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Matvett
TA VARE PÅ MATEN

Report on edible food waste in Norway: food industry, education and care sector and consumers

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Summary

Facts and figures

Edible food waste from the food industry, the education and care sector and households amounted to 400 000 tons in 2020.

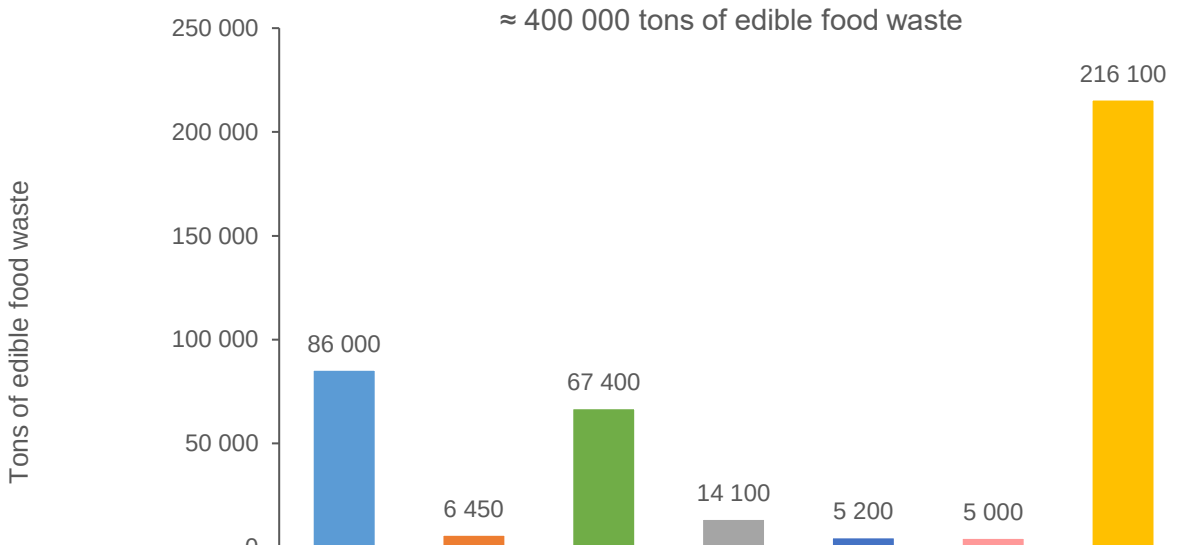
This can be converted to:

- 75 kg of edible food waste per capita/year
- 1.1 million kg of edible food thrown away every day.

and corresponds to:

- an annual carbon footprint of 1.3 million tons of CO_2 equivalents
- an annual financial loss of more than NOK 20 billion.

The distribution of total edible food waste in tons in 2020 for the various stages of the value chain is shown in the figure below. The figure also shows the percentage change from 2015 to 2020 in kg per capita.



	Producers	Wholesale	Retail	Catering	Convenience	Education and care	Households
Tons edible FW 2020	86 006	6 463	67 424	14 100	5 238	4 970	216 106
Change in kg/capita	-1%	-25%	-21%	-27%	-24%	-12%	-6%

Distribution of edible food waste in 2020 and reductions in kg per capita from 2015 to 2020, by stage in the value chain

Facts and figures for the food industry

Matvett is an organization that helps the food industry to prevent and reduce its edible food waste. Below we present key figures and trends for the food industry.

Edible food waste in the food industry (producers, wholesalers, retailers, hospitality and convenience stores) amounted to around 180 000 tons in 2020.

This can be converted to:

- 33 kg of edible food waste per capita/year
- half a million kg of edible food thrown away every day

and corresponds to:

- an annual carbon footprint of about 0.5 million tons of CO_2 equivalents
- an annual financial loss of more than NOK 7 billion.

Edible food waste in the food industry was reduced by 14% in kg per capita, or 21 000 tons, from 2015 to 2020.

This corresponds to:

- A reduction in the carbon footprint of 21%.
- A reduction in the financial loss of 22%.

Factors affecting the results

The results for the period 2015-2020 are affected by the fact that 2020 was a “different kind of year”. The COVID-19 pandemic with its travel restrictions and closures has affected the production and sale of food and beverages in Norway. Infection control measures eliminated cross-border trade and people ate more at home. The quantity of food and drink sold by retailers increased by more than 14 percent compared with 2019 (Bergh, Finci, & Oyier, 2021), while sales in the hospitality sector fell sharply and were unstable due to reopenings and new closures (NHO Reiseliv). Combined with a shift in the market towards increased sales of goods affected by cross-border trade (alcoholic beverages, snacks, etc.) and reduced sales of on-the-go products and smaller portion packs (NTB, 2020), this meant that 2020 was a challenging year for the food industry to make forecasts. This led to an increase in edible food waste from 2019 to 2020 for the food industry as a whole, but the increase was small compared with the overall reduction in waste from 2015 to 2019.

Our habits also changed: more people took their holidays in Norway and worked from home. Schools and kindergartens were closed periodically, which may have contributed to lower waste in the education and care sector. One-third reported discarding less food in 2020 as a result of COVID-19 (Stensgård, Prestrud, Hanssen, & Callewaert, 2020), but since a larger proportion of food was eaten at home, it is not clear whether the pandemic meant that more or less food was thrown away by households in 2020 than in 2019.

The way forward towards a 50% reduction in 2030

The figures in this report show that, despite COVID-19, edible food waste in the food industry is declining. From 2015 to 2020, edible food waste in the industry as a whole fell by 14%, just below the goal of a 15% reduction. This is in addition to the reduction of 14% from 2010 to 2015 that producers, wholesalers and retailers achieved through the ForMat project (Stensgård & Hanssen, 2016).

Although edible food waste has been reduced in all stages of the value chain, the figures also show variation between the results for the individual stages. In future it will therefore be important to examine trends for the value chain as a whole. A key reason for this is that edible food waste often shifts between the stages of the value chain; reduced waste in one stage can lead to increased waste in another. There is often no direct link between where in the value chain edible food waste occurs and who is ultimately responsible for the waste. The most important point going forward towards 2025 and 2030 is that the value chain as a whole achieves the goals, not just individual sectors.

The results also show that in order to achieve the next interim target, it will be important to concentrate work on edible food waste that occurs early and late in the value chain, i.e. at the production and consumer stages; here we find respectively the second largest and largest annual amounts of edible food waste in tons, and the smallest decreases to date. Everyone has a responsibility to reduce edible food waste from households, from major brand manufacturers through product adaptations and good labelling, to the retail sector and restaurants and cafes, which have the most direct contact with consumers, and the education and care sector which is Norway's largest employer and provides education to all young Norwegians, and last but not least, the government with its responsibility for legislation and verification.

In addition, we must continue to focus on the large product groups that often result in waste (bread and baked goods, fruit and vegetables). It is to be expected that these groups make up a relatively large proportion of edible food waste due to the shorter shelf life of these products compared to others. But much waste is also due to the practice of free return of unsold items, cultural factors such as high consumption of bread, consumer expectations and attitudes about how fresh food must be as well as knowledge of what can be eaten, etc. Expensive product groups with a high carbon footprint are also important, but a great deal is already being done in this area.

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1 Introduction

1.1 About the report

This report has been prepared by NORSUS, the Norwegian Institute for Sustainability Research (formerly Ostfold Research) on behalf of Matvett and is based on the sector report from the food industry, the education and care sector and households to the Norwegian Environment Agency for its first main report under the "Sector Agreement on Edible Food Waste Reduction" (Stensgård, Prestrud, Callewaert, & Booto, 2021).

Matvett aims to prevent and reduce edible food waste in the food and hospitality industry and is responsible for reporting under the Sector Agreement on Edible Food Waste Reduction on behalf of the Food and Drink section of the Confederation of Norwegian Enterprise (NHO Mat og Drikke), the Grocery Producers of Norway (DLF), the Environmental Forum of the Norwegian Grocery Sector (DMF), the Norwegian Hospitality Association (NHO Reiseliv) and the Federation of Norwegian Enterprise (Virke), who are the owners of Matvett. The following stages of the value chain are included: producers (except for the seafood industry), wholesalers, retailers, hospitality and convenience stores. In addition, the Ministry of Climate and the Environment has allocated funding to Matvett to report on the education and care sector and on households in connection with the main report.

1.2 About the edible food waste statistics

When the Sector Agreement on Edible Food Waste Reduction was signed in 2017, with its goal of halving edible food waste by 2030, compared to the 2015 level, producers, wholesalers and retailers already had well-established mapping and reporting procedures for edible food waste. This was because efforts to prevent and reduce waste in these sectors had started with the ForMat project in 2010 (Stensgård & Hanssen, 2016). The timeline of edible food waste statistics in these sectors therefore goes all the way back to 2015, the base year of the sector agreement. The statistics for these sectors are of relatively good quality.

Efforts to prevent and reduce edible food waste in the hospitality industry, the education and care sector and convenience stores began with the three-year sector and research projects "KuttMatsvinn2020" (Møller, Callewaert, & Stensgård, 2020). For the hospitality industry, statistics started in 2017, for convenience stores in 2018 and for the education and care sector in 2019. The statistics for these sectors are of varying quality.

Work on edible food waste in households started as part of the ForMat project and has continued in Matvett's annual consumer surveys from 2010 onwards and detailed sample analyses of household waste from 2011 and 2015 (Stensgård & Hanssen, 2016). In 2016, edible food waste from households was calculated on the basis of a greater number of waste sample analyses (Syversen, Hanssen, Bratland, Stensgård, & Bjørnerud, 2018). In 2021, the Ministry of Climate and the Environment tasked Matvett with performing a similar calculation for 2020, aiming to ensure comparability. The edible food waste statistics for households therefore only cover the years 2016 and 2020; for the years in between, values are only extrapolated.

In general, work related to the prevention and reduction of edible food waste has been ongoing for several years in Norway in various stages of the value chain. All the stages included in this report show a downward trend in the sector agreement's key figure of "kg of edible food waste per capita" from 2015 to 2020. However, it should be noted that several of the calculations in this report can only be regarded as estimates.

1.3 Definition of edible food waste

The definition of edible food waste in the sector agreement is used as the basis for this report:

> *"Edible food waste consists of 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." (Norwegian Government, 2017a)*

This definition thus includes only the wastage of edible parts of food (not inedible parts such as bones, pits, shells, etc.).

What is covered by the term "useful" is often a straightforward matter, but for some product groups it can be challenging to assess whether the item is useful or not (e.g. parts of animals that are eaten elsewhere in the world, but not in Norway). Where it is unclear whether an item is useful or not, it is assumed that items that Norwegians culturally consider to be food are to be regarded as useful. Water used as an ingredient is also considered useful, while washing water, such as that used to wash machines, is not considered useful, based on the methodology developed as part of the EU FUSIONS project (Tostivint et al., 2016).

Another important aspect of the Norwegian definition is that edible food waste only means food produced for humans, even though it may end up for purposes other than human food. If it is grown, produced or sold for purposes other than human food, it is not included in the surveys of edible food waste. However, food used as animal feed is regarded as edible food waste, since it has not been used as human food.

1.4 Resource use

The parties to the sector agreement on reducing edible food waste aim at optimal resource utilization in the entire value chain; Matvett's resource pyramid illustrates the hierarchy of how food should be utilized in the entire food industry (Figure 1-1) (Norwegian Government, 2017a, 2017b).

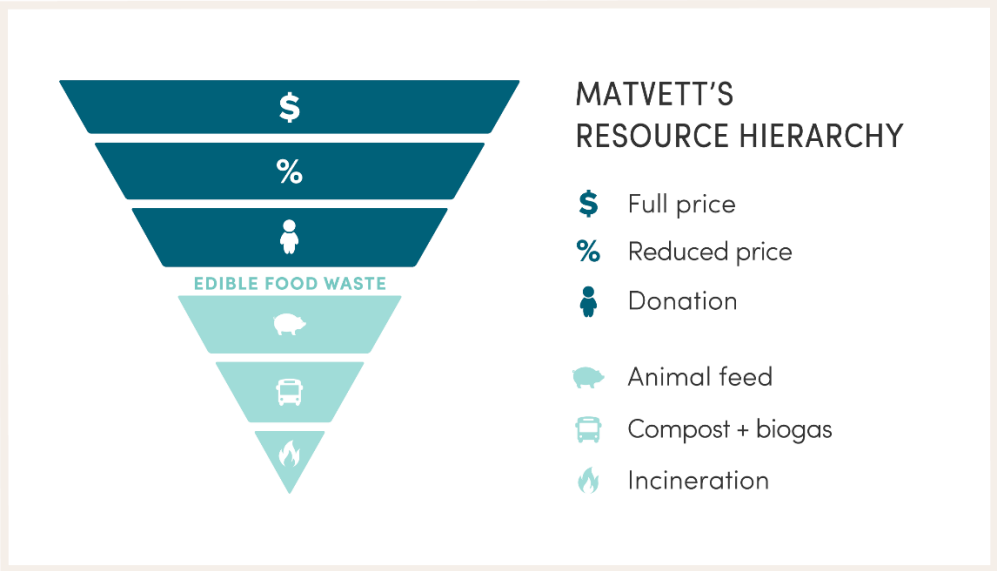

Figure 1-1 The Matvett resource pyramid

The main goal for the companies involved is to have as much food as possible at the top of the pyramid, i.e. to sell the maximum amount of food at full price. Secondarily, they should attempt to sell the food at a reduced price or to process the product into something different[1] and if this is not possible, they can donate or give away the food.

All of the upper parts of the resource pyramid (in dark blue in the figure) ensure that food is eaten rather than wasted. Apart from food sold at full price, these parts of the pyramid are often referred to as "utilization of surplus food". In this report, this term is used for food that is sold at a reduced price, processed or donated.

The lower parts of the pyramid, animal feed, compost, biogas and incineration (marked light blue) are different ways of handling edible food waste. Since the parties to the sector agreement also aim to optimize utilization of edible food waste, it is also important for companies to shift edible food waste upwards in the pyramid from e.g. incineration to biogas or animal feed.

These ways of using resources have been quantified for several of the stages of the value chain in this report.

[1] Processing food into a new product can be done in many different ways and will vary according to the stage of the value chain. In the production stage, it will often be a matter of reselling a by-product, or using a waste product from production (e.g. using starch from the production of potato chips in the production of aquavit). Retailers may use an item that is close to its expiry date or has reduced quality in their own production (e.g. brown bananas in a smoothie). In the catering sector, leftovers from a buffet may be used in new dishes.

1.5 Calculation of carbon footprint

The survey also includes the carbon footprint and financial loss associated with edible food waste.

The carbon footprint is calculated on the basis of greenhouse gas emissions per kg of a product based on life cycle analysis (LCA) methodology, which NORSUS has used in a number of projects. Greenhouse gas emissions include all greenhouse gases associated with the production, transport and packaging of food that is discarded. Emissions associated with waste management of packaging and food waste are not included.

The carbon footprint is estimated on the basis of the amount and composition of edible food waste that occurs in the various stages of the value chain, and is calculated by multiplying the amount of waste in tons for product groups and sectors by emission factors for each product group. It is important to note that edible food waste also affects many other environmental indicators beyond climate (e.g. acidification, eutrophication, emissions of particulates, etc.) as well as resource use (e.g. use of land, water and fossil energy).

1.6 Calculation of financial loss

Financial loss related to edible food waste only includes the market value of the food discarded, not costs associated with food preparation or waste management. For wholesalers, retailers and convenience stores, the calculation of financial losses associated with edible food waste is relatively simple, since waste is recorded in financial 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 (see Appendix 1).

Since data from food producers, hospitality, the education and care sector and households are measured in tons, financial loss for edible food waste was calculated in terms of key figures (NOK per kg) for each product group. These figures were then multiplied by tons of waste calculated for the relevant sector. The key figures (NOK per kg) are net prices obtained from retail outlets. This means that calculations of financial losses in the above sectors are highly unreliable.

All values have been converted to 2015 NOK values to ensure comparability between years.

2 Producers

2.1 About the production stage

In this report, the production stage includes companies that process food in Norway, with the exception of the seafood industry.

Companies that import food without further processing in Norway are included in the wholesale stage, not in the production stage. Producers of animal feed are also not included in these statistics, as edible food waste statistics only deal with wastage of food for human consumption.

Surveys of edible food waste by producers began with the ForMat project (2010-2015), a collaborative project that covered much of the value chain for the food and beverage sector in Norway. Several producers have thus been recording, preventing and reducing edible food waste for over ten years.

Some comments on the quality of data from producers:

- The sample of companies that report edible food waste data is not random (reporting is voluntary). It would therefore seem likely that the sample is dominated by companies that have an excellent record in terms of edible food waste (a biased sample).
- Edible food waste reporting covers only about half of all food production in Norway, and is mainly represented by large companies.

In addition, despite being unreliable, the production statistics are scaled up to national statistics and thus affect calculations of tons of edible food waste. The statistics from producers must therefore be regarded as an estimate.

2.2 Results from producers

Trends
From 2015 to 2020, edible food waste at the production stage was reduced by 1%, measured in kg per capita. Producers are therefore a long way from the goal of a 15% reduction by 2020.

Although the overall trend shows a minimal decline, the producers reporting reduced their edible food waste by 13% in kg per capita in the same period. The reason why total edible food waste only fell by 1% is that the quantity of food produced increased by 7% at the same time. This is a challenge that particularly affects the initial stages of the food chain (the primary and production stages), where an increased degree of self-sufficiency will always counteract waste reduction efforts, since edible food waste is measured in total quantities or kg per capita. However, if we consider the trend in terms of the percentage of the quantity produced, this problem will be avoided.

The carbon footprint associated with edible food waste by producers was reduced by 10%, while financial losses decreased by 15%. The difference in trends seen in carbon footprint, financial loss and edible food waste is because waste declined for relatively expensive and environmentally unfriendly products, such as dairy products and meat, while it increased for relatively inexpensive and environmentally friendly products, e.g. frozen vegetables and beverages.

Efforts for the future
Trends in the companies reporting show that good work is being done to reduce edible food waste at the production stage, but in order to achieve the next interim target of a 30% reduction, efforts must be redoubled and far more companies must become involved. Companies must intensify their work on internal procedures, optimize the production process and increase collaboration with the stages of the value chain before and after the production stage, since much of edible food waste is related to quality requirements, poor forecasting (overproduction) and challenges in relation to new launches and seasonal products.
In addition, some companies must improve their measurement methods; edible food waste is sometimes counted twice, i.e. in both the primary and production stages (frozen fruit and vegetables) and there may be lack of waste data from the production process (breweries). Food producers also have great potential for increasing their use of new, alternative sales channels, such as “Verdimat”, which involves food waste cooperation between producers, wholesalers and consumers, and “Holdbart” and “Too Good To Go”, which both involve the sale of surplus food at reduced prices. Further, producers can donate surplus food, which will also help to reduce edible food waste in the industry.
The major brand manufacturers in the food industry package and produce most of the food we eat and throw away at home. By developing their products and packaging to improve quality and shelf life as well as clearly labelling products and informing consumers about shelf life, storage, etc., food producers have a key responsibility and role in decreasing edible food waste in households.

The authorities must continue to remove obstacles to donating food, such as preventing a situation where fees or other rules provide incentives to discard food. Today, for example, it can be difficult to donate food that has not been cleared by customs and there is a limit on deposits covered by donation; the lack of financial incentives therefore limits the amount of food that can be donated.

2.2.1 Trends in national statistics

It is estimated that the total quantity of edible food waste by producers was 83 700 tons in 2015 and 86 006 tons in 2020 (Table 2-1).

Edible food waste in the production stage has thus increased by around 2300 tons or 3.0% from 2015 to 2020. However, this still corresponds to a 1% reduction in kg per capita, due to an increase in the population. Measured as kg per capita, waste by food producers has been reduced from 16.2 kg in 2015 to 16.0 kg in 2020.

Table 2-1 Annual figures 2015-2020 for edible food waste in tons and kg per capita at the production stage

	2015	2016	2017	2018	2019	2020
Waste in tons	83 700	85 400	84 650	82 100	78 950	86 000
Waste in kg per capita	16.2	16.4	16.1	15.5	14.8	16.0

The main reason for the increase in edible food waste from producers is higher and more unpredictable production as a result of COVID-19.

For several companies and product groups, waste as a percentage of the quantity produced has decreased, while the total amount of waste has increased, especially from 2019 to the pandemic year 2020. In 2020, many companies reported increased demand for certain product groups, especially items affected by cross-border trade and retail store products in general. At the same time, the hospitality market declined sharply, and many producers had to discard food due to cancelled orders from the hospitality sector.

2.2.2 Trends in the companies reporting

The companies reporting to the project reduced their edible food waste by 13% in terms of kg per capita. The reasons why waste as a whole was not reduced as much are that the amount of food produced has increased by 7% (SSB, 2021f) and that the waste statistics include total production, not only production from the companies reporting.

Of the companies reporting, 43% reduced edible food waste by 15% or more, 24% reduced waste by less than 15% and 32% increased their waste, in terms of kg per capita.

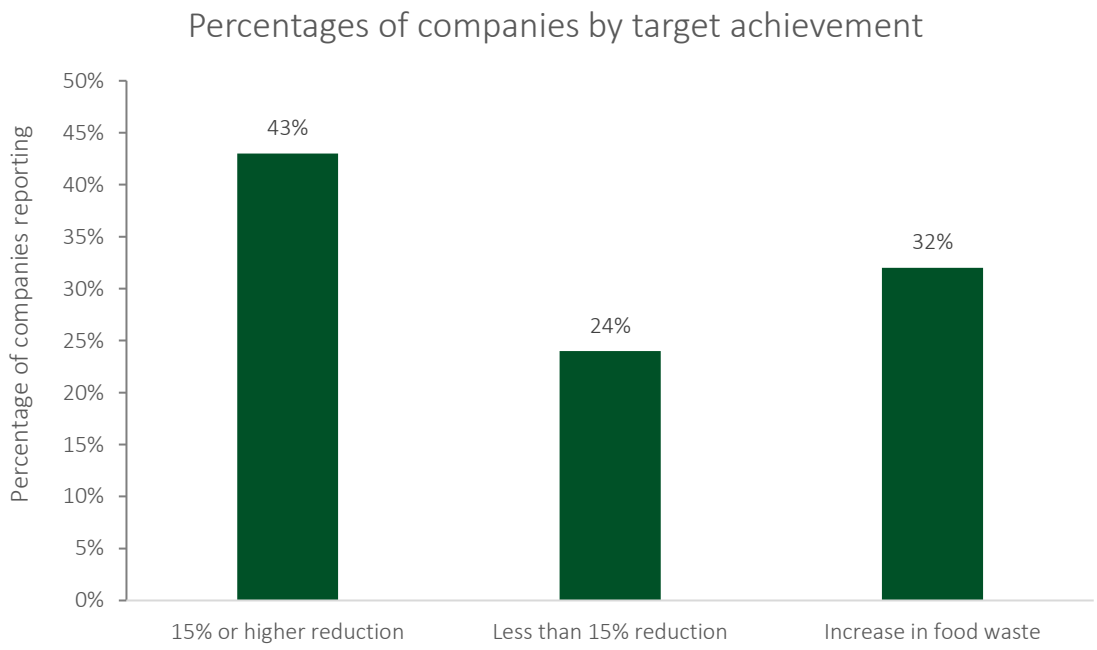

Figure 2-1 Percentages of companies reporting by change in waste in kg per capita

2.2.3 Distribution of waste by product group

Figure 2-2 shows trends in tons of waste by producers in 13 product groups.

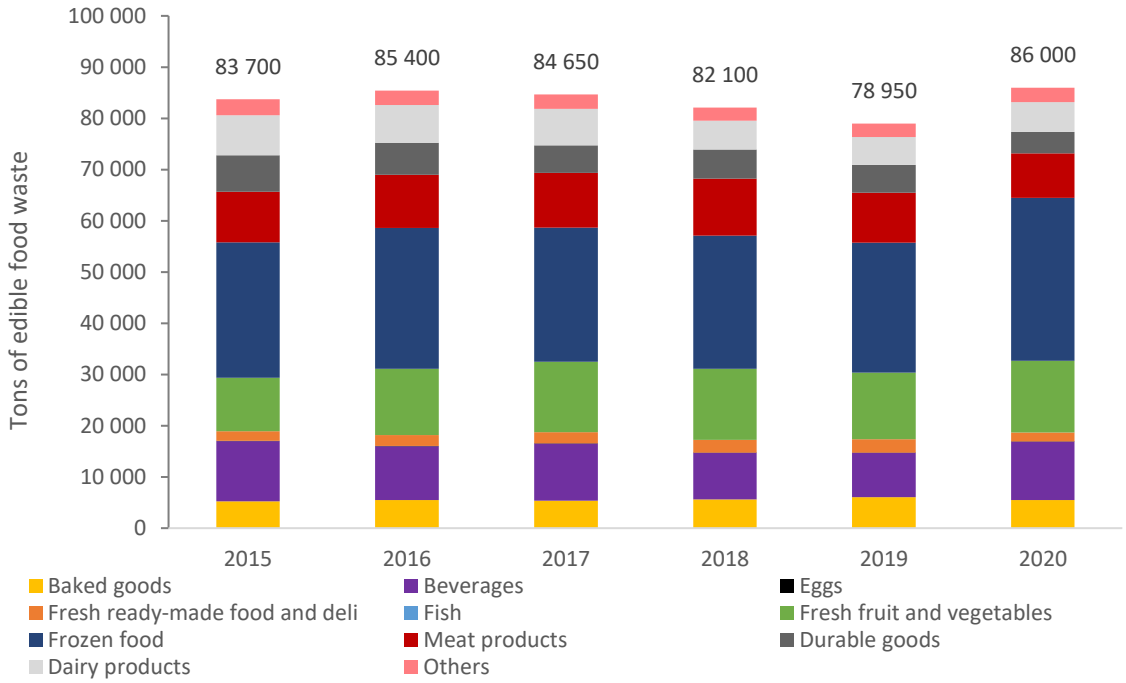

Figure 2-2 *Trends in tons of edible food waste by producers from 2015 to 2020, divided into product groups*

The product groups showing the greatest waste in tons are frozen food (including frozen fruit/vegetables/berries), followed by fresh fruit and vegetables and beverages, while those with the least waste are fish, eggs and ready-made food and delicatessen items (Table 2-2).

Table 2-2 *Percentage of total amount of waste in 2020 by product group*

Product group	Percentage of total amount of waste in 2020
Baked goods	6%
Beverages	13%
Eggs	0%
Fresh ready-made food and delicatessen items	2%
Fish	0%
Fresh fruit and vegetables	16%
Frozen food	37%
Meat products	10%
Durable goods	5%
Dairy products	7%
Others	3%

Measured in tons, edible food waste increased most for these groups:

- Fresh fruit and vegetables (+3558 tons)
- Frozen food (+5355 tons)
- Baked goods (+224 tons)

Measured in tons, edible food waste decreased most for these groups:

- Durable goods (-2913 tons)
- Dairy products (-2057 tons)
- Meat products (-1210 tons)

2.2.4 Waste as a percentage of amount produced

Edible food waste has also been calculated as a percentage of tons produced. This indicator provides a better picture of food waste efficiency in the production stage than tons per year and kg per capita. This is because waste figures in terms of quantity are very sensitive to changes in production quantities; an increase in the quantity produced can lead to a greater amount of edible food waste even though waste as a percentage of the quantity produced has decreased.

At the production stage, product groups with the most waste as a percentage of production (in tons) in 2020 were:

1. Frozen vegetables/fruit/berries (15.9%)
2. Prepared fruit/vegetables (13.7%)
3. Frozen ready-made food (8.6%)

Product groups with the least waste as a percentage of production (in tons) in 2020 were:

1. Cheese (0.2%)
2. Flour, grains, cereals, starch, baking ingredients, etc. (0.2%)
3. Eggs (0.2%)

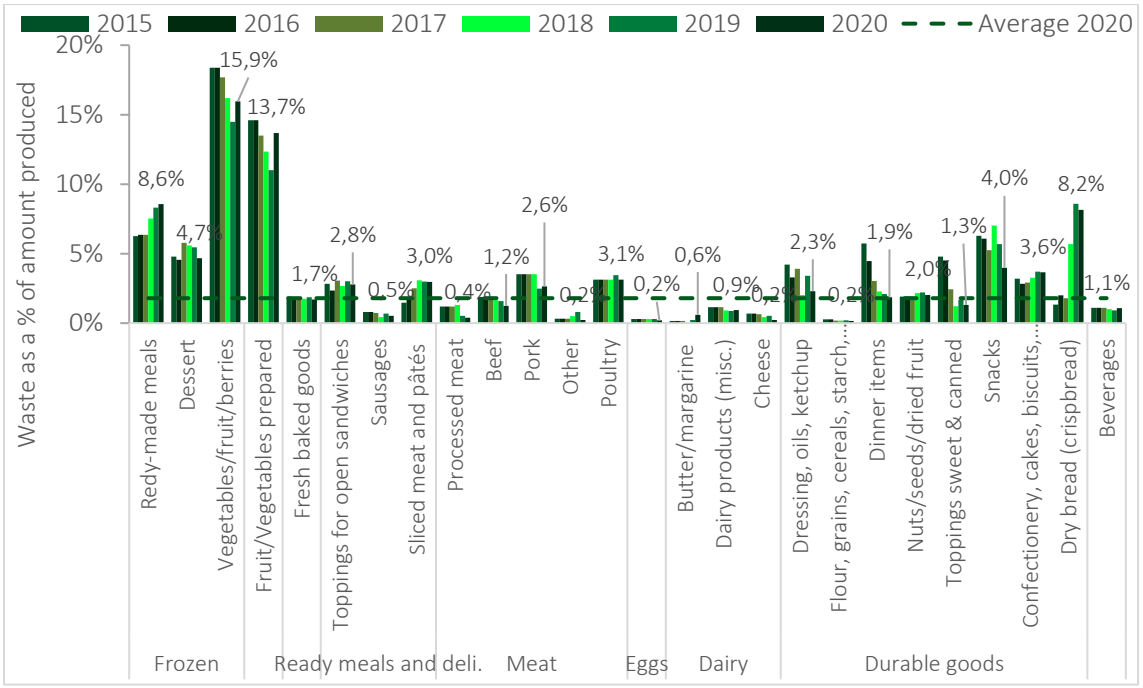

Figure 2-3 shows edible food waste as a percentage of annual production in tons from 2015 to 2020. The percentages marked represent the waste for the various product groups in 2020 and the broken line shows the weighted average for waste in 2020.

