about a quarter of total sales in the Norwegian food industry. The sample is considered to be representative of several product groups in economic terms.

Data at the product group level is shown as the percentage of waste from production, and has been calculated by dividing the reported amount of 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. Data for the annual production volume of each product group are taken from Statistics Norway's Table 10455 "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) have been calculated, which were then combined with production statistics expressed as sales value in order to calculate annual production.

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

It has not been possible to calculate the amount of waste in production in the fishing industry, brewery industry and in mills and flour producers, as the data from these sectors is of poor quality or has not yet been collected. These sectors will be covered in next year's report.

2.2.2 Wholesalers

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.
Data from wholesalers are expressed in economic terms, so to calculate the amount of food waste in tons at the wholesale stage, the key figures in terms of NOK per kg have been used to convert from economic value to tonnage. The key figures were collected in 2010 and have been CPI-adjusted for the years 2011-2016.

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

2.2.3 Retailers

For retailers, 89 stores from three chains have provided data. The stores are a representative cross-section of retail grocery outlets in Norway, with regard to geographical region, population density, and stores with or without fresh food sections. As for wholesalers, the data from the retail sector are expressed in economic terms, so to calculate the amount of food waste in tons at the retail stage, the key figures in terms of NOK per kg have been used to convert from economic value to tonnage.

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

2.2.4 Consumers

The consumer studies used a sample of 1000 respondents representative of Norwegian consumers. The studies were conducted annually from 2010 to 2015 and in 2017. They dealt with the types of food consumers had discarded, reasons for discarding food, and a number of questions about their behaviour and attitudes related to planning, purchasing, meals, packaging, date stamps, etc.

The studies were conducted using the Norstat web panels (electronic questionnaires). Data were also collected on age, gender, place of residence, education, social status, number of persons in the household and household income for all respondents, to enable the responses to be analysed in terms of different consumer characteristics.

The analysis for 2017 is not 100% comparable to previous studies, because some adjustments and improvements have been made to the questions that may have affected how respondents have interpreted the questions and therefore also their responses. There are also additional questions relevant to the interpretation of the responses in the surveys, including purchasing patterns and where meals are eaten. In addition, the 2017 survey consisted of one single data collection, compared with two separate collections of data on the frequency and causes of food discard and questions on attitude and behaviour in the years 2010-2016. This will provide a much better basis for statistical analysis, as it will be possible to see relationships between answers from the same respondents.

2.3 Key National Figures

2.3.1 Calculation of 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 then 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.

As 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.

2.3.2 Calculation of Greenhouse Gas Emissions

The environmental analysis was limited to one indicator, namely greenhouse gas emissions; these were calculated using life cycle analysis 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.

The emission factors include all greenhouse gases related to the production, transport and packaging of food. Emissions connected to the disposal of packaging and food waste have not been included. All emissions have been converted into CO2 equivalents.

3 Results

3.1 Tons of Food Waste by Stage in the Value Chain in 2016

Figure 3-1 shows total tonnages and percentages of food waste in the surveyed stages of the value chain in 2016 and changes from 2015 to 2016.

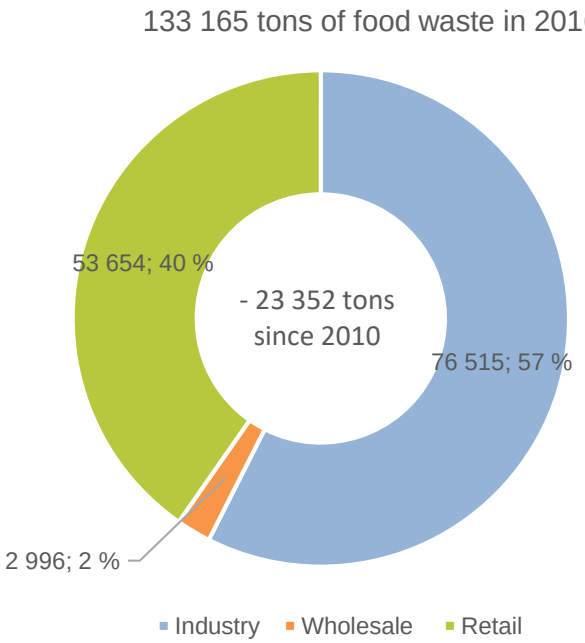

Figure 3-1 Tonnages and percentages of food waste by stage in the value chain in 2016

The figure shows that 133 165 tons of food were wasted from the three stages of the value chain in 2016. Producers accounted for most (57%) of the food waste, followed by retailers (40%) and finally wholesalers (2%). Compared with 2010, this gives a reduction of 23 352 tons, or about 15%.

Note that the entire food production industry has not been studied, as food waste from the fishing industry, mills and flour producers and breweries are not included due to the lack of data. In other words, there is more food waste in this stage than shown in the figure.

The results for retailers and wholesalers are the most reliable figures, as the data for these stages are of good quality. For these stages, 100% of food waste has been included. However, there are some uncertainties regarding system boundaries between wholesalers and transport companies that are not part of the wholesale business and whether food waste from their vehicles is captured at present. This will be studied in more detail in 2018.

3.2 Overall Trends

This section gives a brief summary of overall trends in amounts of food waste and associated economic loss and greenhouse gas emissions for the three stages of the food value chain (producers, wholesalers and retailers) from 2010 to 2016.

As the baseline year for the sector agreement is 2015, the main focus in this and the remaining sections will be on changes from 2015 to 2016. However, it is important to point out that changes in food waste from one year to another will vary; long-term trends are therefore more significant than short-term changes. For a more detailed description of developments from 2010 to 2015, see the Final Report from the ForMat Project (Stensgård & Hanssen, 2016).

3.2.1 Trends in Amounts of Food Waste

Figure 3-2 shows historical changes in tons of food waste for the three stages of the value chain. The percentages above the bars indicate the total tonnage of food waste for the three stages combined and the percentage change from 2010 for the year in question.

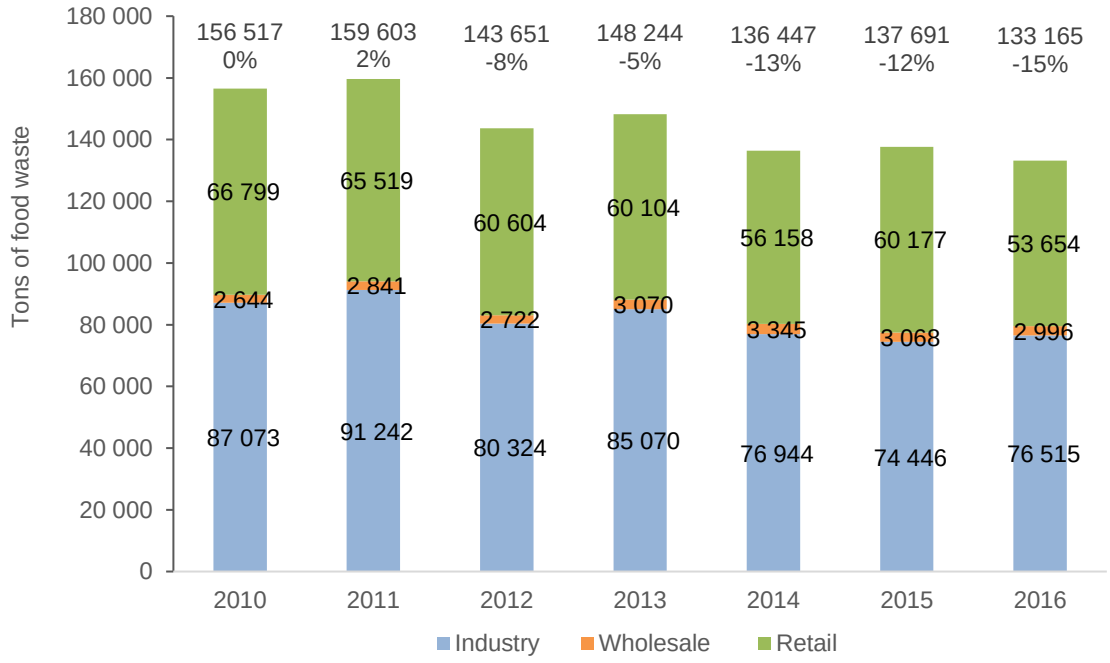

Figure 3-2 Tons of food waste by stage in the value chain from 2010 to 2016

The figure shows that the total amount of food waste in the three stages was reduced from 156 517 tons in 2010 to 133 165 tons in 2016. This is a reduction of 23 352 tons or 15%.

Note that changes in food waste from one year to another will vary. It is therefore important to focus on long-term trends rather than short-term variations.

From 2015 to 2016, the total amount of food waste for the three stages combined declined by 5226 tons (3.3%). In terms of the individual stages, retail and wholesale food waste declined, while it increased in the production stage.

Table 3-1 shows changes in tons of food waste, by stage of the value chain and in total, from 2010 to 2016 and from 2015 to 2016.

