

# Breaking Barriers: Empowering Effective Food Waste Solutions in the Nordic Countries



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# Recommendations

## **1. Limit promotions in retail**

Retailers are experts at getting us consumers to buy more than we intended, and once we get home with an excess of food, it is easy for some of it to go to waste. Research shows that there is more waste in stores when promotional items do not sell, or when other similar items sell less. Offers like “buy two for a discounted price” also result in us bringing home more food than planned. Promotions should be limited to when there is a surplus of fresh food that needs to be sold to avoid waste.

## **2. Review labelling regulations and practices**

“Best before” is perceived by many as meaning that the food cannot be eaten after this date, a perception reinforced by the fact that retailers do not sell products after the “best before” date has passed. Additionally, the date is set with a large safety margin by producers. We suggest that retailers significantly reduce the price of products when the “best before” date has passed instead of throwing them away, preferably in combination with information about what “best before” actually means. This would send a clear signal that the food can still be eaten after the “best before” date, and it would also allow people to buy good food at a lower price instead of it being discarded.

## **3. Highlight the role of packaging in reducing food waste**

Packaging has ended up in the “green shame corner” due to its environmental impact, but the function of packaging—to reduce food waste—is often forgotten or taken for granted. A common reason for food to be thrown away is that the consumer uses part of the contents of the packaging, places it back in the fridge, and then later finds that the contents have gone bad. When the package is opened, the ingenious protections built into it often disappear, and the food deteriorates quickly. Smaller amounts of food per package can, in some cases, reduce waste. Packaging can also serve as a messenger, providing information on how the consumer can determine if the food in a specific product is safe to eat. We propose that food packaging should have its own legislation, separate from other packaging, where the benefits of packaging for reducing food waste and ensuring food safety are weighed against its environmental impact.

## **4. Engage citizens in measuring their food waste on International Food Waste Day**

In our research, we clearly see that many people change their behaviour when they become aware that their actions lead to unnecessary food waste. When someone realizes that they pour out brewed coffee every day, it becomes hard to continue brewing the same amount. By involving many people in measuring their food waste for a day, waste behaviours are made more visible. If designed correctly, such a day can generate a lot of attention and impact.

## **5. Strengthen Nordic cooperation and establish a Nordic collaborative body for the reduction of food waste**

There are major opportunities to increase learning on this complex topic through increased cooperation among the Nordic countries. The different countries have variously organised their work among authorities, research institutes, universities, and industry organisations. Different countries apply different methods for measuring food waste and have introduced different policies. By sharing experiences from both successful and less successful measures, there is much to learn from each other. Increased cooperation regarding policy measures would also be desirable to ensure similar rules for companies in the Nordic market. A collaborative body tasked with coordinating food waste efforts in the Nordic countries should be established. There is also a need for an inventory of the rules, nationally and in the EU, that hinder measures against food waste as well as a common Nordic strategy for how to relate to these rules.

## **6. Expand systematic measurement and follow-up**

Few, if any, interventions to reduce food waste are implemented in a way that allows for measuring effectiveness and durability. To increase knowledge about the effectiveness of interventions, it is proposed that more focus be placed on systematically evaluating them.

## **7. Establish clearer requirements for data sharing and food waste reporting**

There is potential to reduce food waste through data sharing among actors. Sometimes, the causes of waste for one actor depend on how other actors behave, which can make it difficult or impossible for the affected actor to take measures. This can be due to power imbalances, unwillingness to share data, and so-called "take-back" agreements in retail (an agreement between a manufacturer or distributor and a retailer to take back unsold products). Clearer requirements should also be placed on actors in the value chain to carefully and systematically assess and report how their activities affect food waste for other actors, known as "due diligence" or "aktsomhetsvurdering".

# Introduction

Nearly nine years have passed since the target of halving food waste by 2030 was adopted in Agenda 2030.<sup>[1]</sup> Despite good intentions and initiatives, the reduction in food waste has fallen far short of this goal. It is time to act; if the goal is to be achieved, efforts must be scaled up with considerably more powerful measures.

Reduced food waste leads to less environmental impact (food waste is estimated to account for about 10% of human climate impact<sup>[2]</sup>), less resource extraction, and socio-economic benefits. Food waste also leads to social injustice, as fewer people can eat their fill. Moreover, since work on food waste began, our world has become more unstable with accelerating climate change and wars. There is every reason to include the food waste issue in efforts to ensure good preparedness if food and other necessary goods for food production cannot be imported. Efficient food flows without waste contribute to better-prepared countries.

## **The purpose of this report was formulated in the assignment as follows:**

The purpose of this report is to provide policy recommendations for the Nordic countries to further action in each country and regionally. The report should also serve as a handbook for officials in the Nordic countries to access results and lessons learned from each country.

The report is structured as follows: Chapter 3 describes some fundamental and guiding principles based on the hierarchy of waste that the work focuses on. Chapter 4 describes general causes of food waste and emphasises the need to understand the complexity of why food is thrown away so as to design sufficiently effective measures. Chapter 5 discusses the difficult art of measurement and evaluation. Are we really measuring the right things? Chapter 6 provides suggestions on what legislators, authorities, and public decision-makers can do. Reaching the goal of halving food waste is likely to require some

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1. Target 12.3: By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.
  2. IPCC. 2020. Climate Change and Land. An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. (Section 5.5.2.5.).

radical measures. The selection of proposals is partly from literature and partly based on the authors' experiences from twenty years of research. Chapter 7 describes the causes of waste in different parts of the food chain and the measures that various actors can take. Thereafter, a more detailed description of the literature search and interviews is presented in Chapter 8. Chapter 9 provides some summarising views. Appendix 1 presents some worthwhile tips on further reading in studies, reports, and documents for those who wish to deepen their understanding.

As a result of increasing attention on the issue of food waste, there has been much forward thinking and innovation. In the report, we want to highlight this by providing a number of good examples from different sectors and countries to serve as inspiration and demonstrate possibilities.

Our aim has been for the report to be easily accessible and provide a good overview of the complex area that food waste represents. This has meant that we have been restrictive in terms of details, instead referring to other works for deeper understanding. Likewise, to avoid burdening the reader, we have chosen to provide a selection of references in the text where appropriate.

We also sought to include more examples from all Nordic countries. Despite searches of relevant websites complemented by interviews with key persons, however, we were unable to access many of the interesting works conducted in Finland, Iceland, and the Faroe Islands due to our lack of knowledge in these languages. Generally, there is sparse documentation of measures written in English in the context of the Nordic region. It would be desirable for English titles and summaries to be published in reports and on websites to enable a better exchange of experiences.

In the report, we consistently refer to food waste as "food loss and waste" (FLW) due to the lack of an unambiguous and commonly used definition of what is meant by food waste (see Chapter 5 for a closer description).

Finally, as the report will illustrate, we believe that more attention needs to be paid to what happens in the store. This is where the consumer fills their shopping basket, which in many ways determines how much FLW occurs in households – which is by far the largest in the value chain, has the highest environmental impact, and is the most difficult to influence. What the consumer encounters in the store in terms of price, information, and packaging can play a decisive role in the possibility of reaching the goal of halving FLW. However, before we dig deeper into this, it is appropriate to provide some guiding principles.

# Guiding Principles

There are occasional stories about organisations that have managed to reduce their FLW by astonishing figures. In a deeper look into the measures used to reduce waste, actions such as donations or food being repurposed into new products (e.g. old bread used to make beer) are being described. Naturally, donations and a second life are better than food being thrown away; however, one might ask whether these are the best solutions. They provide rapid statistical reductions for the actors implementing them, but there is a risk that some of the food going to donations is being discarded if it has gone bad,<sup>[3]</sup> and when food is used to produce other food products, losses always occur. Moreover, the food must be transported, which has environmental impacts, especially if it is chilled or frozen. Today, it is also not possible to say how much of the food that is donated or resold is actually being consumed by humans, and there is a significant risk that some FLW is simply moved from one actor to another.

For every planned measure to reduce FLW, one should ask whether there is an even better measure. Generally, the waste hierarchy in Figure 1 should be followed.<sup>[4]</sup>

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3. A Swedish study estimated the food loss of donations to 22%. Sundin N. 2024. Sustainability of food waste prevention through food consumption. PHD thesis, Swedish University of Agricultural Sciences. Uppsala. Sweden.  
<https://pub.epsilon.slu.se/34408/1/sundin-n-20240612.pdf>
  4. V. Pasarín and T. Viinikainen. 2022. Enabling a legal environment for the prevention and reduction of food loss and waste. Food and Agriculture Organization of the United Nations.  
<https://openknowledge.fao.org/server/api/core/bitstreams/d00567a4-e47e-4814-bca7-75123709bbf2/content> (2024-08-14)