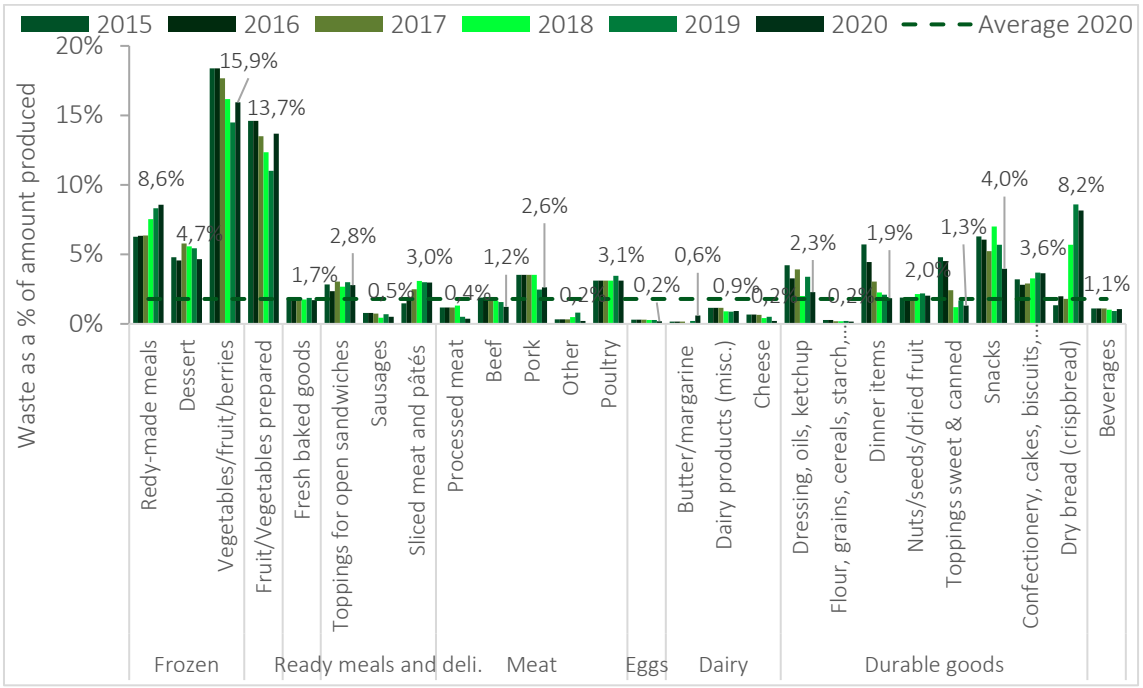

Figure 2-3 *Trends in waste from producers 2015-2020 as a percentage of production*

The figure shows that average edible food waste by producers for all product groups amounted to 1.8% in 2020 (broken line). In 2015 this figure was 2.0%, which means that the proportion of waste was reduced by about 11% in the period 2015 to 2020.

Nineteen product groups show reduced waste over the period, while six show increased waste. Edible food waste increased the most for dry bread (crispbread) (+509%), followed by butter/margarine (+269%) and sliced meat and pâtés (102%), and decreased the most for toppings for open sandwiches (-73%), cheese (-68%) and food for meals (-68%).

2.2.5 Carbon footprint and financial loss

Trends in carbon footprint of edible food waste

It has been calculated that the total amount of edible food waste in the production stage produced a carbon footprint of 261 700 tons of CO2 equivalents in 2015 and 235 900 tons of CO2 equivalents in 2020 (Figure 2-4).

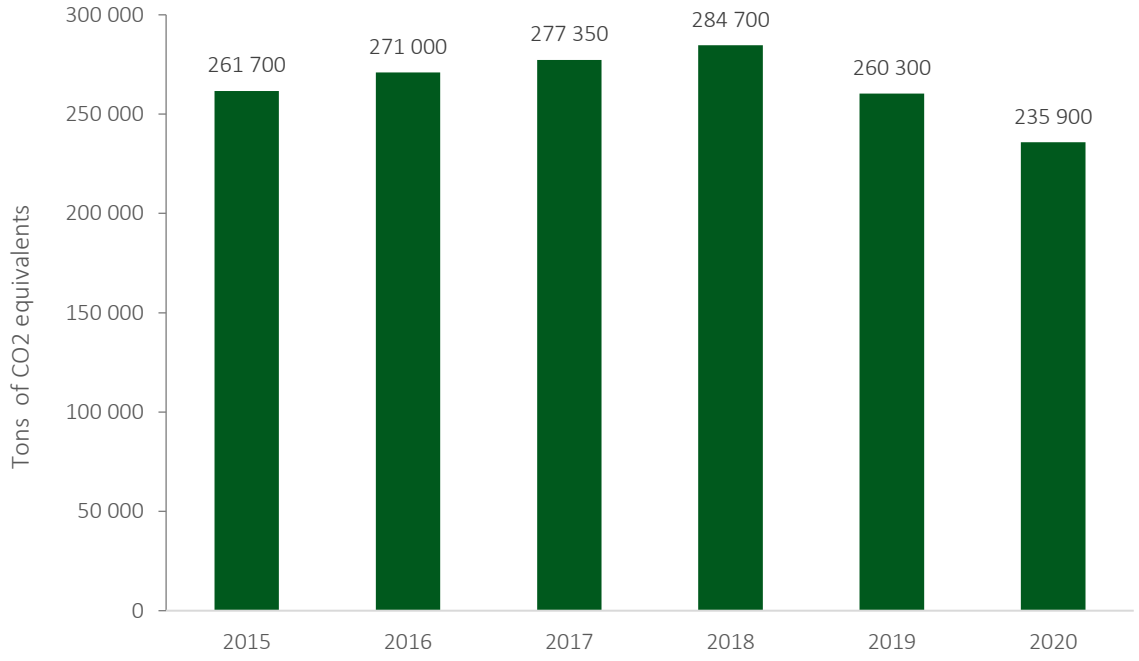

Figure 2-4 *Tons of CO_2 equivalents related to edible food waste by producers from 2015 to 2020*

The carbon footprint of edible food waste was thus reduced by 25 800 tonnes of CO2 equivalents or 10% from 2015 to 2020. This is despite the fact that waste in tons increased in the same period, the reason being that waste increased for items with a relatively low carbon footprint (fruit/vegetables), but decreased for those with a higher footprint.

Trends in financial loss due to edible food waste

It has been calculated that the total amount of edible food waste at the production stage led to a financial loss of NOK 4.12 billion in 2015 and NOK 3.48 billion in 2020 (in 2015 NOK values) (Figure 2-5).

Financial losses associated with edible food waste thus decreased by NOK 0.63 billion or 15% from 2015 to 2020. This is despite an increase in tons of waste in the same period, which is because waste increased for relatively inexpensive items (fruit/vegetables) but declined for more expensive foods.

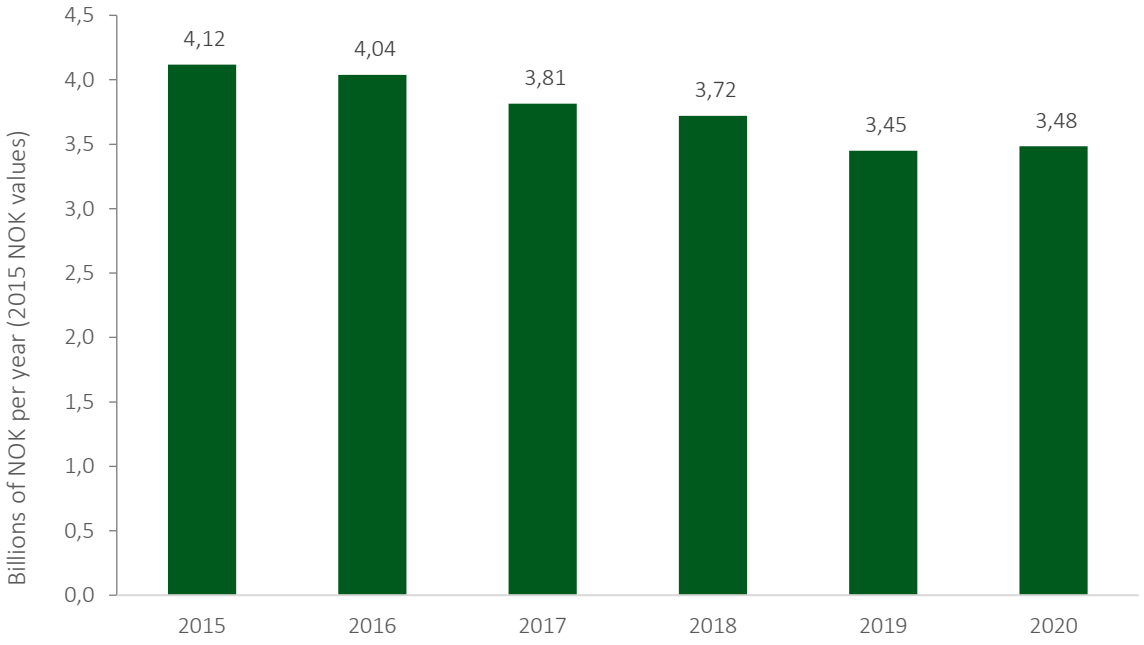

Figure 2-5 Financial losses due to waste by producers from 2015 to 2020

2.3 Causes of edible food waste

General reasons for edible food waste

The following are the main causes of wastage of food from raw material stock (in order of priority):

- Past storage date
- Poor raw material quality
- Breakage/poor handling
- Discontinued product

Other causes of waste from raw material stock are technical faults, wrong storage temperature, accidents, damage, too large minimum orders, cleaning, and errors in orders and deliveries. In general, the causes are very homogeneous, i.e. the three most common causes (expired date, poor quality and breakages) account for almost 80% of causes of edible food waste.

In general, food is wasted during processing for the following reasons (in order of priority):

- Production errors
- Production stops
- New production operations
- Items dropped on floor
- Accidents during production

Other causes during processing are scraps, cleaning of equipment, etc. In general, the causes are of a technical nature.

Food is generally discarded during packing due to (in order of priority):

- Faulty production
- Damaged packaging
- Accidents/items dropped on floor
- Labelling errors

Other causes during packing are forecasting errors, faulty machinery and machine stops. Here too, the causes are usually technical or related to equipment.

In general, finished products in storage and distribution are discarded by producers due to (in order of priority):

- Expired date, due to overproduction or cancelled orders
- Poor handling/breakage
- Crediting of goods from retailers related to defects/damage to the product or packaging

2.4 Measures implemented to reduce waste

2.4.1 Redistribution of surplus food

Figure 2-6 shows how producers utilized surplus food in 2020, i.e. food that could have become edible food waste.

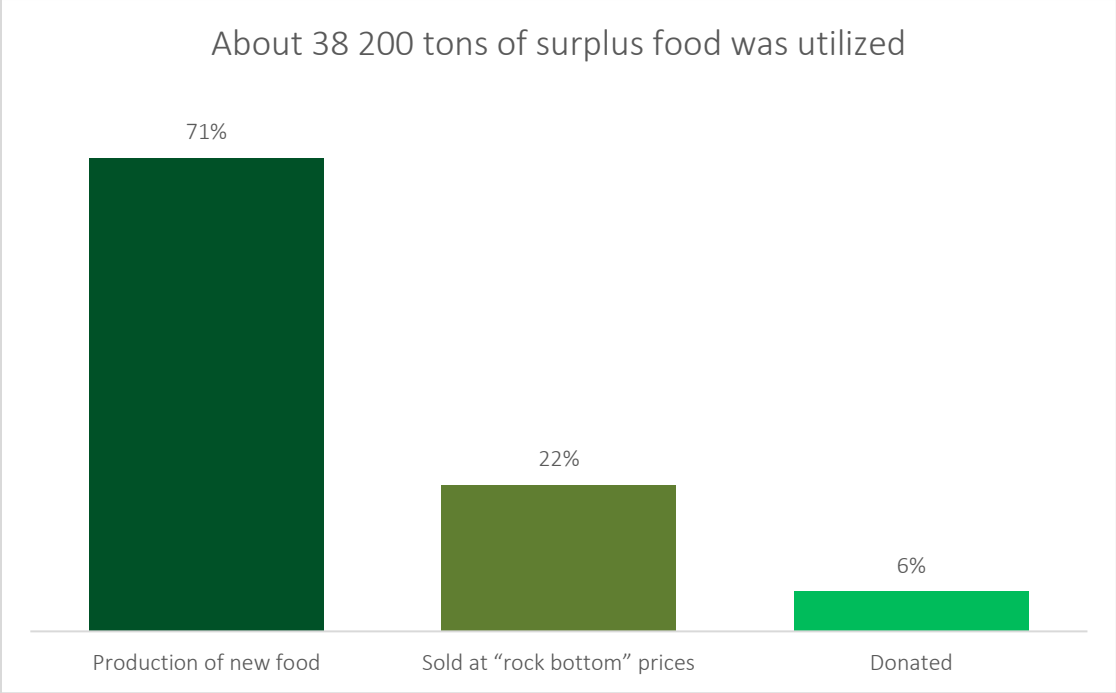

Figure 2-6 Utilization of surplus food by producers in 2020

The figure shows that about 38 200 tons of surplus food was utilized by food producers in 2020. Most of the food was used in the production of new food (71%), while 22% was sold at "rock bottom" prices and 6% was donated.

Note that these estimates are somewhat unreliable:

- The total amount of surplus food utilized may be somewhat underestimated, as several companies have reported donating food but do not know the exact quantities.
- The potential utilization of food in producing new food, selling it at rock bottom prices, donating it and using it for animal feed depends on the particular products of companies; e.g. alcoholic beverages cannot be donated or sold at rock bottom prices. The above information is therefore only representative of the product groups of the companies reporting.

2.4.2 Treatment of edible food waste

Figure 2-7 shows how edible food waste from the production stage was treated in 2020.

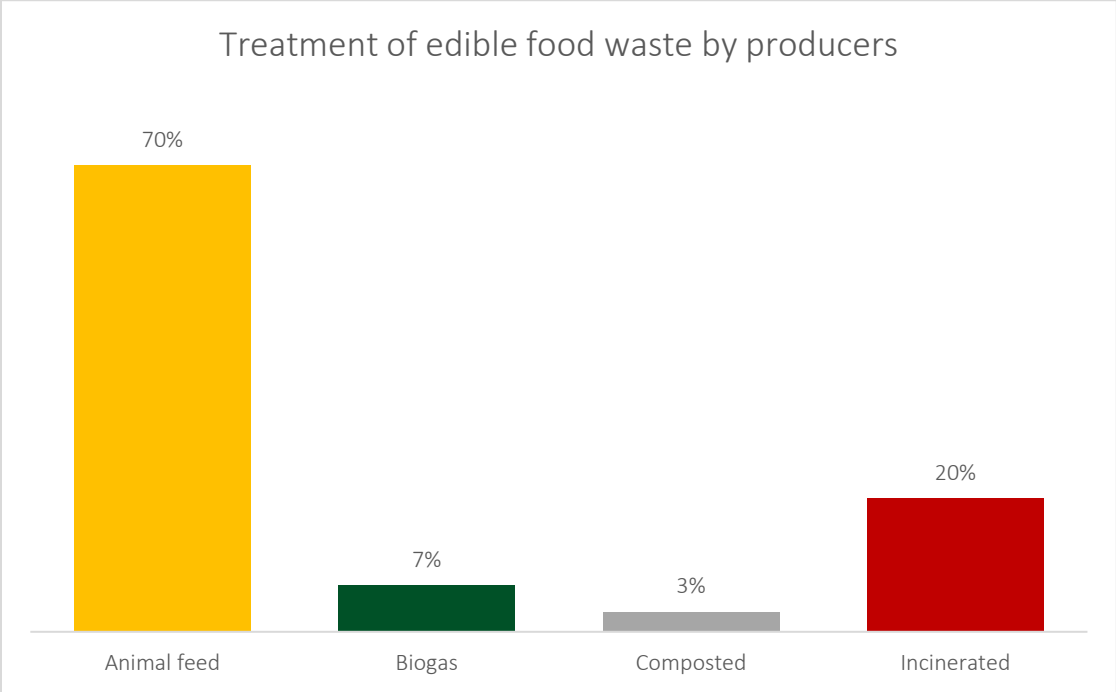

Figure 2-7 Methods of treating edible food waste from the production stage in 2020

Of the 86 000 tons of food discarded by producers, about 70% was used for animal feed, 7% was converted to biogas, 3% was used as compost and 20% was incinerated.

Note that these estimates are somewhat unreliable:

- Some companies have reported the total amount of food waste (including non-edible parts), instead of edible food waste, that was used for animal feed, biogas, composting and incineration. Due to the data collection method used here, the figures cannot be converted to edible food waste as the composition of product groups is unknown.

2.4.3 Measures implemented

The following general measures have been implemented to improve the recording of waste at the production stage:

- Matvett, in collaboration with NORSUS, published a guide for mapping edible food waste in the production stage in 2018 (Stensgård, Hanssen, & Møller, 2018) and has conducted annual workshops to help producers improve waste mapping and reporting.
- In 2018, Matvett cooperated with NORSUS to launch a portal for edible food waste mapping at the production stage.

Measures implemented in companies

Ninety-three percent of the food producers reporting to the project have implemented measures to reduce their own edible food waste in 2018-2020.

Figure 2-8 shows the proportion of the companies that reported having implemented various internal waste reduction measures in 2018-2020.

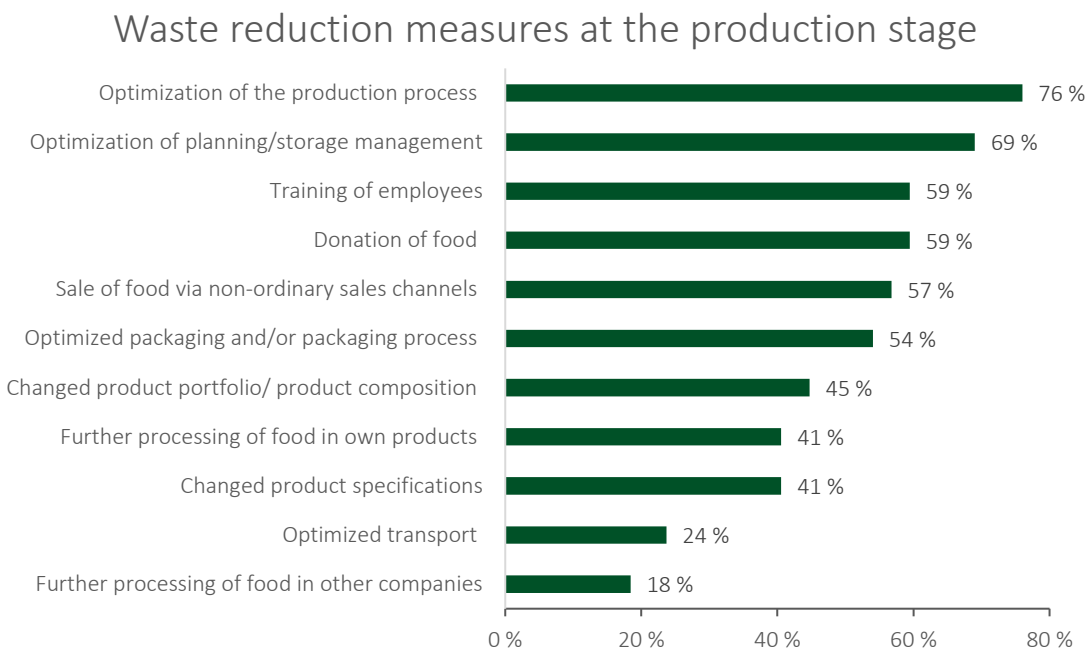

Figure 2-8 Percentages of companies reporting having implemented various internal measures to reduce edible food waste in 2018-2020.

The figure shows that optimization of the production process and of planning/storage management systems were the most frequently used measures, followed by staff training and food donation.

In addition to internal measures, companies have also reported measures to reduce edible food waste elsewhere in the value chain. Fifty-nine percent of the food producers implemented such measures in 2018-2020.

Figure 2-9 shows the percentages of the companies that reported having implemented various measures to reduce waste elsewhere in the value chain in the period 2018 to 2020.

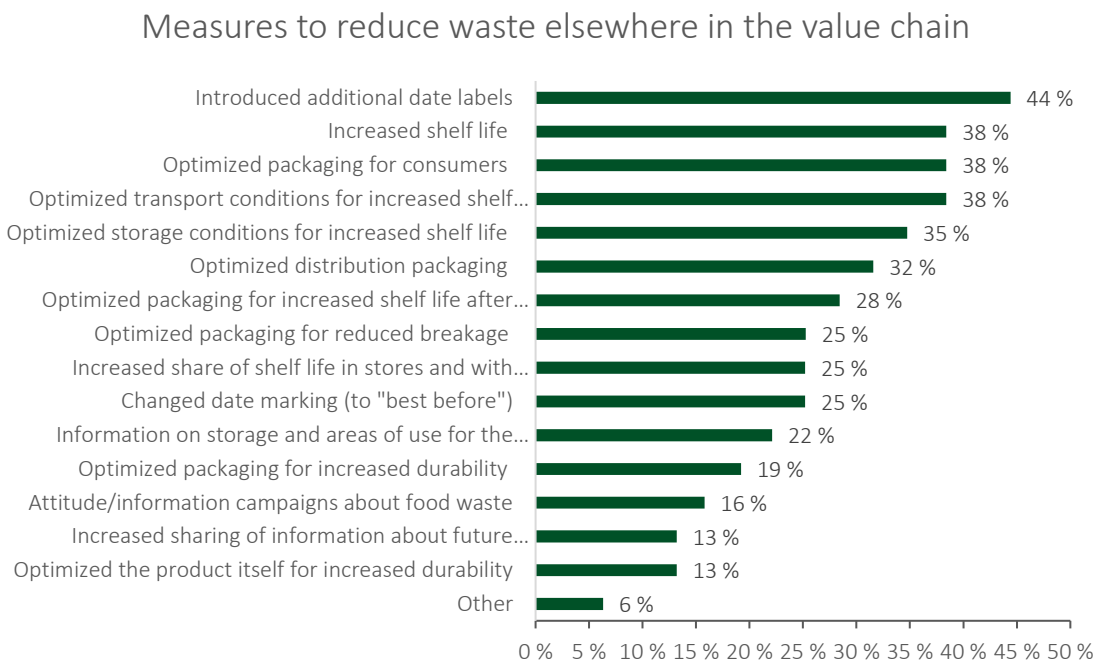

Figure 2-9 Percentages of companies reporting having implemented various measures to reduce edible food waste elsewhere in the value chain in 2018-2020.

The figure shows that a large number of companies have introduced additional information on date labels, increased shelf life and optimized packaging for consumers such as providing improved opening and closing mechanisms.

NORSUS
Norsk institutt for bærekraftsforskning

3 Wholesalers

3.1 About the wholesale stage

In this report, wholesalers are defined as those companies that distribute food in Norway.

Distribution of non-food and animal feed is not included in these statistics as edible food waste statistics only apply to wastage of food for human consumption. Food supplements and water are included.

Surveys of edible food waste at the wholesale stage began with the ForMat project (2010-2015), a collaborative project that covered much of the value chain of the food and beverage sector in Norway. Several wholesalers have therefore been recording, preventing and reducing their waste for over 10 years.

Some comments on the quality of data from wholesalers

- There is voluntary reporting of edible food waste data, and the companies reporting are therefore not a random sample. The sample is therefore likely to be dominated by companies that are “best in class” in terms of edible food waste (a biased sample).
- Edible food waste is mainly reported in economic terms and must be converted to tons based on prices per kilo from retailers. This conversion is not entirely reliable as there are no useful wholesale-specific prices per kilo.
- Some companies have been unable to remove food that is donated or sold at reduced prices from the waste statistics. This means that edible food waste is somewhat overestimated.

On the other hand, edible food waste reporting from the wholesale level covers a large share of the total market and data collection from wholesalers is of relatively high quality since the recording of edible food waste forms part of the companies’ financial systems. Edible food waste statistics at the wholesale stage are therefore assumed to be of medium quality.

3.2 Results from wholesalers

Trends
From 2015 to 2020, edible food waste by wholesalers was reduced by 25% in kg per capita. Wholesalers are therefore well ahead of the target of a 15% reduction by 2020.
Edible food waste has seen a large decrease for fresh fruit and vegetables and a smaller decrease for durable foods. At the same time, it has increased for the remaining product groups.

The carbon footprint associated with waste at the wholesale stage has increased by 2%, while financial losses have declined by 28%. The difference in the trends for carbon footprint and financial loss is because edible food waste has been reduced for the more environmentally friendly foods, such as fruit and vegetables, but increased for less environmentally friendly foods, such as meat and dairy products. This increase is due to a shift from direct distribution to distribution via wholesalers, which means that the increase in the wholesale sector is probably a shift in waste from producers to wholesalers.

Efforts for the future
Developments at the wholesale stage indicate that good work is being done by wholesalers to reduce edible food waste, and they are well on their way to reaching the next interim target of a 30% reduction by 2025. Although the trend in kg per capita is very encouraging at the wholesale level, the carbon footprint of edible food waste is increasing. This is because waste has increased for goods with a high carbon footprint (meat and dairy products). Wholesalers should therefore make greater efforts with these product groups in the future to enhance the environmental benefits of lower edible food waste.

The wholesale stage is an intermediate stage, with relatively little waste compared to the stages before and after. This makes the wholesale stage rather vulnerable to any shifts in edible food waste across the value chain. However, it also means that wholesalers have a key role to play in increasing cooperation between food producers and the later stages (retailers, hospitality, the education and care sector and convenience stores). The goal of a 50% reduction must be achieved for the entire value chain, and wholesalers should therefore in the future examine how they can help to reduce edible food waste elsewhere in the value chain.

3.2.1 Trends in national statistics

It is estimated that the total amount of edible food waste at the wholesale stage was 8250 tons in 2015 and 6450 tons in 2020 (Table 3-1).

Wholesalers have thus reduced edible food waste by 1750 tons, or 22%, from 2015 to 2020. This corresponds to a reduction of 25% in kg per capita, from 1.6 kg in 2015 to 1.2 kg in 2020.

Table 3-1 Annual figures 2015-2020 for edible food waste in tons and kg per capita at the wholesale stage

	2015	2016	2017	2018	2019	2020
Waste in tons	8250	7100	7700	7500	6150	6450
Waste in kg per capita	1.6	1.6	1.5	1.4	1.2	1.2

The main reason for the reduction in edible food waste by wholesalers is an increased focus on internal procedures, internal action plans and more frequent internal reporting of waste. In addition, several wholesale companies have reported increased cooperation with food banks for the redistribution of surplus food.

At the wholesale level, we also see an increase in edible food waste from 2019 to 2020, due to greater unpredictability in the market due to the COVID-19 pandemic.

3.2.2 Trends in the companies reporting to the project

Two of the wholesalers have unchanged edible food waste (primarily because they are new wholesalers who reported data for the first time this year), one has increased its waste, while four have reduced their waste.

Of those who have reduced their edible food waste, only one has achieved the goal of a 15% reduction; this wholesaler is also approaching the target of halving waste.

3.2.3 Distribution of waste by product group

Figure 3-1 shows trends in tons of edible food waste in 13 product groups at the wholesale stage.

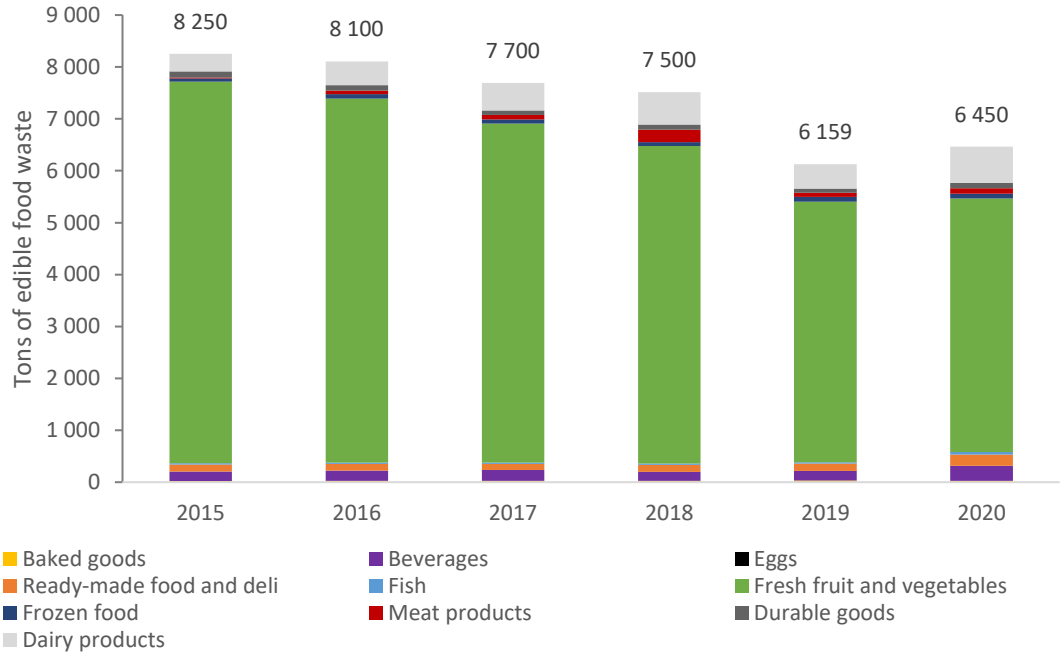

Figure 3-1 *Trends in tons of edible food waste by wholesalers from 2015 to 2020 by product group*

The largest product group in tons is fresh fruit and vegetables (76%), while the smallest groups are baked goods and eggs (Table 3-2). Fresh fruit and vegetables are easily damaged during transport and storage, and have a short shelf life, which may explain why this group dominates the statistics.

Table 3-2 *Percentages of total amount of edible food waste in 2020 for different product groups*

Product group	Percentage of total amount of waste in 2020
Frozen food	1%
Fresh fruit and vegetables	76%
Baked goods	0%
Fresh ready-made food and delicatessen items	3%
Fish	1%
Meat products	2%
Eggs	0%
Dairy products	11%
Durable goods	2%
Beverages	4%

Measured in tons, edible food waste has increased most for:

- Dairy products (+356 tons)
- Beverages (+99 tons)
- Meat products (+90 tons)

Measured in tons, edible food waste has decreased most for:

- Fresh fruit and vegetables (-2473 tons)
- Durable goods (-13 tons)

The increase for dairy products and meat products is due to the shift from direct distribution to distribution via wholesalers, which means that the increase at the wholesale level is probably a shift in waste from producers to wholesalers.