Table 3-1 Changes in tons of food waste by stage in the value chain and in total from 2010 to 2016 and 2015 to 2016

Stage of value chain	Change in tons of food waste (2010-2016)	Change in tons of food waste (2015-2016)	Percentage change (2015-2016)
Producers	-10 558	+2 069	+3%
Wholesalers	351	-72	-2%
Retailers	-13 146	-6 523	-11%
Total	**-23 352**	**-4 526**	**-3.3% (weighted average)**

The table shows that total food waste in the industry fell by 23 352 tons from 2010 to 2016 (-15%) and by 4 526 tons from 2015 to 2016 (-3.3%).

Food waste by producers decreased throughout the period but showed an increase from 2015 to 2016. This was due to various factors, such as increased production, greater complexity in the product range and changes in the logistics system (see Section **Feil! Fant ikke referansekilden.**). The reduction in the retail sector was mainly due to discounts on items with a short remaining shelf life (see Section 3.3.3). Wholesalers are the only stage of the value chain that shows an increase in waste from 2010 to 2016, but unfortunately the reasons for this are unknown.

Figure 3-3 shows historical changes in kilos of food waste per capita for the three stages of the value chain. The percentages above the bars indicate the total amount of food waste (kg per capita) for the three stages combined and the percentage change from 2010 for the year in question.

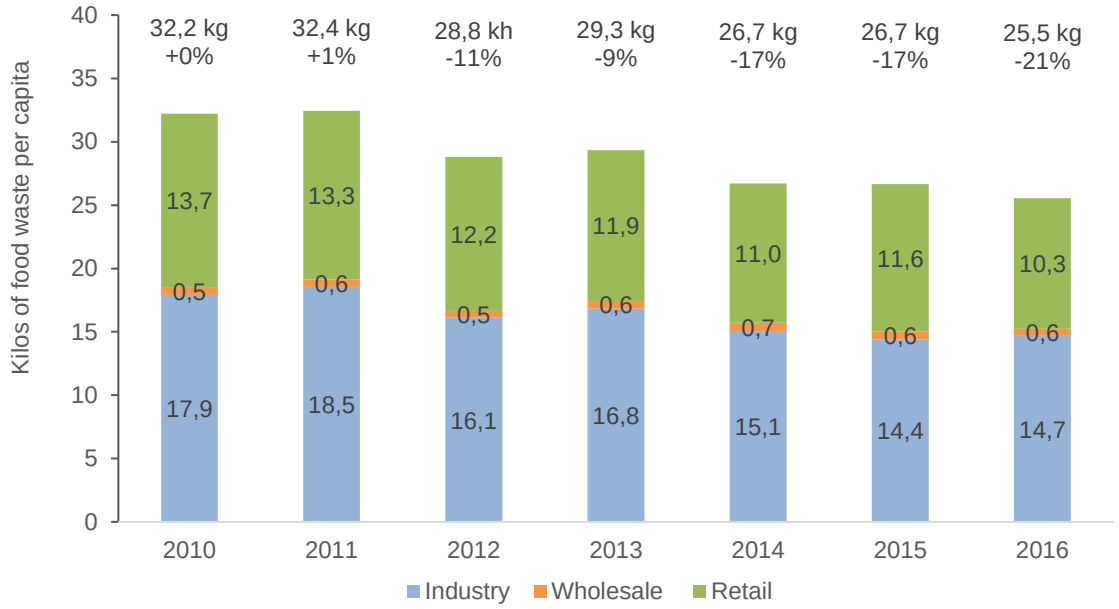

Figure 3-3 Kilos of food waste per capita by stage in the value chain from 2010 to 2016.

The figure shows that food waste in kg per capita in the three stages of the value chain decreased from 32.2 kg in 2010 to 25.5 kg in 2016. This is a per capita reduction in food waste of 6.68 kg or 21%.

From 2015 to 2016, total food waste per capita in the industry fell by about 1.1 kg or 4%.

Table 3-2 shows changes in kilos of food waste per capita in total and in each stage of the value chain from 2010 to 2016 and 2015 to 2016.

Table 3-2 Changes in kg of food waste per capita in total and in each stage of the value chain from 2010 to 2016 and 2015 to 2016.

Stage of value chain	Change in kg of food waste per capita (2010-2016)	Change in kg of food waste per capita (2015-2016)	Percentage change (2015-2016)
Producers	-3.25	+0.26	+2%
Wholesalers	+0.03	-0.02	-3%
Retailers	-3.46	-1.36	-12%
Total	**-6.68**	**-1.1**	**-4%** (weighted average)

The table shows that food waste in the industry was reduced by 6.68 kg per capita from 2010 to 2016 (-21%) and by 1.1 kg per capita, or 4%, from 2015 to 2016.

For further details of trends in the individual stages of the value chain, see the relevant parts of Section 3.3.

3.2.2 Financial Loss Linked to Food Waste

Figure 3-4 shows historical changes in financial loss associated with food waste for the three stages of the value chain. The percentages above the bars indicate the total financial loss (in billion NOK) for the three stages combined and the percentage change from 2010 for the year in question.

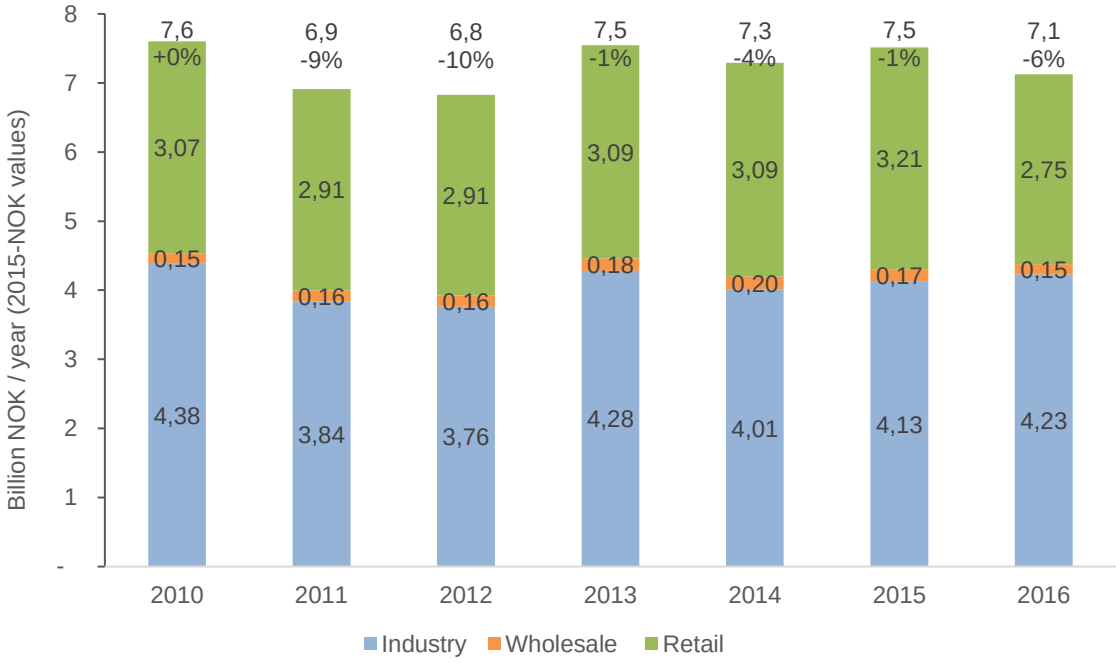

Figure 3-4 **Financial loss (in billion NOK) linked to food waste by stage of the value chain from 2010 to 2016.**

The figure shows that financial loss associated with food waste in the three stages of the food value chain remained relatively stable throughout the period, despite the fact that food waste was considerably reduced during the same period. This is because food waste decreased for cheaper items and increased for more expensive ones. In 2016, financial loss linked to food waste in the three stages amounted to NOK 7.13 billion (2015 NOK value). This is a reduction from 2010, when the equivalent figure was NOK 7.60 billion.

From 2015 to 2016, financial loss linked to food waste for the three stages of the value chain decreased from NOK 7.5 billion to NOK 7.1 billion, which is a reduction of roughly 6%.

Table 3-3 shows changes in financial loss in million NOK and in percentages, in total and in each stage of the value chain from 2010 to 2016 and 2015 to 2016.

Table 3-3 **Changes in financial loss (in million NOK) in total and in each stage of the value chain from 2010 to 2016 and 2015 to 2016.**

Stage of value chain	Change in million NOK (2010-2016)	Change in million NOK (2015-2016)	Percentage change (2015-2016)
Producers	-155	+96	+2%

Wholesalers	-4	-23	-13%
Retailers	-317	-462	-14%
Total	**-475**	**-389**	**-5% (weighted average)**

The table shows that financial loss linked to food waste in the industry decreased by NOK 475 million from 2010 to 2016 (-6%) and by NOK 389 million, or 5%, from 2015 to 2016.