Figure: Food waste hierarchy

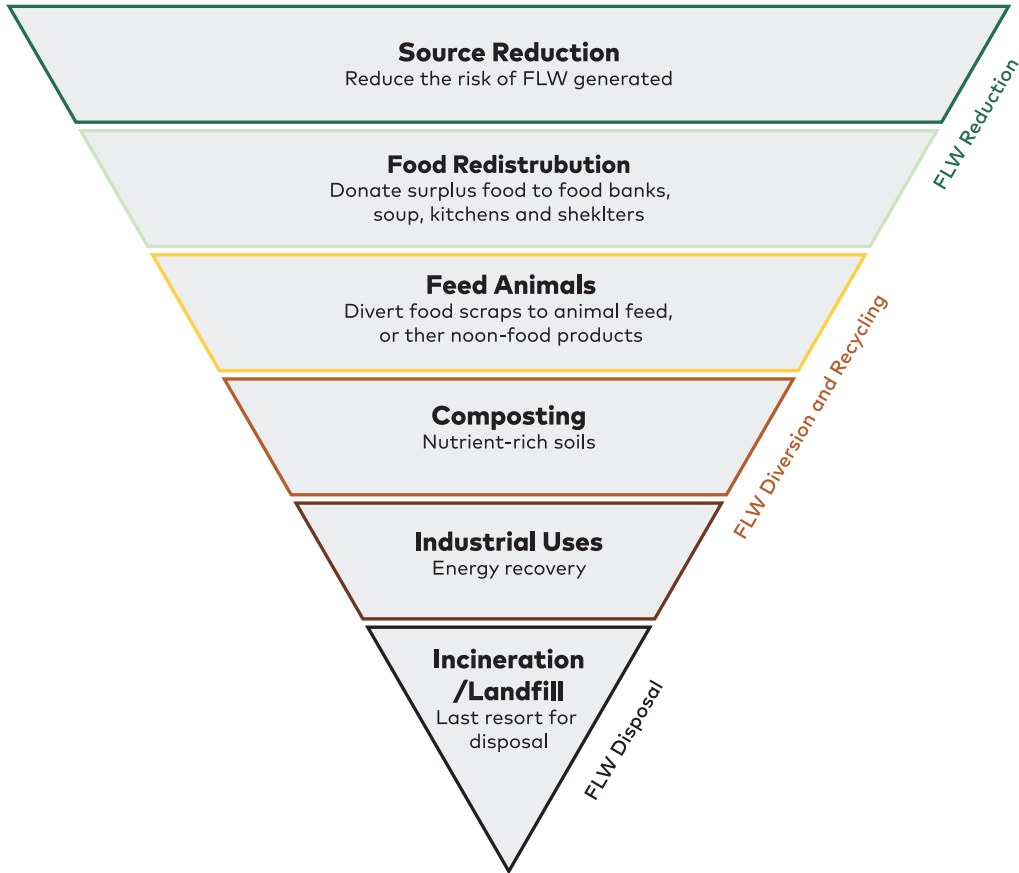


Figure 1: To reduce environmental impacts as much as possible, solutions should be sought as high up the hierarchy as possible.

According to this, measures should primarily be directed towards reducing waste where it occurs: in agriculture, the food industry, shops, and so on. For example, when there are problems with surplus bread in a shop, one should first look for measures that can reduce the surplus. The remaining surplus can, as the next best alternative, be donated, which is an important social contribution.<sup>[5]</sup> If the food cannot be donated without significant amounts being discarded, the bread can be used as raw material for new products for human consumption, such as beer (Sweden<sup>[6]</sup>), flour from crumbs (Norway<sup>[7]</sup>), and pasta

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5. F. Galli, A. Cavicchi, and G. Brunori. 2019. Food waste reduction and food poverty alleviation: a system dynamics conceptual model. *Agriculture and Human Values*, Vol. 36: 289–300. <https://doi.org/10.1007/s10460-019-09919-0>
  6. Crumbs Beer. <https://www.crumbs.beer/home-english/> (2024-06-10).
  7. Nofima, Every Minute, 200 loaves of bread are wasted in Norway. 2023. <https://nofima.com/press-release/every-minute-200-loaves-of-bread-are-wasted-in-norway-now-research-that-will-halve-that-number-begins/> (2024-06-10).

(Denmark<sup>[8]</sup>). However, there is a need for transport for both donations and raw material conversion, increasing the risk of waste and nutrient loss. Only after this will it be appropriate to use the bread as animal feed. Large amounts of bread are turned into animal feed today, which means that it is not classified as waste. Nevertheless, it is still a waste of food. Statistically, food that becomes animal feed is not always reported as waste, even if it was initially produced for human consumption.

As a last resort, the food should go towards energy production in the form of biogas or biofuel. For example, ethanol is produced from bread residues in Finland.<sup>[9]</sup> There should be waste management of food that cannot be consumed in any form by humans and animals so that the nutrients in the food can be returned to agricultural land. In biogas production, energy can be extracted, and digestate is formed, which is well suited to improving soil quality in fields, provided they have not been contaminated.

From a political standpoint, it is important to keep track of this hierarchy when considering measures. Above all, it is important that economic and legal policy instruments do not counteract the hierarchy so that it does not, for example, become economically more advantageous to provide food for biogas production than for donations or animal feed.

Finally, one should note that FLW should not only be counted in tonnes. One kilogram of meat can cause 300 times more climate impact than one kilogram of onions. This means that the climate impact is further reduced if meat waste can be reduced by 1 gram compared to if onion waste is reduced by 250 grams.<sup>[10]</sup>

Similarly, it is more important to reduce waste in later parts of the value chain because of the cumulative environmental impact. When frozen pizza lands on the plate, it would have undergone a long and environmentally impactful journey involving processing and preparation in a factory; it would have been frozen and transported in freezer trucks and freezer displays; it would have been transported home and ended up in yet another freezer before the final energy-demanding preparation in the oven. The total environmental impact of an uneaten piece of pizza is, of course, infinitely greater than if the raw materials had been discarded earlier in the value chain. This underscores the importance of prioritising measures that reduce waste among consumers and in households and various types of restaurants.

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8. The Local. 2021. Denmark to repurpose unsold bread as pasta. <https://www.thelocal.dk/20210917/denmark-to-repurpose-unsold-bread-as-pasta> (2024-06-10).
  9. Bioenergy International. 2018. Finnish Breadcrumbs to become Swedish ethanol. <https://bioenergyinternational.com/finnish-breadcrumbs-to-become-swedish-ethanol/> (2024-06-10).
  10. RISE. Öppna listan. <https://www.ri.se/sites/default/files/2024-01/RISE%20Öppna%20listan%202.2%202023.pdf> (2024-08-18)

# What Drives Food Waste?

No one wakes up in the morning with the intention of throwing away food. In fact, most people see it as morally wrong to discard food. Despite this, at least one-third of all food produced is thrown away. When a food product ends up in the rubbish bin, or at best in a biogas plant, there is often a long chain of causes behind it. In order to reduce FLW, it is important to understand the complex dynamics that cause food to be discarded and the driving forces that either enhance or hinder efforts aimed at combatting this waste. If one does not understand the complexity, the effect of the work will be limited. For example, if a measure is not economically profitable, it will likely be difficult to achieve behavioural changes through psychological interventions.

In this chapter, we account for the most common reasons why food is thrown away at a general level and present an overview of the various stages in the value chain in more detail in Chapter 7, where various measures at the actor level are also discussed.

## 4.1 Economic causes

The claim that food is too cheap can be perceived as provocative, as it appears to lack consideration for people who have difficulty making ends meet. Nevertheless, in studying people's and organisational behaviour, it is difficult to say otherwise. The economic cost of throwing away food is rarely sufficiently burdensome to motivate people or organisations to change. It should be noted, however, that many people cannot afford good food, but for most food expenditure is about one-tenth of their income.<sup>[11]</sup> If twenty percent of this is thrown away, the cost becomes one to two percent of income, a cost that is not sufficiently impactful to motivate most people when other things in life are perceived as more urgent. In the business world, it is often not perceived as economically profitable to invest in new technology and more staff working hours to reduce FLW. For the farmer, the least costly alternative may be to

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11. The World Economic Forum. 2016. Which countries spend the most on food? This map will show you. <https://www.weforum.org/agenda/2016/12/this-map-shows-how-much-each-country-spends-on-food/> (2024-02-16).

plough the surplus vegetables back into the fields. For retailers, campaigns can be profitable even if they drive up waste. Consumers can sometimes benefit from buying in bulk even if some of it spoils and must be thrown away due to lower comparative prices.

When planning measures against FLW, it is important to analyse the economic conditions, including any personnel costs for implementing changes. While some individuals lead the way for moral reasons, for measures to have broad impact, they must not constitute an economic burden for the individual actor.

## 4.2 Lack of knowledge

There are plenty of examples of economically profitable measures that are not carried out for a range of reasons. Consumers generally have low knowledge about what date labelling means and how food could be stored as appropriately as possible to extend its shelf life.<sup>[12]</sup> In retail, it can be profitable to invest in more staff time to reduce fruit and vegetable waste, but this analysis is rarely done.<sup>[13]</sup> Parallels can be drawn to work on energy efficiency, where research has identified numerous economically profitable measures in both industry and households that are not implemented for various reasons.

Often, there is a lack of knowledge about what is possible, and the incentives to gather information or explore possibilities oneself are too low. The focus may be on other factors, such as producing and selling as much as possible and having satisfied customers. Perceived stress, whether among staff or consumers, reduces the drive and energy to acquire knowledge, plan, act, and follow up.

In several areas along the food chain, there are staff on low-income jobs experiencing stressful working conditions. Often, they are not sufficiently involved in the work of reducing FLW, which can also be explained by high staff turnover. If staff have inadequate knowledge and are sometimes lacking in motivation, it can be difficult to maintain routines and development work. For organisations, it is crucial for management to show that a reduction in FLW is important and that this bears out in action.