3.2.4 Edible food waste as a percentage of sales

Edible food waste has also been calculated as a percentage of sales at the wholesale level.

The product groups with the most waste as a percentage of sales at the wholesale stage in 2020 were:

1. Fresh fruit and vegetables (0.28%)
2. Fresh ready-made food and delicatessen items (0.25%)
3. Fish (0.25%)

The product groups with the least waste as a percentage of sales at the wholesale stage in 2020 were:

1. Eggs (0%)
2. Durable goods (0.2%)
3. Beverages (0.3%)

Figure 3-2 shows edible food waste as a percentage of annual sales from 2015 to 2020. The percentages marked represent the waste for the various product groups in 2020 and the broken line shows the weighted average for waste in 2020.

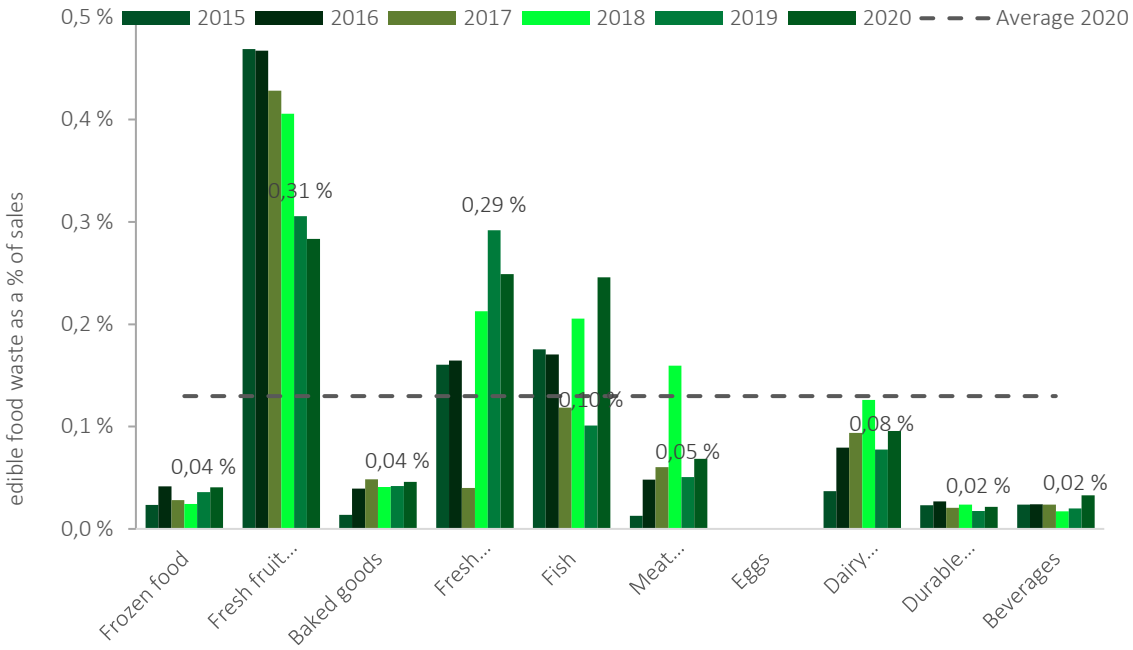

Figure 3-2 *Trends in edible food waste as a percentage of sales at the wholesale level from 2015 to 2020*

The figure shows that the average percentage of edible food waste by wholesalers for all product groups was 0.13% in 2020 (broken line). In 2015, this figure was 0.22%, which means that the percentage of edible food waste has been reduced by 0.9 percentage points from 2015 to 2020.

Only two product groups have reduced waste over the period, while seven show an increase. However, since one of the two groups with lower waste (fruit and vegetables) is the largest group measured in tons, edible food waste has still been reduced overall.

3.2.5 Carbon footprint and financial loss

Trends in carbon footprint of edible food waste

It is estimated that the total amount of edible food waste at the wholesale stage resulted in a carbon footprint of 14 000 tons of CO2 equivalents in 2015 and 14 250 tons of CO2 equivalents in 2020 (Figure 3-3).

The carbon footprint of edible food waste has thus increased by about 250 tons of CO2 equivalents (2%) in the period 2015 to 2020. This is despite the fact that waste in tons declined in the same period; it is because there was an increase for environmentally unfriendly foods (meat products and ready-made food) and a decrease for environmentally friendly foods, such as fruit and vegetables.

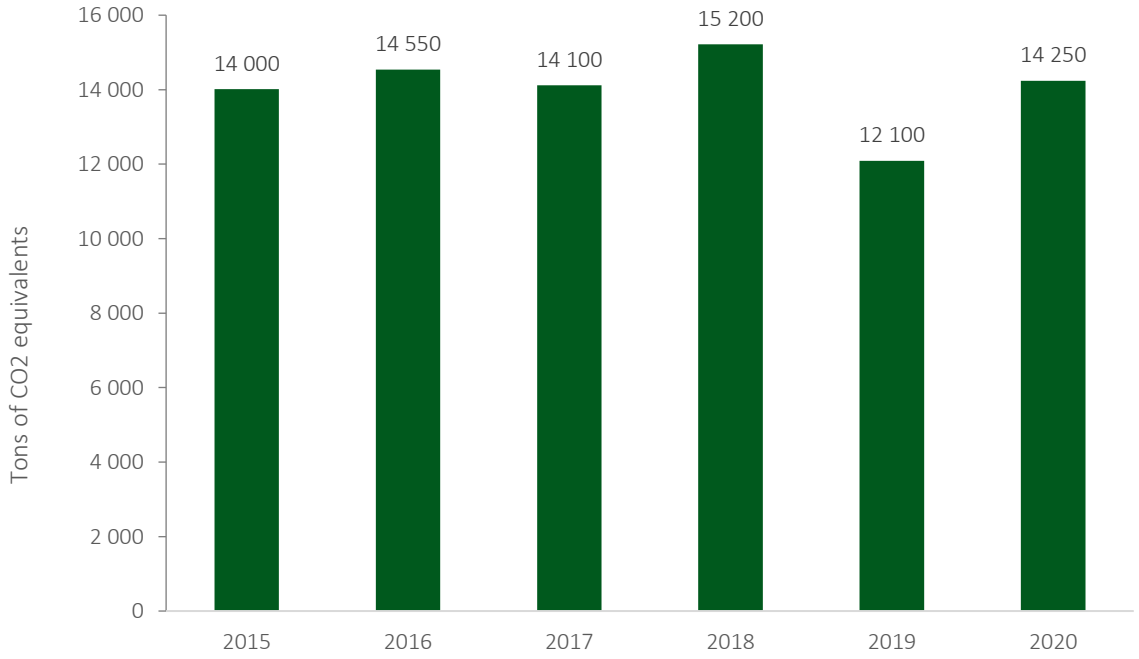

Figure 3-3 *Tons of CO_2 equivalents associated with edible food waste by wholesalers from 2015 to 2020*

Trends in financial loss due to edible food waste

It is estimated that the total amount of edible food waste at the wholesale stage represented a financial loss of around NOK 0.34 billion in 2015 and NOK 0.24 billion in 2020 (in 2015 NOK values) (Figure 3-4).

Financial losses associated with edible food waste were thus reduced by NOK 0.10 billion, or 28%, in the period 2015 to 2020.

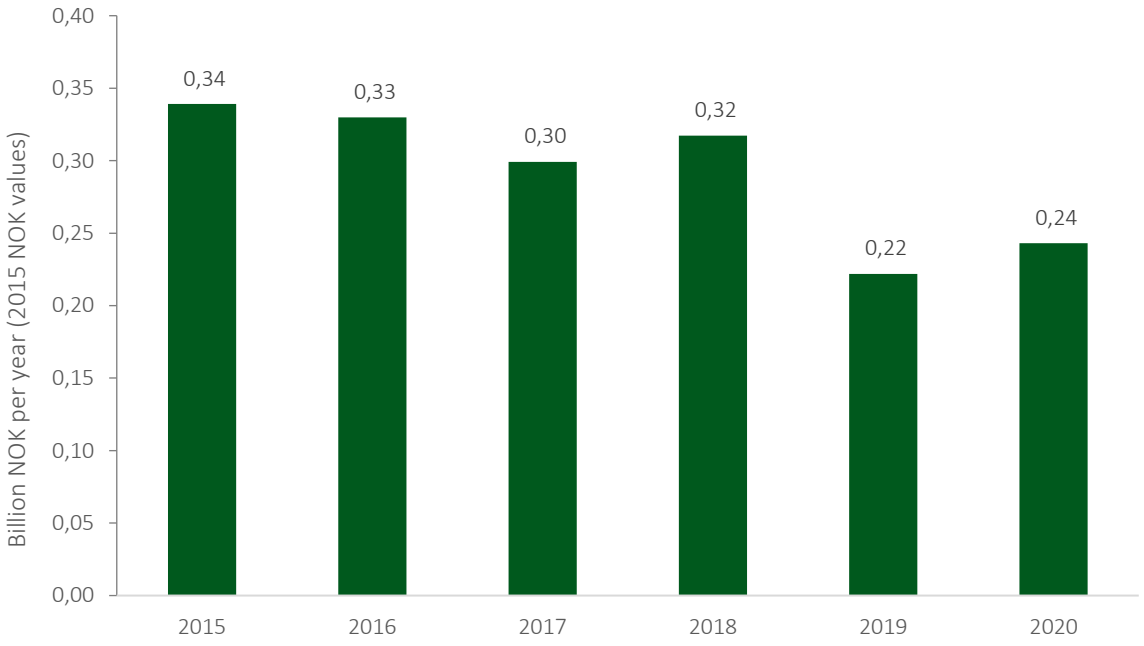

Figure 3-4 *Financial loss linked to edible food waste by wholesalers from 2015 to 2020*

3.3 Causes of edible food waste

General causes of edible food waste at the wholesale stage

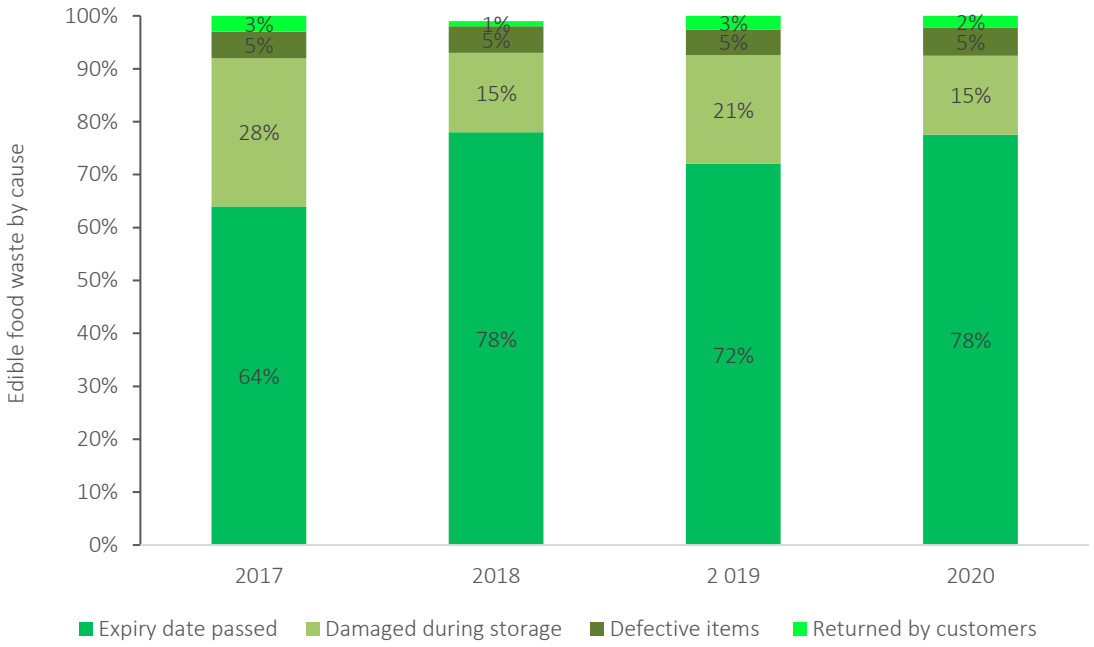

Figure 3-5 shows the distribution of edible food waste by wholesalers by cause from 2017 to 2020.

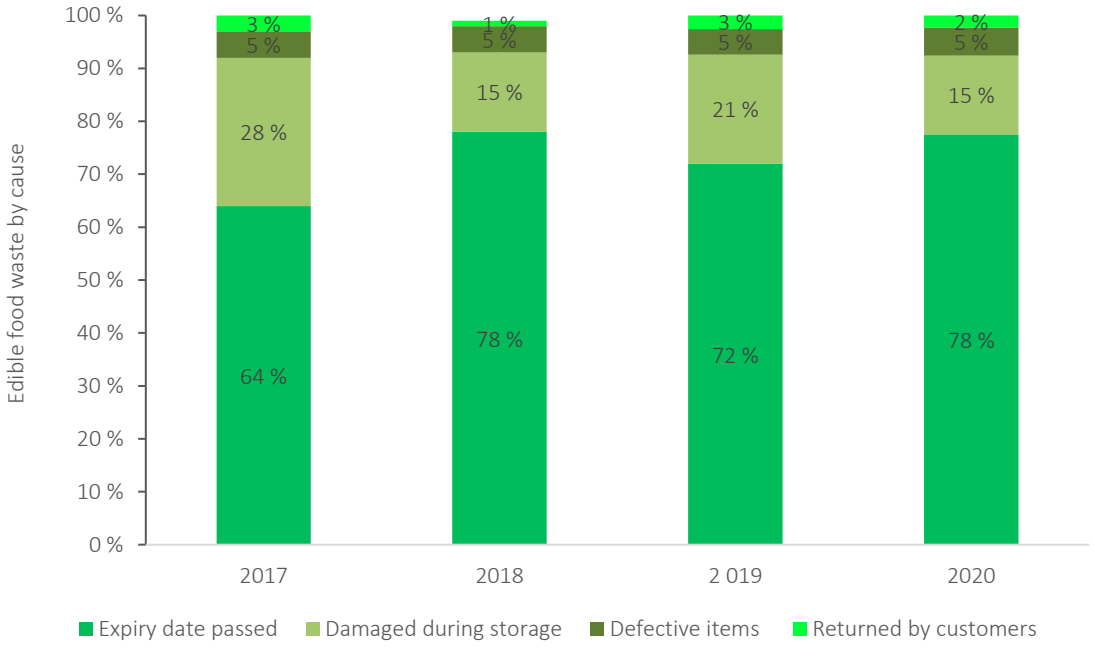

Figure 3-5 Wholesale waste by cause from 2017 to 2020

In general, food is discarded by wholesalers because it is past its expiry date (78% of edible food waste in 2020), which means the final sales date for the wholesale stage based on the divisions in the Norwegian regulation STAND 001. In addition, some foods are damaged during storage (15% in 2020), while defective items and those returned by customers account for a smaller proportion.

Estimated edible food waste at the wholesale level is very low (only 0.13% of total sales); thus, although much of the waste is because food has passed its expiry date, this is still a marginal proportion of all the food sold.

3.4 Measures implemented to reduce waste

3.4.1 Redistribution of surplus food

In 2020, Norwegian food banks received 1533 tons of food from 36 wholesale companies. If this food had not been donated, the level of edible food waste by wholesalers would have been about 25% higher than it was in 2020. Food donated increased by 30% compared to 2019.

In addition, wholesalers sold food with a short shelf life at reduced and rock bottom prices to avoid discarding it, but the extent of this is unknown.

3.4.2 Measures implemented

At the wholesale stage, implemented measures have not been recorded as systematically as at the production stage, but several companies have reported carrying out the following measures:

- Increased focus on internal procedures to avoid wastage (inventory management, correct handling of goods to avoid breakage, etc.).
- Employment of dedicated staff responsible for mapping and preventing edible food waste.
- Implementation and follow-up of internal action plans and more frequent internal reporting of food waste.
- Increased cooperation with food banks for redistribution of surplus food.
- Collaboration on forecasting with other sectors in the value chain.
- Use of alternative sales channels and increased sales of food that has passed its “best before” date.

4 Retailers

4.1 About the retail stage

In this report, retailers are defined as those companies that sell food to consumers in Norway.

Note that distribution of non-food and animal feed is not included in these statistics as edible food waste statistics only apply to wastage of food for human consumption. Neither does the retail stage include various types of convenience stores. Edible food waste that occurs here is mapped in the convenience stores sector.

Food waste surveys in the retail stage began with the ForMat project (2010-2015), a collaborative project that covered much of the value chain of the food and beverage sector in Norway. Several retail chains have therefore been recording, preventing and reducing their waste for over 10 years.

Some comments on the quality of data from retailers

- Edible food waste is reported by some retail chains in economic terms and must be converted to tons based on prices per kilo from other chains. This conversion is not entirely reliable as prices per kilo are based on the purchase price in retail chains, which can vary somewhat between chains.
- Some retailers have been unable to remove food that is donated or sold at reduced prices from the statistics. This means that edible food waste is somewhat overestimated.

Although there is voluntary reporting of edible food waste data (the chains are not a random sample), the data are considered to be of high quality, as more than 99% of retail sales are represented. Further, data collection in retail outlets is of relatively high quality since the recording of edible food waste forms part of the stores' financial systems. Waste statistics at the retail stage are therefore assumed to be of good quality.

4.2 Results from retailers

Trends
From 2015 to 2020, edible food waste by retailers was reduced by 21% in kg per capita. Retailers are therefore well ahead of the target of a 15% reduction by 2020. Edible food waste has been reduced for all product groups, and the decrease is greatest for product groups that are often sold at reduced prices such as fresh ready-made food, meat products and dairy products.

The carbon footprint associated with waste at the retail stage has declined by 32%, while financial losses have decreased by 26%. The difference in the trends for carbon footprint and financial loss is because edible food waste has been reduced most for expensive and less environmentally friendly foods, such as dairy products and meat.

Efforts for the future
Developments at the retail stage indicate that good work is being done by retailers to reduce edible food waste, and suggest that they are well on their way to reaching the next interim target of a 30% reduction by 2025.
Measured in percentages, edible food waste was reduced the least for fruit and vegetables and bread and baked goods. These are also the two largest product groups measured in tons. To achieve the target of a 50% reduction, retail chains must consider further specific preventative measures aimed at precisely those two groups, such as reducing the selection on offer towards closing time, examining current return schemes and purchasing procedures/forecasts, in addition to adopting waste reduction measures such as reduced prices and alternative sales channels, such as Too Good To Go, to a greater extent. In addition to efforts directed at large-volume product groups, retailers should also continue the work of reducing waste in the less environmentally friendly product groups, such as meat, dairy products and fresh ready-made food.

The retail sector is the part of the food industry that has most direct contact with consumers, and it also sells most of the food that is either eaten or thrown away in households. Retail chains can influence the amount and type of food we buy, and they have a key responsibility and role in relation to our attitudes to food and edible food waste. This is a challenging area for retail chains to be involved in, probably requiring research and innovation work, in addition to courage to challenge established truths related to consumer expectations.

4.2.1 Trends in edible food waste in tons and kg per capita

It is estimated that total edible food waste in the retail stage amounted to 82 350 tons in 2015 and 67 400 tons in 2020 (Table 4-1).

Edible food waste by retailers was thus reduced by 14 950 tons or 18% in the period 2015 to 2020. This corresponds to a reduction of 21% in kg per capita. Measured as kg per capita, waste by retailers was reduced from 15.9 kg in 2015 to 12.6 kg in 2020.

Table 4-1 Annual figures 2015-2020 for edible food waste in tons and kg per capita at the retail stage

	2015	2016	2017	2018	2019	2020
Waste in tons	82 350	75 850	74 400	72 950	69 100	67 400
Waste in kg per capita	15.9	14.5	14.2	13.8	13.0	12.6

The main reason for reduced quantities of edible food waste in the retail stage is price reductions on items close to their expiry date. Further reasons are a greater focus on forecasting and ordering procedures and increased cooperation with food banks and alternative channels for the sale of discounted food ("Too Good To Go", "Throw No More", "FoodList", etc.).

The retail sector saw strong growth in sales from 2019 to 2020 due to the COVID-19 pandemic (+ 17%) (NielsenIQ, 2021b), but this did not have a negative effect on edible food waste by retailers, which shows a steady downward trend.

4.2.2 Distribution of waste by product group

Figure 4-1 shows trends in tons of waste by retailers in 13 product groups.

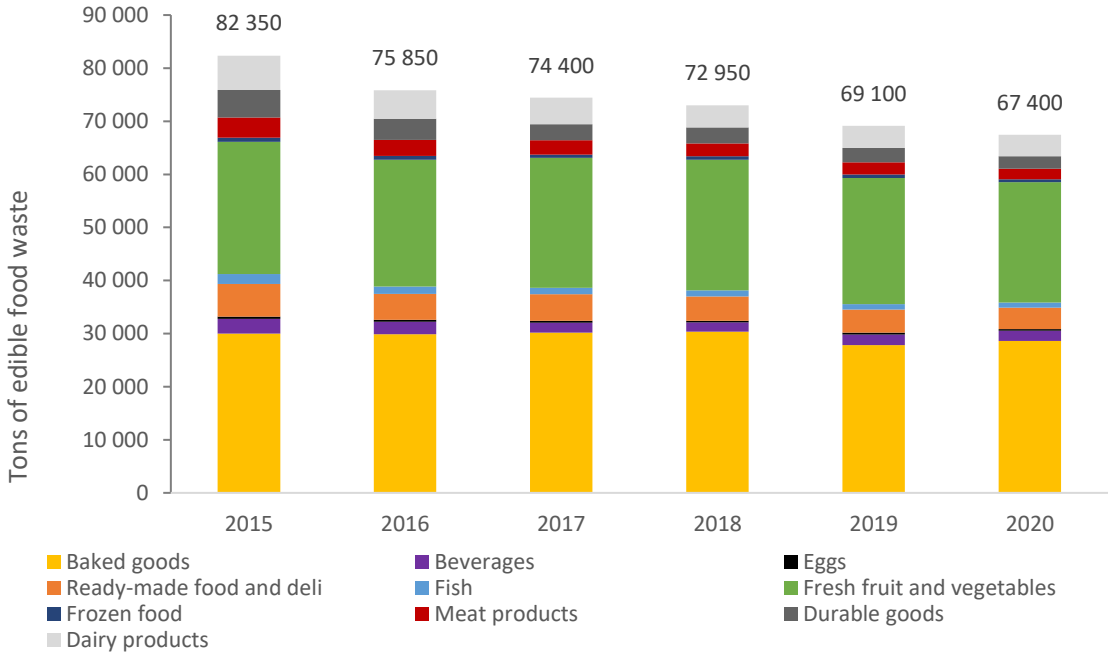

Figure 4-1 *Trends in tons of edible food waste by retailers from 2015 to 2020, divided into product groups*

The product groups showing the greatest waste in tons are baked goods (42%) and fresh fruit and vegetables (34%), while those with the least waste are eggs, frozen food and fish (Table 4-2).

Table 4-2 Percentage of total amount of waste in 2020 by product group

Product group	Percentage of total amount of waste in 2020
Frozen food	1%
Fresh fruit and vegetables	34%
Baked goods	42%
Fresh ready-made food and delicatessen items	6%
Fish	1%
Meat products	3%
Eggs	0%
Dairy products	6%
Durable goods	3%
Beverages	3%

Measured in tons, edible food waste has decreased for all product groups, but most for:

- Durable goods (-2855 tons)
- Dairy products (-2411)
- Fresh fruit and vegetables (-2289 tons)

4.2.3 Edible food waste as a percentage of sales

Edible food waste has also been calculated as a percentage of sales at the retail stage.

The product groups with the *most* waste as a percentage of sales at the retail stage in 2020 were:

1. Baked goods (9.8%)
2. Fresh fruit and vegetables (4.2%)
3. Fish (4.1%)

The product groups with the *least* waste as a percentage of sales at the retail stage in 2020 were:

1. Beverages (0.2%)
2. Frozen food (0.3%)
3. Durable goods (0.4%)

Figure 4-2 shows edible food waste as a percentage of annual sales from 2015 to 2020. The percentages marked represent the waste for the various product groups in 2020 and the broken line shows the weighted average for waste in 2020.

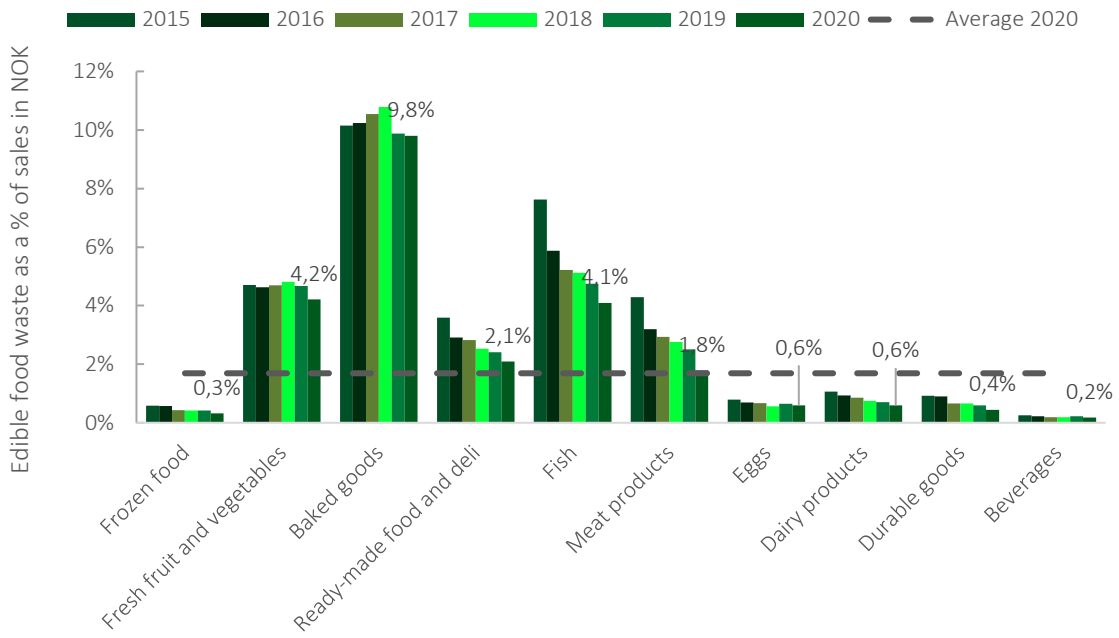

Figure 4-2 *Trends in edible food waste as a percentage of sales at the retail level from 2015 to 2020*

The figure shows that the average percentage of edible food waste by retailers for all product groups was 1.7% in 2020 (broken line). In 2015, this figure was 2.5%, which means that the percentage of edible food waste has been reduced by 1.2 percentage points from 2015 to 2020.

There has been no increase in edible food waste in any product group during the period.

4.2.4 Carbon footprint and financial loss

Trends in carbon footprint of edible food waste

It is estimated that the total amount of edible food waste at the retail stage resulted in a carbon footprint of 225 050 tons of CO2 equivalents in 2015 and 154 000 tons of CO2 equivalents in 2020 (Figure 4-3).

The carbon footprint of edible food waste has thus decreased by about 71 050 tons of CO2 equivalents (2%) in the period 2015-2020.

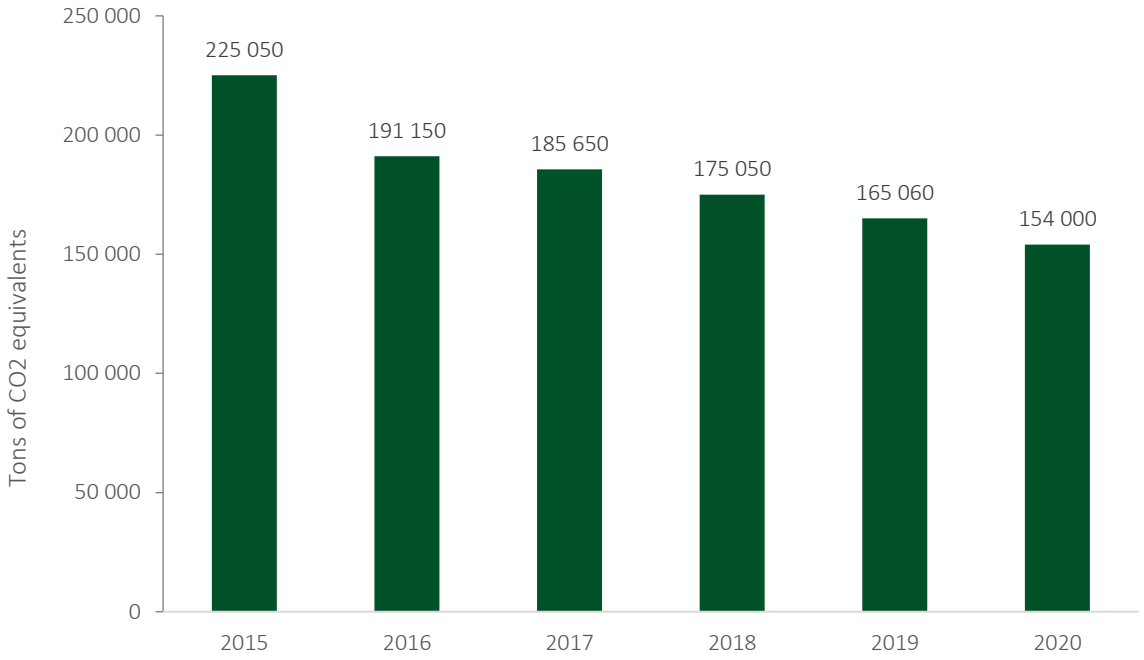

Figure 4-3 *Tons of CO2 equivalents associated with edible food waste by retailers from 2015 to 2020*

Trends in financial loss due to edible food waste

It is estimated that the total amount of edible food waste at the retail stage represented a financial loss of around NOK 3.43 billion in 2015 and NOK 2.53 billion in 2020 (in 2015 NOK values) (Figure 4-4).

Financial losses associated with edible food waste were thus reduced by NOK 0.90 billion, or 26%, in the period 2015 to 2020.