From 2015 to 2016, financial loss associated with wholesale food waste declined by 13% (NOK 23 million), while it decreased by 14% (NOK 462 million) in the retail sector. In food production, however, financial loss increased by 2%, or NOK 96 million. For further details of trends in the individual stages of the value chain, see the relevant parts of Section 3.3.

3.2.3 Greenhouse Gas Emissions Linked to Food Waste

Figure 3-2 shows historical changes in tons of CO2 equivalents linked to the production, packaging and transport of food that is 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 2010 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 storage in retail stores, transport from store to home, food preparation and waste management are not included.

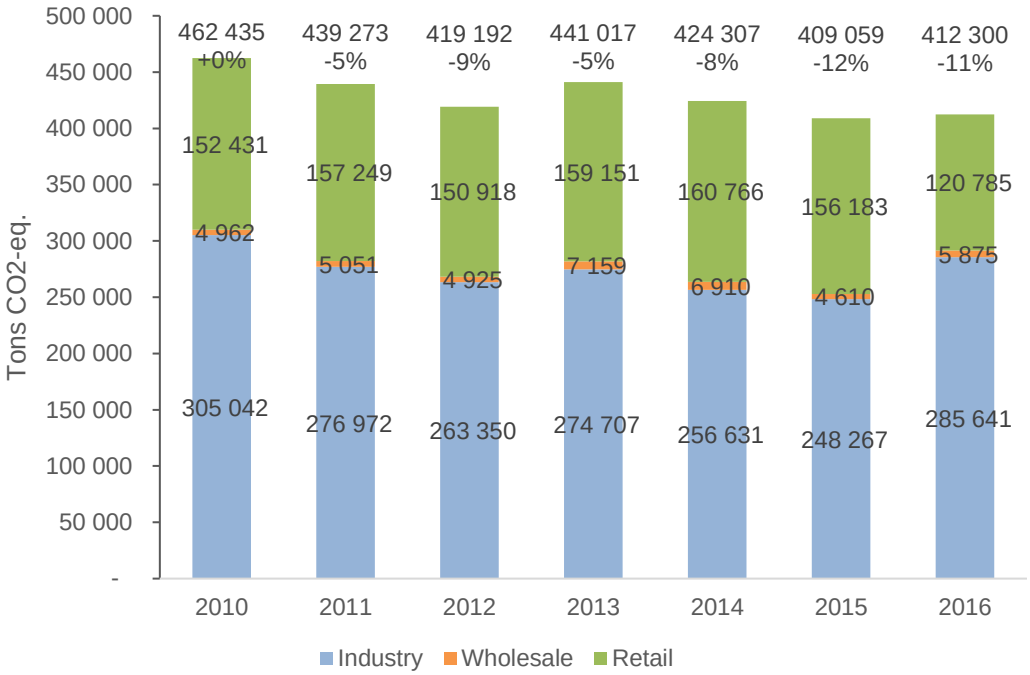

Figure 3-5 **Tons of CO2 eq. linked to food waste by stage of the value chain from 2010 to 2016**

The figure shows that the total environmental impact related to food waste in the three stages of the value chain decreased from 462 435 tons of CO2 equivalents in 2010 to 412 300 tons in 2016. This is a reduction of 50 135 tons of CO2 equivalents, or 11%.

From 2015 to 2016, the carbon footprint from food waste increased by 3 241 tons of CO2 equivalents (1%), due to a combination of an increase in total food waste by producers and an increase in the carbon footprint per kilo of food waste from producers and wholesalers. The increase in the carbon footprint per kg of food waste in the two sectors is mainly because food waste contains an increased proportion of meat products, which are relatively environmentally unfriendly.

At the same time, the carbon footprint from retail food waste declined by 23%, due to a reduced quantity of waste and a lower carbon footprint per kilo of food waste.

Table 3-4 shows changes in the carbon footprint of food waste in total and by stage of the value chain from 2010 to 2016 and from 2015 to 2016.

Table 3-4 Changes in carbon footprint in total and by stage of the value chain from 2010 to 2016 and 2015 to 2016

Stage of the value chain	Change in tons of CO2 eq. (2010-2016)	Change in tons of CO2 eq. (2015-2016)	Percentage change (2015-2016)
Producers	-19 401	+37 374	+15%
Wholesalers	+913	+1 292	+28%
Retailers	-31 646	-35 398	-23%
Total	**-50 135**	**+3 241**	**+1% (weighted average)**

The table shows that greenhouse gas emissions linked to food waste in the industry were reduced by 50 135 tons of CO2 equivalents from 2010 to 2016 (-11%), but rose by 3 241 tons of CO2 equivalents from 2015 to 2016 (+1%).

From 2015 to 2016, greenhouse gas emissions associated with food waste in the retail sector decreased by around 23%, or 35 289 tons of CO2 equivalents. For producers and wholesalers, greenhouse gas emissions linked to food waste increased by 15%, or 37 374 tons of CO2 equivalents, and 28% or 1 292 tons of CO2 equivalents, respectively. For further details of trends in the individual stages of the value chain, see the relevant parts of Section 3.3.

3.3 Detailed Results

3.3.1 Producers

The results for producers show that food waste as a proportion of production increased by 1.2% from 2015 to 2016.

Food waste varied between product groups: liquid dairy products, snacks and minced meat had the highest proportion of waste, while baked goods, solid dairy products and fresh meat had the lowest.

Four out of ten product groups showed a reduction in waste, while six showed an increase.

Fact Box 3-1 Summary of food waste figures for producers in 2015 and 2016, and trends from 2015 to 2016.

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

1) Liquid dairy products (3.6%)
2) Snacks (2.7%)
3) Minced meat (2.6%)

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

1) Baked goods (1.0%)
2) Solid dairy products (1.2%)
3) Fresh meat (1.3%)

Product group	% waste 2015	% waste 2016	Change in % waste 2015-2016
Fresh baked goods	1.2%	1.0%	-19.5%
Fresh ready-made food	1.9%	1.7%	-14.2%
Frozen ready-made food	2.5%	2.2%	-12.4%
Solid dairy products	1.3%	1.2%	-8.6%
Liquid dairy products	3.3%	3.6%	+10.7%
Snacks	2.4%	2.7%	+12.4%
Sausages	2.1%	2.4%	+13.0%
Sliced meat and pâtés	1.3%	1.5%	+18.7%
Fresh meat	1.1%	1.3%	+22.6%
Minced meat	2.0%	2.6%	+27.9%
Total	**2.1%**	**2.1%**	**+1.2%**

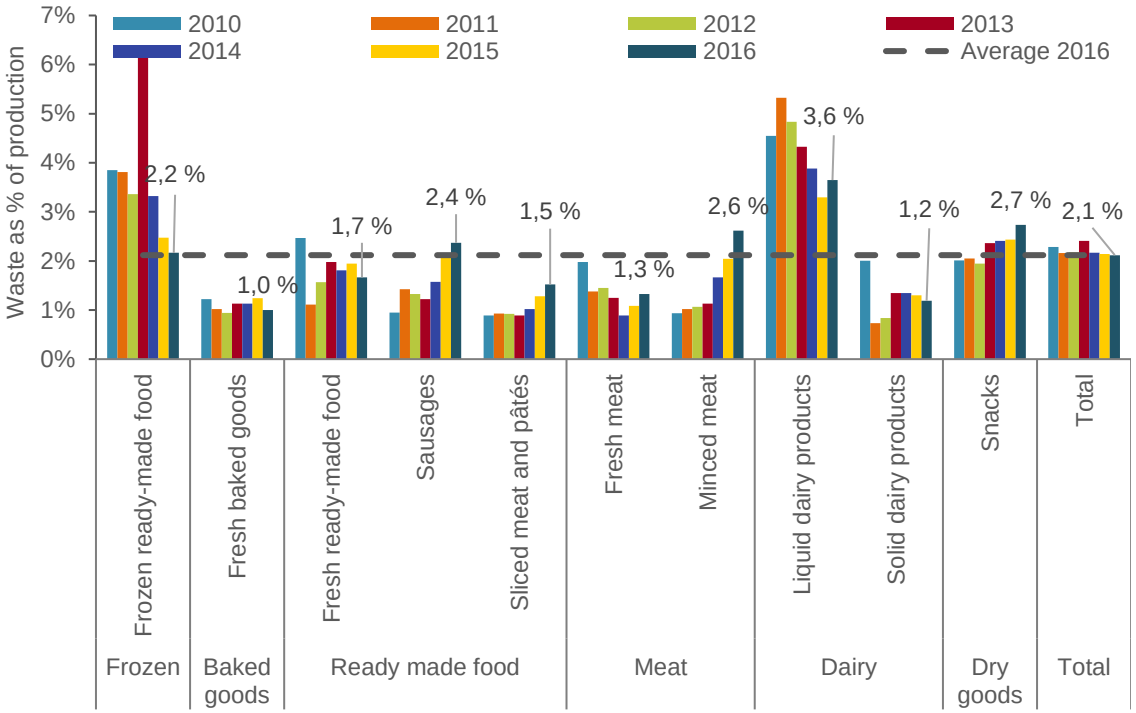

Figure 3-6 shows food waste as a percentage of annual production in tons from 2010 to 2016 for all companies reporting to the project. The percentages marked represent the waste for the various product groups in 2016 and the broken line shows the weighted average for waste in 2016.