## 4.3 Lack of cooperation between stages

The cause of waste often originates in a location or setting other than where it actually occurs. For example, consumer demand for perfect vegetables is one cause of waste in primary production; fish is sometimes thrown away in shops

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12. European Commission. 2018. Market study on date marking and other information provided on food labels and food waste prevention. Final Report. [https://food.ec.europa.eu/system/files/2018-07/fw\\_lib\\_srp\\_date-marking.pdf](https://food.ec.europa.eu/system/files/2018-07/fw_lib_srp_date-marking.pdf) (2024-06-13).
  13. L. Mattsson and H. Williams. 2022. Avoidance of Supermarket Food Waste—Employees' Perspective on Causes and Measures to Reduce Fruit and Vegetables Waste. *Sustainability*, Vol. 14: 10031. <https://doi.org/10.3390/su141610031>

because of inadequate cooling during the wholesale stage; FLW in elderly care or schools can be due to the kitchen cooking too much food, which can be due to them not receiving sufficient need-related information. The school kitchen may, for example, be unaware that there is unusually high sick leave, thus leading to excess cooking. It can also be difficult to implement measures where the actor who suffers economically from FLW does not have the authority to influence the actor who could take measures.

Lack of cooperation between actors in the value chain can have many causes. Commonly, actors do not want to share data with other actors in the chain. This complicates planning in the network, wherein actors may suddenly find themselves with an amount of perishables that far exceeds demand. Furthermore, there is often a lack of standardised systems for data sharing, even when there is a will to share.

In several cases, there are so-called take-back agreements, where an actor can return goods at no cost to previous stages. In some cases, a producer rents shelves in a shop, chooses the assortment offered, and clears out products that do not sell from the shelves. This is a common practice in the bread market in Sweden. Leftover bread can be turned into animal feed or raw material for other food production. However, it would be better if the shops could sell the bread on site at a reduced price.

There are also agreements between parties that make it difficult to take measures against FLW, such as prohibiting an actor from reselling food to parties other than what was agreed. <sup>[14]</sup>

## 4.4 The view on packaging

The purpose of packaging is primarily to protect food during its journey from producer to consumer. Within the value chain, there is awareness of the importance of packaging as well as constant work towards developing better packaging. Packaging in today's context generally protects food much better than in the past while reducing the environmental impact, although exceptions do exist.

The dream of the packaging-free shop and packaging legislation, however, bears witness to the fact that for consumers, environmental organisations and legislative assemblies, it is the environmental impact of the packaging that is usually in focus. Its protective functions are often forgotten or taken for granted. In concrete terms, this means that the consumer does not consider which packages minimise FLW at home. It also means that laws are introduced

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14. Report from matsvinnsutvalget. 2023. Anbefalningar till helhetlige tiltak og vikemidler. <https://www.regjeringen.no/contentassets/5a5cadf8907a4f4c94740d23d7c4c6e4/rapport-frac-matsvinnutvalget-anbefalinger-til-helhetlige-tiltak-og-virkemidler-31.12.23.pdf> (2024-06-14). In some cases, the types of agreements above arise due to power imbalances between actors. A strong actor can force through agreements because others feel that they have no option to say no.

that increase FLW, such as bans on plastic-wrapped vegetables.

From an environmental point of view, the environmental impact of packaging should be balanced against the environmental impact of the FLW that it seeks to prevent, and it is important to acknowledge that packaging protects food from breaking down and going bad. Other packaging functions are not as noticeable but also have a significant impact on how much is thrown away in households. The two most important are quantity and communication relating to date labelling. The packaging should contain the right amount so that the contents can be consumed before the food goes bad or the "expiry" date. When the package is opened, much of its protection disappears, causing it to age faster. If the consumer buys too large a quantity, either because there are no packages with smaller quantities or because comparative prices entice larger package sizes, the risk of waste increases. In a pioneering study, the share of food waste in households due to packaging was calculated to be around 50%.<sup>[15]</sup> There is major potential to reduce FLW if the role of packaging is made clearer.

## 4.5 Regulations as barriers

There are numerous laws and regulations in agriculture, food safety, and waste management, most of which have usually been introduced without analysing the consequences for FLW. Some examples are as follows:<sup>[16]</sup>

- The design of agricultural support means that there may be a surplus of certain products in the market and that there is a high risk that some of this surplus will be thrown away.
- EU standards regarding the appearance of fruit and vegetables mean that a great deal of harvest does not reach consumers.
- EU food safety regulations mean that producers, shops, etc. often throw away a batch of products rather than donate it in order to avoid being held responsible if any product should cause illness.
- EU import controls can sometimes cause delays lasting several days, thereby shortening the shelf life of perishables in the market.
- In the fishing industry, by-catches are thrown away due to the design of regulations. Fish that do not meet requirements, for example, regarding size are released, but it is uncertain how large a proportion survive.
- To achieve good food safety, the handling of food is carefully regulated.

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15. H. Williams, J. Trischler, F. Wikström, and Z. Rowe. 2020. Avoiding Food Becoming Waste in Households – The role of packaging in consumers' practices across different food categories. *Journal of Cleaner Production*, Vol. 265.

16. Examples from H. Bos-Brouwers, M. Kok MSc, J. Snels, and A. van der Sluis. 2020. Changing the rules of the game. Impact and feasibility of policy and regulatory measures on the prevention. <https://edepot.wur.nl/529888>. This report analyses barriers from the perspective of the Netherlands.

While safety should never be compromised, it appears that because of regulations, and the interpretation of them, unnecessarily large margins are affected, leading to wastage of food that is safe to eat.

- Rules and tax rates aimed at stimulating bioenergy production from FLW can sometimes counteract food being used as animal feed.
- In some countries, VAT is charged on donated food, and sometimes, there is uncertainty around what applies. This can lead to food being thrown away instead of being donated. Uncertainty around responsibility for food safety relating to donated food also leads to food being thrown away unnecessarily.

To our knowledge, no studies have quantified how much FLW arises due to the design of regulations, even though it is likely to account for significant amounts.

# The Art of Measuring and Evaluating

The most important question to ask before embarking on a measure is what the measurement data will be used for. While this sounds trivial, in today's society, vast amounts of data are measured without any thought as to how they will be used. This also means that substantial resources are spent on something that does not generate significant benefit.

## 5.1 Why measure?

We can exemplify the need to measure by the example of waste in households. Through so-called pick analysis studies, where household food waste is sorted, one can get a good picture of how much is thrown away (except for liquid waste), including the most common categories of food. If the goal is to know how much is thrown away, this is a good measurement method, albeit resource-intensive. Nevertheless, if the goal is to understand which measures can reduce FLW, then not much information is provided – we only know what was thrown away, not why. Moreover, pick analysis studies provide aggregate values for residential areas. However, how much and what is thrown away varies greatly between households. This means that there is a need for a range of measures. In summary, measurements of aggregate quantities provide a poor basis for designing effective measures.

To get a good basis for designing measures, more fine-grained information is needed, especially about why food is thrown away. Behind every piece of food that is thrown away is an individual decision. This decision can be traced to everything from attitudes to legislation, often in combination with different factors. If much of the focus of measurements so far has been about defining and quantifying the amount of FLW (which remains unfinished), more measurement and evaluation are now needed to understand why individuals throw away food. What makes the stressed mother of young children repeatedly find mouldy food in the refrigerator; what makes the shop employee throw away food in the store; what makes the machine operator in the food industry have to throw away parts of the production? All these decisions depend not only on attitudes and knowledge but also on conditions in the systems around individuals. What conditions govern decisions, and how can the conditions be changed? An understanding around the conditions governing decisions will enable much better opportunities to design effective measures.



In summary, to design effective measures to reduce FLW, more detailed information is needed about what is thrown away and why.

## 5.2 What is thrown away – and how much?

The definition of what constitutes FLW has varied over time and between organisations, and there is still no consensus on the concept. Within the UN, the responsibility for food loss has been divided between the FAO, which is responsible for food waste up to trade, while UNEP is responsible for food waste from trade and later on in the value chain. The reason for the division seems primarily to have been to adapt the concepts to the ways in which each organisation measures FLW.

The EU's definition of food waste has also evolved,<sup>[17]</sup> and it is this that the Nordic countries have to relate to in their reporting. However, there are possibilities for interpretation, and in some cases, there is every reason to include areas in food waste work that are not included in the EU definition. For example, only food that is thrown away after harvest or slaughter is included in the definition. This means that fully edible carrots that are ploughed back into the fields for economic reasons are not reported as food waste nor are animals that die during transport to slaughter or old laying hens that are culled and thereafter destroyed.

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17. Guidance on reporting of data on food waste and food waste prevention according to Commission Implementing Decision (EU) 2019/2000.  
<https://ec.europa.eu/eurostat/documents/342366/351811/Guidance+on+food+waste+reporting/5581b0a2-b09e-adc0-4e0a-b20062dfe564> (2024-08-14)

			Food loss (FAO)	Food waste (FAO)	Households
Primary production	Food industry	Wholesaler		Grocery store	
Pre harvest/ Pre slaughter losses					Restaurants/Public kitchens
Unharvested crops and animals dying on farm					
<b>Food losses</b>					
Food or by-products that become fodder, left in the field or for the grower's own biogas plant					
<i>Food Waste (EU)</i>					
Food that has become waste (normally goes to a waste facility) according to EU 2008/98					

Figure 2: Concepts and definitions of food waste: food loss and waste from the FAO and EU. <sup>[18]</sup>

18. The Swedish board of agriculture. 2024. Slutrapport om livsmedelsförluster. Resultat och åtgärder för att mer ska bli mat. [https://www2.jordbruksverket.se/download/18.23e68dd418d7c649d1713a30/1707493705544/ra24\\_1.pdf](https://www2.jordbruksverket.se/download/18.23e68dd418d7c649d1713a30/1707493705544/ra24_1.pdf) (2024-08-14)

Furthermore, there is also food that while produced for human consumption is used for animal feed. Here, there is variation in terms of whether or not these food flows are included in calculations of FLW. It also varies whether only the edible part of the food is included in the statistics or whether inedible parts are also included. In addition, there are varying views on what is edible and what is not.