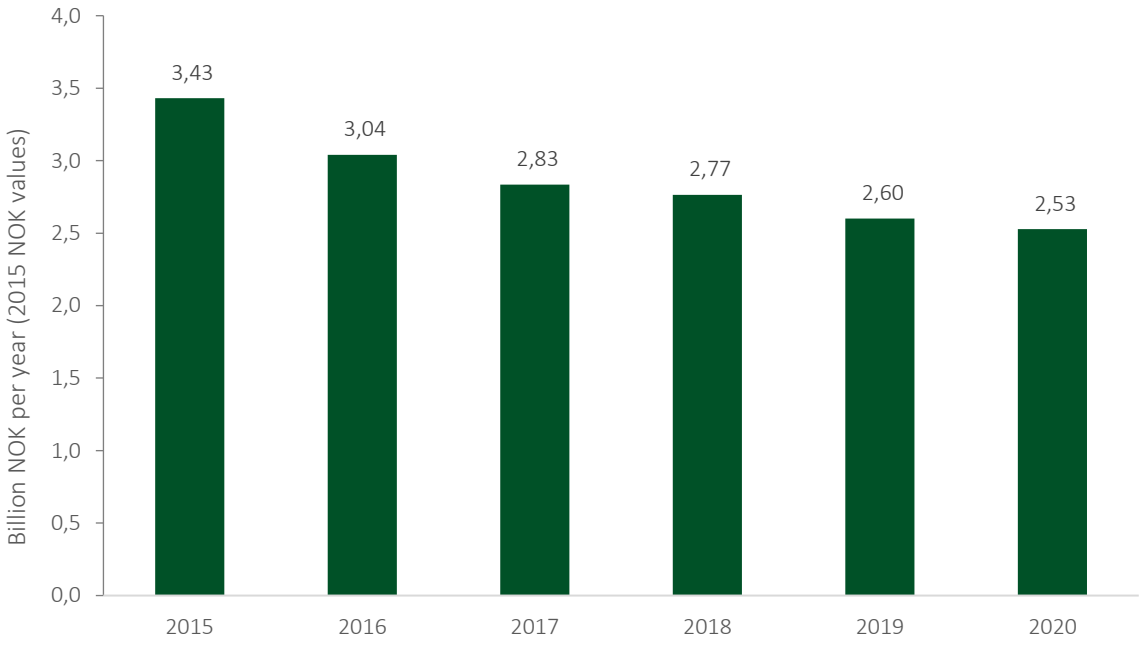

Figure 4-4 *Financial loss linked to edible food waste by retailers from 2015 to 2020*

4.3 Causes of edible food waste

General causes of edible food waste at the retail stage

Most edible food waste by retailers occurs because food must be discarded due to reduced quality (fruit/vegetables and bread/baked goods) or because it is past its expiry date. This is to be expected as the retail sector is one of the last stages of the value chain.

Food past its expiry date or of reduced quality is often due to the following underlying reasons:

- Over-ordering, i.e. the store has ordered more than they needed. This may be due to miscalculations or lack of information on sales statistics.
- Poor forecasting also leads to ordering more goods than needed, but is due to unforeseen events, such as changes in the weather.
- Suboptimal display of products. This applies, for example, to fruits and vegetables that are stored cool and dark until they are displayed in the store.
- 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.

Other common causes of edible food waste, but which often represent a relatively small volume in the retail stage, are as follows:

- The smallest order from the supplier is too large.
- There are too many consumer packs in the distribution pack.
- Faulty packaging.

4.4 Measures implemented to reduce waste

4.4.1 Redistribution of surplus food

Figure 4-5 shows the utilization of surplus food from retailers in 2020.

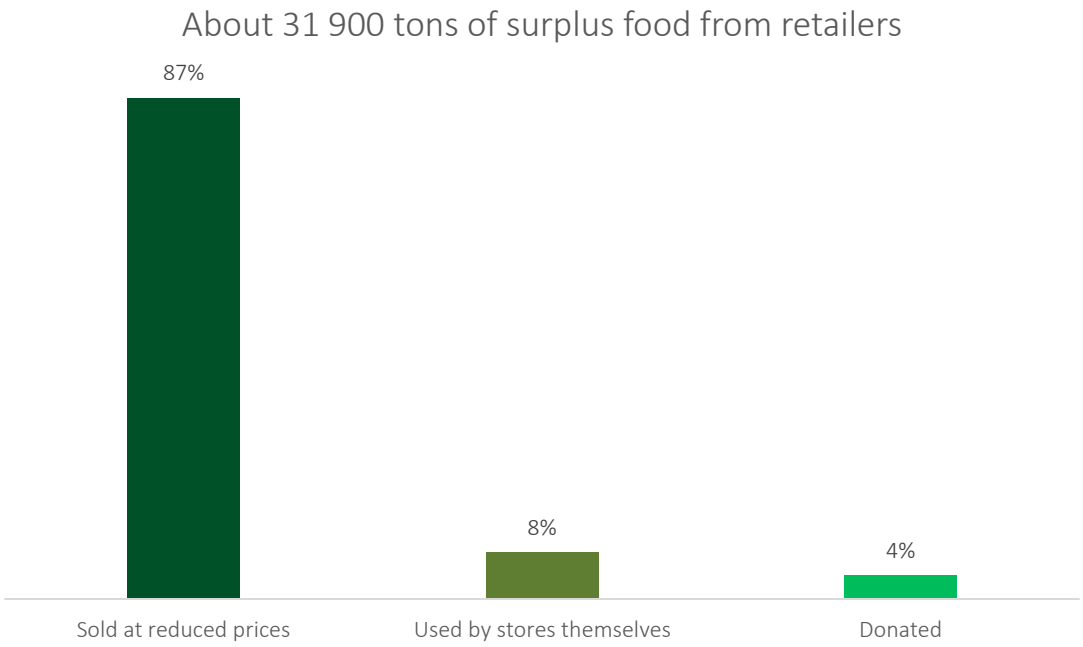

Figure 4-5 Utilization of surplus food by retailers in 2020

The figure shows that about 31 900 tons of surplus food was utilized by retailers, most of which was sold at reduced prices (87%), while 8% was used by stores themselves and 4% was donated.

Note that these estimates are somewhat unreliable:

- The amount of food salvaged may be somewhat underestimated, as several retail chains have reported donating food but do not know the exact quantities.

4.4.2 Treatment of edible food waste

Some retail chains have also reported amounts of edible food waste in terms of various treatment methods. This has led to an estimate of how the waste was treated.

Figure 4-6 shows how edible food waste in the retail stage was treated in 2020.

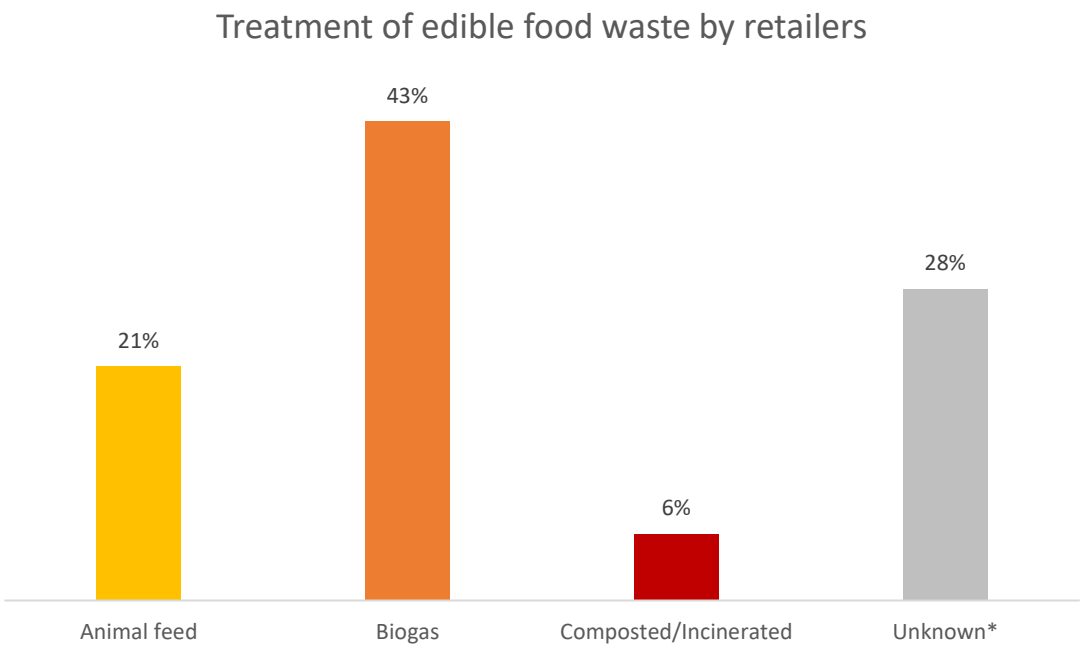

Figure 4-6 Methods of treating edible food waste from the retail stage in 2020

Of the 67 400 tons of edible food discarded by retailers, about 21% was used for animal feed, 45% was converted to biogas, 6% was used as compost or incinerated, while 28% is unknown and may have been returned to producers/wholesalers, delivered to local refuse collectors or local farmers, or discarded as general waste.

The estimates may be unreliable for the following reasons:

- Retail chains have used slightly different categories; some have combined biogas and composting, while others have combined biogas and incineration.
- Some retail chains have reported the total amount of food waste (including non-edible parts), instead of edible food waste, that was used for animal feed, biogas, compost and incineration.

4.4.3 Measures implemented

The management of the retail chains is ultimately responsible for work on edible food waste and most chains have made efforts to prevent and reduce waste since the start of the ForMat project in 2010.

In the retail sector, the following measures have been implemented to prevent and reduce edible food waste:

- Discounting of food close to its expiry date. This measure has led to the greatest reduction in waste in the retail sector.
- Development of systems to alert stores about goods that will soon expire or where the stock is too large in relation to expected sales.
- A greater focus on product flow, including a pilot project to integrate the date stamp in 2D codes to enable store staff to notice foods that are approaching their expiry date.
- Promotional discounting or sales promotion apps to market discounted food, such as Too Good To Go, Throw No More and others.
- Solutions for more accurate forecasting and improved product flow. Such measures are implemented in collaboration with the entire value chain and represent a focus area that will probably lead to a significant reduction in total waste.
- Financial support to Food Banks Norway, in addition to donating surplus food to food banks.
- Collaboration with suppliers to push sales of foods with a short expiry date or when suppliers' inventories are too large.
- Improved procedures for campaigns and date checking.

In addition to the above prevention and reduction measures, various actions have been aimed at consumers and other stages of the value chain, such as the sale of "ugly" fruit and vegetables, and information and attitude-changing campaigns. Retailers have also made efforts to improve packaging of their own brands, including the introduction of a better opening/closing mechanism, additional information on date labels and "look, smell and taste campaigns".

5 Hospitality sector

5.1 About the hospitality sector

In this report, the hospitality sector includes hotels, canteens and restaurants.

Note that bars, hospitality firms, cafes, campsites and youth hostels are not included in the statistics. This is because edible food waste has not yet been mapped for these segments. Neither does the hospitality sector include various types of convenience stores. Edible food waste that occurs here is mapped in the convenience stores sector.

The survey of edible food waste in the hospitality sector commenced in 2017 in the research project "KuttMatsvinn2020". Edible food waste statistics for hospitality therefore start in 2017.

For much of the hospitality industry, the COVID-19 pandemic led to closures and layoffs. This made it impossible to map edible food waste in 2020 in several of the companies that have signed the sector agreement and reported waste data in previous years. Edible food waste statistics for the hospitality sector are thus greatly affected by COVID-19, but an attempt has nevertheless been made to estimate waste in 2020. The data from 2017-2019 are of better quality and trends for this period are considered to be more reliable.

Some comments the quality of data in the hospitality sector

- There are some uncertain factors associated with the use of a key figure for the proportion of edible food waste in total food waste. The use of a fixed key figure may lead to some overestimation of amounts of edible food waste by restaurants that have measured all food waste, as it is reasonable to believe that the ratio of edible food waste to total food waste will change over time. Another uncertain factor is that the key figure is based on waste sample analyses from a few selected companies for a limited period. The sample is too small to be representative of the sector and makes the results very unreliable when total food waste recorded is corrected in relation to the key figure. In addition, there is considerable variation in results for production waste and leftover waste from the waste sample analyses, especially from hotels and staff cafeterias.
- In order to increase representativeness and ensure comparability, edible food waste data from 2019 have been used as an estimate for 2020 for companies that have not provided data. It is unclear whether this leads to an over- or underestimation of edible food waste.
- Only a small proportion of restaurants have provided data (1.4% in 2019 and 0.3% in 2020) and edible food waste statistics are therefore very unreliable for this segment.
- There are some discrepancies between sales statistics from Statistics Norway and sales reported by companies, as several of the companies sell other services such as cleaning, accommodation, etc. in addition to hospitality. This may imply a poor basis for scaling up from company data to national statistics.

Edible food waste statistics for the hospitality sector must therefore be regarded as estimates.

5.2 Results from the hospitality sector

Trends
From 2017 to 2020, edible food waste in the hospitality industry was reduced by 27%, measured in kg per capita. The sector is therefore well ahead of the target of a 15% reduction by 2020. It is unclear how much of the reduction was due to COVID-19, but since much of the sector was shut down or greatly restricted in 2020, it seems likely that the pandemic affected developments. The figures for 2017 to 2019, which were not affected by COVID-19, showed a reduction in edible food waste of 7%.

The carbon footprint and financial losses associated with edible food waste in the hospitality sector have been reduced by 25%. Note that this figure is less reliable since changes in the composition of the waste are not known.

Efforts for the future
Although the effect of the pandemic cannot be quantified, the results suggest that efforts are being made to reduce edible food waste in the sector. If the decline in waste continues after the pandemic, the hospitality sector will be well on its way towards the next interim target of a 30% reduction by 2025.
COVID-19 has challenged the hospitality sector in several areas, including those with a direct effect on edible food waste. For example, buffets had to be removed due to infection control regulations. Several companies found that this helped to reduce waste and that guests were not dissatisfied; they understood the reason as long as it was explained to them. In order to maintain the reduction in waste until after the pandemic, the hospitality sector must learn from this experience and not be afraid to find out whether guests can accept smaller buffets and more limited menus if the problem of edible food waste is communicated to them. A survey conducted by NHO showed that more than 50% of the population are positive to this change.

Much of the edible food waste in the hospitality industry is from the plates of guests. In order to achieve the target of a 50% reduction in waste, the hospitality sector must take steps to ensure that food served is also eaten. There are many ways to solve this, such as the size of portions and extras, plate refills and doggie bags. In addition, the industry must encourage guests to be more aware of reducing their waste by informing them about the importance of measures such as a reduced choice in buffets and taking smaller portions.

5.2.1 Trends in edible food waste in tons and kg per capita

It is estimated that the total edible food waste in the hospitality sector amounted to 18 850 tons in 2017 and 14 100 tons in 2020 (Table 5-1).

Edible food waste in the hospitality sector was thus reduced by 4750 tons or 25% in the period 2017 to 2020. This corresponds to a reduction of 27% in kg per capita. Measured as kg per capita, edible food waste in hospitality sector was reduced from 3.6 kg in 2017 to 2.6 kg in 2020.

As mentioned in the introduction, the survey of edible food waste in the hospitality sector did not commence until 2017. Waste statistics for this stage of the value chain thus go no further back than 2017.

Table 5-1 Annual figures 2017-2020 for edible food waste in tons and kg per capita in the hospitality sector

	2017	2018	2019	2020
Waste in tons	18 850	19 150	17 700	14 100
Waste in kg per capita	3.6	3.6	3.3	2.6

Table 5-2 shows the distribution of edible food waste between the three segments of the hospitality sector in 2017-2020.

Table 5-2 Tons of edible food waste in the segments of the hospitality sector 2017-2020

	2017	2018	2019	2020
Tons of waste in canteens	3 866	3 828	4 052	2 877
Tons of waste in hotels	3 364	3 154	3 601	1 994
Tons of waste in restaurants	11 629	12 151	10 055	9 229

Changes in edible food waste in the hospitality sector were influenced by two factors:

- One is a real reduction in edible food waste due to various measures implemented: a greater focus on procedures and competence building, smaller portions, reuse of surplus food, sales of surplus food via other channels and reduced prices at the end of the day (Prestrud 2021).
- The second is closures due to COVID-19, which meant a sharp decline in sales. Some edible food waste increased as a result of the pandemic, e.g. hospitality establishments had to empty their stock when they closed, while some waste was reduced, either due to infection

control measures (e.g. specially adapted buffets with ordering) or because establishments had to close.

5.2.2 Distribution of waste by product group

The distribution of edible food waste between different product groups has only been recorded via waste sample analyses from 2017 and 2019 (Møller et al., 2020) and the figures are therefore very unreliable. Table 5-3 shows the composition of edible food waste for the three hospitality segments, divided into six product groups.

The largest product groups are ready-made food (19-53%), fruit and vegetables (27-31%) and baked goods (8-16%).

Table 5-3 Various product groups' share of total edible food waste in the hospitality sector in 2020

	Hotels	Canteens	Restaurants
Baked goods	16%	8%	11%
Ready-made food	19%	53%	38%
Meat	8%	3%	5%
Fish	8%	3%	5%
Dairy products	4%	1%	4%
Various	15%	5%	7%
Fruit and vegetables	31%	27%	30%

5.2.3 Grams of edible food waste per meal

Edible food waste has also been calculated as grams per meal in the hospitality sector. Figure 5-1 shows trends from 2017 to 2020 in this key figure for the three segments.

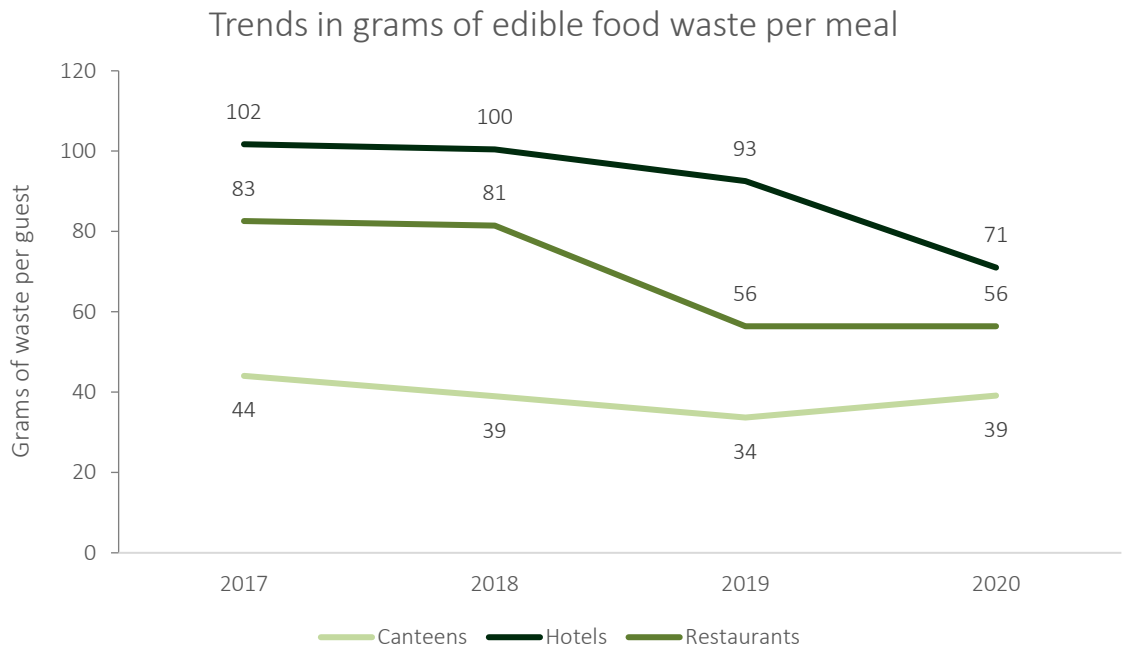

Figure 5-1 Trends in the key figure of grams of edible food waste per meal in the three segments of the hospitality sector

The figure shows that edible food waste in grams per meal declined in all segments; restaurants reduced waste by 32%, hotels by 30% and centeens by 11%.

It is worth noting that the reduction for the hotel segment in 2020 only applies to one chain, as this was the only hotel chain providing data for that year. In other words, the figures for the hospitality sector are unreliable.

5.2.4 Carbon footprint and financial loss

Trends in carbon footprint of edible food waste

It is estimated that the total amount of edible food waste in the hospitality sector resulted in a carbon footprint of 68 500 tons of CO2 equivalents in 2017 and 51 200 tons of CO2 equivalents in 2020 (Figure 5-2).

The carbon footprint of edible food waste thus decreased by 17 300 tons of CO2 equivalents (25%) in the period 2017 to 2020.

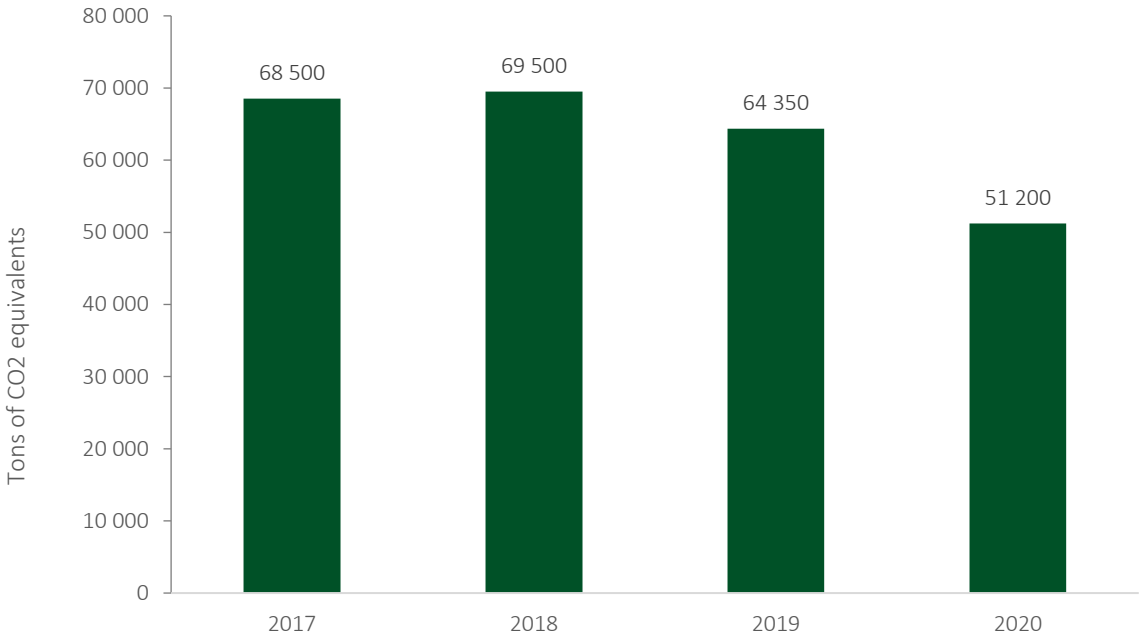

Figure 5-2 *Tons of CO2 equivalents associated with edible food waste in the hospitality sector from 2017 to 2020*

Trends in financial loss due to edible food waste

It is estimated that the total amount of edible food waste in the hospitality sector represented a financial loss of around NOK 1.16 billion in 2017 and NOK 0.87 billion in 2020 (in 2015 NOK values) (Figure 5-3)

Financial losses associated with edible food waste were thus reduced by NOK 0.30 billion, or 25%, in the period 2017 to 2020.

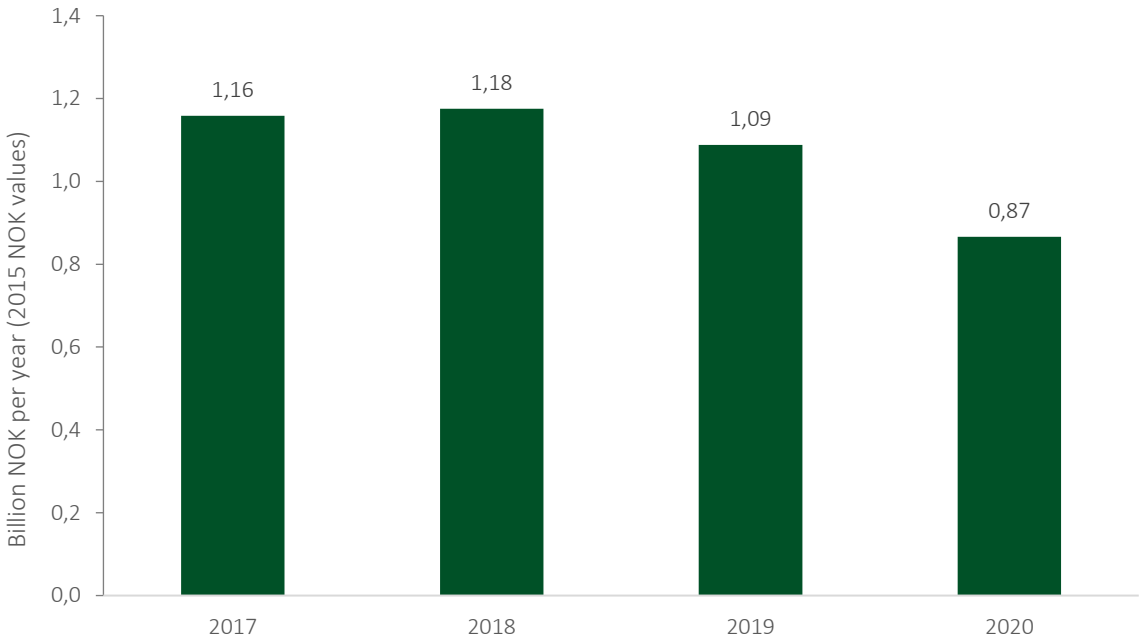

Figure 5-3 *Financial loss linked to edible food waste in the hospitality sector from 2017 to 2020*

5.3 Causes of edible food waste

General causes of edible food waste in the hospitality sector

Most edible food waste in the hospitality sector is related to serving food, either as plate waste or due to buffets or overproduction (Prestrud 2021). Common causes of waste are guests taking more than they can eat, too large portions being served and food remaining in a buffet or on display for too long.

Figure 5-4 shows reasons given for why edible food waste occurs in hotels and restaurants (Møller et al., 2020). The most common reason stated was “guests take more than they can eat”, followed by “food must be thrown away because it stays in the buffet or on display for too long”.

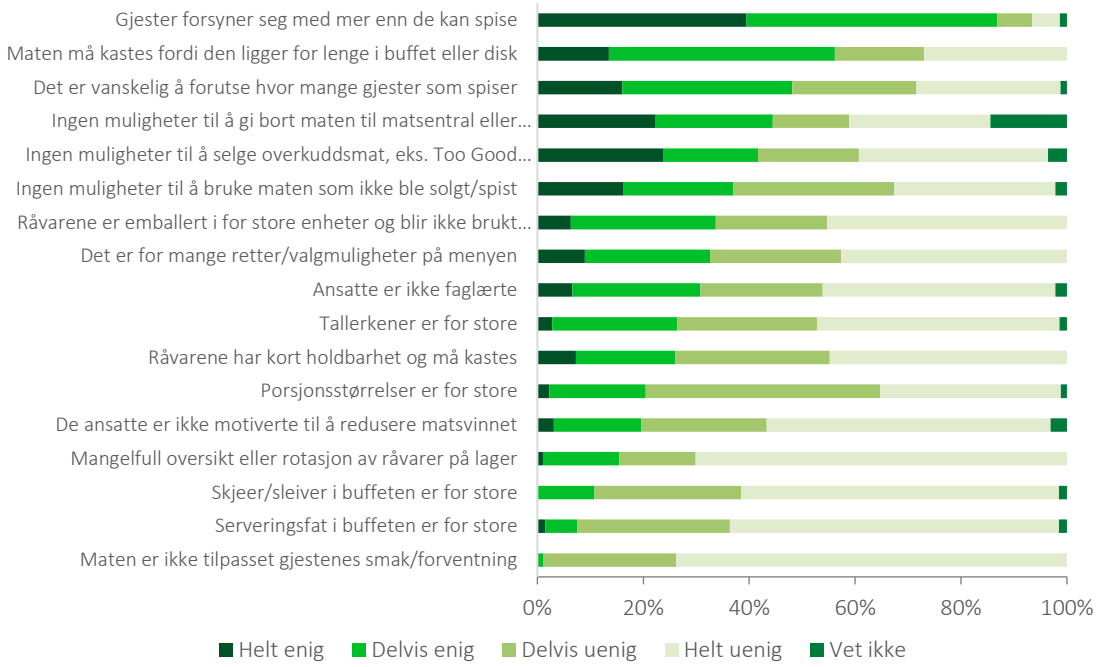

Figure 5-4 *Perceived causes of edible food waste in restaurants and hotels*

5.4 Measures implemented to reduce waste

5.4.1 Measures implemented

The following general measures have been implemented to improve the mapping of edible food waste in the hospitality sector:

- Matvett, in collaboration with NORSUS, published a guide for mapping edible food waste in the hospitality industry in 2021 (Stensgård et al., 2018) and conducted a workshop on waste mapping and reporting for hospitality companies.
- As part of the KuttMatsvinn2020 project, Matvett collaborated with Nofima to launch a guide for the safe reuse of food (Matvett and Nofima, 2020).
- Matvett has developed information material for staff and guests with the aim of raising awareness of relevant procedures and measures.

Figure 5-5 shows which measures have been implemented in hotels and restaurants and their assessment of how well they have worked (Møller et al., 2020).