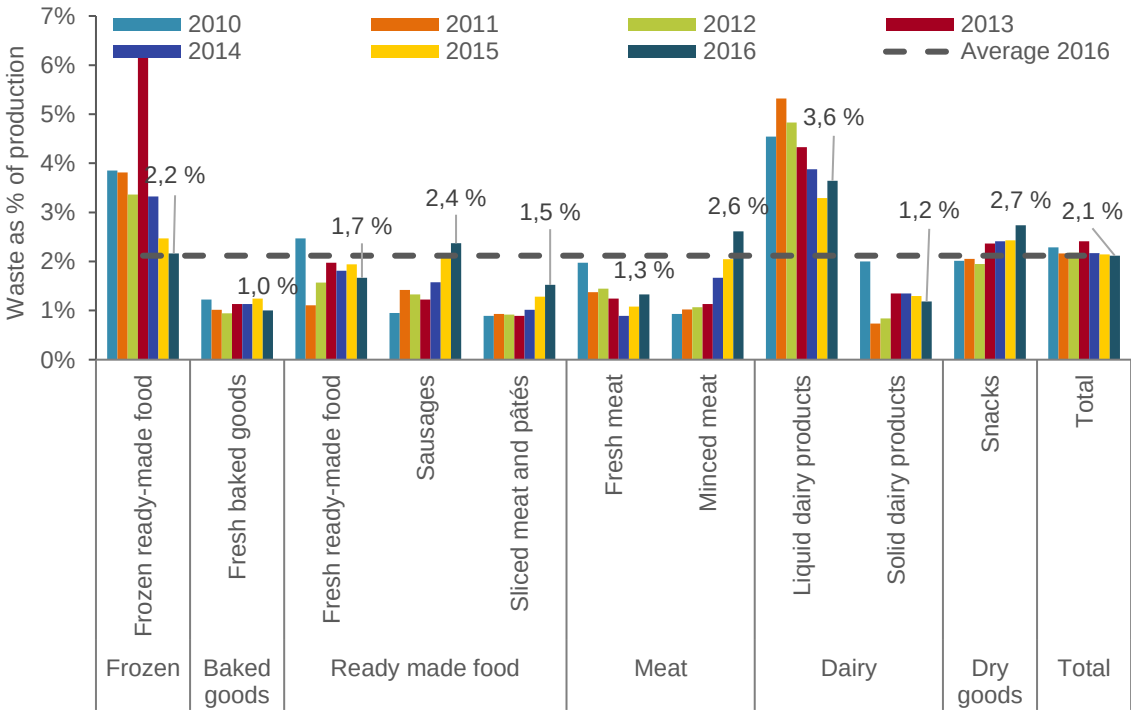

Figure 3-6 Trends in waste from producers 2010-2016 as a percentage of production

The figure shows that the proportion of food waste in the production stage was about 2.1% overall in 2016. From 2015 to 2016, waste as a proportion of production increased by 1.2%.

As shown in Section 0, total tonnage of food waste in the production stage showed a slight increase of 3% (Figure 3-2) from 2015 to 2016, while financial loss and greenhouse gas emissions increased by 2% and 15%, respectively (Figure 3-4 and Figure 3-5). The relatively large increase in greenhouse gas emissions is linked to an increase in food waste for meat-based products: sliced meat and pâtés (+18.7%), fresh meat (+22.6%), minced meat (+27.9%), liquid dairy products (+10.7%) and snacks (+12.4%).

Food waste was reduced for the following product groups: frozen ready-made food (-12.4%), fresh baked goods (-19.5%), fresh ready-made food (-14.2%) and solid dairy products (-8.6%).

Part of the increase in food waste is due to the fact that production in the Norwegian food industry increased by 6% from 2015 to 2016 (Statistics Norway 2017). The increase in waste for sausages, fresh meat and minced meat is due to two factors: increased complexity in the product range for manufacturers, and changes in the logistics system. It is assumed that the logistics challenges are temporary and that the waste linked to the changes will not continue after the initial phase. The complexity challenges in the production stage indicate that increased collaboration across the value chain is crucial to achieve a reduction in food waste at this stage. There is a need for greater streamlining of the value chain for the products involved.

In the case of sliced meat/pâtés and snacks, the increases in waste are not expected to continue, as they were due to an individual incident (accident) for sliced meat/pâtés, and a trial run of snacks products.

3.3.2 Wholesalers

Results for wholesalers show that food waste as a percentage of sales increased from 2015 to 2016 by about 26%, or 0.09 percentage points.

Waste decreased for one of the nine product groups (fish and shellfish), was unchanged for two (eggs and fruit and vegetables), and increased for the remaining seven product groups. Fresh meat, dairy products and baked goods showed the greatest increases.

Food waste from wholesalers represents a relatively small proportion of total food waste in the value chain.

Fact Box 3-2 Summary of food waste figures for wholesalers in 2015 and 2016, and trends from 2015 to 2016.

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

1) Fresh fruit and vegetables (1.03%)
2) Fresh fish and shellfish (0.17%)
3) Fresh ready-made food and delicatessen items (0.16%)

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

1) Baked goods (0.04%)
2) Frozen ready-made food (0.04%)
3) Dry goods (0.07%)

Product group	% waste 2015	% waste 2016	Change in % waste 2015-2016
Frozen ready-made food	0.02%	0.04%	+44%
Fresh fruit and vegetables	1.03%	1.03%	0%
Baked goods	0.01%	0.04%	+65%
Fresh ready-made food and delicatessen items	0.16%	0.16%	+2%
Fresh fish and shellfish	0.18%	0.17%	-3%
Fresh meat	0.01%	0.05%	+74%
Dairy products	0.04%	0.13%	+73%
Dry goods	0.03%	0.07%	+60%
Total	**0.27%**	**0.36%**	**+26%**

Figure 3-7 shows wholesale food waste as a percentage of sales from 2010 to 2016 for all companies reporting to the project. The percentages marked represent the waste for the various product groups in 2016 and the broken line shows the weighted average for waste in 2016.

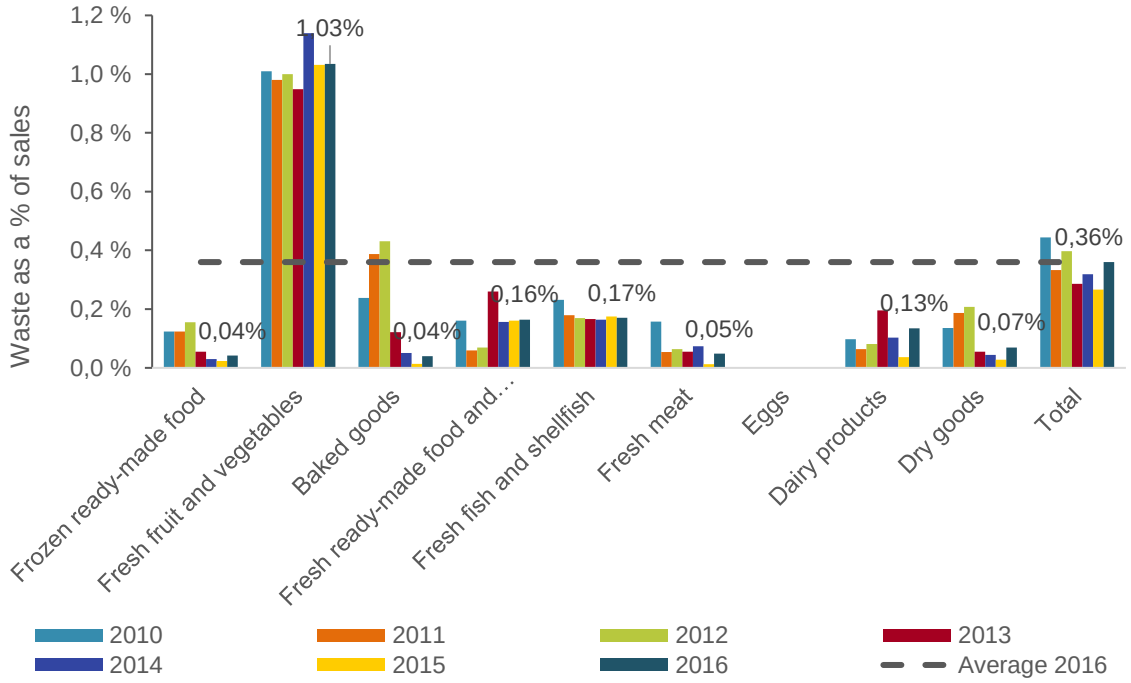

Figure 3-7 Trends in waste from wholesalers as a percentage of sales from 2010 to 2016.