Consequently, there is a need to develop common definitions of what should be measured to get a better quantitative picture of what and how much is thrown away. Extensive work has been done in various Nordic countries. Since 2018, Luke in Finland has been working on this issue.<sup>[19]</sup> Likewise, Norsus and Matvett in Norway have worked systematically to produce statistics and good ways of measuring that can map and compare FLW for different actors over time. Reports highlight difficulties around this undertaking and that many external factors and actors play a role.<sup>[20]</sup> For example, the pandemic shifted consumption, where more people cooked and ate food at home than normal. In addition, the EU and Eurostat have published guidelines on how food waste should be measured and followed up for increased comparability between countries.<sup>[21]</sup> This work could be better coordinated between the Nordic countries to avoid duplication and produce more comparable data.<sup>[22]</sup> At the same time, a lack of quantitative information is not the biggest obstacle to designing and implementing effective measures to reduce FLW. Above all, more knowledge is needed about why food is thrown away (and the courage to take on board the implications of the knowledge).

## 5.3 How to understand why food is thrown away

As mentioned in the previous chapter, there are many reasons why food is thrown away. Later chapters will describe in more detail the causes within the different stages. There is a great deal of knowledge about why food is thrown away, but it is an area that currently needs to be explored to a much greater extent. However, it is not an entirely simple area; it is also interdisciplinary, since knowledge in everything from behavioural science to economics and legislation may be needed, and partly because it is about one of the most difficult phenomena to study – what happens in the human brain.

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19. Luke. <https://projects.luke.fi/ruokahavikkiseuranta/> (2024-08-14)

20. A. Stensgård, K. Prestrud, P. Callewaert, and G. Booto. 2021. Sektorrapport for matbransjen, offentlig sektor og husholdningsleddet. ISBN 978-82-7520-873-4. <https://norsus.no/wp-content/uploads/OR.36.21-Sektorrapport-for-matbransjen-offentlig-sektor-og-husholdningsleddet.pdf?v=1>

21. Eur-Lex. Decision 2019/1597. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019D1597> (2024-08-14)

22. Nordic Council of Ministers. 2021. Monitoring Food Waste and Loss in the Nordic Region. Definitions, methods and measures for prevention. <https://pub.norden.org/temanord2021-504/>

To understand why individuals decide the way they do, we need to follow their behaviour and interpret it alongside interview data. There are many difficulties in obtaining accurate data. First, individuals need to agree to participate. An important aspect is the significant bias owing to the probability of overrepresentation of engaged individuals.<sup>[23]</sup> Those who do not care about FLW rarely participate. Second, most people are influenced by their participation in a study (e.g. people want to behave in ways they perceive to be correct), and few people believe that it is okay to throw away food. Both interview responses and behaviour are influenced in an undesirable way. In a diary study, it was observed that respondents threw away more food at the end of the week, as they had become aware of their behaviour.<sup>[24]</sup> Third, respondents may be unaware of the real reason why they throw away food. For example, the reason for throwing out sour milk from the refrigerator could be that the package was too large for the household's needs, but the respondent might think that the cause is their own behaviour, that is, that they bought too much.

Similarly, it can be difficult to trace why the shop employee throws away food. Is it because the central management of the business chain is pushing for campaigns? Could it be a poor work environment that generates high staff turnover and low engagement? Is there a lack of commitment from the shop owner/manager on the issue? Answering these questions requires respondents who want to offer their time to provide answers, which in turn requires trust that the answers will not affect them negatively. One can assume that in most cases those who participate have their own commitment to the FLW issue, which can bias the results. However, it is the best that can be achieved – we simply have to be aware that the results will not be representative of the whole.

To really understand the causes of FLW in depth, we recommend more studies where researchers participate in daily operations and can observe and ask individuals about the reasons for their behaviours. This closeness would facilitate insights that cannot be uncovered in other types of studies.

Before measures are implemented, the causes of FLW should be mapped. If FLW can be traced to the fact that it is the lowest economic cost to throw away food compared to other measures, then the measures need to be directed towards changing the economic incentives rather than influencing attitudes and behaviours. The better the knowledge of the causes, the greater the chance of designing effective measures.

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23. V. Amicarelli and C. Bux. 2021. Food waste measurement toward a fair, healthy and environmental-friendly food system: a critical review. This study critically reviews food waste measurements, focusing on the stages from agricultural production to retail, including Sweden among other countries.

24. H. Williams, J. Trischler, F. Wikström, and Z. Rowe. 2020. Avoiding Food Becoming Waste in Households – The role of packaging in consumers' practices across different food categories. *Journal of Cleaner Production*, Vol. 265.

## 5.4 Measuring the effectiveness of measures

A great deal of measures is being taken to reduce FLW, but very rarely are they evaluated in a way that allows one to assess their effectiveness. During the work on this report, we sought to identify measures implemented in the Nordic countries, where the effects thereof on FLW have been evaluated in order to find good examples. Unfortunately, it was difficult to find such examples. Whether this was because of a lack of evaluations or because they have not been documented, we do not yet have the answers. It can also be difficult to determine whether the figures highlighted are due to FLW being moved to another actor. For example, if the reduction is mainly due to food being donated instead of thrown away and there is no follow-up on how much of the donated food is thrown away after all, the effectiveness of the measure would remain unclear. Food that becomes raw material for new products reduces waste, but as mentioned earlier, this alternative is considerably worse from an environmental point of view than measures geared towards human consumption directly.

A number of variables can be evaluated.<sup>[25]</sup> We highlight a couple below:

**Efficiency:** how change was achieved per resource invested. Change can be measured in the amount of reduced FLW, changed attitudes, reduced environmental impact, social effects or whatever was the goal of the measure. Invested resources can be economic investments in time, technical equipment, the environmental impact of invested resources, etc.

**Sustainability over time:** the result of a measure can be limited over time. For example, informing students about the environmental consequences of FLW can lead to reduced waste. With time, the effects fade, and new students who have not received the information start school. Similarly, staff training efforts can fizzle out over time with high staff turnover.

To evaluate measures and increase learning about effectiveness, more time often needs to be spent in the planning phase. What is to be achieved? Is more knowledge needed about the causes of waste? How should the measures be evaluated?

More well-planned and evaluated measures are needed to sift through effective measures. Here, authorities and public operations have an important responsibility. Better documentation is also needed to spread information about experiences and increase learning.

With this said, measurement requirements should not be increased ad absurdum. The requirements to measure and report generally unnecessarily burden many operations. For example, the Stockholm region has been criticised

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25. C. Patinha Caldeira, V. De Laurentiis, and S. Sala. 2019. Assessment of food waste prevention actions, EUR 29901 EN, Publications Office of the European Union, Luxembourg.

for forcing nurses to measure FLW instead of spending time on patient care.<sup>[26]</sup>  
The article, written by a nurse, testifies to the importance of measures being perceived as meaningful by those affected. There needs to be a balance between targeted and well-thought-out initiatives for systematic learning as well as more free initiatives where one can work their way forward in accordance to their specific context and situation.

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26. H. Kjöllér: Ska undersköterskor leverera underlag till powerpoint – eller vård? Ledare i Dagens Nyheter 2023-05-15. Sverige. <https://id.bonniernews.se/login?returnUri=https%3A%2F%2Fwww.dn.se%2Fledare%2Fhanne-kjoller-ska-underskoterskor-leverera-underlag-till-powerpoint-eller-varld%2F> (2024-06-10)

# What Can Authorities and Public Decision-makers Do?

To date, many of the measures taken against FLW in the Nordic countries has relied on voluntary agreements. These witnesses the importance of collaboration among various actors, while also showcasing challenges associated to different procedures, logics and objectives. To increase the degree of collaboration in the Nordic countries, authorities and public decision-makers have an important role to fill. In this chapter, we account for measures that the authorities can take to reduce FLW in the overall system.

## 6.1 Background

The measures taken to reduce FLW have largely relied on voluntary agreements. One example is the Norwegian Bransjeavtale om reduksjon av matsvinn, in which actors in a value chain commit to reducing FLW and are given the opportunity to deepen their knowledge about how waste can be reduced throughout the chain. This is made possible because the Bransjeavtalen provides opportunities for actors within a value chain to meet and understand how one actor affects the food waste of other actors, thereby enabling them to jointly find solutions that benefit all actors in the value chain. Several Nordic countries have followed suit and introduced variants of voluntary industry agreements.<sup>[27]</sup>

The use of voluntary agreements should continue and be further developed, not least through cross-border collaborations. However, the slow reduction in FLW over the last decade suggests that stronger economic and legal instruments are also required. Several countries have taken such measures, as evidenced by the range of policy proposals.