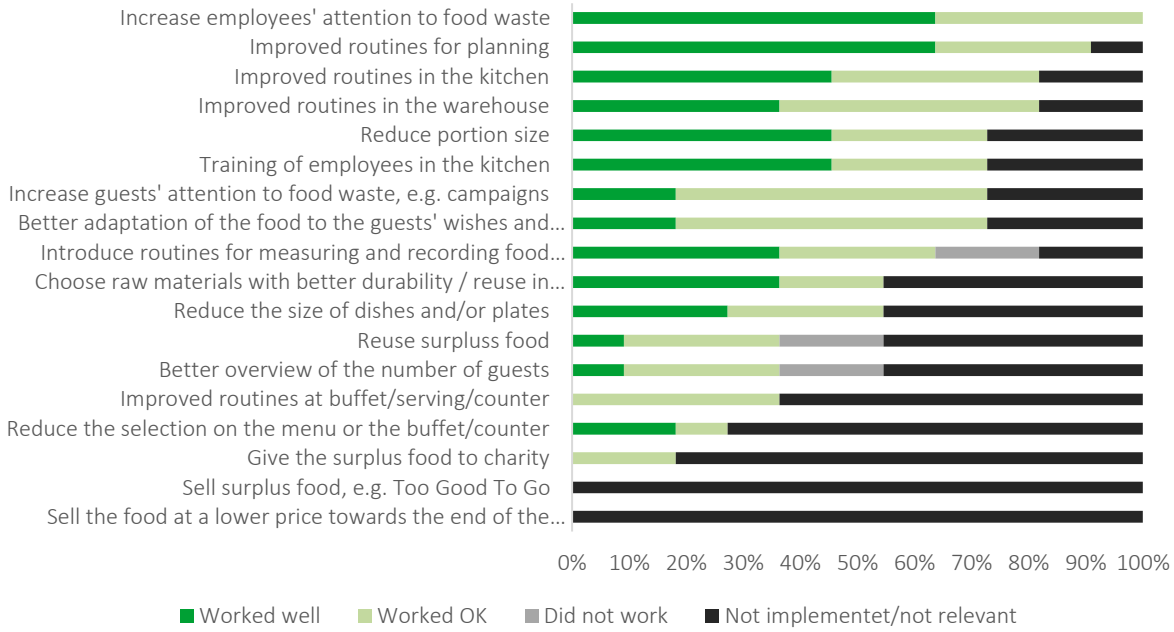

Figure 5-5 Measures implemented in hotels and restaurants and their assessment of how well the measures have worked

Many of the hotels and restaurants felt that staff training, improved procedures, raising staff awareness of edible food waste and introducing procedures for measuring and recording waste have worked well to reduce wastage.

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6 Convenience stores

6.1 About convenience stores

In this report, convenience stores include petrol stations, kiosks and similar types of retail outlets.

Edible food waste in convenience stores was first surveyed in 2018 through the sector and research projects “KuttMatsvinn2020”. The statistics for convenience stores therefore commence in 2018.

Some comments on the quality of data from convenience stores

- For convenience stores, food waste is reported in economic terms and must be converted to tons based on prices per kilo from retailers. This conversion is not entirely reliable as the prices per kilo are not specific to convenience stores and they are based on the purchase price (cost price), which can vary between companies.
- Several companies have been unable to remove food that is donated or sold at reduced prices from the edible food waste statistics. This may lead to an overestimation of edible food waste, but this is probably by a relatively small amount.
- Food that customers do not eat but throw away at the convenience outlet (plate waste) is not captured by the edible food waste statistics for convenience stores as of today.
- The sample of companies in the convenience stores category covers around 30% of sales in the sector.

On this basis, the edible food waste statistics for convenience stores should be regarded as an estimate.

6.2 Results from convenience stores

Trends
From 2018 to 2020 edible food waste in convenience stores decreased by 23% in kg per capita. The sector is thus well ahead of the target of a 15% reduction by 2020.

It is unclear how much of the reduction is due to COVID-19. Although the sector was not shut down in the same way as the hospitality industry, parts of the sector saw a large decline in sales, which may have had a negative effect on edible food waste, since more food was discarded due to a more unpredictable market. Alternatively, it could have had a positive effect, since there was decreased demand for products typically wasted such as buns and fresh food, leading to lower production and thus less total waste.
The change from 2018 to 2019, which was not affected by COVID-19, showed a reduction in edible food waste of 9%.

The carbon footprint of edible food waste in convenience stores was reduced by 36%, while financial losses decreased by 27%. Note that this trend is somewhat uncertain, as changes in the composition of edible food waste were affected by changes in the division into product groups by the companies reporting to the project.

Efforts for the future
Although the effects of the pandemic cannot be quantified, the results indicate that efforts are being made to reduce edible food waste in the sector. If the decrease in edible food waste is maintained after COVID-19, the sector will be well on its way to achieving the next interim target of a 30% reduction by the year 2025.
To reach the target of a 50% reduction, the convenience stores sector must concentrate on the main waste categories, i.e. buns, baguettes, hot dogs and other fresh food. These foods are especially likely to be thrown away due to their poor durability after production; they also have particular challenges related to shelf life due to the way they are displayed. Much edible food waste in convenience stores can be reduced by putting less of the food on display, changing the display method, reducing the display range and/or time (e.g. only having hot dogs on the grill for a period when they are likely to be bought). This also requires clear communication with customers about what foods are available but not on display, as well as the reason for the changes. Waste reduction measures such as selling surplus food via Too Good To Go, etc. or donating it to disadvantaged people through food banks should also be considered.

6.2.1 Trends in edible food waste in tons and kg per capita

It is estimated that total edible food waste in convenience stores amounted to 6850 tons in 2018 and 5200 tons in 2020 (Table 6-1).

Edible food waste by convenience stores was thus reduced by 1650 tons or 23% in the period 2018 to 2020. This corresponds to a reduction of 24% in kg per capita. Measured as kg per capita, waste by convenience stores was reduced from 1.3 kg in 2018 to 1.0 kg in 2020.

As mentioned in the beginning of this section, edible food waste surveys in convenience stores did not commence until 2018. The statistics for this sector therefore only go back to 2018.

Table 6-1 Edible food waste in tons and in kg per capita in convenience stores by reporting year

	2018	2019	2020
Waste in tons	6850	6200	5200
Waste in kg per capita	1.3	1.2	1.0

Edible food waste in convenience stores has been reduced through an increased focus on adapting the fresh food display according to the time of day and the location (e.g. urban area vs. roadside). In addition, several convenience outlets have begun to sell surplus food through other sales channels such as Too Good To Go, and to sell food at reduced prices towards closing time.

The changes in the figures for convenience stores from 2019 to 2020 are probably also affected by the pandemic to some extent; total sales fell by 6.2% from 2019 to 2020 (NielsenIQ 2021c). It seems likely that some of the decline in edible food waste was due to lower sales.

6.2.2 Distribution of waste by product group

The distribution of edible food waste between eight product groups is shown in Table 6-2.

The highest figures are in fresh ready-made food and delicatessen items (49%) and beverages (34%). Note that “fresh ready-made food and delicatessen items” is a very large group that includes buns, hot dogs and baguettes. These items also account for most of the waste in this product group.

Table 6-2 Percentages of total amount of edible food waste in 2020 for different product groups in convenience stores

	Percentage of total amount of waste
Baked goods	1%
Beverages	34%
Solid dairy products	1%
Fresh ready-made food and delicatessen items	49%
Liquid dairy products	3%
Fresh fruit and vegetables	1%
Frozen food	2%
Durable goods	10%

6.2.3 Edible food waste as a percentage of sales

Edible food waste has also been calculated as a percentage of sales for convenience stores.

However, it is not possible to show any trends at the product group level for convenience stores as changes have been made to the product groups used for recording waste, which means that the figures are not comparable.

Figure 6-1 shows edible food waste as a percentage of annual sales from 2018 to 2020.

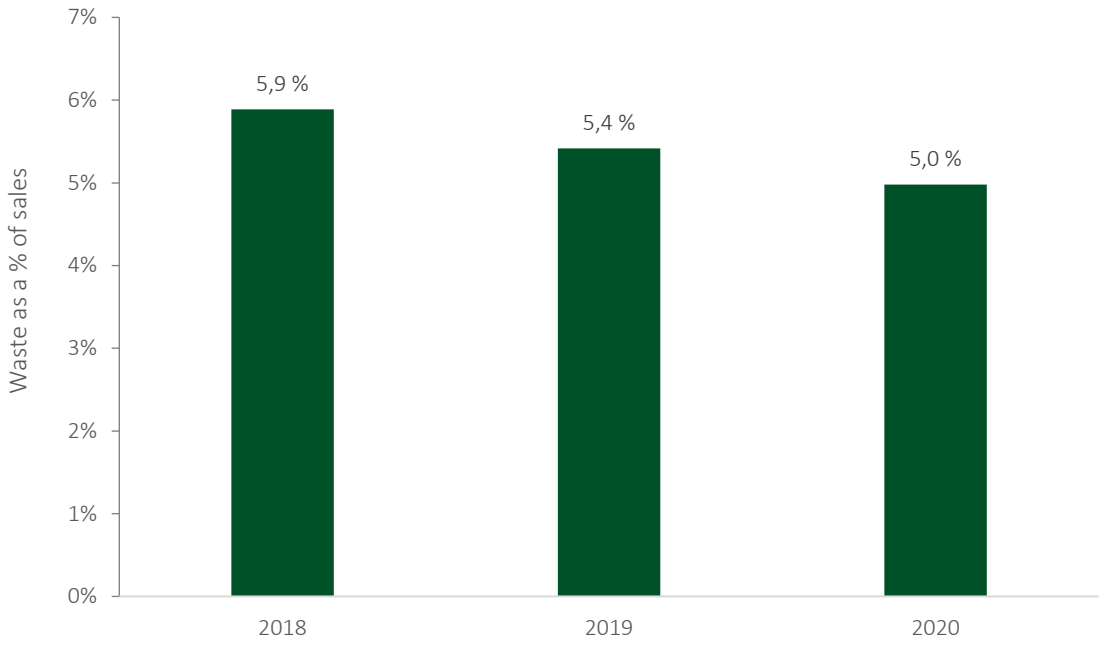

Figure 6-1 *Trends in edible food waste as a percentage of sales in convenience stores from 2018 to 2020.*

The figure shows that the average percentage of edible food waste by convenience stores for all product groups was about 5.0% in 2020. In 2018, this figure was 5.9%, which means that the percentage of edible food waste has been reduced by 0.9 percentage points from 2018 to 2020.

6.2.4 Carbon footprint and financial loss

Trends in carbon footprint of edible food waste

It is estimated that the total amount of edible food waste by convenience stores resulted in a carbon footprint of 23 250 tons of CO2 equivalents in 2018 and 8 400 tons of CO2 equivalents in 2020 (Figure 6-2).

The carbon footprint of edible food waste has thus decreased by about 8400 tons of CO2 equivalents or 36% from 2018 to 2020.

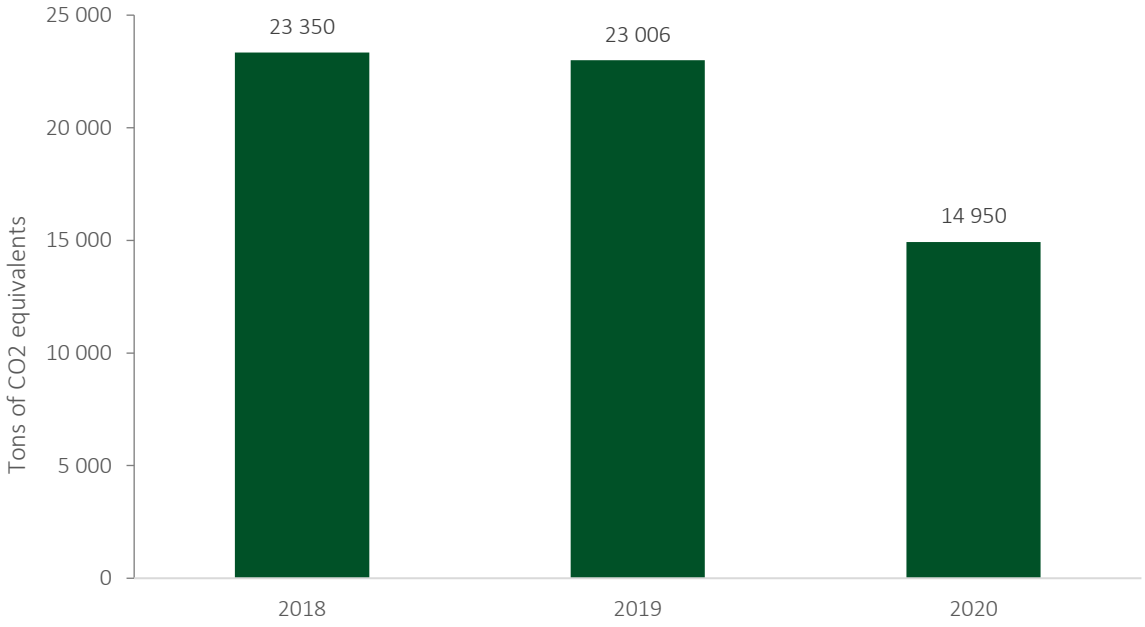

Figure 6-2 *Tons of CO_2 equivalents associated with edible food waste by convenience stores from 2018 to 2020.*

Trends in financial loss due to edible food waste

It is estimated that the total amount of edible food waste by convenience stores represented a financial loss of around NOK 0.42 billion in 2018 and NOK 0.31 billion in 2020 (in 2015 NOK values) (Figure 6-3)

Financial losses associated with edible food waste were thus reduced by NOK 0.11 billion or 27% in the period 2018 to 2020.

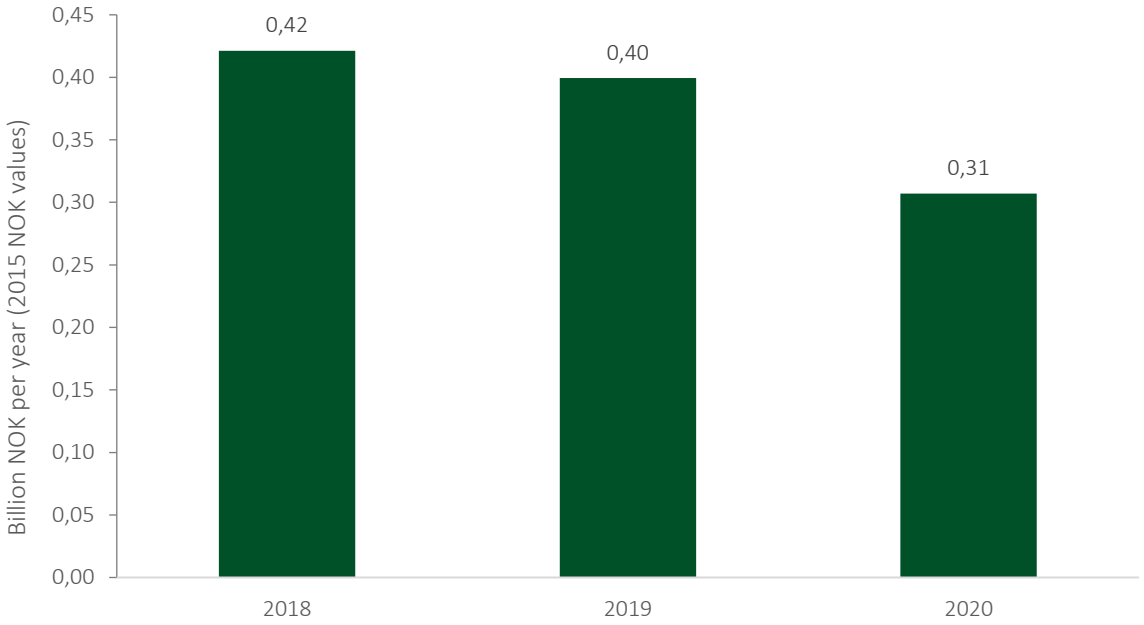

Figure 6-3 *Financial loss linked to edible food waste by convenience stores from 2018 to 2020*

6.3 Causes of edible food waste

General causes of edible food waste by convenience stores

As part of the KuttMatsvinn2020 projects, a survey was conducted among convenience store companies. The results of this survey showed that most of the edible food waste in convenience stores is related to:

- Overproduction of fresh/ready-made food (62%)
- Past the expiry date (17%)
- Food preparation (10%)

The waste associated with fresh/ready-made food is primarily due to a large selection of fresh food on display that deteriorates in quality during the day and must therefore be discarded. Examples are hot dogs on a grill, freshly baked buns and baguettes with fillings.

6.4 Measures implemented to reduce waste

6.4.1 Measures implemented

In convenience store companies, an increased focus on adjusting the quantity and selection of fresh food on display has been an important waste reduction measure. Production is also adapted to local conditions (which items sell well in a particular outlet) and the time of day (when do people buy baguettes and when do they prefer hot dogs).

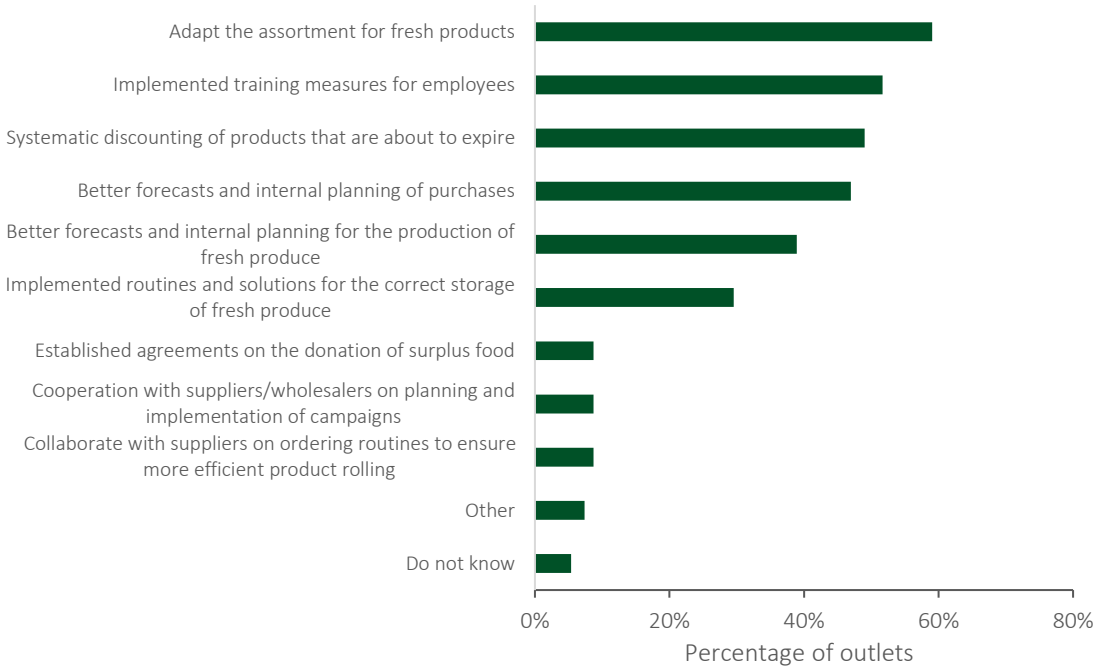

Figure 6-4 shows the proportion of the reporting companies that have implemented various waste reduction measures.

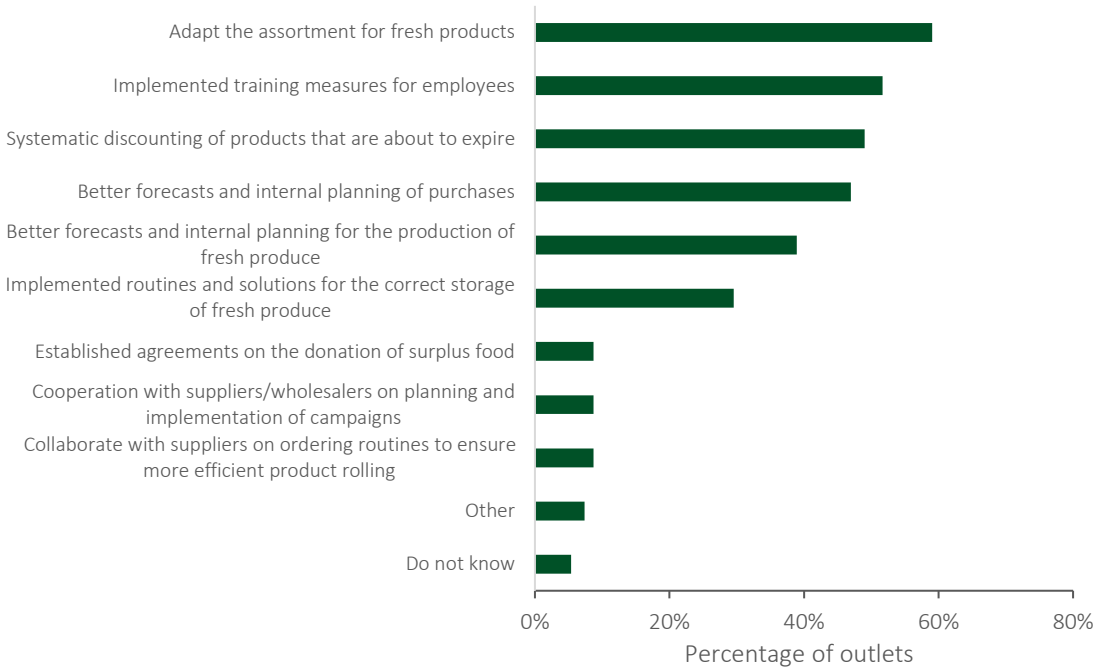

Figure 6-4 *Measures implemented in convenience stores*

The figure shows that in addition to the focus on adapting displays of fresh food, staff training, price reductions on surplus food and efforts to improve forecasting for correct ordering are important measures that have reduced edible food waste in convenience stores.

7 Education and care sector

7.1 About the education and care sector

In this report, the education and care sector includes nursing homes, kindergartens and primary and lower secondary schools, including after school programmes. The statistics also include private facilities.

A pilot survey of edible food waste in the education and care sector was conducted under the sector and research projects “KuttMatsvinn2020”. However, after KuttMatsvinn2020 was completed, there was no continuation of reporting or further work on the figures from the education and care sector. This meant that the pilot survey was not followed up until Matvett in February 2021 was tasked by the Ministry of Climate and Environment to report on trends in edible food waste on behalf of the education and care sector.

Upper secondary schools, universities, colleges, folk high schools, hospitals, other care facilities and cafeterias in public organizations are not included in these statistics. This is because edible food waste has not yet been mapped for these segments, although data have been received from a small sample.

The COVID-19 pandemic led to a major upheaval in the sector due to infection control measures and closures. Measurements of edible food waste had therefore low priority and it has been a great challenge to perform these measurements in the sector. The few institutions where waste was measured did not operate normally; many kindergartens and schools offered limited or no food for much of the year. The edible food waste statistics for the education and care sector are therefore strongly affected by COVID-19, but an attempt has nevertheless been made to estimate waste in 2020. Due to few institutions reporting in 2017 and 2018, edible food waste statistics have only been calculated for 2019 and 2020.

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Some comments on the quality of data from the education and care sector

- There are some uncertain factors related to the conversion of total food waste to edible food waste based on waste sample analyses in the hospitality sector. The use of a fixed key figure may lead to some overestimation of amounts of edible food waste by institutions that have measured all food waste, as it is reasonable to believe that the ratio of edible food waste to total food waste will change over time. Another uncertain factor is that the waste sample analyses were conducted in a few selected companies for a limited period. The sample is too small to be representative, and it is not from the education and care sector, which may have a different waste profile from the hospitality sector. In addition, there is considerable variation in the results from waste sample analyses.
- Due to a small sample that varied considerably between the years, the figures that form the basis for edible food waste statistics in 2019 are based on figures for both 2019 and 2020, and similarly, the statistics for 2020 are based on both 2019 and 2020 figures. This means that the trend in edible food waste from 2019 to 2020 is less reliable than if only figures for the relevant year were used in the statistics. It is therefore also assumed that the effect of COVID-19 is less visible in the statistics, which may have led to some overestimation of edible food waste from the education and care sector in 2020.
- The figures that form the basis for the edible food waste statistics are limited. The representativeness of the figures behind the food waste statistics in 2020 is as follows:
    - Figures for nursing homes represent 12% of all places in nursing homes in Norway
    - Figures for kindergartens represent 4% of all children in kindergarten in Norway
    - Figures for schools represent 11% of all primary and lower secondary schools in Norway

Edible food waste statistics for the education and care sector must therefore be regarded as a rough estimate, especially those for kindergartens.

7.2 Results from the education and care sector

Trends
From 2019 to 2020, edible food waste in the education and care sector was reduced by 12% in kg per capita. The sector has therefore not reached the target of a 15% reduction by 2020.

It is uncertain how much of the reduction is due to COVID-19. Schools and kindergartens were closed for a period, and food was not served there again until 2021 in many places, which is likely to have decreased edible food waste in schools and kindergartens. At the same time, infection control measures probably increased food waste in the care sector.

The climate footprint and financial losses related to edible food waste in the education and care sector declined by 11%. Note that this trend is less certain as changes in the composition of edible food waste are unknown.

Efforts for the future
Since the effects of the pandemic cannot be quantified, the data are unreliable and we only have figures for 2019 to 2020, it is difficult to judge whether the education and care sector will be able to reach the next interim target of 30% reduction by 2025. Furthermore, much of the sector has not been mapped yet (hospitals, upper secondary schools, etc.), which means that work on edible food waste in these parts of the sector has been further delayed. The education and care sector must therefore now make efforts to map and measure edible food waste to enable interventions to be targeted at the areas where they are most needed.

The education and care sector takes care of and educates the consumers of the future and is also Norway's largest employer. The sector has a joint responsibility with food producers and the retail chains to halve food waste in households, as the sector has a considerable influence on behaviour and attitudes in the population.

7.2.1 Trends in edible food waste in tons and kg per capita

It is estimated that total edible food waste in the education and care sector amounted to 5600 tons in 2019 and 5000 tons in 2020 (Table 7-1)

Edible food waste in the education and care sector was thus reduced by 600 tons or 11% in the period 2019 to 2020. This corresponds to a reduction of 12% in kg per capita. Measured as kg per capita, waste in the education and care sector was reduced from 1.1 kg in 2019 to 0.9 kg in 2020.

As mentioned in the beginning of this section, mapping of edible food waste in the education and care sector started in 2017 with a pilot survey, but only a small number of municipalities provided data in 2017 and 2018. The edible food waste statistics for this sector therefore only go back to 2019.

Table 7-1 Edible food waste in tons and in kg per capita in the education and care sector by reporting year

	2019	2020
Waste in tons	5600	5000
Waste in kg per capita	1.1	0.9

Table 7-2 shows the distribution of edible food waste between the segments surveyed in the education and care sector

Table 7-2 Tons of edible food waste in the education and care sector by segment and reporting year

	2019	2020
Tons of waste in nursing homes	3100	3050
Tons of waste in schools and after school programmes	950	950
Tons of waste in kindergartens	1550	1000

Trends in the education and care sector are as mentioned highly uncertain due to the use of measurements from 2019 in 2020 and vice versa. Nevertheless, we see a decline, which is due to a change in two figures:

- From 2019 to 2020, the number of places in nursing homes and children in kindergartens and schools fell slightly (-1%). This means that tons of edible food waste from the three segments also decreased, given that kg of waste per service user (resident, child or pupil) remained stable.

- The key figure of kg of waste per service user (resident, child or pupil) has been reduced in all three segments for two reasons:
    - The first is a real reduction in edible food waste as a result of measures such as a focus on routines and increased food waste knowledge, suitably-sized portions, reuse of surplus food, etc. (Bærum kommune, 2020).
    - The second is closures and limited food served in schools and kindergartens as a result of COVID-19.

7.2.2 Kg of food waste per service user

Edible food waste has also been calculated as kg per service user and year in the education and care sector. Figure 7-1 shows the changes in this key figure from 2019 to 2020 for the three segments surveyed.

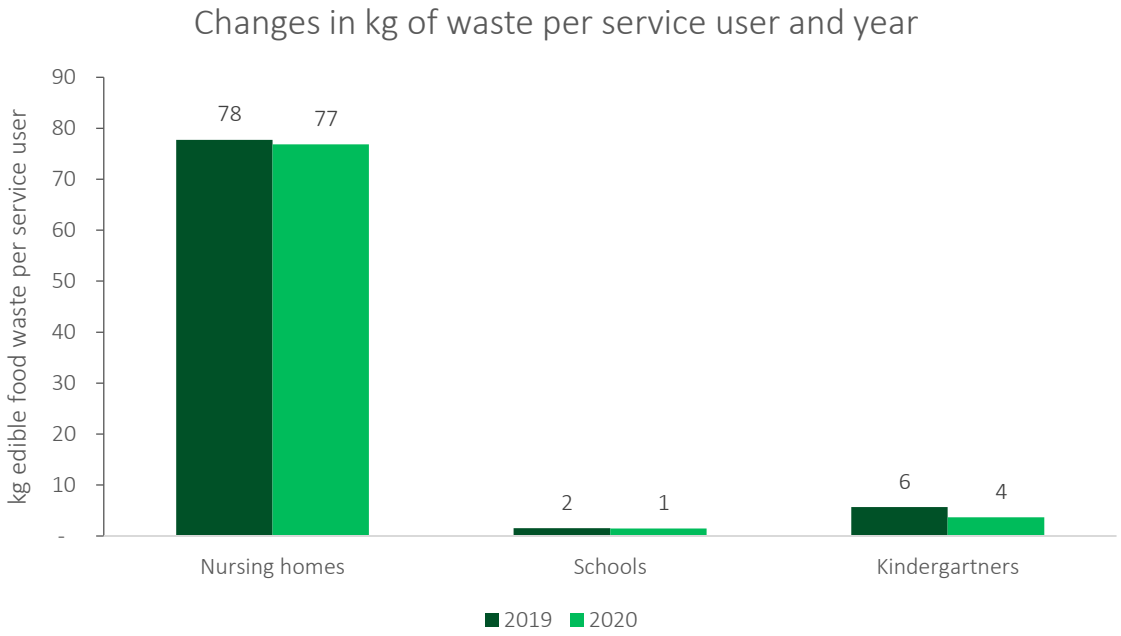

Figure 7-1 Changes in the key figure of kg of waste per service user and year for the segments surveyed in the education and care sector

The figure shows that edible food waste in kg per service user has been reduced for all segments; kindergartens have reduced their waste by as much as 35%, while nursing homes and schools have reduced waste by 1%. The sharp decline for kindergartens is probably linked to a reduction in food served in 2020 due to COVID-19.

7.2.3 Carbon footprint and financial loss

Trends in carbon footprint of edible food waste

It is estimated that the total amount of edible food waste in the education and care sector resulted in a carbon footprint of 19 850 tons of CO2 equivalents in 2019 and 17 650 tons of CO2 equivalents in 2020 (Figure 7-2).

The carbon footprint of edible food waste thus decreased by 2200 tons of CO2 equivalents (11%) in the period 2019 to 2020. Note that the carbon footprint figures are very unreliable in the education and care sector due to a lack of measurements of waste at the product group level.