The figure shows that wholesale food waste as a percentage of sales was about 0.36% overall in 2016. From 2015 to 2016, waste as a percentage of sales increased by 0.09 percentage points, or 26%.

As shown in Section 0, total tonnage of food waste in the wholesale stage showed a slight reduction of 2% (Figure 3-2), from 2015 to 2016, while financial loss decreased by 13% and greenhouse gas emissions increased by 28% (Figure 3-4 and Figure 3-5). The reduction in waste in tons and the increase in waste as a percentage of sales may seem contradictory, but this is because sales decreased for some large product groups, leading to a reduction in the total amount of food waste despite the fact that waste increased in relation to sales. The causes of the trends in the wholesale sector are unknown at present, but will be further studied in 2018.

The increase in greenhouse gas emissions in the wholesale sector is linked to increased food waste for animal products (meat and dairy products), which are more environmentally unfriendly than vegetable products and seafood.

3.3.3 Retailers

Results for retailers show that food waste as a percentage of sales decreased from 2015 to 2016 by 18%.

Waste decreased for thirteen of the fifteen selected product groups, and increased for two (fresh fruit and fresh vegetables). The decrease was greatest for fresh meat, sausages and fresh ready-made food and was mainly due to the broad introduction in the retail chains of systematic price reductions.

Fact Box 3-3 Summary of retail food waste figures for selected product groups in 2015 and 2016, and trends from 2015 to 2016.

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

1) Fresh baked goods (9.2%)
2) Fresh fish and shellfish (5.1%)
3) Fresh fruit (4.6%)

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

1) Frozen ready-made food (0.3%)
2) Fresh eggs (0.6%)
3) Dry goods (0.7%)

Product group	% waste 2015	% waste 2016	Change in % waste 2015-2016
Frozen ready-made food	0.3%	0.3%	-13%
Fresh fruit	4.5%	4.6%	3%
Fresh vegetables	4.2%	4.3%	3%
Fresh potatoes	2.3%	2.0%	-16%
Fresh baked goods	9.4%	9.2%	-1%
Fresh ready-made food	4.8%	3.7%	-32%
Sausages	3.3%	2.4%	-35%
Sliced meat and pâtés	2.2%	1.8%	-19%
Fresh fish	6.5%	5.1%	-27%
Fresh meat	5.0%	3.6%	-38%
Minced meat	2.2%	1.7%	-30%
Fresh eggs	0.7%	0.6%	-14%
Milk products	1.1%	0.9%	-25%
Cheese	1.0%	0.9%	-7%
Dry goods	0.9%	0.7%	-15%
Total of selected product groups	**3.3%**	**2.8%**	**-18%**

Figure 3-8 shows retail food waste as a percentage of sales from 2013 to 2016.

Note that this bar graph shows a selection of product groups. The selected categories are not representative of the entire range of products in retail outlets with regard to food waste, since several large groups with high sales and a low level of waste are not included (soft drinks, beer, durable goods and non-food products such as tobacco, detergents, etc.). Total retail food waste as a percentage of sales is lower, at about 1.8%. The percentages marked

represent the waste for the various product groups in 2016 and the broken line shows the weighted average for waste in 2016.

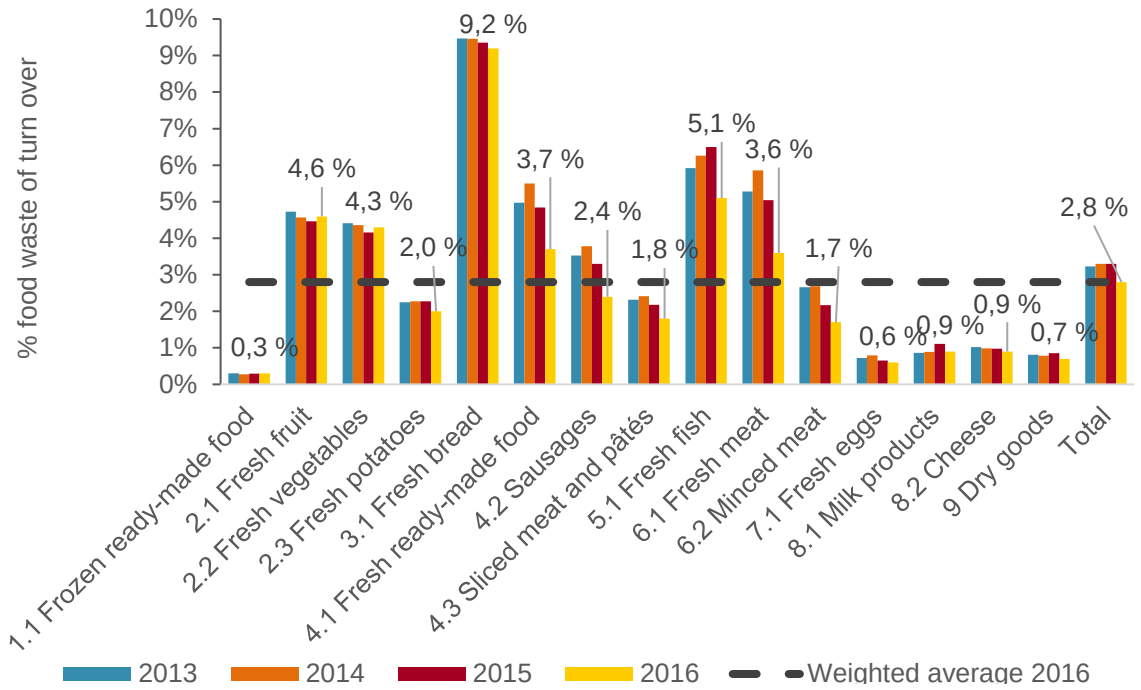

Figure 3-8 Trends in retail waste as a percentage of sales from 2013 to 2016.

The figure shows that overall retail food waste in selected product groups as a percentage of sales was about 2.8% in 2016. From 2015 to 2016, waste as a percentage of sales fell by 18%.

As shown in Section 0, total tonnage of food waste in the retail stage showed a large reduction of 11% (Figure 3-2) from 2015 to 2016, while financial loss and greenhouse gas emissions declined by 14% and 23%, respectively (Figure 3-4 and Figure 3-5).

The reduction in food waste is largely due to discounts on items with a short remaining shelf life. This is an offer that has long existed in some stores and chains, and for certain periods (seasonal goods), but was first introduced as a permanent scheme in most of the retail trade at the end of 2015. In 2016, these discounts were mainly used on items with date stamps, which means that the reduction in waste has been greatest for these product groups, while the groups without date stamps (fruit, vegetables and fresh baked goods) have not shown the same downward trend.
In 2017, several major retail chains introduced price reductions on some goods without date stamps, such as half price on fresh baked goods one hour before closing time, which may have a positive impact on waste in the product groups involved.

Price reductions have also led to significant reductions in greenhouse gas emissions and financial loss associated with food waste in the retail sector, as food waste mostly declined for relatively expensive and environmentally unfriendly products.

3.4 Consumer Studies

The consumer studies show that more people now report that they discard less food and are more aware of food discard as a problem. A further positive trend is that fewer and fewer consumers say that they throw away food just because it is past its expiry date.

At the same time, we see an increase in the percentage who report discarding pan leftovers, fresh fruit, fresh vegetables and fresh baked goods. These results may indicate that more consumers have become more aware of their own food discard, and that the consumer studies show greater agreement with household food waste logs (Final Report from the ForMat Project).

The two main reasons provided by consumers for food waste are that they have forgotten about the food in the fridge or cupboard and that the food has passed its expiry date. Further, important root causes of food waste by consumers are poor planning of purchases and incorrect storage.

The results of the consumer study showing the proportion of consumers reporting having discarded different types of food in 2017, compared with previous years, are shown in Figure 3-9.