The Nordic countries can benefit tremendously from coordinating their work on economic and, above all, legal instruments so that companies do not incur unnecessary costs. There is potential for innovation if companies within the Nordic countries can operate smoothly with the same concepts. We would like to emphasise that economic and legal instruments are not in opposition to innovation and new thinking. On the contrary, the increased economic value of

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27. In Norway, this is coordinated by Matvett: <https://www.matvett.no/bransje>; in Sweden by IVL: <https://www.ivl.et>; and in Denmark by OneThird: <https://onethird.dk>

food and restrictions on throwing away food can give rise to new innovations or simply increase the incentives to review and streamline processes. A key factor in reducing food waste is the development of cooperation between different actors; as such, the increased value of food and restrictions on throwing away food can increase incentives for new collaborations. However, it is important that regulations do not unnecessarily hinder innovations, as is the case today. To further stimulate innovations that reduce food waste, controlled experimental environments, known as "sandboxes," could be introduced. In these sandboxes, different actors in the supply chain could safely and non-competitively share data and test new ideas aimed at reducing food waste.<sup>[28]</sup>

In December 2023, the Norwegian Matvinnutvalget published the report "Rapport fra matsvinnutvalget - Anbefalinger til helhetlige tiltak og virkemidler",<sup>[29]</sup> which provides a comprehensive overview of possible measures, including detailed descriptions and analyses of various measures, and a legal impact analysis. The report is highly recommended. Some of the proposals presented below originate from it, together with examples from other Nordic countries and our own proposals.

Generally, measures with a limited administrative burden for actors are advocated first. Regulations on campaigns, date labelling, and increased food VAT require significantly fewer administrative resources from actors than, for example, documentation obligations. However, we have chosen to highlight a palette of measures as inspiration. The measures deemed most effective are found in Section 1, Recommendations.

We are well aware that some of the proposals are politically sensitive. However, our assessment is that given the effects of current measures, more radical proposals will be required in order to come close to the goal of halving food waste by 2030. This is especially true for household food waste, where substantial reductions in waste are needed to reach the goal. Politicians will face a choice – to implement sensitive reforms or abandon the goal of halving food waste.

## 6.2 Policies for reduced food waste

One of the most common reasons for food waste in households is that the "date has expired". There is a widespread perception that "best before" means that the food is not safe to eat thereafter. This perception is reinforced by the fact that retailers do not sell goods after the "best before" date, despite the fact that the food is safe for consumption. Despite numerous attempts by both

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28. Deloitte Insights. 2023. <https://www2.deloitte.com/xe/en/insights/industry/public-sector/government-trends/2023/regulatory-agencies-and-innovation.html> (2024-06-14).

29. Report from matsvinnutvalget. 2023. Anbefalinger till helhetlige tiltak og virkemidler. <https://www.regjeringen.no/contentassets/5a5cadf8907a4f4c94740d23d7c4c6e4/rapport-fra-matsvinnutvalget-anbefalinger-til-helhetlige-tiltak-og-virkemidler-31.12.23.pdf> (2024-06-14).



authorities and companies to communicate to households that in the majority of cases, food is edible despite a past “best before” date, the perception persists. To reduce food being thrown away unnecessarily due to this misconception, we propose the following measures:

- A review of how standards for date labelling should be designed. Today, “best before” dates are set relatively arbitrarily by producers, often with a good margin, as they want to ensure that the product will be of good quality up to the date even under inadequate storage conditions.
- Extensive information campaigns about the meaning of date labelling. Can shops be given greater responsibility for information dissemination? This could also be done in a joint commitment within the retail sector.
- Packaging should inform consumers how to determine whether the food is safe to eat, at least through a QR code on the packaging.
- That retailers sell products after the best before date has passed (see below).
- An investigation into the possibility of freezing goods marked with “use by” dates in order to extend the time before the food can be donated.

#### ***Requirements for reduced prices for goods with “short” dates***

We propose requirements for shops to reduce the price of goods with short dates. Most of the waste in shops should be avoidable if the reduction is large enough. The requirements for a price reduction should not be quantified, as conditions differ between products and shops. With engaged staff who have the mandate to lower prices, the reduction should be able to be adjusted so that it is sufficient to avoid waste. Retailers should, while maintaining food safety, be able to sell goods after the “best before” date has passed. This would send a strong signal that the food is safe to eat after the date has passed. If consumers were confident that the goods were safe to eat, these goods would be attractive at a significantly reduced price. We believe that such a measure would be the most effective way to reach out with knowledge about the meaning of date labelling to consumers, preferably in combination with information campaigns. COOP Norway, for example, has taken measures in relation to this and gives a 70% discount on goods that have passed their best before date.<sup>[30]</sup> We assess that this is a potentially effective measure to reduce waste both in shops and with consumers. This measure can also have positive social effects in enabling the purchase of quality products at a lower price.

#### ***Include the packaging aspect in food waste work***

As mentioned in Section 4.4, packaging design has a significant impact on the amount of FLW. There is great potential to reduce food waste (not the least in

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30. European Supermarket magazine. 2024. Coop Norway To Sell Products Past Best Before Date At 70% Discount. <https://www.esmmagazine.com/retail/coop-norway-to-sell-products-past-best-before-date-at-70-discount-256581> (2024-08-14)

households) where packaging design can have a significant impact. We therefore propose that the role of packaging in reducing FLW is included more clearly in packaging legislation; packaging should be designed to minimise the total environmental impact of the packaged food, where food waste is included in calculations. Furthermore, the communicative role of packaging regarding messages indicating when food is safe to eat should be included in the work of spreading knowledge about date labelling. The packaging is an excellent messenger of information on how the specific product should be stored and how to determine if it is safe to eat. Communication can take place via text if space or a QR code is available. Finally, information on choosing the right packaging size should be included in the communication about FLW to households, with data on how the economy and environment are affected by it.

### ***Regulation of campaigns***

One of the main causes of FLW in households is simply that consumers, for various reasons, buy more food than they need. One explanation has to do with campaigns aimed at encouraging additional purchases.<sup>[31]</sup> Campaigns cause more waste in shops (see Section 7.4) and most likely in relation to consumers, although there is no scientific evidence of this. However, it is very difficult to conduct studies that can provide good evidence on this issue<sup>[32]</sup> (see Chapter 4), which is why we believe that measures to regulate campaigns can be implemented according to the precautionary principle. Since campaigns are used by shops to increase sales and attract and satisfy customers, it is difficult for individual retail chains to implement such measures. Thus, there is a need for either legislation or industry agreements. Most importantly, it is proposed that campaigns that provide quantity discounts of the type "buy three for the price of two" and "reduced price when you buy 2" cease. In addition, centrally planned campaigns on fresh goods with reduced prices should be avoided entirely, except for large batches of fresh goods that need to be sold before they spoil.

### ***Increased VAT on food***

Swedish statistics show that there has been a reduction in FLW in recent years,<sup>[33]</sup> as food prices have risen. The more expensive food is, the less waste is generated. Low VAT on food is motivated by social considerations, as everyone should be able to eat good and nutritious food. However, it is a costly measure for the state treasury, with imprecise targeting; food is subsidised for everyone, even high-income earners' *entrecôte* purchases. The Swedish National Audit

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31. Gravert, C., Gunnarsson, E., Järneteg, A., Leandersson, C. 2021. Can interventions in supermarkets reduce household food waste? Livsmedelsverkets externa rapportserie. Livsmedelsverket, Uppsala.
  32. Tsalis, G., Boutrup Jensen, B., and Aschemann-Witzel, J. 2024. The relationship between retail price promotions and household-level food waste: Busting the myth with behavioural data? *Waste Management*, Vol.173: 29-39. [doi:https://doi.org/10.1016/j.wasman.2023.10.032](https://doi.org/10.1016/j.wasman.2023.10.032)
  33. The Swedish Environmental Protection Agency. 2024. Livsmedelsavfall I Sverige 2022. ISBN 978-91-620-8908-5. <https://www.naturvardsverket.se/49501f/globalassets/media/publikationer-pdf/8900/978-91-620-8908-5.pdf>

Office investigated the issue and found that reduced VAT on food has a lower cost-effectiveness compared to other forms of support.<sup>[34]</sup> Increasing the VAT on food brings in many billions that can be used for more targeted support, such as increased child benefits and pensions. We also propose the exemption of fruits and vegetables from the increase. This would overall support the The Nordic Nutrition Recommendations (NNR2023) calling for a reduced meat and sugar intake.<sup>[35]</sup> Our proposal is that the issue of increased VAT on food is among the measures aimed at reducing food waste and that previous investigations on this issue are reviewed in order to identify appropriate compensatory support for vulnerable groups. Considering the extent to which such a restructuring could improve the situation of socially vulnerable people, such a reform should be able to gain acceptance if it is explained in a manner that is accessible and compensatory support reaches the target groups before the VAT increase.

### ***A Nordic Day for Measuring Food Waste***

Measuring FLW has proven to be one of the most effective measures to bring about behavioural change.<sup>[36]</sup> We propose that in connection with the International Day of Awareness of Food Loss and Waste, there should be campaigns where all citizens are encouraged to measure their waste for one day and report on an appropriate web portal. This should generate a great deal of media attention, in addition to the impact on those who measure.

### ***Regulation of "take-back agreements"***

The practice of entering into agreements where the shop can return goods to the producer at no cost should be regulated. In Finland, a ban on such agreements has been introduced,<sup>[37],[38]</sup> which requires further investigation, where the effects of such a ban are also evaluated.