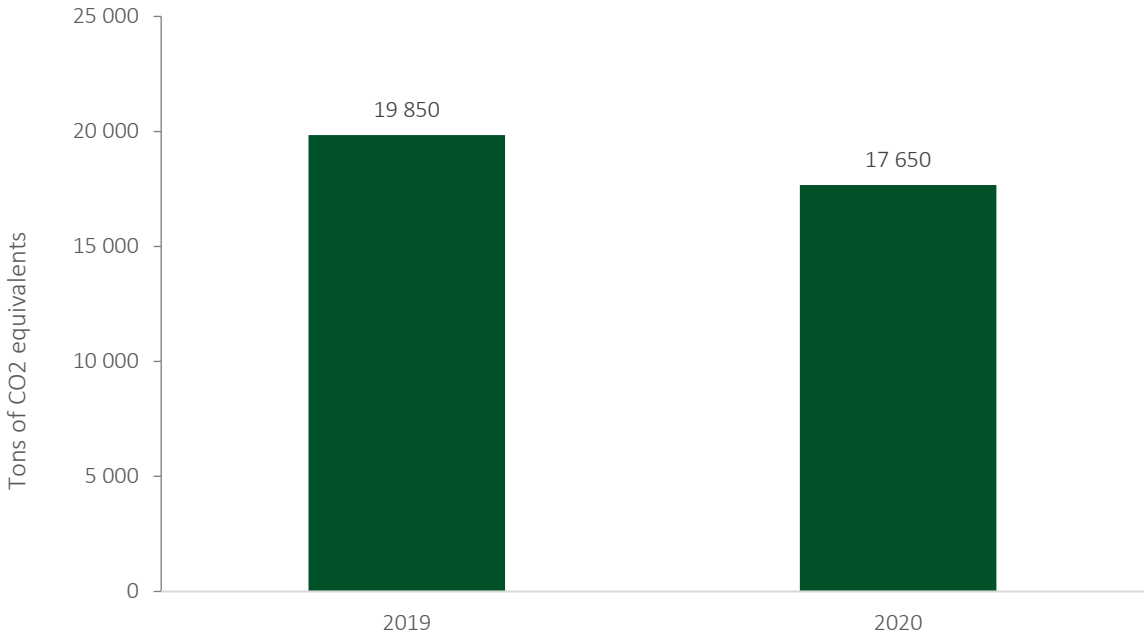

Figure 7-2 Tons of CO2 equivalents associated with edible food waste in the education and care sector from 2019 to 2020.

Trends in financial loss due to edible food waste

It is estimated that the total amount of edible food waste in the education and care sector represented a financial loss of around NOK 0.34 billion in 2019 and NOK 0.30 billion in 2020 (in 2015 NOK values) (Figure 7-3).

Financial losses associated with edible food waste were thus reduced by NOK 0.04 billion, or 11%, in the period 2019 to 2020. Note that the figures for financial loss are very unreliable in the education and care sector due to a lack of measurements of waste at the product group level.

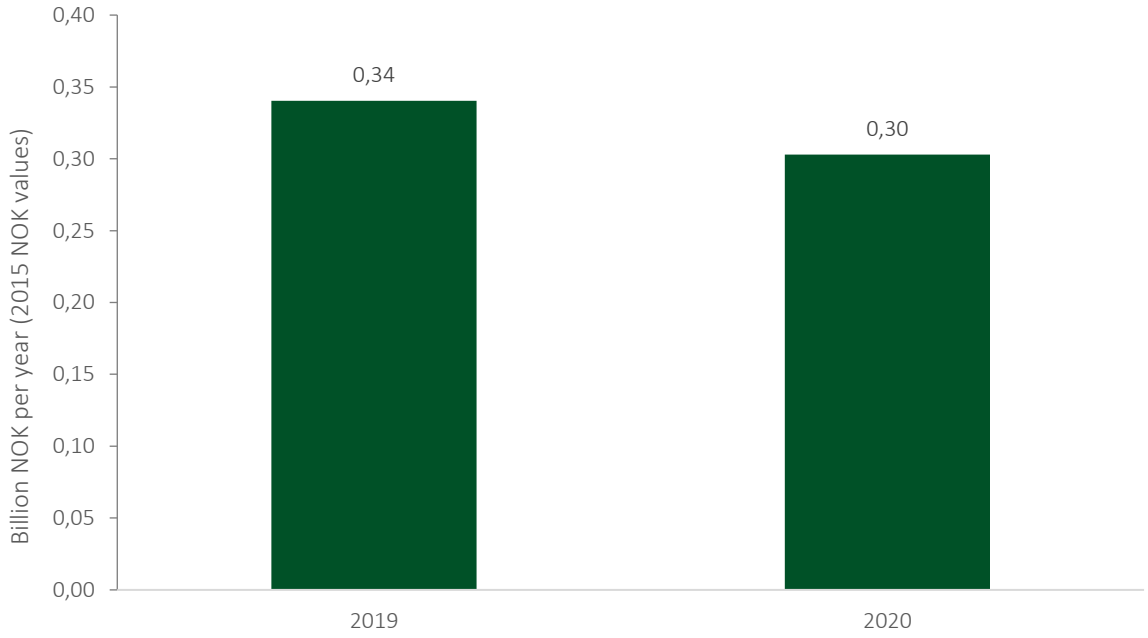

Figure 7-3 *Financial loss linked to edible food waste in the education and care sector from 2019 to 2020*

7.3 Causes of edible food waste

General causes of edible food waste in the education and care sector

In the period 2017 to 2020, several projects were conducted to prevent and reduce edible food waste in nursing homes, kindergartens and schools in Norwegian municipalities. These were part of the KuttMatsvinn2020 projects, but were also based on environmental funding from the Norwegian Environment Agency, where NORSUS, Future in Our Hands and others were hired to contribute to the work.

Below we present a number of reasons why waste occurs in nursing homes based on reports and experiences from the edible food waste projects in Oslo, Bærum, Fredrikstad, Voss-Herad and Østre Toten (Bærum kommune, 2020; Larsen, 2019; Møller, 2017; Nilsen, 2020a; Nilsen & Prestrud, 2021).

Similar projects have been carried out in a selection of kindergartens and after school programmes in Oslo in connection with the KuttMatsvinn2020 projects, but there are no reports on causes and corrective measures from this work. Documentation of causes and corrective measures in the remainder of the education and care sector will be increased from the year 2022.

There are many reasons why food waste occurs in the care sector. Factors involved include purchasing, storage, food preparation and serving, menu planning, calculation of portion sizes and communication. The primary focus in nursing homes is to take care of the residents, and the staff naturally ensure that the residents receive adequate amounts of healthy food rather prioritizing waste reduction. Healthcare workers may have poor knowledge of food and food waste in terms of e.g. serving food and the size of portions. Serving food and ensuring that meals are enjoyed are important aspects of nursing care. Staff attitudes to food and meals will have great influence on how food is prepared and what is eaten. The staff must be familiar with patients' needs and wishes, and the person serving food must know if a patient has any problems that affect eating.

The following causes of edible food waste are listed in random order:

- Lack or varying degrees of awareness of waste and motivation to reduce this among staff and management.
- Time pressure in relation to meals and the notion that residents should help themselves are challenging for the safe reuse of food that has been at room temperature for some time.
- Nursing home staff have many other areas of competence building to focus on, and shift work means different staff at work every day. Training in nutrition and preparation of hot food is necessary for all staff, but it is challenging to ensure that this takes place.
- Too little knowledge and time in relation to heating food can result in poorer food quality, which can then mean that patients eat less.
- Poor understanding of guidelines and procedures. The regulations of the Norwegian Food Safety Authority on food safety or the understanding of these make it difficult to reuse food.
- Varying levels of knowledge of date stamps and food storage
- Excessive portions from the central kitchen, too large packs from suppliers and too much bread delivered
- Varying levels of information flow and routines between central kitchens and wards

- Varying procedures for checking stock in wards before ordering new food can often lead to over-ordering. This applies to both ordering procedures and general purchasing agreements.
- Difficulty in predicting numbers of people who will eat a meal can lead to miscalculations of the number of portions, especially in large wards with patients who eat little or in daycare facilities where numbers are unknown in advance.

Most of the edible food waste in the education and care sector occurs when food is served, i.e. plate waste.

7.4 Measures implemented to reduce waste

7.4.1 Measures implemented

Several institutions state that staff training, improved routines, increasing staff awareness of edible food waste and introducing procedures for measuring and recording waste have worked well as waste reduction measures.

The following general measures have been implemented to enhance efforts to prevent and reduce edible food waste in the education and care sector:

- In 2020, NORSUS published a guideline on behalf of the Norwegian Environment Agency for reducing edible food waste in the care sector. The guideline is based on experience from several municipalities and provides specific advice on how to prevent and reduce food waste in the care sector (Nilsen, 2020b).
- As part of the research project KuttMatsvinn2020, Matvett collaborated with NORSUS (then Ostfold Research) to produce a guideline for mapping edible food waste in public institutions (Østfoldforskning & Matvett, 2018).
- Environmental funding from the Norwegian Environment Agency, which has conducted workshops on edible food waste to encourage funding applicants to be involved in anti-waste projects and apply for funding to improve such projects
- Several municipalities including Oslo have required local public institutions to receive Eco-Lighthouse certification. Edible food waste reduction is an important criterion in this certification scheme, which will increase the focus on the problem and eventually lead to waste reporting by all certified institutions.

The following specific anti-waste measures have been implemented as part of projects in the care and hospitality sectors:

- Organization:
    - Dedicated project resources from central management to monitor measurements of edible food waste and coordinate corrective measures, as well as measurement and reporting of waste data.
- Purchasing:

  - Clearer procedures for different methods of ordering by central kitchens
  - Introduction of food cards for each nursing home resident to improve food ordering, with a column for updated information on ordering or a notice board in the staff room showing changes in residents' needs and preferences.
  - In large wards, food should be ordered for fewer patients than the actual number, because there are always some who are ill or eat little, empty rooms, etc.
  - Different sizes of packs from central kitchens, e.g. sauce in packs of 0.5 l, 1 l and 1.5 l (where previously the minimum volume was 1 l).
- Menus:
  - Adjustment of the lunch menu to include a greater variety of food
- Serving:
  - Fewer ready-made sandwiches for sale in cafeterias; sandwiches can instead be made when the demand is known
  - Serving food in smaller plates and bowls, where food is added as needed
  - Keeping fridges tidy
  - Making smoothies from leftovers of stewed fruit, bananas and yoghurt
  - Freezers installed in wards to enable bread and other food to be frozen and used "fresh" as needed
  - Increased dialogue with patients about how much food and what kinds of food they prefer
  - Sharing of food between wards
- Training:
  - Films and posters to inform and motivate staff
  - A workshop to review results and exchange experience and an "initiative bank" of anti-waste ideas available to all staff
  - Emphasizing the positive effects of the measures in order to increase staff involvement and inform residents and relatives about why they are important, i.e. not only to reduce edible food waste, but also to improve nutrition and free up resources for the wards.

8 Households

8.1 About households

Much of Norwegian edible food waste arises from consumers, and this section addresses the waste that occurs in this important stage of the value chain, as well as the causes of this waste and consumer behaviour. Two different approaches have been used to determine edible food waste in households: waste sample analyses and surveys. Waste sample analyses map the actual edible food waste that occurs in households by scaling up the quantities found in household waste, while consumer surveys explore what consumers themselves believe that they throw away and associated behaviour, attitudes and causes.

Edible food waste surveys in Norwegian households based on waste sample analyses commenced in 2013 on behalf of the Norwegian Environment Agency, when the methodology for the surveys was established in addition to an estimate of the amount of waste. The work was partly based on detailed analyses of edible food waste in Fredrikstad and Hallingdal conducted under the ForMat project (Hanssen, Skogesal, Møller, Vinju, & Syversen, 2013). In this report, edible food waste in the waste sample analyses includes food that is discarded via the collection scheme for total food waste and residual waste. Waste disposed of via drains (liquid food waste) and home composting schemes or fed to pets has not been included.

The first major waste sample survey of household edible food waste was conducted for the year 2016; the calculations were based on the same methodology as before, but the number of analyses was considerably larger (Syversen et al., 2018). Other waste sample analyses financed by the ForMat project were also included. In connection with the main reports under the Sector Agreement on Edible Food Waste Reduction, similar analyses have been conducted for the year 2020, based on the same methodology and a similar sample as for 2016. Household edible food waste statistics therefore start in 2016 and statistics for the period between 2016 and 2020 are extrapolated.

In addition to the quantitative data collection described above, qualitative data has also been collected through annual consumer surveys. These have been conducted by Matvett in collaboration with NORSUS to determine the types of food consumers report having 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 2021. In addition to questions that specifically concern edible food waste and behaviour related to purchasing and storing food, data are collected on the respondents' age, gender, place of residence, education, etc. This makes it possible to examine associations between the waste-related questions and consumers' sociodemographic characteristics, which have been analysed in previous reports (Stensgård et al. 2020).

Some comments on the quality of data from households

- Calculations of amounts of edible food waste are based on a small number of waste sample analyses. The waste sample analyses that form the basis of waste calculations in 2016 and 2020 are from municipalities/inter-municipal companies that represent 47% and 45% of the Norwegian population respectively, but actual representativeness is considerably lower: the waste sample analyses are not only limited to a selection of households in the relevant municipality/company, but were also conducted over a limited period. They therefore only apply to a very small proportion of the total amount of waste collected during one year for a municipality/inter-municipal company (<0.05% of the waste stream analysed).
- However, it is also important to point out that waste sample analyses are the most accurate method to date for calculating household edible food waste. They are therefore considered the best approach rather than alternative methods such as questionnaires and food waste diaries, which are either more unreliable or more expensive to implement to achieve similar representativeness. Furthermore, the waste sample analyses are linked to national statistics on total waste, which cover almost 100% of households in Norway, which also improves the quality of the calculations.
- The waste sample analyses that form the basis for the calculations are from several years (2019, 2020 and 2021), and although most of them (7 out of 12) are from 2020, it is uncertain whether the overall figure is representative of 2020. This applies particularly to possible effects of the COVID-19 pandemic, when more people spent more time and probably ate more at home (restaurants closed or only offering take-away food, homeworking, closed schools and kindergartens). A similar approach was used for the calculations of edible food waste in 2016, where the waste sample analyses from 2015, 2016 and 2017 formed the basis.
- The results of the consumer survey are based on consumers' subjective perceptions of their own behaviour, attitudes and frequency of discarding food. This method of reporting may not provide a correct and objective picture of how and why edible food waste actually occurs and the actual behaviour of consumers. Perceptions of throwing away food may have changed over time due to greater food waste awareness, not necessarily because people actually discard more or less.
- The following waste streams are not included in the edible food waste statistics:
  - Edible food waste disposed of via drains. This is assumed to be a significant amount, and the amount of edible food waste discarded via drains in Sweden has been calculated at 26 kg per capita and year (Andersson & Stålhandske, 2020).
  - Edible food waste composted at home. This is probably of little significance as home composting accounts for only a small proportion of food waste (Syversen et al., 2018).
  - Edible food waste fed to pets or other domestic animals.
  - Edible food waste disposed of via other waste streams than residual waste and total food waste (incorrect sorting or inadequate emptying/washing of packaging made of sorted plastic, glass/metal, etc.).
  - Edible food waste that is returned to nature (e.g. in hunting or fishing, or fallen fruit collected via garden waste).

In view of the above, edible food waste statistics for households should be considered as an estimate.

8.2 Results from households

Trends
From 2016 to 2020, edible food waste from households was reduced by 6% in kg per capita. Households have therefore not reached the target of a 15% reduction by 2020.

The results of the consumer survey show that in 2020 more people reported discarding the most wasted food groups than in 2017, but the increase was generally small. At the same time, a large proportion of consumers believe that they throw away less food than the average person does, and only a minority state that they discard more than the average (from 6 to 22% for the different food groups). It is natural to find differences between the results from the waste sample analyses and the consumer survey, since the survey results only tell us something about self-perceived frequency of food discard and the subjective perception of the quantity, but not about the actual quantities wasted.

It is uncertain how far COVID-19 affected edible food waste in households, but the closed hospitality industry, homeworking, closed schools and kindergartens as well as less travel and other leisure activities meant that people ate more at home, which in turn probably led to a larger share of total edible food waste occurring in people's homes. The real reduction in edible food waste in households could therefore have been greater than 6% if it had not been for the pandemic.

Efforts for the future
Since the effect of the pandemic cannot be quantified, and we only have figures for 2016 and 2020, it is difficult to judge whether the household sector will be able to achieve the next interim target of a 30% reduction by 2025. However, there is no doubt that if Norway as a whole is to achieve a 50% reduction, the edible food waste problem in the household sector must be solved. This will require a major cooperative effort by the entire value chain and the government; all stages of the value chain have a duty to contribute to reducing edible food waste by consumers.

8.2.1 Amounts of edible food waste in 2016 and 2020

It is estimated that total edible food waste in the household sector amounted to 222 300 tons in 2016 and 216 100 tons in 2020 (Table 8-1).

Edible food waste in the household sector was thus reduced by 6200 tons or 3% in the period 2016 to 2020. This corresponds to a reduction of 6% in kg per capita. Measured as kg per capita, waste in the household sector was reduced from 42.6 kg in 2016 to 40.3 kg in 2020.

As mentioned in the beginning of this section, mapping of edible food waste in the household sector was not established until 2016, although waste sample analyses were conducted in 2011. The edible food waste statistics for this sector therefore only go back to 2016.

Table 8-1 Edible food waste in tons and in kg per capita in the household sector by reporting year

	2016	2017	2018	2019	2020
Waste in tons	222 300	220 800	219 200	217 650	216 100
Waste in kg per capita	42.6	42.0	41.4	40.9	40.3

Note that the figures for the years 2017 to 2019 are merely extrapolated, based on the calculations for 2016 and 2020. In other words, no actual surveys were conducted in 2017-2019.

It is difficult to make a direct connection between trends in household edible food waste and various actions, causes or trends in society, as these are two independent observations. Furthermore, it is uncertain whether the 6% is a real reduction or is due to sources of error in the data and/or the methodology.

Nevertheless, it seems reasonable to believe that edible food waste in households may have decreased as a result of three major changes in the period 2016 to 2020:

- Increased awareness of edible food waste as a problem. Matvett, the food industry, municipalities, public institutions, more and more actors in the sale and donation of surplus food (Too Good To Go, Throw No More, Foodlist, Food Banks Norway, Holdbart, Havaristen, etc.), networks, profiles on social media (such as Spisoppmaten and Fattig student) have all contributed to putting edible food waste on the agenda. In addition, more research has been conducted on edible food waste in recent years and the topic has been raised on the political agenda both nationally and internationally (Steinnes & Hebrok, 2019). Since 2015, interest[2] in the search term "food waste" has increased more than tenfold (Google, 2021).
- Physical changes to food products. Food waste in households has probably also been reduced as a result of specific waste reduction measures in the food industry in relation to products and packaging. This includes the introduction of additional information on date

[2] Definition of "interest" by Google Trends: "The numbers represent the search interest relative to the highest point on the chart for the selected region and time. A value of 100 is the peak popularity of the term, whilst a value of 50 means that the term is half as popular. Scores of 0 mean that a sufficient amount of data was not available for the selected term".

labels, better opening/closing mechanisms on packaging, increased shelf life, information about shelf life and recommended storage, a better selection of small packs, etc.

- The COVID-19 pandemic. Trends in households were probably also affected by the pandemic, when more people spent more time and probably ate more at home (restaurants closed or only offering take-away food, homeworking, closed schools and kindergartens). One would expect this to have increased the amount of edible food waste in households, which may also be the case since trends are uncertain, and unknown from 2019 to 2020. At the same time, about one-third of consumers stated that the pandemic made them throw away less food since they had more time available, bought food less frequently and/or cooked proper meals more often (A. Stensgård et al., 2020).

The effect of each of these changes is difficult to estimate.

8.2.2 Composition of edible food waste

The distribution of edible food waste between seven groups is shown in Figure 8-1.

The main groups in 2020 were meal leftovers (31%) and fruit and vegetables (22%).

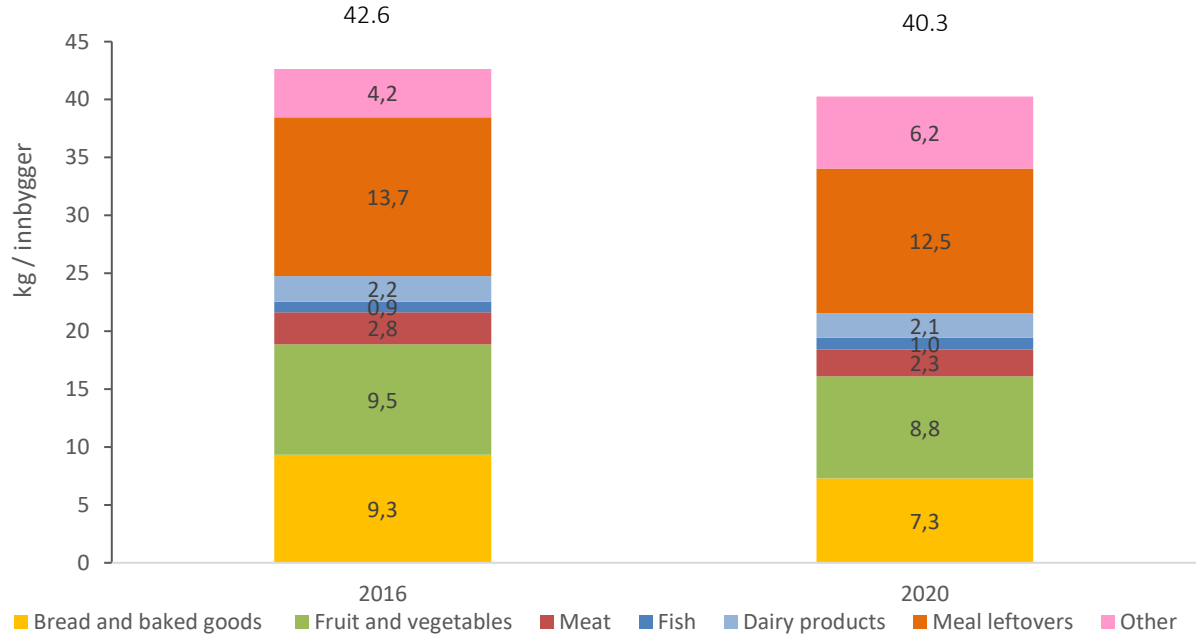

Figure 8-1 Distribution of household edible food waste of various food groups in kg per capita

The following groups decreased in kg per capita from 2016 to 2020:

- Bread and baked goods (-22%)
- Fruit and vegetables (-8%)
- Meat (-16%)
- Dairy products (-5%)
- Meal leftovers (-9%)

The following groups increased in kg per capita from 2016 to 2020:

- Fish (+14%)

- Other food (+49%)

It should be noted that the figures at the food group level are unreliable, since the trends are based on a small number of waste sample analyses (five).

8.2.3 Carbon footprint and financial loss

Trends in carbon footprint of edible food waste

On the basis of the waste sample analyses, it has been calculated that the total amount of edible food waste by households produced a carbon footprint of 793 350 tons of CO2 equivalents in 2016 and 803 100 tons of CO2 equivalents in 2020 (Figure 8-2).

The carbon footprint of edible food waste thus increased by 9 700 tons of CO2 equivalents or 1% from 2016 to 2020.

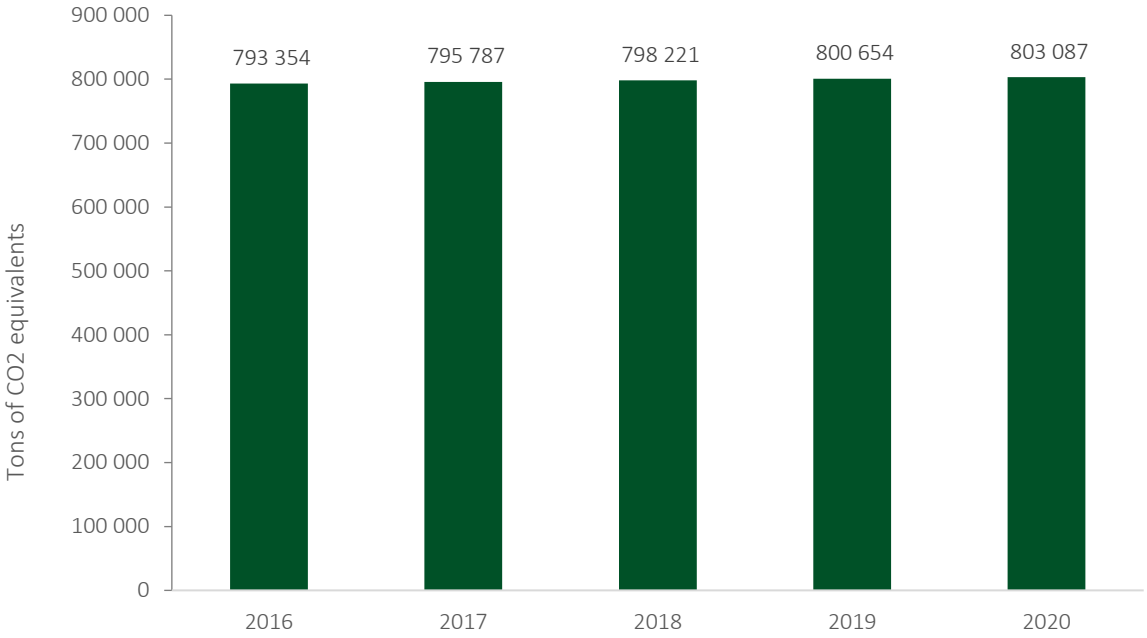

Figure 8-2 *Tons of CO2 equivalents related to edible food waste by households from 2016 to 2020*

The carbon footprint has increased despite a reduction in edible food waste in the same period, including a reduction for meat. This is because edible food waste has increased for few, but relatively environmentally unfriendly products, i.e. fish and "other food". Here it is worth noting that it is difficult to estimate the carbon footprint of "other food" because this category consists of many different product groups (including crisps, nuts, chocolate, mayonnaise, dressings, ketchup, oils, cereals, biscuits, packets of soup and sauces, seeds, spices, tea, flour, sugar, etc.) (Syversen, Bjørnerud, Skogesal, & Bratland, 2015), which means that the calculations of carbon footprint are highly unreliable.

Trends in financial loss due to edible food waste

It is estimated that the total amount of edible food waste from households led to a financial loss of NOK 12.58 billion in 2016 and NOK 12.51 billion in 2020 (in 2015 NOK values) (Figure 8-3).

Financial losses associated with food waste were thus reduced by NOK 0.07 billion or 1% in the period 2015 to 2020.

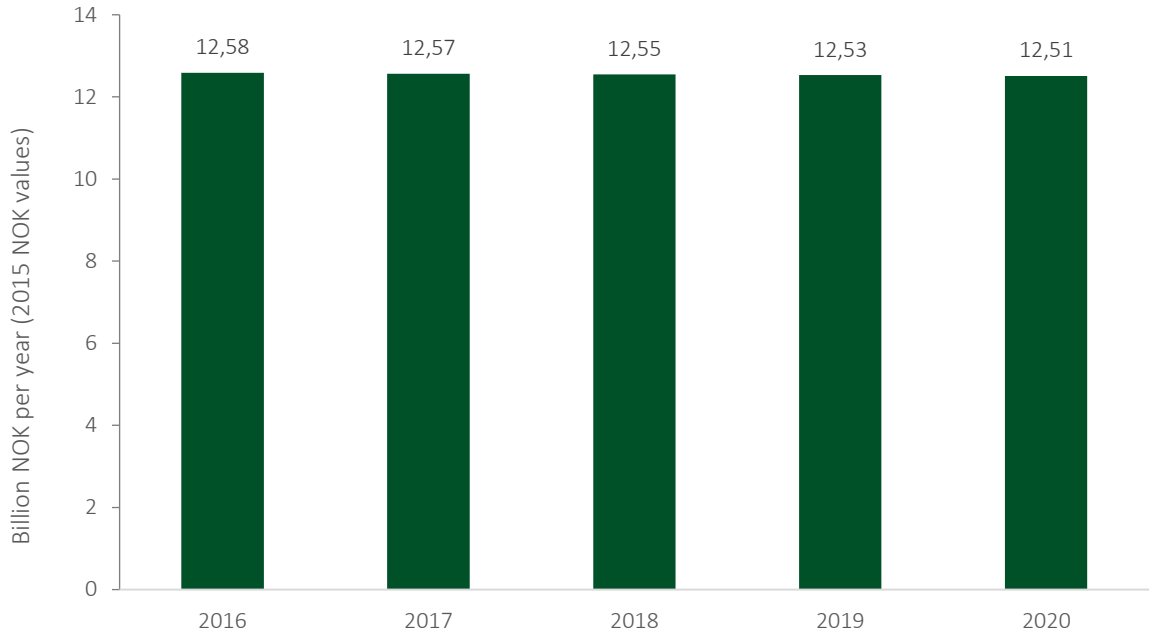

Figure 8-3 *Financial loss linked to edible food waste by households from 2016 to 2020*

8.2.4 Self-reported edible food waste

Now we turn to the results of consumer surveys from 2017 to 2020. The number of times in the past week that consumers report having thrown away different types of food is presented in Figure 8-4.

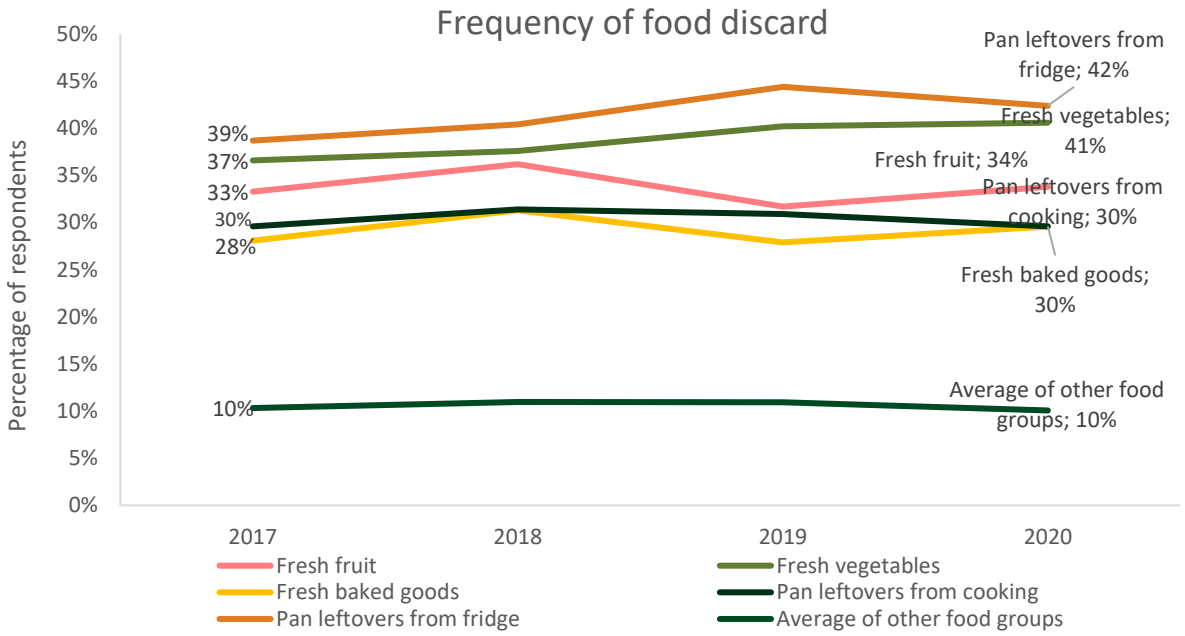

Figure 8-4 Proportion of consumers reporting having thrown away different types of food in the past week (2017-2020)

The figure shows that Norwegian consumers most often report having thrown away fridge leftovers (42%). Other points to note:

- Between 30% and 41% reported having discarded fresh baked goods, pan leftovers from meals, fresh fruit and fresh vegetables in the past week.
- There was a slight increase in waste frequency between 2017 and 2020 for five of the six major food groups, but the changes are generally small in all of them.
- On average, 10% of consumers responded that they had thrown away food in "other food groups" in the past week.