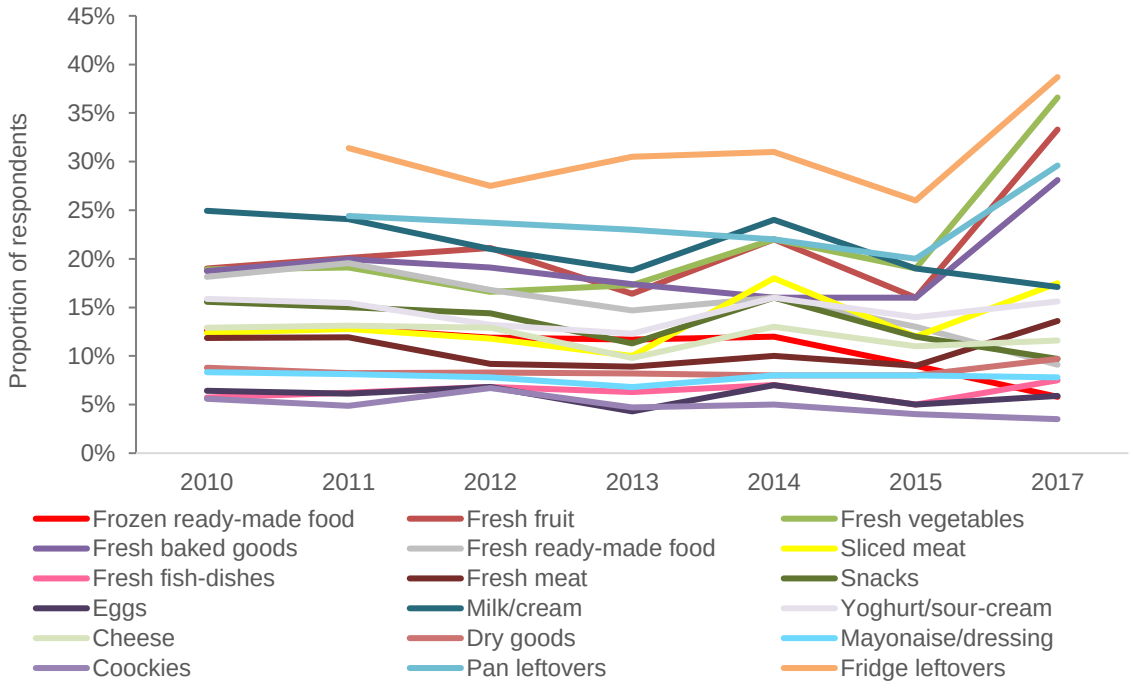

Figure 3-9 Proportion of consumers reporting having thrown away different types of food in the past week 2010-2017

The figure shows that five product groups/types of food increased considerably from 2015 to 2017, namely fridge leftovers (from 26% to 28.7%), fresh vegetables (20% to 36.6%), fresh fruit (16% to 33.3%), pan leftovers (20% to 29.6%) and fresh baked goods (16% to 28.1%).

Sliced meat and fresh meat have also shown notable increases: 12.6% to 17.5% and 9% to 13.6%, respectively (see Figure 3-9).

These are very marked increases that are probably linked to changes in the issues mentioned in the questions or the fact that people have become more aware of what food they actually throw away. Since the results are now more consistent with waste sample analyses, including the composition of the waste (Final Report from the ForMat Project), it is possible that consumers have become more aware of what they are actually throwing away, making the results more in line with reality. The other product groups are all well below 20% frequency among respondents in 2017 and also show little change over time from 2010 to 2017.

Reasons for discarding food in 2017 are seen in Figure 3-10. The questions in 2017 were somewhat different from those of previous ForMat surveys, which makes it impossible to compare the 2017 results directly with results from previous years.

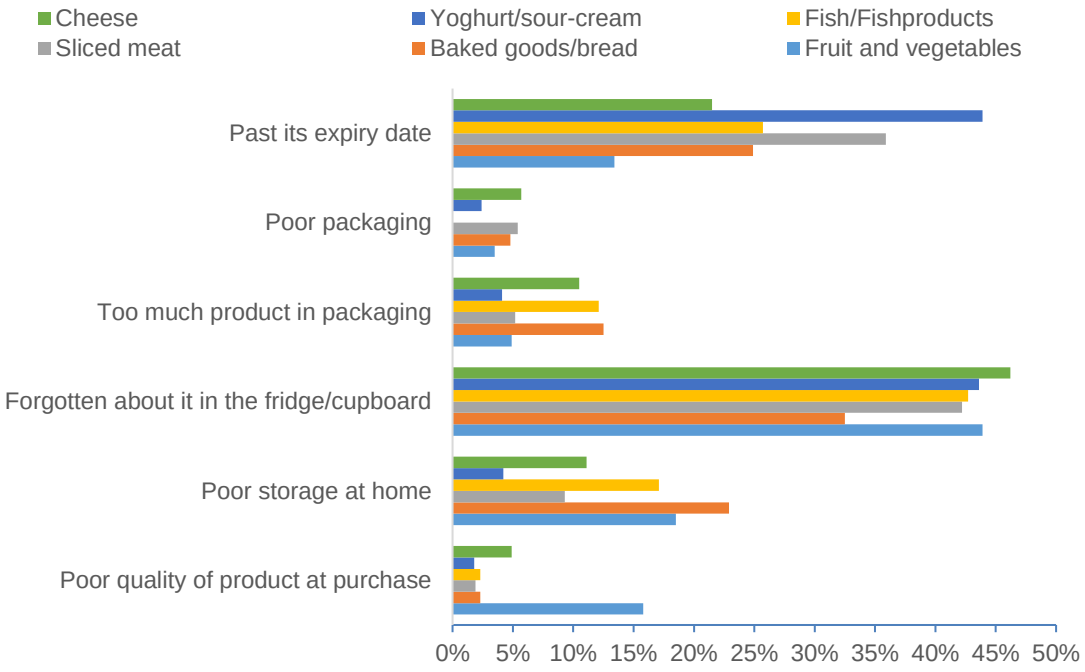

Figure 3-10 The main reason stated for discarding different types of food in 2017

In general, for all groups, the figure shows that the two main reasons for food discard were “forgotten about it in the fridge/cupboard” with a frequency of almost 45%, while “past its expiry date” was the second most important reason overall, ranging from 21.5% to 43.9%. “Forgotten about it in the fridge/cupboard” was the most important reason for all product groups. For fruit and vegetables, poor storage at home was the second most important reason (18.5%) and poor quality of the product at the time of purchase was the third most important reason at 15.8% (Figure 3-10). For baked goods, “past its expiry date” was the second most important reason at 24.9%, while poor storage at home was in third place at 22.9%.

Packaging-related reasons were generally of little importance, except for the size of packs, which was said to be too large for fresh baked goods (12.5%), fish products (12.1%) and cheese (10.5%). The latter is somewhat unexpected, since one can buy smaller packs of sliced cheese, but it may be that consumers also want smaller packs of unsliced cheese.

Figure 3-11 shows results for the planning of purchases and behaviour related to meals for the period 2010-2015 and for 2017.

Figure 3-11 Consumer behaviour related to meals and planning of purchases: average for the period 2010-2015 and 2017

A general overview of the causes of food discard suggests that the biggest challenge for consumers is to keep track of the food in their fridge and cupboards and take a look before shopping, to find out what food is needed before buying new items. For the food industry and for Matvett, the greatest challenge is to make the consumers realise that much food can be eaten even when it has passed its expiry date. Here, the campaigns have clearly not been successful enough, although there are some signs of improvement.

This is also indicated by the responses to questions about planning and implementation of food purchases, where 35% stated that they often buy too much food and too much of each product, while the corresponding average figures for the period 2010-2015 were 26% and 24% respectively (Figure 3-11). There are also fewer people who report knowing how much food they need when shopping (61.7% versus 85% for 2010-2015), and who say they always use a shopping list (52.9% compared to 64% for 2010-2015).

Is it possible that people are now presenting a more realistic self-image than in previous studies, because the increased focus on food waste has made them give greater thought to their food-related behaviour? The questions in 2017 are exactly the same as in previous years, suggesting that there are no methodological reasons for these large changes.

Responses to questions on cooking and meals in 2017 reveal only minor differences from previous years, and they are also more positive. 65.3% reported taking smaller helpings in order to throw away less food, compared to 48% for the period 2010-2015 (Figure 3-11). However, there are also more people who state that they take too large helpings and throw away the leftovers (25.3% in 2017 as against 20% for the whole period 2010-2015).

Here it may be interesting to examine the statistics in more detail to detect any differences in the population groups that provided the various responses. The proportion stating that they often make too much food and throw away the leftovers (31.5% in 2017, 33% in 2010-2015) and that they often make too much food for dinner (31.5% in 2017, 31% for 2010-2015) is at about the same level in 2017 as for the entire period 2010-2015. The question about eating a little more to avoid throwing away food was not included in the 2017 survey.

Figure 3-12 shows results for transport and storage of food and opinions/behaviour related to packaging, date stamps and food waste, for 2017 and as an average for 2010-2015.