The possibility of producers "renting" shelves in shops should also be investigated. In these cases, the shop has no opportunity to work with measures to reduce waste, such as limiting the range or lowering prices before the goods are sorted out. This creates difficulties regarding ownership of the work against food waste and should be understood in relation to the work of the various

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34. Riksrevisionens granskningsrapport 2018:25. Sveriges Riksdag. [https://www.riksdagen.se/sv/dokument-och-lagar/dokument/riksrevisionens-granskningsrapport/nedsatt-moms-pa-livsmedel---priseffekt\\_H6B525/html/](https://www.riksdagen.se/sv/dokument-och-lagar/dokument/riksrevisionens-granskningsrapport/nedsatt-moms-pa-livsmedel---priseffekt_H6B525/html/) (2024-06-05)
35. Nordic Council of Ministers. 2023. Nordic Nutrition Recommendations 2023-Integrating Environmental Aspects. 2023:003.
36. G. J. Ramos, J.A.R. Borges, C. H. de Faria Domingues, and E. van Herpen. 2024. Reducing food waste by simply measuring it: insights from interventions to reduce household food waste. *British Food Journal*, Vol. 126, No. 2: 812-833. <https://doi.org/10.1108/BFJ-02-2023-0092>
37. A. Stensgård. 2023. Measures for prevention and reduction of food waste Europe. Norsus. Norway. ISBN 978-82-7520-919-9
38. Personal communication with Inkeri Riipi (2024-02-06)

actors involved.

### ***Donation obligation***

Finland introduced a donation obligation, which means that food operators must donate surplus food so long as it can be done without compromising food safety and must do so at a reasonable cost. In Norway, similar measures are being investigated in the form of a "food waste law" and "due diligence assessment".<sup>[39]</sup> We propose the leveraging of Finnish experiences and an evaluation of whether it is an effective measure and how regulations can be developed. Another possibility is a ban on throwing away food where a reasonable level of food waste is determined by best practices in the area. A pilot study showed that food waste in public large-scale kitchens would decrease by 76% if best practices became the norm.<sup>[40]</sup>

### ***Documentation obligation***

A further example of legislation is the documentation obligation introduced in Finland.<sup>[41],[42]</sup> It means that restaurants, retail, and the food industry must be able to report to supervisory authorities the amount of waste, the composition of the waste, and the treatment of the waste. There are several advantages to this documentation obligation; for example, actors can become more aware of their FLW and be motivated to reduce it. Measuring FLW is in itself a measure that has shown good waste reduction effects. However, it is important to also consider that it is labour-intensive if all operations are to measure and account for the composition of food waste (see Section 5.4). To the best of our knowledge, evaluations of the effectiveness of this measure are lacking. We recommend an evaluation of the Finnish experiences in this regard. Perhaps documentation obligation should be introduced selectively to certain operations that handle large volumes? The level of detail in the reporting also has a significant impact on the work effort.

### ***Development of standards and regulations for data sharing***

For several companies, internal data sharing has led to a reduction in FLW by considerable amounts. Similar data sharing between actors in the value chain would likely also yield good results. Several reports have called for enhanced data sharing, but we have not seen any work on how this could be implemented or how such data sharing could be standardised. Many actors have testified to

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39. Report from matsvinnsutvalget. 2023. Anbefalningar till helhetlige tiltak og vikemidler. <https://www.regjeringen.no/contentassets/5a5cadf8907a4f4c94740d23d7c4c6e4/rappport-fra-matsvinnutvalget-anbefalinger-til-helhetlige-tiltak-og-virkemidler-31.12.23.pdf> (2024-06-14).

40. M. Eriksson, J. Christenson and C. Malefors. 2022. Making food waste illegal in Sweden – Potential gains from enforcing best practice in the public catering sector. *Sustainable Production and Consumption*, Vol. 35: 229–237. <https://pub.epsilon.slu.se/29755/1/eriksson-m-et-al-20221123.pdf>

41. A. Stensgård. 2023. Measures for prevention and reduction of food waste Europe. Norsus. Norway. ISBN 978-82-7520-919-9

42. Personal communication with Inkeri Riipi (2024-02-06)

the difficulties of sharing data in the value chain for technical and strategic and legal reasons. The question, therefore, is whether voluntariness within “industry agreements” and similar agreements is sufficient or whether binding legislation is needed. We propose that this issue should be investigated separately a common Nordic standard could have a major impact on the waste of fresh goods in the value chain.

### ***Ban on throwing away food in its packaging***

In 2022, there was a proposal in Norway specifying that packaging needed to be emptied of its contents before it could be placed in the waste.<sup>[43]</sup> The proposal was criticised and previous practice remained in place, which means that some packaged food waste is source-sorted in shops (e.g. fruit and bread), while others that are more difficult to source-sort (e.g. yogurt containers and salad mix) could be sent on and sorted at a recycling facility. In Denmark, shops do not need to empty the packaging of its contents before it is thrown away.<sup>[44]</sup> A ban on throwing away food in its packaging came into effect for shops in Sweden on 1 January 2024.<sup>[45]</sup> Such a proposal would greatly increase incentives for shops to reduce food waste through price reductions and donations; however, it needs to be evaluated.

### ***More resources to lead the work***

In general terms, the authorities have allocated too few resources towards the work of reducing FLW based on the complexity of the task. There are many actors who need to be influenced and made to cooperate. We propose that the Nordic countries use the British Waste and Resources Action Programme (WRAP<sup>[46]</sup>) as a role model and allocate resources and a mandate. WRAP has presented completely different opportunities to engage in serious work on the issue, with a significantly larger and more long-term budget. More resources would also enable national bodies to have sufficient time to exchange experiences and coordinate with other Nordic countries. In the interviews, it emerged that such exchange was desirable; however, there was not enough time to engage in such activities.

### ***Review of rules that hinder good measures***

As mentioned in Section 4.4, laws and regulations make it difficult or impossible for many measures to reduce FLW, as they are in direct opposition to initiatives aimed at reducing FLW. One reason is that rules relating to food safety, standards of appearance, etc. did not take the issue of waste into account

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43. Norska Miljødirektoratet. 2023.

<https://www.miljodirektoratet.no/aktuelt/fagmeldinger/2023/desember-2023/anbefaler-endrede-krav-til-emballert-matavfall/> (2024-08-14)

44. Kosmopol. 2023. <https://www.tv2kosmopol.dk/spoerg-os/her-er-forklaringen-derfor-maa-supermarkeder-smide-emballage-og-bioaffald-i-samme-container> (2024-08-14)

45. Svensk Författningssamling SFS 2022/614. Förordning om ändring i avfallsförordningen 2020:1307.

46. WRAP. <https://www.wrap.ngo> (2024-08-13)

during the design stage. We propose an investigation and compilation of legal obstacles to measures addressing FLW. This would include both the regulatory framework within the EU and national rules. In particular, national legislation should be identified and, if possible, promptly adjusted. An urgent area is to remove obstacles to donations, both in terms of economics (VAT) and responsibility for food safety.<sup>[47]</sup>

Thus, an investigation of the regulatory framework of the EU should be able to be done jointly through Nordic cooperation, and work should be carried out jointly for justified changes. Routines should also be developed so that the FLW issue is integrated when regulations for food safety and other standards are updated.

## Case: **Format**

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*Format is a Norwegian government initiative that establishes agreements of intent with actors in the food industry to reduce FLW. This agreement focuses on improved methods and collaborations throughout the food chain. It requires companies to report their FLW annually and implement reduction measures. It has been successful in many stages of the food chain; however, it has proven difficult to engage households to reduce FLW at the consumer level.*

The main goal of the *bransjeavtalen* (industry agreement) is to halve FLW in Norway by 2030, with interim goals of a 15% reduction by 2020 and 30% by 2025. The agreement covers the entire value chain from producers to consumers and focuses on reducing FLW through improved methods and collaborations. An important part of the strategy is that all affiliated companies must report their FLW annually and implement measures to reduce it.

Despite significant efforts, the 2020 report showed that the goal of a 15% reduction in FLW was only partly achieved, as the figure was approximately 10% between 2015 and 2020. This indicates the need for additional efforts to achieve the overall goal of a 50% reduction by 2030. One of the major challenges is getting households to reduce their FLW. Household FLW constitutes a significant portion of total FLW, and despite campaigns and initiatives, reduction in this area has lagged. Another challenge is ensuring that FLW is not simply moved from one stage in the value chain to another and that waste is effectively reduced at each step of the chain.

To strengthen the *bransjeavtalen*, the introduction of *aktsomhetsvurderinger* (due diligence assessments) was proposed to ensure that each actor in the value chain takes responsibility for its contribution towards FLW and implements

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47. One/Third. 2022 Anbefalinger til Regeringen 2022. <https://onethird.dk/wp-content/uploads/2022/12/ONETHIRD-Anbefalinger-2022.pdf> (2024-08-14)

effective measures. Furthermore, the need for increased cooperation and exchange of experiences between different sectors and actors was emphasised as a way of achieving the goals. To further reduce FLW, the authorities plan to include the public sector into the industry agreement, which would mean that municipalities and other public institutions would also commit to following the agreement and reporting their FLW.

The industry agreement on the reduction of FLW in Norway represents a comprehensive and ambitious initiative to halve FLW by 2030. Despite progress, significant challenges remain, especially in terms of engaging households and ensuring effective measures throughout the value chain. Through continued cooperation and the introduction of stricter rules, Norway hopes to achieve its goals and contribute towards global food security and environmental protection.