It is natural that the results of waste sample analyses and the consumer survey differ in the percentages for the largest food groups, as the results of the consumer survey do not tell us anything about quantities of waste, only about self-perceived frequency. However, a comparison of the percentages for the various groups in terms of frequency and composition suggests that consumers have a realistic idea of which groups they discard the most. Consumer perceptions of their own edible food waste have remained relatively constant since 2017, in comparison with the changes in their actual wastage of the most common groups. This is especially true of bread and baked goods.

In this year's consumer survey, respondents were presented with information on how much of different groups is thrown away on average per day/week. They were then asked if they believe they are discarding more or less than average. The results are presented in Figure 8-5.

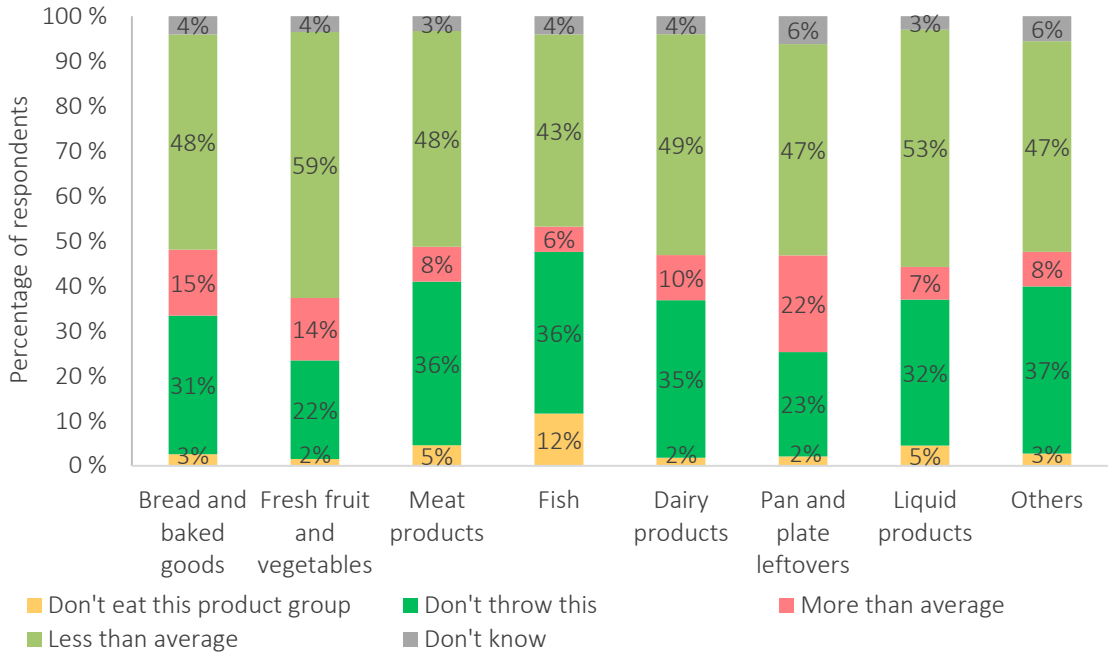

Figure 8-5 Consumer perceptions of whether they discard more or less than average (2021)

Many consumers believe that they waste less food than the average, especially fruit and vegetables and liquid products. Other points to note:

- A large percentage (43-59%) of respondents believe that they throw away less than average of all groups they were asked about.
- Few consumers think that they throw away more useful food than the average, in fact only 6-22%.
- The group that most people think they throw away more than the average is pan and plate leftovers (22%). This suggests that some consumers are aware that pan and plate leftovers are one of the groups they discard the most, which corresponds with actual results from waste sample analyses.

8.3 Causes of edible food waste

Consumers' perceived causes of their edible food waste have been mapped in annual consumer surveys since 2010, and the results from the 2020 survey are presented below (Figure 8-6).

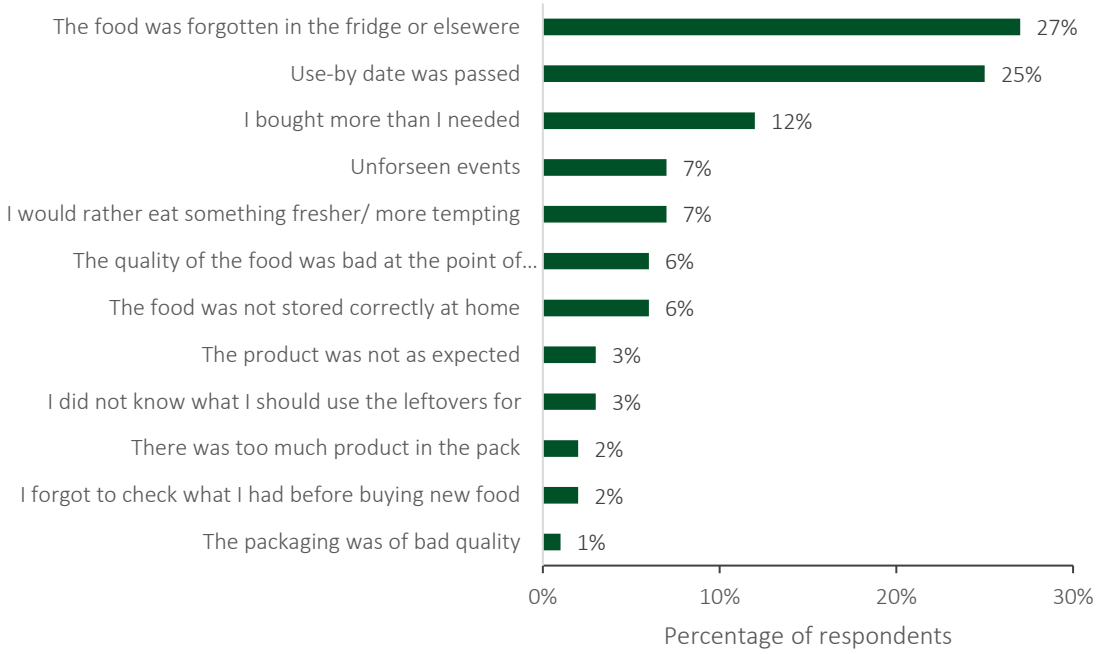

Figure 8-6 Main reasons for throwing away eight food groups in households in 2020 (A. Stensgård et al., 2020)

For the eight food groups that Norwegian consumers throw away the most, the respondents stated the following as the main reasons why they threw away food:

- Left in the fridge or elsewhere (27%)
- Past its expiry date (25%)
- They bought more than they needed (12%)

Based on these results, there is little indication that packaging-related causes, such as poor packaging, too much of the product in the pack or poor food quality when purchased are important factors in edible food waste in households.

8.4 Consumer knowledge of food and how to store it

8.4.1 Behaviour and routines

Consumers were also asked about their routines for purchasing and storing food and for utilizing leftovers from meals. Some of these routines tend to be associated with lower edible food waste, for example:

- They always know what food they need when they shop for food
- They use a shopping list when buying food
- They take smaller portions rather than throwing away food

An analysis by Stensgård et al. (2019) showed that consumers who know how much to buy when they are in the store, take smaller portions rather than throwing away leftovers and/or try to lead an eco-friendly life as far as possible generally discard less food than consumers who do not have these kinds of routines.

Figure 8-7 presents the responses to the questions in the consumer survey about routines related to the purchase, storage and choice of food.

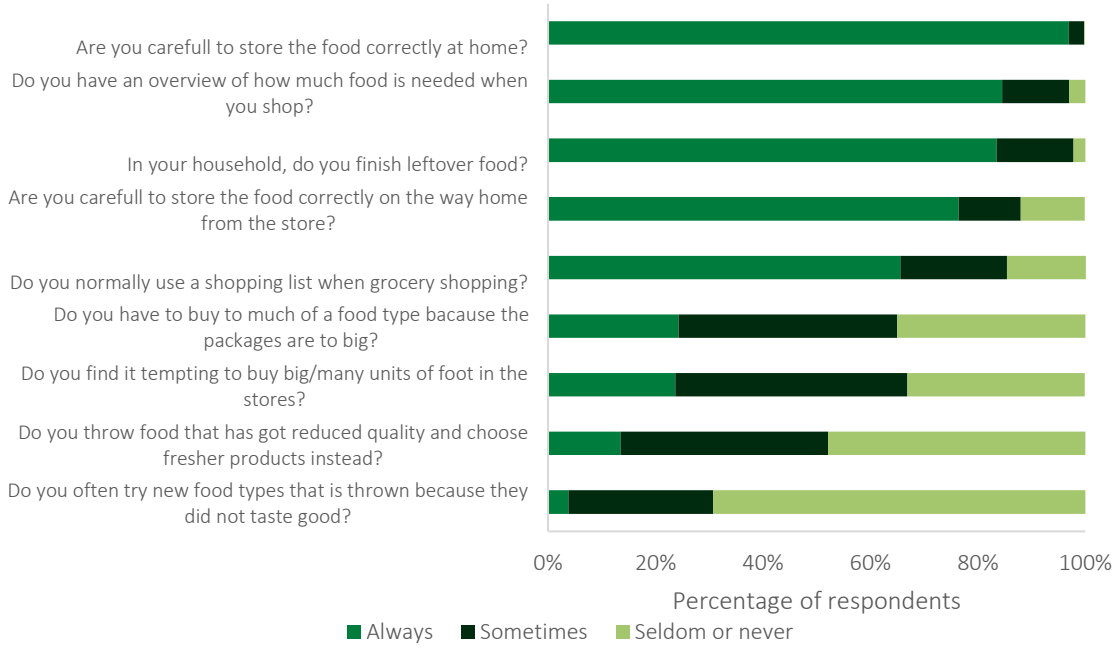

Figure 8-7 *Consumer routines for purchasing, storing and disposing of food (2021)*

Almost all consumers stated that they always or often store their food correctly at home, which is a good routine for limiting food waste.

- A high percentage of the respondents stated that they have a good idea of how much food they need when shopping (85%) and that they use a shopping list (66%) often or always; these are also routines that we know from previous analyses to be generally linked to lower edible food waste (Stensgård et al 2019).
- About two-thirds of respondents occasionally, often or always find that they have to buy too much of a kind of food because the pack or container is too large. This contradicts the results

of consumers' perceived reasons for edible food waste, where few mentioned packaging as a reason why they throw away food (Figure 8-6).

8.4.2 Knowledge of food, storage and expiry dates

Consumers are also asked questions about their knowledge of storage and handling of food and their assessment of the condition of food. The responses to these questions in the consumer survey from 2020 are presented in Figure 8-8.

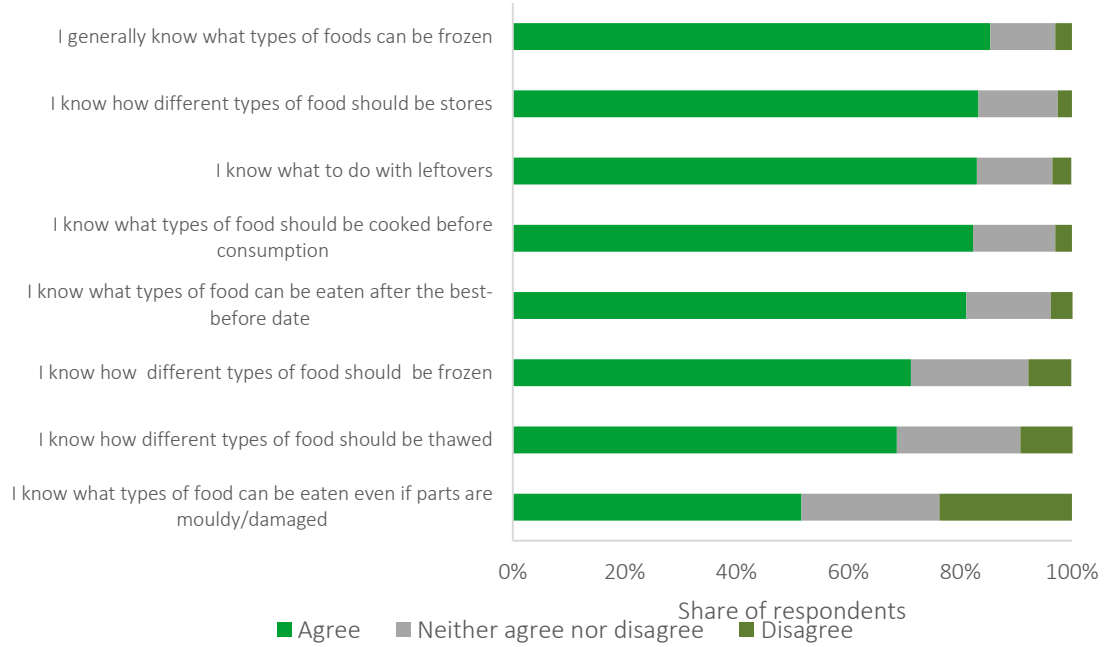

Figure 8-8 *Consumer knowledge of food storage and assessment of the condition of food (2020)*

There is generally good knowledge of food storage and over 80% of respondents state that they agree with five out of eight "I know" statements. Further points to note:

- Consumers are somewhat more unsure about how to freeze and thaw food, but over two-thirds still state that they know this.
- Only 52% state that they know what kinds of food can be eaten even if parts of the food are mouldy or damaged. Consumers clearly need more knowledge about mould and damage to food.

An analysis of these questions in relation to age (Prestrud, 2019) shows considerable differences in the degree of knowledge about food storage and what kinds of food can be eaten even if some of the food is damaged or mouldy. The results suggest that the youngest consumers need more information and knowledge about storage and handling of different types of food.

In this year's survey, consumers were also asked whether they always throw away food past its expiry date marked as 1) "Use by" and 2) "Best before". The results of these questions are presented in Figure 8-9.

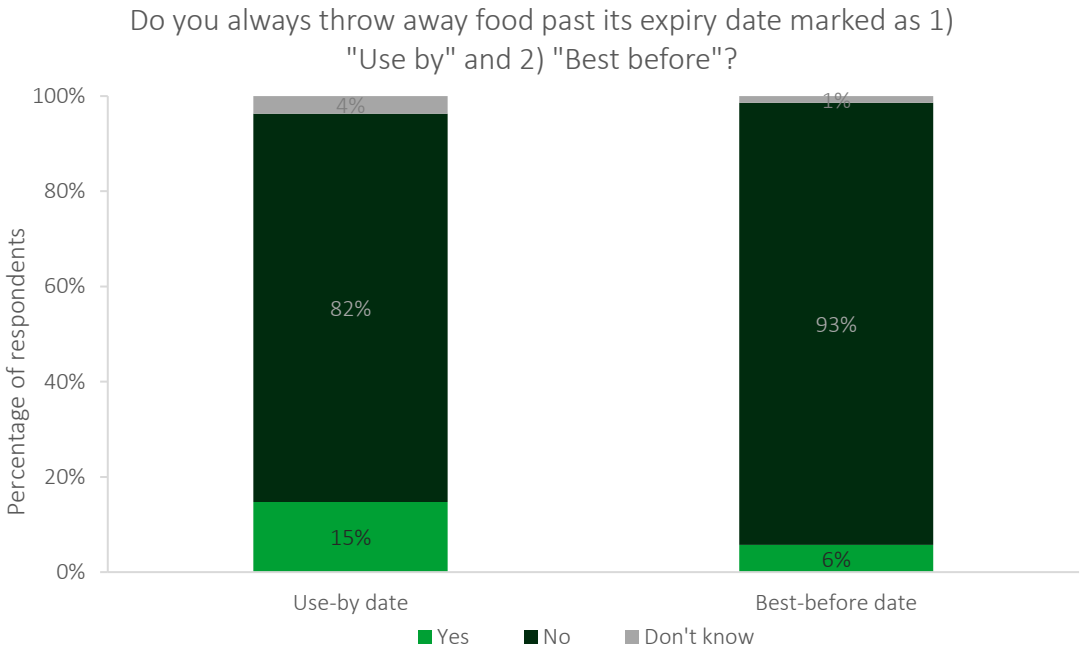

Figure 8-9 *Respondents' replies to the question of whether they always throw away food that is past its expiry date marked as "use by" and "best before"*

There is little difference between the two labels in terms of the percentage of respondents stating that they always throw away food past its expiry date. This may suggest that consumers are generally unaware of the difference between the labels. The fact that only 15% reported always discarding food past a date marked as "Use by" may indicate that they do not know that this is a label intended to ensure food safety that applies to perishable foods. Here consumers seem to be more concerned with appearing to be discarding little food rather than thinking about the difference between the two labels. On the other hand, it is a good sign for edible food waste reduction in households that as many as 93% of consumers responded that they do not always throw away food labelled "Best before" after the expiry date.

In previous years, the questions on date labels were formulated differently; respondents were able to state how much they agreed with the statement "I always throw away food marked…" on a five-point scale from "Strongly disagree" to "Strongly agree", rather than answering yes/no/don't know. In the previous surveys, significantly fewer (59% in 2019 and 62% in 2020) answered that they do not always throw away food marked "Use by" than in this year's survey. This suggests that a yes/no question may make consumers less sure about their idea of the difference between the two labels, and thus are more interested in stating that they do not throw away food just because it has passed its expiry date than thinking about whether they know what the different labels actually mean.

8.4.3 The effect of the COVID-19 pandemic on consumers' routines and amounts of edible food waste

In 2020 and 2021, respondents in the consumer survey were also asked questions related to the COVID-19 pandemic in order to explore whether the pandemic and the associated shutdown had any effect on consumers' food waste behaviour. Figure 8-10 shows the areas in which consumers had experienced changes since the first shutdown in March 2020 (the question was asked in June 2021).

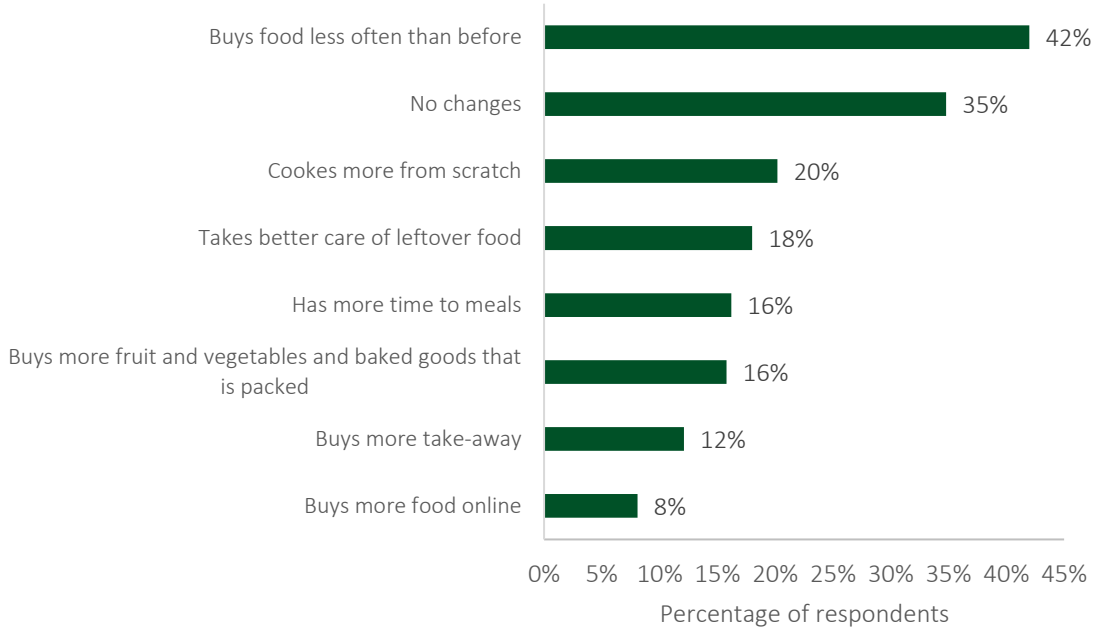

Figure 8-10 Areas in which consumers experienced changes after COVID-19 hit Norway in March 2020 (2021)

The figure shows that almost half of consumers bought food less often than before, and 20% answered that they cooked proper meals more often. However, about a third stated that they had not experienced any changes since the pandemic broke out.

Consumers were also asked how COVID-19 had affected edible food waste in their household; the results are presented in Figure 8-11.

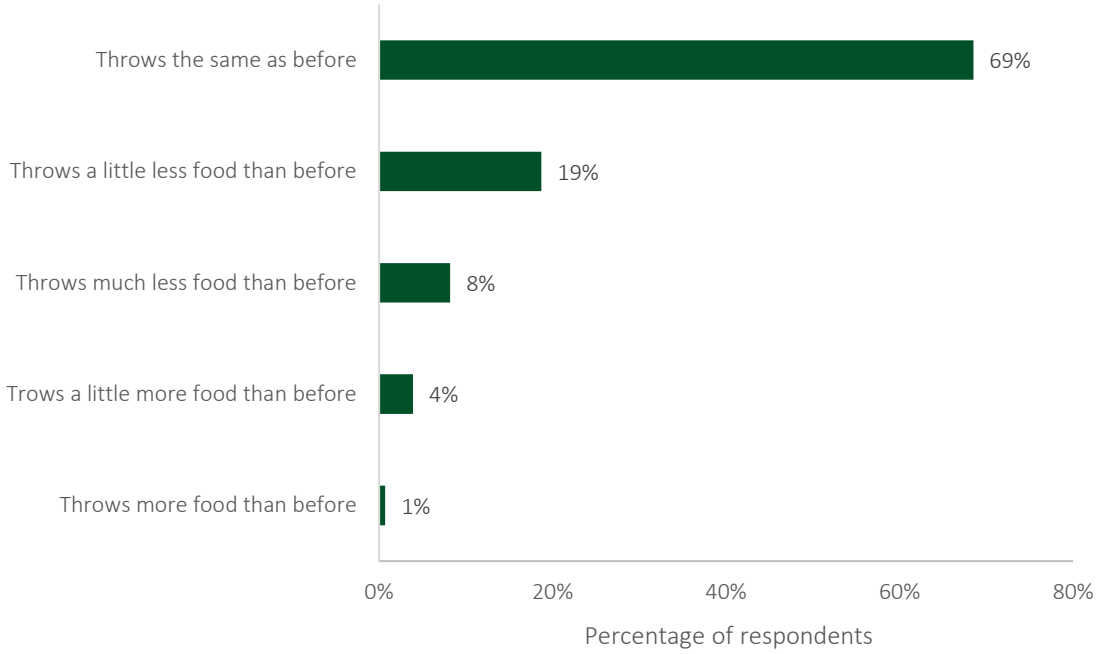

Figure 8-11 Consumer perceptions of their edible food waste since COVID-19 (2021)

Over two-thirds of consumers thought that they were throwing away the same amount of food as before the pandemic broke out. About 20% of consumers reported throwing away a little less food than before COVID-19, and a small percentage stated that they discarded much less food than before. Only 5% of felt that they were throwing away more food than before the pandemic broke out. If consumers' perception of changes in their edible food waste has changed corresponds to actual food waste, COVID-19 should have led to some reduction in consumer waste. On the other hand, the pandemic has probably meant that more of total edible food waste occurred in households because people were spending more time and eating more at home, which may have led to the perceived reduction not being reflected in actual waste.

8.5 Measures implemented to reduce waste in households

8.5.1 Measures implemented

Measures implemented by the food industry aimed at consumers:

In the annual consumer survey, respondents were asked whether various measures introduced by the food industry have led to less edible food waste in their household.

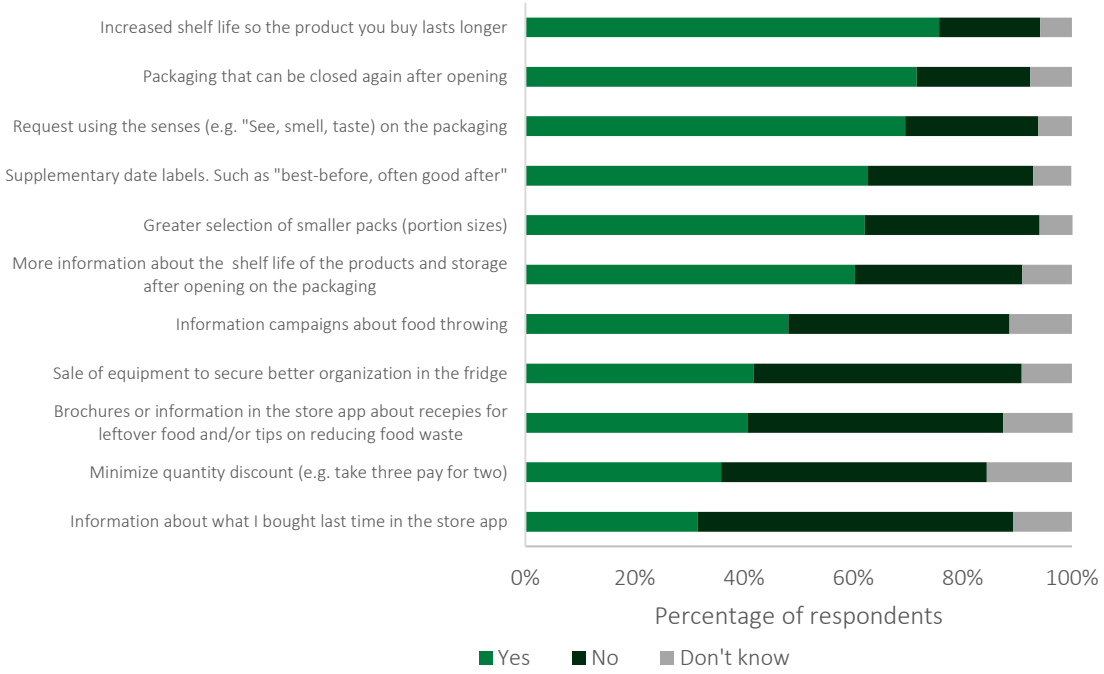

Figure 8-12 Percentage of respondents who believe that they discard less food because of various measures introduced by the food industry (2021)

Measures that over 50% of consumers think have made them discard less food are as follows (in order of priority):

- Longer shelf life
- Opening/closing mechanisms
- Information on shelf life and recommended storage of products
- Additional information on date labels
- Greater selection of smaller packs

Only 37% of respondents in the survey stated that they knew that the food industry had increased the shelf life of products, while as many as 72% felt that longer shelf life made them throw away less food. This suggests that information about this measure does not reach consumers, and/or that they do not consider the increased shelf life of products as a specific anti-food waste measure introduced by the industry.

In this year's consumer survey, respondents were also asked whether they were satisfied with the food industry's efforts to reduce edible food waste. Here, 22% answered "Yes", 40% answered "No",

while the remainder did not know. The high proportion of "Don't know" responses suggests that many consumers are unaware of what kinds of anti-food waste measures the food industry has introduced, or what effect these measures have had on edible food waste.

Specific questions were also added for measures related to bread, and the responses to these questions are presented in Figure 8-13.

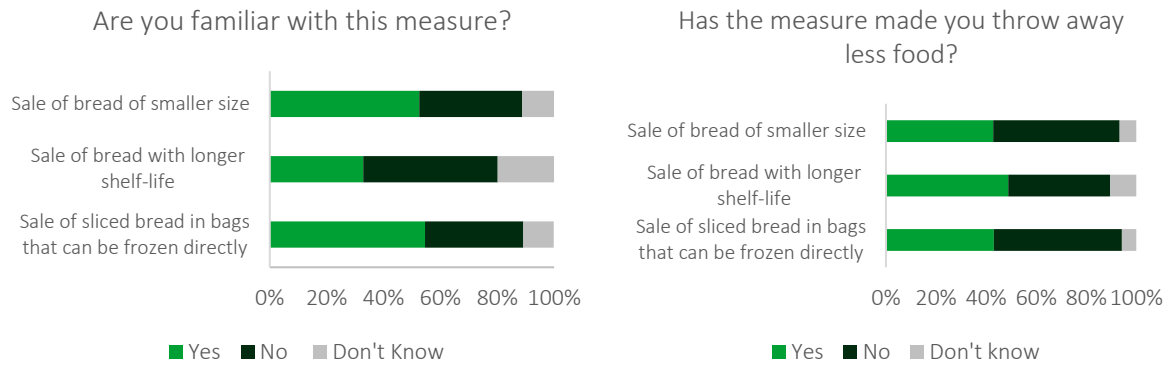

Figure 8-13 *Consumer knowledge of food industry measures aimed specifically at bread (left), and whether each measure has made them throw away less food (right)*

- Just over half of the respondents were familiar with "smaller loaves of bread" and "sliced bread in bags that can be frozen directly", while only a third stated that they had heard of "bread with a longer shelf life".
- About half believed that "bread with a longer shelf life" had made them throw away less bread, while slightly fewer stated that "smaller loaves of bread" and "sliced bread in bags that can be frozen directly" had led less waste of bread in their household.
- It is interesting that as many as half of those who were familiar with "smaller loaves of bread" and "sliced bread in bags that can be frozen directly" believed that these measures had not led to less waste of bread in their household. The figures from the waste sample analyses show that edible food waste in the category "bread and baked goods" has decreased significantly. These conflicting findings may indicate that the measures from the food industry for this product group have worked, but that consumers do not share this view, according to the consumer surveys.