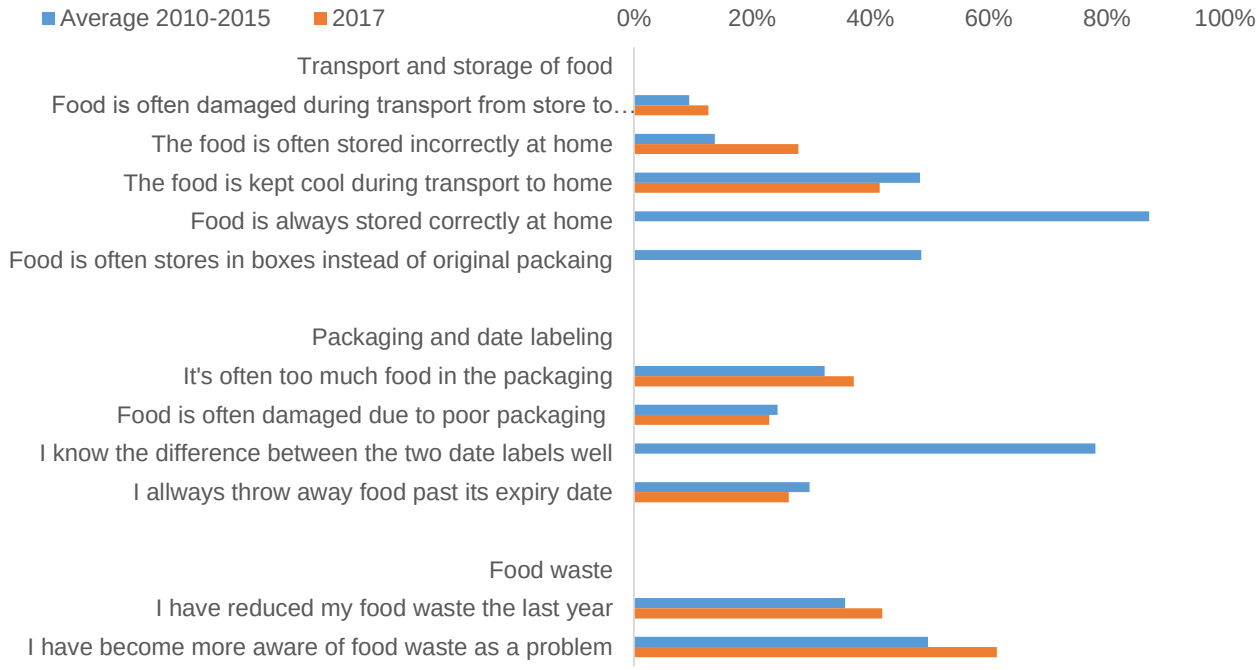

Figure 3-12 Consumer behaviour with regard to transport and storage of food, and opinions/behaviour related to packaging, date stamps and food waste: average data for 2010-2015 and 2017

The responses also show a strong increase in the proportion of consumers stating that they often store food incorrectly at home: 27.8% in 2017 compared to 14% in 2010-2015 (Figure 3-12). The proportion stating that food is often damaged due to transport from store to home was slightly higher in 2017 than in 2010-2015 (12.6% versus 9%), which is consistent with a smaller number of respondents reporting keeping food cool during transport home (41.6% compared to 48%).

In 2017, as many as 37.2% of respondents stated that there was often too much food in each pack, compared to 32% in the period 2010-2015. The proportion reporting that food was often damaged due to poor packaging was somewhat lower in 2017 than in 2010-2015 (22.9% in 2017 compared to 24% in 2010-2015). One positive trend was that the proportion who replied that they throw away food just because it is past its expiry date decreased slightly from 2010-2015, from 30% to 26.2%. Here, the figures are not entirely comparable because the question in 2010-2015 referred to the date stamp in general terms, while in 2017 a distinction was made between “best before” and "use by”. The results in Figure 3-12 apply to responses to “use by”, and will be higher than an average for both types of date stamp.

With regard to reducing one’s own food waste last year, 42% believed they had done so in 2017, compared to 36% for the entire period 2010-2015. We see the same trend for the question about awareness of food waste as a problem, where in 2017, 61.4% reported having become more aware, compared to an average of only 50% for 2010-2015. There are therefore a number of indications that consumers have become more aware of the problem of food waste in society, and that this awareness increased in 2017.

3.5 Food Waste in Norway and Europe

The FUSIONS project has estimated food waste in the 28 EU countries by compiling data from different studies (Stenmarck et al., 2016). It was estimated that 88 million tons of food were wasted in the European Union in 2012. This is the equivalent of 173 kg of food waste per person per year, and covers primary production, food manufacturers, wholesalers, retailers, catering and households.

The FUSIONS Project operated with a different definition of food waste from that used in Norway. The food waste figures for the EU include both edible and non-edible parts of food and do not include food used as animal feed. This makes it challenging to compare Norwegian figures with other European studies, and the Norwegian food waste figures for households, retailers and wholesalers have therefore been calculated according to the definition used in the FUSIONS Project.

The figures for food producers have not been included. This is because the Norwegian figures are not complete, and also because the countries' exports and imports must be seen in relation to food waste figures to be comparable. In other words, there is little point in comparing amounts of food from producers in terms of kg per capita across different countries.

Table 3-5 shows amounts of edible and general food waste per person in Norway in 2016 (retailers and wholesalers) and in 2015 (households). General food waste (both edible and inedible) has been calculated using the definition in the FUSIONS Report.

Note that general food waste in kg per capita does not include food used for animal feed; amounts of general food waste are therefore lower than amounts of retail and wholesale edible food waste.

Table 3-5 Kilos of edible food waste per capita in Norway in 2016 (wholesalers and retailers) and in 2015 (households (ForMat Final Report)), and kilos of general food waste per capita (includes inedible parts of food and excludes food used as animal feed).

Stage of the value chain	kg of edible food waste per capita	kg of general food waste per capita
Wholesalers	0.57	0.09
Retailers	10.29	6.53
Households	42.1	74.8
Total	**52**	**81**

The table shows that total general food waste in the three stages of the value chain amounted to 81 kg per person per year, and 74.8 kg or 92% occurred in households.

General food waste is significantly greater than edible food waste in households, as the inedible parts are included. At the wholesale and retail stages, general food waste is lower than edible food waste; although inedible parts are included, food used to feed animals is excluded (according to the FUSIONS definition), which gives lower total figures.

Figure 3-13 shows general food waste per capita from the FUSIONS report by stage of the value chain (households, retailers and wholesalers) and by country (total EU, UK, Sweden and Denmark), compared with Norwegian figures of kg per capita of general food waste in 2016 and 2015 (FUSIONS definition).

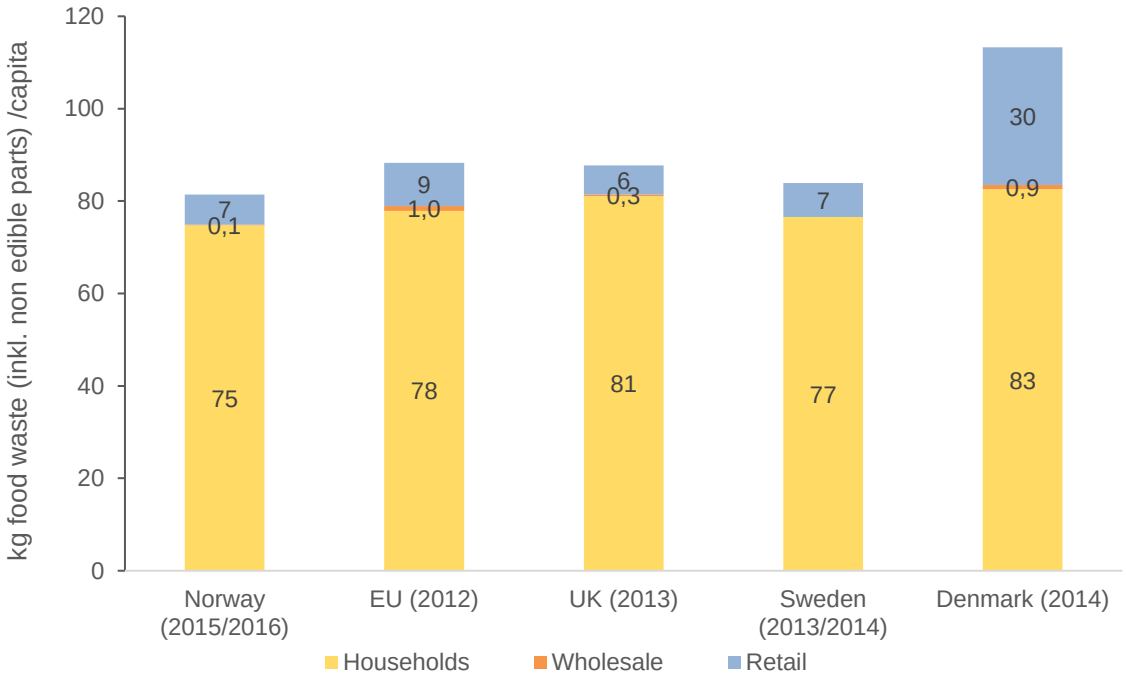

Figure 3-13 **Kg food waste per capita (including inedible parts of food and excluding food used for animal feed) by stage of the value chain and country (figures from abroad are from Stenmarck et al. 2016). *Figures from Denmark do not include domestic composting.**

The figures should be relatively comparable, as the same definition and system boundaries have been used. Only the calculations for households in Denmark differ, as domestic composting is not included here. Food discarded via drains is not included in any calculations for households.

The differences in definitions between countries may lead to a false impression of food waste in the different countries. One may easily think that Norwegian households throw away less food than other European countries, because the kg figure for edible food waste in households is considerably lower than the kg figure for general food waste. It may also appear that Norwegian retailers waste much more food than in other European countries, since the amount of food used as animal feed is included in the Norwegian figures.