### References:

Matsvinnsutvalget. 2023. Anbefalinger til helhetlige tiltak og virkemidler.  
[Read more](#) (2024-08-14)

# What Can Different Actors in the Value Chain Do?

As mentioned in Chapter 4, there are many reasons why food is discarded. In this chapter, we examine more specific causes of FLW among the various actors in the value chain and what they themselves can do to reduce it. Some measures are relatively easy to implement, whilst others realistically require support from policy change, as outlined in the previous chapter.

Some aspects are common to all actors. Management commitment is fundamental. An engaged management shows that they prioritise the issue; they can drive initiatives, implement various strategies, and delegate authority to staff to work on the matter. Feedback also plays an important role internally, as staff need to gain insight into how their engagement and efforts make a difference. Education and training of personnel are necessary to increase awareness and improve practical work towards reducing FLW. Finally, collaboration between different actors in the value chain, from producers to consumers, is necessary to lead efforts against FLW and not simply shift the problem from one actor to another.

## 7.1 Primary production

The food chain begins at the level of primary production and includes producers from large-scale commercial farms to small family businesses. The sector includes growing and harvesting fruits, vegetables, berries, raising animals, producing milk and eggs, as well as fishing, hunting, and mushroom picking. It thus includes activities such as raising and caring for animals of various kinds, as well as planting and harvesting crops.

### ***Overall analysis of causes***

In primary production, a considerable quantity of potentially edible products is lost,<sup>[48],[49]</sup> partly due to overproduction, which leads to surplus food. Such

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48. Strid I., Fernqvist F., Thörning R and Andrae L. 2023. Livsmedelsförluster av potatis vid odling, skörd, lagring och packeri (2023:2). Jordbruksverket. Sverige.

49. H. Hartikainen, L. Mogensen, E. Svanes, and U. Franke. 2018. Food waste quantification in primary production – The Nordic countries as a case study. Waste Management, Vol 71: 502–511.



overproduction can occur because farmers account for potential pest attacks, weather, and market uncertainties and guarantee contractual obligations they may have towards buyers.<sup>[50]</sup> It can also be difficult to know what proportion of the harvest meets the high aesthetic standards that the market demands for fruits and vegetables.

Primary production, therefore, is highly affected by external factors, such as unpredictable weather conditions and diseases. In primary production, the point at which the product can be labelled as “food” is also less clear and, therefore, when waste should be considered FLW.<sup>[51]</sup> One can argue whether food that is damaged and destroyed on the farm due to weather conditions should be counted as FLW at all, as the damage is almost impossible to avoid.<sup>[52]</sup>

Oversupply can lower market prices, leading to a lack of profitability when all produce is harvested. Some products are simply not harvested or are discarded immediately after harvest, as they do not meet the quality or aesthetic standards, such as shape, size, colour, and weight, required by the market. Gaps in knowledge and practice can also cause FLW in primary production. Choosing the wrong variety that is not adapted to a particular location and inadequate handling of nutrients and water can contribute to lower quality in production, thus leading to losses. Moreover, poor harvesting methods and inadequacies in mechanisation can lead to food losses.<sup>[53]</sup>

There are many good examples of technical investments that reduce FLW. For instance, the proportion of fish that ends up on the floor and is consequently discarded has been reduced with better technology and routines.<sup>[54]</sup> A more digitalised food production process with attempts to reduce FLW seems promising. However, the purpose of increased digitalisation is often focused on maximising food production rather than managing waste, and thus, important resource and environmental aspects in the agricultural stage may be overlooked.<sup>[55]</sup>

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50. R. Ishangulyyev, S. Sanghyo Kim, and S. Lee. 2019. Understanding Food Loss and Waste— Why Are We Losing and Wasting Food? *Foods*, Vol. 8, No. 8: 297. <https://www.mdpi.com/2304-8158/8/8/297>
  51. H. Hartikainen, L. Mogensen, E. Svanes, and U. Franke. 2018. Food waste quantification in primary production – The Nordic countries as a case study. *Waste Management*. [Volume 71](#), January 2018, Pages 502-511
  52. K. Joensuu, H. Hartikainen, S., Karppinen, S., A.-K., Jaakkonen, A.-K., and M. Kuoppa-aho. 2021. Developing the collection of statistical food waste data on the primary production of fruit and vegetables. *Environmental Science and Pollution Research*, Vol. 28, No. 19: 24618–24627. <https://link.springer.com/content/pdf/10.1007/s11356-020-09908-5.pdf>
  53. K. Joensuu, H. Hartikainen, S. Karppinen, A.-K. Jaakkonen, and M. Kuoppa-aho. 2021. Developing the collection of statistical food waste data on the primary production of fruit and vegetables. *Environmental Science and Pollution Research*, Vol. 28, No. 19: 24618–24627. <https://link.springer.com/content/pdf/10.1007/s11356-020-09908-5.pdf>
  54. A. Carvaljal. 2023. Matvinn i sjømatindustrien. Sintef Ocean. [https://www.sintef.no/contentassets/b6afb5b64bd247db9c248fc358e5b0cf/matsvinn\\_sjo\\_matindustrien\\_oppdatert\\_12\\_04\\_2023.pdf](https://www.sintef.no/contentassets/b6afb5b64bd247db9c248fc358e5b0cf/matsvinn_sjo_matindustrien_oppdatert_12_04_2023.pdf) (2024-08-14)
  55. A. Benyam, T. Soma, and E. Fraser. 2021. Digital agricultural technologies for food loss and waste prevention and reduction: Global trends, adoption opportunities and barriers. *Journal of Cleaner Production*, Vol. 323: 129099. <https://www.sciencedirect.com/science/article/pii/S0959652621032881>

### **Proposed measures**

Both production methods and market factors play a significant role in reducing FLW. Measures sometimes need to be implemented at several stages in the value chain, as they may affect the waste of another actor. The following proposed measures are largely based on a summary of action areas highlighted in the final report on food loss by the Swedish Board of Agriculture.<sup>[56]</sup>

**New production methods:** To reduce loss, primary producers need to develop robust production methods that ensure quality even in a changing climate. Production methods should also enable high utilisation of produced raw materials. This will require primary producers to be sufficiently profitable to invest in, for example, smarter animal housing, fishing gear, storage, irrigation technology, and machinery. Protection against wildlife damage, plant pests, and animal diseases is also important.

From both environmental and economic perspectives, more animals need to survive to reach slaughter; therefore, preventive work for animal care needs to be strengthened.

**More knowledge:** Food producers need to continue to invest in their own knowledge building in order to contribute to reduced food losses, increase resource efficiency, and reduce climate and environmental impacts. For this, they need access to advice and tools to measure and evaluate their production. Advice needs to be based on good knowledge of the specific conditions of the different sectors.

Consumers need more knowledge about the quality of raw materials and the preparation of "new" dishes that make greater use of raw materials.

**Research and innovation:** The changing climate is a clear example of the need for more knowledge and research to ensure that we have robust and resilient production methods. To strengthen research and innovation, cooperation between authorities is important.

Product development and innovation: More animal parts (e.g. the offal and blood) and plant parts (e.g. wheat bran) could be used as food through the development of new products. Innovation, financing, and consumer demand are important for profitability in these ventures. The use of more parts and by-products is also needed to increase our preparedness in times of crisis.

**New rules:** New rules should be designed to both prevent FLW and guard against jeopardising food safety, for example, access to and the use of plant protection products and their handling during animal disease outbreaks.

**Collaboration along the value chain:** Increased collaboration between chain actors needs to increase to meet the market challenges faced by primary

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56. Jordbruksverket. 2024. Slutrapport om livsmedels förluster. Resultat och åtgärder för att mer ska bli mat.  
[https://www2.jordbruksverket.se/download/18.23e68dd418d7c649d1713a30/1707493705544/ra24\\_1.pdf](https://www2.jordbruksverket.se/download/18.23e68dd418d7c649d1713a30/1707493705544/ra24_1.pdf) Volume 71, January 2018, Pages 502-511

producers. This includes both the aesthetic requirements for food and knowledge and curiosity about new products that use parts that would otherwise have been discarded. Here, the retail sector can also play a greater role in highlighting such new innovations. Restaurants are already doing some work by cooking with ingredients that would have been discarded, which can inspire consumers. Public actors can lead the way and procure good quality food that is not in demand in retail, for example by using "ugly fruits".

**New business models:** There is a need for the development of new and more flexible business models and sales channels where surplus can be absorbed by larger local buyers, for example, for large-scale kitchens. Actors who help mediate such surpluses can play an important role.

## Case: **100% Fish Initiative**

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*The 100% Fish initiative in Iceland is an inspiring example of how a country can take responsibility for its natural resources within an important national industry. The initiative promotes innovation in several areas, with technological advancements, global expansion of the methodology, and collaborations between various types of actors to maximise resource utilisation.*

The Icelandic initiative *100% Fish* is driven by the Iceland Ocean Cluster and has revolutionised the way in which fish and fish products are handled and utilised. The goal of the initiative is to inspire the fishing industry and the communities dependent on it to maximise the use of every caught fish, increase the value of landed fish, support new business opportunities, increase employment, and reduce waste.

The initiative has had an enormous impact, especially in Iceland where it originated. By transforming fish by-products – such as heads, skin, bones, and innards – into valuable products, Iceland has managed to increase the utilisation rate of its fish products to approximately 80%. This means that practically nothing goes to waste. Examples of products produced include dietary supplements, cosmetics, pharmaceutical products, and even textiles and biomedical applications.