Consumer-oriented measures by Matvett

Matvett has implemented a wide variety of consumer-oriented measures since 2015, such as developing tools and materials and collaboration with other actors. Since 2010, the qualitative consumer surveys have provided a great deal of knowledge about what food is wasted, who wastes it and the main causes of edible food waste. This knowledge has aided the work of the food industry, the media and others involved to inform consumers and encourage them to reduce their wastage. A selection of measures aimed at consumers is presented here:

- **Website:** Matvett.no is a website with advice and tips for consumers, including a "use up" reference list with details for over 70 foods and a meal planner that provides recipes based on the ingredients one has available (Matvett, 2021).

- **Social media:** With almost 10 000 followers on Facebook and 2500 followers on Instagram, Matvett reaches consumers with specific tips and advice on how to take care of food in addition to pointing out how companies help consumers throw away less food, such as longer shelf life, better packaging solutions and tips for storing food.
- **The Food Waste Table:** A laid table of food based on waste sample analyses. This has been an exhibition used to communicate food waste at food and music festivals, industry events to raise staff awareness in various companies, and municipal environmental days, etc. Various materials and films have been produced in connection with the Food Waste Table.
- **"Often good after" and "Look, smell and taste":** In 2018, much of the food industry agreed to use "Often good after" on food marked "best before" where appropriate. Many actors in the industry use this today. To provide further guidance to consumers, the food industry has also developed a common "Look, smell and taste" symbol to encourage people to use their senses on food that has passed the "best before" date. Matvett has conducted several look, smell and taste campaigns on social media aimed at consumers.
- **Food waste calculator:** A digital calculator that works out the average of a household's edible food waste in kilos, NOK and CO2.
- **Collaboration with other actors:** Matvett has been involved a great variety of projects initiated by companies, municipalities and information offices in recent years. One example is with Findus, where several publicity stunts and digital campaigns aimed at consumers were conducted during two years (2018-2019), in addition to a teaching programme involving Grefsen School.
- **Collaboration with the media:** Matvett collaborates with many different actors to spread the message about taking care of food, in the form of information and tips about edible food waste on various websites, in articles and in national and local radio and TV interviews, in addition to various activities. Matvett has contributed to many news items in the media in recent years to enhance awareness of edible food waste, including in NRK FBI reports and NRK Matsjokket.
- **The KuttMatsvinn network:** In 2018, Matvett initiated a KuttMatsvinn network consisting of various actors involved in edible food waste reduction activities (Spisoppmaten, Too Good To Go, Food Banks Norway, Foodlist, Kompass & Co, Future in Our Hands and TotalCtrl). The network has collaborated on the arrangement of several digital KuttMatsvinn weeks and a KuttMatsvinn festival in Oslo City Centre.
- **Communication with guests:** In the KuttMatsvinn2020 project aimed at the hospitality sector, communication materials were developed to increase awareness of edible food waste and to encourage guests to waste less food in hotels, restaurants and staff cafeterias. This material is used daily by many hospitality actors and is highlighted in the KuttMatsvinn weeks and in other KuttMatsvinn projects involving collaboration with actors in the sector.
- **A teaching programme**: In connection with the increased focus in schools on sustainable development, which was introduced as one of three key interdisciplinary subjects in 2020, Matvett and Inland University of Applied Sciences collaborated with LOOP Environmental School and the educational website NRK Skole to develop a teaching programme with various exercises and activities on edible food waste for primary and lower secondary school. The programme has received positive feedback from teachers, especially for the way it is directly linked to both learning goals and sustainability goals.

Consumer-oriented measures by other actors:

Spisoppmaten: Mette Nygård Havre has run the popular movement Spisoppmaten ("Eat up your Food") since 2017. Her engagement is based on several years as communications manager in the waste management company BIR AS, where she saw how much edible food was being thrown away. Spisoppmaten encourages both consumers and the food industry to reduce edible food waste (Spisoppmaten, 2021). Some measures aimed at consumers are:

- Daily posts on social media and very enthusiastic followers. In August 2021, Spisoppmaten had 92 000 followers on Instagram and 30 000 on Facebook.
- Various presentations at festivals, seminars, in companies and at schools. For talks in schools, Spisoppmaten collaborates with the Q Dairies and the Kavli Foundation on teaching programmes and food courses for 6th and 9th grades (food and health). During the pandemic, free digital courses were created. More than 200 lower secondary school teachers have used the digital teaching programme.
- Co-organizer of the Q Dairies' annual Matredderdagen ("Save Food Day"). As an introduction to this day, six food saver prizes are awarded to individuals, associations, schools, companies or others who have shown themselves to be good savers of food.

Too Good To Go coordinates the sale of surplus food from companies to consumers across the country via its technological platform. It also provides knowledge and advice to companies, households and schools and currently has 1.4 million users and 3200 food companies, and has saved 5.6 million meals since it was established. Seventy-three percent of Norwegians have heard of Too Good To Go (TooGoodToGo, 2021). Some measures aimed at consumers are:

- **Regular posts on social media** about how to become a food saver and prevent edible food waste by your followers and customers.
- **Outdoor advertising all over Oslo: "**Let's fight food waste together" with a focus on bread, which is one of the largest waste categories. The campaign against bread waste used an app to teach more people how to help their local store/bakery to reduce waste.
- **A campaign to get the food industry involved in the fight against food waste:** A "threatening letter" was written to the confectionery producer Nidar to tell them to join the app. The campaign resulted in 1800 imperfect confectionery items being posted in the app and immediately saved from being wasted.
- **A campaign against egg waste:** 2.8 million Norwegians were reached with an Easter campaign with a message about how to check that eggs can be eaten, based on the "best before" date. The campaign was well covered by the press (40 media reports and one radio interview) and by Nortura, MENY, Bunnpris and Joker among stores.

Food Banks Norway is a network of eight food banks that redistribute surplus food from the food industry to charities that help disadvantaged people. Since 2017, Norwegian food banks have redistributed 14 200 tons of food, which corresponds to over 28 million meals, and they currently have agreements with 250 companies in the entire value chain (Matsentralen Norge, 2021). Some measures aimed at consumers are:

- The development of teaching programmes and about ten school visits to four food banks in collaboration with other actors.

- Arrangement of an “Open Day at the Food Bank” for schools at the food banks in Oslo, Western Norway and Central Norway
- Contributions to events such as the “World’s Coolest Day”, the “Save Food Centre” in Trondheim, the “Save Food Day” organized by Q/Kavli, Oslo The Environmental Capital, the Bergen Food Festival, the KuttMatsvinn Festival, etc., with various activities to increase awareness of the problem of edible food waste.
- Provided expert advice for the preparation of common sense rules on cartons of milk in collaboration with Q Dairies and Matvett
- Provided expert assistance to the editors of the 2019 television series about food waste, “NRK Matsjokket”.

Foodlist is a free app used by consumers who want to share information about food with a short shelf life that is available in grocery stores. The app is based on user-generated content where consumers enter data themselves, without any link to the stores’ computer systems or payment solutions**.**

TotalCtrl offers software to improve food storage and reduce edible food waste through automation and digitization. The target group is hotels, restaurants, kindergartens, nursing homes and households. **TotalCtrl Home** is a digital kitchen assistant that helps consumers improve their control over the food they have at home by notifying them before items reach their expiry date, automatically generating recipes based on what they have at home, and providing a digital shopping list. The app has about 15 000 downloads and just under 3000 active users every month. Feedback from users shows that they throw away less and eat more varied food (TotalCtrl, 2021).

Thrownomore is a free app containing an overview of discounted food in stores in the consumers’ neighbourhood, either because they are approaching the expiry date or because they cannot be sold at full price for other reasons. The food is bought in the usual way. Over 10 000 people have downloaded the app and Thrownomore collaborates with 509 Joker and SPAR stores. Feedback from store staff shows that the app is effective in reducing edible food waste in stores (Throw No More, 2021).

Kompass & Co is a social entrepreneur company that creates jobs and turns them into coping opportunities for the most vulnerable young people in Oslo. Through the Compass Food concept, they run the Frydenberg school canteen together with young people and have developed a school canteen model with surplus food on the menu. They have helped more than 100 young people return to work or school and make the edible food waste problem in Norway visible by organizing food courses and developing and testing various surplus food menus through the concept of a long surplus food table (Kompassmat, 2021).

9 Efforts for the future

Summary of trends in edible food waste

Edible food waste from the food industry, the education and care sector and households amounted to 400 000 tons in 2020. The food industry accounted for 180 000 tons, which corresponds to 33 kg per capita and year, an annual carbon footprint of 0.5 million tons of CO_2 equivalents and an annual financial loss of more than NOK 7 billion.

This report shows that edible food waste in the food industry was reduced by 14% from 2015 to 2020. This is close to the target of a 15% reduction and is in addition to the reduction of 14% from 2010 to 2015 that producers, wholesalers and retailers achieved through the ForMat project (Stensgård & Hanssen, 2016).

Some stages of the value chain have achieved more than others and Figure 9-1 shows the percentage change for each stage/sector compared to the target of a 15% reduction by the year 2020.

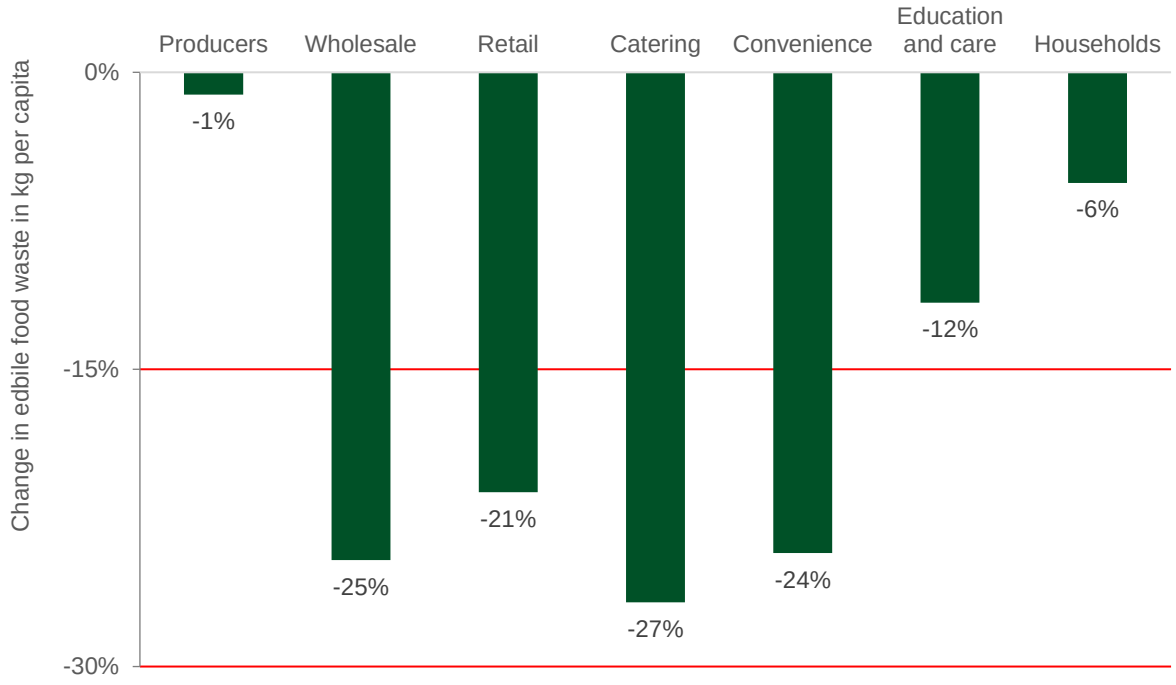

Figure 9-1 Changes in edible food waste in kg per capita for each stage/sector

The figure shows that producers, the education and care sector and households are the sectors that have not reached the target. Here it is important to note that the trends are unreliable for the education and care sector and to some extent for households. Wholesalers, retailers, the hospitality sector and convenience stores are well ahead of the target and already approaching the next target of -30%, which is to be achieved in 2025.

The effects of COVID-19 cannot be isolated, but there is little doubt that the pandemic affected edible food waste in 2020. Travel restrictions and closures affected the production and sale of food and beverages in Norway. Infection control measures eliminated cross-border trade and people ate more at home.

The amount of food produced increased by 7% (SSB, 2021f), food and beverages sold by retailers increased by more than 14% compared to 2019 (Bergh et al., 2021), while sales in the hospitality sector decreased sharply and were unstable due to closures and reopenings (NHO Reiseliv). Combined with a shift in the market towards increased sales of goods affected by cross-border trade (alcoholic beverages, snacks, etc.) and reduced sales of on-the-go products and smaller portion packs (NTB, 2020), this meant that 2020 was a challenging year for the food industry to make forecasts. This led to an increase in edible food waste from 2019 to 2020 for the food industry as a whole, but fortunately the increase was small compared with the overall reduction in waste from 2015 to 2019.

Our habits also changed: more people took their holidays in Norway and worked from home. Schools and kindergartens were closed periodically, which may have contributed to lower waste in the education and care sector. One-third of consumers reported discarding less food in 2020 as a result of COVID-19 (A. Stensgård et al., 2020), but since a larger proportion of food was eaten at home, it is not clear whether the pandemic meant that more or less food was thrown away by households.

The figures for 2022 will possibly be for the first normal year after the pandemic, which may give us a better idea of the real trends in edible food waste.

Summary for the entire value chain

This report shows that edible food waste has been reduced in all stages of the value chain, but that not all stages have achieved the target of a 15% reduction. There is not always a direct link between where in the value chain edible food waste occurs and who is responsible for the waste. The most important point going forward towards 2025 and 2030 is not who manages to cut food waste by half, but that the value chain as a whole achieves it. It will therefore now be important to consider the entire value chain, and here Matvett has a key role in increasing cooperation and transparency across the value chain in order to boost efforts to address the systemic challenges.

In order to achieve the next interim target, it will be important to focus on the large product groups that often result in waste (bread and baked goods, fruit and vegetables). These products have a relatively short shelf life, which naturally means that they make up a relatively large proportion of edible food waste compared to other products. At the same time, there are several other more systemic and consumer-related factors such as free return of unsold items and consumer preferences and knowledge that also contribute to relatively high waste in these product groups. More effort should be put into examining these causes in the future. Expensive product groups with a high carbon footprint are also important, but a great deal is already being done in this area.

In addition, edible food waste reduction and prevention must be intensified early and late in the value chain, i.e. at the production and consumer stages. These are the two stages of the value chain that have reduced edible food waste the least, and are also the two largest stages in tons. It is vital that the entire value chain takes joint responsibility for helping households to reduce their waste and invites consumers to be part of the solution. We cannot expect households to be able to reduce edible food waste solely on their own initiative, yet it is important to influence consumer attitudes and behaviour related to expectations of ready supplies of a wide variety of food. The changes in eating habits and the way food is served caused by COVID-19 should be exploited to continue the measures that we know will reduce edible food waste. Many actors share the responsibility for enabling households to reduce their wastage: the major brand manufacturers who produce the food

we buy, the retail sector and restaurants and cafes, which have the most direct contact with consumers, the education and care sector which is Norway's largest employer and provides education to all young Norwegians, and the government with its responsibility for legislation and verification.

Efforts for the future for the different sectors

- Producers

Since the production stage is the second largest stage in the value chain in tons of edible food waste per year, but has reduced its waste the least (-1%), efforts must be redoubled in order to achieve the next interim target for the value chain as a whole. The overall trend at the production stage is negatively affected by increased production in the industry and the effect of COVID-19 is unknown, but if we look at developments in some producers from 2015 to 2019, it is quite feasible to reduce edible food waste considerably also at this stage. The companies in the sector agreement have actually reduced their edible food waste by 13% on average. It is therefore strategically important to recruit more companies so that more can begin to measure and report their waste.

Companies must continue their work on internal procedures, optimize the production process and increase collaboration with the stages of the value chain before and after the production stage, since much of edible food waste is related to quality requirements, poor forecasting (overproduction) and challenges in relation to new launches and seasonal products. Food producers also have great potential for increasing their use of new, alternative sales channels, such as "Verdimat", "Holdbart" and "Too Good To Go", in addition to donating surplus food.

- Wholesalers

Wholesalers should make greater efforts to reduce waste of foods with a relatively high carbon footprint (meat and dairy products), since these have increased during the period, in order to enhance the environmental benefits of lower edible food waste. However, the increase for these groups is due to the shift from direct distribution to distribution via wholesalers, which indicates a probable shift in waste from producers to wholesalers, and thus not a real increase in total amounts of edible food waste.

Otherwise there is much to suggest that good work is being done by wholesalers to reduce edible food waste, and they have a good chance of reaching the next interim target. In addition to continuing their own efforts at reducing waste, wholesalers have a key role to play in increasing cooperation between food producers and the later stages (retailers, hospitality, the education and care sector and convenience stores). The goal of a 50% reduction must be achieved for the entire value chain, and wholesalers should therefore in the future examine how they can help to reduce edible food waste elsewhere in the value chain.

- Retailers

In addition to continuing work on the less environmentally friendly groups such as meat and dairy products, retailers must also focus on the two largest product groups, namely fruit and vegetables and bread and baked goods. To achieve the target of a 50% reduction, retail chains must consider further specific preventative measures aimed at those two groups, such as reducing the selection on offer towards closing time, examining current return schemes and purchasing procedures/forecasts, in addition to adopting waste reduction measures such as reduced prices and alternative sales channels, such as Too Good To Go, to a greater extent. Some chains have tested such measures, such as selling yesterday's bread or fruit and vegetables that are no longer fresh at a reduced price. However, this work is challenging as it requires different mechanisms than for packaged products with a longer shelf life.

Otherwise there is much to suggest that good work is being done by retailers to reduce edible food waste and they are well on their way to reaching the next interim target. In addition to continuing their own waste reduction, retail chains have a key responsibility and role to influence consumer behaviour and attitudes to food and edible food waste.

- The hospitality sector

Much of the edible food waste in the hospitality industry is from the plates of guests. In order to achieve the target of a 50% reduction in waste, the hospitality sector must take steps to ensure that food served is also eaten. There are many ways to solve this, such as the size of portions and extras, plate refills and doggie bags. In addition, the industry must increase guests' food waste awareness.

It will also be important to recruit more actors in the hospitality industry to join the fight against edible food waste. Several of the sectors, such as restaurants and cafés, are poorly represented in the figures.

Otherwise the hospitality sector is well on its way towards the second interim target of the sector agreement, but it is unclear how much of the reduction is due to COVID-19. The pandemic not only led to closures but also to specific measures such as the removal of buffets. Several companies found that this helped to reduce waste and that guests were not dissatisfied; they understood the reason as long as it was explained to them. This is supported by a survey conducted by NHO Reiseliv that showed that more than 50% of the population are positive to either removing buffets or reducing the selection in order to reduce edible food waste. In order to maintain the reduction in waste until after the pandemic, the hospitality sector must learn from such experiences and not be afraid to find out whether guests can accept smaller buffets and more limited menus if the problem of edible food waste is communicated to them.

- Convenience stores

To reach the target of a 50% reduction, the convenience stores sector must concentrate on the main waste categories, i.e. buns, baguettes, hot dogs and other fresh food. These foods are especially likely to be thrown away due to their poor durability after production; they also have particular challenges related to shelf life due to the way they are displayed. Much edible food waste in convenience stores can be reduced by putting less of the food on display, changing the display method, reducing the display range and/or time (e.g. only having hot dogs on the grill for a period

when they are likely to be bought). This also requires clear communication with customers about what foods are available but not on display, as well as the reason for the changes.

Otherwise convenience stores are in a strong position to achieve the second interim target of the sector agreement, but it is unclear how much of the reduction is due to COVID-19.

- The education and care sector

Trends in the education and care sector are highly uncertain, since the effects of the pandemic cannot be quantified, the data are unreliable and we only have figures for 2019 and 2020. Furthermore, much of the sector has not been mapped yet (hospitals, upper secondary schools, etc.), which means that work on edible food waste in these parts of the sector has been further delayed. The education and care sector must therefore make efforts to map and measure edible food waste to enable interventions to be targeted at the areas where they are most needed.

- Households

Households are the largest sector in the value chain and if Norway as a whole is to achieve the goal of a 50% reduction, efforts in this sector must be intensified.

Since the effect of the pandemic cannot be quantified, and we only have figures for 2016 and 2020, it is difficult to judge whether the household sector will be able to achieve the next interim target of a 30% reduction by 2025. However, there is no doubt that if Norway as a whole is to achieve a 50% reduction, the edible food waste problem in the household sector must be solved. This will require a major cooperative effort by the entire value chain and the government; all stages of the value chain have a duty to contribute to reducing edible food waste by consumers. The major brand manufacturers in the food industry package and produce most of the food we eat and throw away at home. By developing their products and packaging to improve quality and shelf life as well as clearly labelling products and informing consumers about shelf life, storage, etc., food producers have a key responsibility and role in decreasing edible food waste in households. The retail sector is the part of the food industry that has most direct contact with consumers, and it also sells most of the food that is either eaten or thrown away in households. Retail chains can influence the amount and type of food we buy, which is a challenging area for them to be involved in, probably requiring research and innovation work. The education and care sector takes care of and educates the consumers of the future and is also Norway's largest employer. The sector has a joint responsibility with food producers and the retail chains to halve food waste in households, as the sector has a considerable influence on behaviour and attitudes in the population.

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11 Appendix
Data basis and methodology

For further details on data basis and methodology, see A. E. Stensgård et al. (2021)

11.1 Data basis

11.1.1 The sample

Edible food waste that occurs in the food industry has been mapped on the basis of data reported by companies that have signed the sector agreement on waste reduction. As data collection is based on companies joining a voluntary agreement, the sample increases every year. The data for 2020 are based on the following sample:

- Producers: Forty-one companies representing a broad selection of production facilities and accounting for about 50% of total sales by Norwegian food producers (excluding the fishing industry, which is surveyed by SINTEF Ocean).
- Wholesalers: Seven companies, four of which are importers/direct distributors from producers (with only one or a few product groups), while three are large wholesale companies with a wide range of products. It is estimated that the companies reporting to the project account for 65-85% of sales in the entire wholesale market, depending on product group.
- Retailers: Five chains (NorgesGruppen, COOP, REMA 1000, Bunnpris and Holdbart). These chains accounted for over 99% of sales in 2020. Some of the retail chains have reported data from all their stores, but not all. The 3600 stores that have provided edible food waste data represent 92% of retail sales in Norway.
- The hospitality industry: five restaurants, 43 hotels and 277 staff cafeterias, which accounted for 0.3%, 17% and 20% of sales in 2020, respectively.
- Convenience stores: The companies account for around 30% of sales in the sector.

In the education and care sector, the following municipalities have provided edible food waste data: Asker, Bærum, Drammen, Fredrikstad, Halden, Oslo, Sandefjord, Voss, Østre Toten and Arendal. The figures from these municipalities represent 12% of all places in nursing homes, 4% of all kindergarten children and 11% of all primary and lower secondary schools in Norway.

In the household sector, edible food waste calculations are based on waste sample analyses that cover 45% of the population for total food waste and 43% of the population for edible food waste. The consumer analyses are based on a representative sample of 1000 respondents.

11.1.2 Reported data

The companies report amounts of edible food wasted (in kg, tons or economic terms) divided into product groups, thus providing a basis for upscaling and calculation of key figures for the industry. These may be e.g. tons of food produced, sales in NOK, numbers of kindergarten children or numbers of guests. In addition, companies have reported data quality, how edible food waste is utilized (animal feed, biogas or incineration), corrective measures implemented and how much waste they have reduced by selling goods at a reduced or rock bottom[3] price, donation of food, and the use of food directly in new food production.

11.1.3 Distinctions between the sectors

In order to distinguish between the edible food waste that occurs in the various stages of the value chain, the European NACE codes have mainly been used:

- Food producers come under NACE codes 10 and 11 (corresponding to main business area C in the SN2007 standard for industry codes).
- Wholesalers are covered by NACE code 46.3 (and are under main business area G in the SN2007 standard for industry codes).
- Retailers come under NACE code 47 (and under main business area G in the SN2007 standard for industry codes).
- The hospitality sector comes under NACE codes 55 and 56 (and under main business area I in the SN2007 standard for industry codes).
- Convenience stores are covered by NACE code 47 (and are under main business area G in the SN2007 standard for industry codes).
- The education and care sector covers institutions under NACE codes 85 and 87 (and under main business areas O and Q in the SN2007 standard for industry codes).

In addition, the following demarcations have been made for edible food waste statistics:

- Between the primary stage (including agriculture, fisheries and aquaculture) and the production stage, the demarcation from the EU FUSIONS project is used (Stenmarck et al., 2016), based on the following definition: “When the raw material is intact, it is still in the primary stage. When it is cut, minced, mixed with other ingredients it is in the production stage”. Edible food waste in the production stage thus includes waste that occurs after the raw material has been delivered from the primary stage for further processing. Based on this demarcation, the following resource streams are excluded from the production stage but included in the primary stage:
    - Edible food waste that occurs at packing facilities
    - Edible food waste that occurs during sorting at a reception facility.

[3] “Rock bottom price” is a term used by producers and wholesalers to distinguish it from “reduced price”. “Reduced price” is a term used for goods that cannot be sold at full price, but which can make a marginal profit. “Rock bottom price” means that the goods must be sold at a loss, such as when food is resold to Holdbart, Too Good To Go or Havaristen. The sale of food at rock bottom prices is thus an emergency solution to avoid wasting edible food.

- If goods are returned, edible food waste must be recorded for the stage in the value chain that is financially responsible for the waste. This applies to all product groups and stages/sectors, except for bread and baked goods and fruits and vegetables, which are covered by free return schemes. For these two groups, edible food waste must be recorded in the stage of the value chain that returns the product if there is free return.
- Several Norwegian food producers have direct distribution (wholesale activity). Where the reporting companies have separated their wholesale activity, the edible food waste from this activity is included in the wholesale segment. In all other cases, edible food waste from direct distribution is included in the production stage.
- For companies that import food from abroad, food waste must also be recorded in the stage of the value chain that is financially responsible for the waste, regardless of where the waste occurs. An example is food that is transported to Norway, but is in poor condition on arrival. The food is then disposed of in Norway as it is not feasible to send it back to the country of origin to be discarded, but as long as the receiving company in Norway does not have to pay for the goods, the waste is not recorded as taking place in Norway, but in the country of origin.
- Food that consumers return to stores is included in the retail stage as long as the store accepts the returned food.
- Food that consumers do not eat up (plate leftovers) in hospitality facilities is counted in the hospitality industry as long as the consumer does not take the food out of the premises.
- Food that consumers do not eat up (plate leftovers) in convenience stores is *not* included in the convenience store sector as of today due to the lack of a system to map this waste.
- Food that children do not eat up in kindergarten or school (plate leftovers) is included in the education and care sector as long as the children do not bring the food home. Because of this, there may be a small proportion of edible food waste in households that should have been included in the education and care sector.

11.2 Methodology for compilation of national statistics and trends

11.2.1 Methodology to ensure comparable trends

As mentioned, more and more companies are now reporting edible food waste data. Although some of the new companies have been able to provide historical data, the increase in the sample 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.

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 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 achieve a 50% reduction in their food waste. The same applies to companies that do not have comparable data because they have changed their data base or methodology.

Table 0-1 illustrates how new companies are included in the statistics.

Table 0-1 Illustration of the methodology for including new companies in the statistics

Example	2015	2016	2017	2018	2019	2020
Company A (new in 2017)	2.1% waste (data for 2017)	2.1% waste (data for 2017)	2.1% waste (first reporting year)	2.0% waste	1.9% waste	2.0% waste
Company B (new in 2015)	4.8% waste (first reporting year)	4.0% waste	4.1% waste	2.9% waste	3.7% waste	3.1% waste

The text in red shows how a company's data from its first reporting year (here 2017) is used again for the previous years in the edible food waste statistics (here 2015 and 2016). This approach means that the time series is annually corrected backwards in time each time new companies join the sector agreement.

This methodology is also used in the hospitality sector and the education and care sector to ensure comparability from 2019 to 2020; hospitality outlets and public institutions that were unable to provide edible food waste data in 2020 (but provided it in previous years) are assumed to have the same amount of food waste in 2020 as in 2019.

11.2.2 Methodology for upscaling to national tonnages

The total amount of edible food waste in Norway is estimated on the basis of the waste that occurs in the reporting companies in the various stages of the value chain. This is done by scaling up the sample to national statistics using the available basis for upscaling, which varies between sectors. Data for the various sectors is scaled up as follows:

- Producers: The total amount of edible food waste by producers is calculated by multiplying the percentage of food waste in the quantity produced by the reporting companies based on 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) (SSB, 2021d). The statistics used include confidential data that are not published by Statistics Norway.
- Wholesalers: The total amount of edible food waste at the wholesale stage is calculated by multiplying the financial losses of the reporting companies by key figures in the form of prices per kilo (NOK/kg) from the retail sector. The sample is then scaled up to the national level based on the wholesale companies' market share for each year during the period.
- Retailers: The total amount of edible food waste by retailers is scaled up to the national level based on the market share of the reporting stores for each year during the period (NielsenIQ, 2021a).
- The hospitality sector: The total amount of edible food waste from the hospitality sector is calculated by dividing the waste from the reporting companies by net sales for each

hospitality outlet and segment. This gives the key figure of grams of edible food waste per NOK revenue. This figure is then multiplied by the sales statistics for the various segments (SSB, 2021b). Business codes 55.1, 56.1 and 56.2 are used for hotels, restaurants and staff cafeterias, respectively.

- Convenience stores: The total amount of edible food waste in convenience stores is estimated by multiplying the financial losses of the reporting companies by key figures in the form of prices per kilo (NOK/kg) from the retail sector. The sample is then scaled up to the national level based on the wholesale companies' market share for each year during the period, using A C Nielsen's annual retail statistics (ACNielsen, 2019; NielsenIQ, 2021c).
- The education and care sector: The total amount of edible food waste in the education and care sector is calculated by dividing the waste by the number of service users (residents, children or pupils) in each institution in the three segments. This gives a key figure of kg of waste per service user, which is then scaled up to the total amount of waste by multiplying by the number of nursing home places in Norway (SSB, 2021e), the number of kindergarten children (SSB, 2021c) or the number of pupils in primary and lower secondary school (SSB, 2021a), according to the segment.
- Households: The total amount of edible food waste in households is calculated by multiplying the percentage of edible food waste in total food waste and residual waste (for municipalities with and without a collection scheme for total food waste) by kg of residual waste per inhabitant and kg of total food waste per inhabitant for the two categories based on the KOSTRA local government statistics and the population statistics from Statistics Norway (SSB, 2020, 2021g). Finally, a weighted average is calculated for the two categories based on amounts in the waste streams analysed.

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