The figure shows that amounts of general food waste by Norwegian consumers, wholesalers and retailers are similar to the figures for the EU, UK and Sweden. Retailers in Denmark show a somewhat different picture, having a relatively large amount of general food waste, measured in kg per capita.

4 Other Activities 2017

4.1 Other Relevant R&D Projects

4.1.1 The Research Project KuttMatsvinn2020

KuttMatsvinn2020 is a three-year project launched in January 2017. The research involves a study of food waste in the Norwegian hotel and catering sector. This three-year research project is funded by the “Bionær Programme” (Sustainable Innovation in Food and Bio-based Industries) of the Research Council of Norway. It is a sectoral partnership with the goal of reducing food waste by 20 percent by 2020 and, in the longer term, reaching the UN Sustainable Development Goal 12.3.

Matvett is the project owner and Ostfold Research manages the project. The partners are the Bama Group, Compass Group, ISS Facility Services, NorgesGruppen, Scandic Hotels, Nordic Choice Hotels, the Norwegian Hospitality Association, IntoLife, Mepex, Fredrikstad Town Council and Østfold County Council. Nofima, Ostfold Research, Luke (Finland) and RISE (Sweden) will be involved in the research.
The results from the project will be included in next year's report.

In parallel with the research project, a sectoral project with the same name was also initiated. At present, about 1000 catering outlets are involved in this project, where the main focus areas are the measurement of food waste, the empowerment of employees 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: www.matvett.no/servering

4.1.2 REforReM

“Right Packaging for Reduced Food Waste” (REforReM) is a three-year industry-oriented innovation project (IPN), led by BAMA, with the companies Grilstad, Hallvard Lerøy, Lauvsnes Gartneri, Tommen Gram, Promens (in future RPC Packaging), BWL Maskin and Lexit as partners. Matvett and the research institutes Nofima and Ostfold Research are also represented.

The project, to be completed in 2018, has studied the impact of new packaging solutions and how different aspects of storage and transportation can help to maintain product quality and provide optimal shelf life, while at the same time meeting customer needs. The aim of the project has been to reduce food waste associated with packaging, primarily by consumers but also by retailers. The project received the Optimisation Award in 2017 and has demonstrated the importance of light, cooling and packaging for waste and environmental footprint for two selected products throughout the food value chain.

4.1.3 Breadpack

Breadpack is a research project conducted in collaboration with Stenqvist, Ostfold Research, Nofima and the Paper and Fibre Institute/RISE, and funded by the BioNær programme of the Research Council of Norway. The aim of the project has been to develop new, eco-friendly services and product and packaging solutions for fresh baked goods, which will meet requirements for food safety, food quality, profitability and manageability throughout the value chain and help to reduce food waste by consumers.
The project has provided new knowledge about discard of bread by consumers on the basis of a PhD by Sofie Østergaard of Norgesmøllene, and forms the basis for the development of new bread packaging to enhance storage of bread in the home.

4.1.4 Seapack

Seapack is a three-year research project that commenced in 2016.
The overall idea of the project is to enhance sustainability and profitability while reducing the environmental impact of food waste, material consumption and transport, and to develop and implement new solutions for the efficient production, packaging, distribution and supply of seafood that also preserve its quality.
This will be achieved by evaluating and developing methods to increase the use of fish raw material in production, to develop and implement eco-friendly and profitable transport/distribution solutions, together with solutions for consumer packaging that are adapted to the product and consumer. The aim is to reduce food waste through good quality, food safety and durability.

Seapack is an industry-oriented innovation project (IPN) and the project owners are Salmar, a company that produces salmon for the REMA 1000 retail chain. The research institutes involved are Nofima and Ostfold Research. The research is funded by the Research Council of Norway and various participating companies in the areas of packaging, processing equipment, packaging gases and labels: Lycro, Tommen Gram, Marel, Praxair (formerly Yara), Multivac, Keep-IT and Norsk Lastbærer Pool.

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

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

Matvett was included in the group as part of a consortium with Ostfold Research. Three general meetings have been held, along with several meetings in working groups dealing with mapping, redistribution and actions.

The reasons for including the Norwegian participants are that Norway has developed methodology and data for measuring food waste throughout the value chain that is unique in Europe, and also that Norway is more advanced than most other countries in organising food waste cooperation involving actors in the food value chain and the government.

5 Discussion

5.1 Overall Trends

The results from the survey show that food waste that occurs in the three stages of the food value chain (production, retail and wholesale) decreased by about 23 000 tons, or 15%, from 2010 to 2016. Measured in kg per capita, this corresponds to a reduction of 6.68 kg, or 21%. Greenhouse gas emissions and financial loss associated with food waste in the industry also declined in the same period, by 11% and 6%, respectively.

From 2015 to 2016, food waste in the industry was reduced by 1.1 kg, or 4%, measured in kg per capita, which is the measure used in the sector agreement and the UN Sustainable Development Goal. This corresponds to a reduction of 4 500 tons, and if this trend continues, the first sub-target of the sector agreement of a 15% reduction will be easily reached by 2020.

From 2015 to 2016, there was a slight increase in food waste from producers (+ 3%), while for wholesalers and retailers, waste was reduced by 2% and 11%, respectively.

5.2 Causes and Relationships

The increase in food waste by producers from 2015 to 2016 is due to several factors, one of which is that production in the Norwegian food industry increased in the same period (+6% (Statistics Norway 2017)). Further reasons were increased complexity in the product range and changes in the logistics system. The logistics challenges are assumed to be temporary, but the complexity challenges require increased cooperation across the value chain.

The reduction in retail food waste from 2015 to 2016 is largely due to discounts on items with a short remaining shelf life. These discounts have also led to a significant reduction in greenhouse gas emissions and financial loss associated with food waste in the retail sector, as food waste was mainly reduced for relatively expensive and environmentally unfriendly products. The causes of the decline in the wholesale sector are unknown, but will be further studied in 2018.

On the basis of the consumer surveys and detailed analysis of the different stages of the food value chain, three product groups stand out as particularly important: baked goods, pan and plate leftovers and fruit and vegetables. These groups are reported by consumers to be often thrown away and they also represent a high proportion of food waste in the industry. In other words, it is important to focus on these groups if the target of a 50% reduction in waste is to be achieved and, as shown in the Final Report from the ForMat Project, consumers must be involved (Stensgård & Hanssen, 2016).

Waste of baked goods mainly occurs in the consumer and retail stages (see Section 3.3.3), and compared to other Nordic and European countries, people in Norway discard large quantities of baked goods, particularly bread (Stensgård & Hanssen, 2016). This is partly because Norwegians eat a great deal of bread (and therefore throw away more), and partly

because Norwegian consumers have relatively high requirements for bread, i.e. that it must be completely fresh. Better forecasting/purchasing routines in the retail trade and better planning in households could significantly reduce bread waste, and thus total waste, in Norway.

Another important group in households is pan/plate leftovers. This food waste is largely a result of miscalculations or poor planning, and is closely linked to the results from the consumer surveys (Section 3.4), where 31% of respondents state that they often make too much food and have to throw away the leftovers, and 25% say they take too large helpings and have to throw away food from their plate.

Waste from meals is particularly high in families with young children. This group is often pressed for time and has challenges in planning meals. For these families, it will be difficult to reduce this food waste if they do not change their planning and serving patterns, which means that the reduction potential of waste from meals may be limited if tools such as leftover recipes and planning apps are not made available to this target group.

Fruit and vegetable waste occurs mainly in the consumer, retail and wholesale stages. In households, much of this waste is also due to poor planning, as the main reason for fruit and vegetable waste in the home is that food was forgotten in the fridge/cupboard (see Section 3.4). Two other important reasons for consumer waste of fruit and vegetables are poor storage or poor product quality, which are also important reasons for fruit and vegetable waste by retailers and wholesalers. To reduce this waste, it is therefore important to focus on correct temperature and lighting during transportation and storage (also in retail outlets), careful handling to avoid damage and correct packaging throughout the value chain.
Here, as always, the environmental benefits and costs involved in reducing food waste must be considered against the input factors (energy for refrigeration, packaging, etc.), in order to realise a net environmental benefit without excessive costs.

In addition to the above groups, we must focus on product groups with a relatively high environmental and economic impact. These factors are often linked, as an increase in input factors (energy, water, land use, etc.) leads to increased emissions and resource use, and thus higher costs. The purpose of the UN Sustainable Development Goal for food waste is to minimise the environmental impact and resource use associated with food production, thus also making more food available to those who need it. By wasting less of the food that requires the most resources, the benefit per kg of a reduction in food waste will be maximised.

The composition of food waste shows that a great deal of wastage can be prevented through lower consumer demands, better household planning, improved forecasting in the food industry, and better handling and storage of products throughout the value chain. In other words, if food waste is to be halved, attitudes and behaviour must change significantly, cooperation must increase across the value chain and knowledge of raw materials and household food management must improve.

6 References

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