Technological advancements have played a key role in this transformation. Increased production yields and improved processes have resulted in a four-fold increase in the export value per kilogram of cod since the 1990s. Through strict regulations and innovative solutions, Icelandic fisheries have been forced to find profitable ways to utilise these by-products.

One of the biggest challenges has been to show fishing companies the value of collaboration. By building trust and demonstrating how collaboration can improve the future prospects of fishing companies and coastal communities, *100% Fish* has helped companies create valuable connections with academic

institutions, startups, and research and development organisations. This network, called the Ocean Cluster Network, facilitates information and knowledge exchange worldwide.

The initiative has now expanded globally and is influencing other regions, such as the Great Lakes in the United States and Canada, the Pacific, and Africa. By adopting *100% Fish* methods, these areas have begun reducing waste and creating more value from their fish stocks, thereby contributing to economic growth, sustainability, and environmental protection.

The 100% Fish programme demonstrates that it is possible to approach zero waste in the fishing industry while remaining economically sustainable. This approach not only results in food security but also creates new job opportunities and promote social innovation, especially in regions dependent on fishing. By promoting collaboration and innovation, 100% Fish is paving the way for a more sustainable future.

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Sjávar Klasinn. 100% Fish.  
[Read more](#) (2024-08-14)

## 7.2 Food Producers

The next stage in the food value chain is in the production of the food, where the outcomes from the primary production are being processed to be turned into the products bought in shops or used in cooking. The food producers concern a heterogenous group of actors, dependent on for instance the type of food. However, many of the reasons for food waste in this stage are shared among these actors, being concerned with for instance cleaning, sorting, cooking, freezing and packing.

### ***Overall analysis of causes***

FLW in production occurs because raw materials and products need to be discarded due to faults and deficiencies that occur with the raw material, in production, or during packaging. One reason is that different parts of the raw material do not become new food products, which may be due to lack of demand. For example, consumers in a specific setting might opt out of meat cuts that are appreciated in other cultures.

Disruptions during production can cause production to cease temporarily, thereby causing FLW. There is often waste in production when switching

between different products or flavours in a facility, such as when the flavour of yoghurt is to be changed from strawberry to mango. During a changeover, all of one flavour must be out of the facility before a new flavour can begin to be packaged. Sometimes, faults are discovered in some raw materials that result in production stoppage and the discarding of contents. Errors can also occur in the printing or sealing of packaging, which cause products to be discarded. Shelf-life requirements from actors after production sometimes lead to products in stock not being sold on but discarded.

There are often economic incentives to ensure that products brought into production come out as food. By working proactively and ensuring that there is no waste in one's own operations, much can be saved. There are many examples of producers who have tried to find new uses for raw materials that do not meet the requirements for the main product.

There are also conflicts of interest between economic and resource management; for example, with high energy prices, it may be more profitable to use residues for energy production than to search for new ideas to utilise the resource in various foods. New machines might be too expensive, serving as a barrier to investments in new innovations.

### ***Proposed measures***

***Measure and plan:*** All operations should measure and identify the causes of their FLW in order to gain knowledge about what is being discarded and the costs arising from FLW. There are direct costs incurred from product losses as well as indirect costs related to working hours to internally manage the waste and costs of waste management. Such a mapping can enable a better basis for identifying effective and profitable measures that reduce waste.

***Improve forecasts and planning:*** Being able to determine how many ingredients are needed for upcoming production is important, especially when fresh or sensitive raw materials are used. Investments in better forecasting models aimed at maximising the utilisation of raw materials are fundamental. Production should be adapted to actual demand to avoid overproduction. This can be done partly by using data analysis to improve demand forecasting,<sup>[57]</sup> but there is also the need for data sharing in both directions between producers and wholesalers.

***Quality systems and development:*** There is a need for continuous development of quality systems for ordering, production processes, and inventory management to monitor inventory status in real time and ensure that products are efficiently rotated. If there are raw materials being discarded, new product development should be prioritised,<sup>[58]</sup> or the raw material should be delivered to other producers.

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57. D. Ivanov, A. Tsipoulanidis, and J. Schönberger. 2019. *Global Supply Chain and Operations Management: A Decision-Oriented Introduction to the Creation of Value*. Springer.

58. K. L. Thyberg and D. J. Tonjes. 2016. Drivers of food waste and their implications for sustainable policy development. *Resources, Conservation and Recycling*, Vol. 106: 110–123.

**Improved packaging:** Better packaging for specific foods plays a major role in reducing waste later on in the chain.<sup>[59]</sup> From both an FLW and cost perspective, it is particularly important to protect food products with high environmental impact such as meat, fish, and dairy products. Technical development in this area has evolved significantly over the last 20 years and continues apace. Solutions involving modified atmosphere, absorbers and effective barriers provide a longer product shelf life. Sterilisation before filling at high temperature or vacuum packaging provides longer shelf life without preservatives. Time–temperature indicators should be implemented to monitor and ensure product quality throughout the distribution chain. However, new technical solutions should not complicate or prevent material recycling. In addition, there needs to be acceptance among consumers of different solutions.<sup>[60]</sup> Choosing the right packaging is about qualified trade-offs between protection, manageability, and various environmental aspects, where data for life cycle analyses become particularly important. As mentioned earlier, there needs to be a greater focus on packaging appropriate amounts to avoid waste among consumers and develop communication about how long the food can be safely consumed.

Unfortunately, there is a lack of knowledge about how packaging should be designed to reduce waste later in the chain; thus, such designs are rarely in demand because knowledge about them is low throughout the chain. When external pressure is weak, internal driving forces often become weak. In addition, it often involves costs to invest in new packaging solutions, and companies tend to be unsure of the effects on sales.<sup>[61]</sup> Importantly, perceived economic profitability tends to take precedence over sustainability goals.<sup>[62]</sup>

**Education and training:** More staff need to be educated about the importance of reducing waste and how they can contribute to this through better handling of raw materials and products.<sup>[63]</sup> Management commitment is, as always, important for cultural creation and maintenance.

**Product development and innovations:** There is a need for a greater focus on what could be used for new products. Utilising residual streams in a better way is an important way of increasing our preparedness. For new products to become profitable, consumer insights needs to be considered in the process.

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59. A. Halloran, J. Clement, N. Kornum, C. Bucatariu, and J. Magid. 2014. Addressing food waste reduction in Denmark. *Food Policy*, Vol. 49, Part 1: 294–301.

60. K. Verghese, H. Lewis, S. Lockrey, and H. Williams. 2015. Packaging's role in minimising food loss and waste across the supply chain. *Packaging Technology and Science*, Vol. 28: 603–620.

61. H. Pålsson and E. Sandberg. 2022. Adoption barriers for sustainable packaging practices: A comparative study of food supply chains in South Africa and Sweden. *Journal of Cleaner Production*, Vol. 374: 133811.

62. B. de Koeijer, J., de Lange, and R. Wever. 2017. Desired, perceived, and achieved sustainability: trade-offs in strategic and operational packaging development. *Sustainability*, Vol. 9, No. 10: 1–29.

63. J. Parfitt, M. Barthel, and S. Macnaughton. 2010. Food waste within food supply chains: quantification and potential for change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences*, Vol. 365, No. 1554: 3065–3081.

**Collaboration with other actors:** There should be increased collaboration with retailers to better understand consumer demand and adapt deliveries accordingly. Donating surplus food to charity organisations instead of letting it go to waste is one way. If donation is not possible, actors need to strive for the surplus to go towards animal feed, and if this is not possible, digestion or incineration (of dry foods) for energy use should be considered.<sup>[64]</sup>

## Case: **Stryhns Gruppen**

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*In the Danish context, Stryhns Gruppen has made impressive progress in reducing FLW and has exceeded expectations just four years after formulating goals to halve FLW. Through innovative and systematic measures, such as updating production lines and creating buffer zones to save food during operational stops, the company managed to drastically reduce its FLW. This has simultaneously built trust with customers and engagement and pride among employees.*

Stryhns Gruppen, a prominent producer and marketer of several food brands in Denmark and has made significant progress in reducing FLW and increasing sustainability. The company was one of the first to sign the voluntary agreement *Danmark mod madspild* in 2018 and with it set an ambitious goal to halve its FLW by 2030. The goal was anchored internally as part of its strategic CSR initiatives. By 2022, Stryhns Gruppen had exceeded this goal and managed to reduce the FLW of finished food by 75%.

This success was achieved through a series of innovative and systematic measures. With an initial inventory documenting where waste was occurring, the company could optimise its production lines and work processes. A large part of the FLW was traced to outdated production lines, where, for example, mayonnaise stuck to the bottom of tanks, and when production experienced operational stops. The findings led to investments in production line updates and the implementation of a so-called buffer zone that could save food in production during operational stops. The new production line enabled improved accuracy in forecasting, which also helped reduce waste. As there was still some FLW related to the business, the surplus production was donated to charitable organisations, such as *FødevareBanken*, amounting to 137,000 meals in 2022 alone. Moreover, all employees were actively engaged in efforts to reduce waste, which created a strong internal culture of responsibility and awareness.

The company's successes in FLW reduction demonstrate how strategic goal-setting, problem-seeking, and innovative solutions can lead to significant environmental and economic benefits while positively contributing to society and customer trust.

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64. S. Lebersorger and F. Schneider. 2014. Food loss rates at the food retail, influencing factors and reasons as a basis for waste prevention measures. *Waste Management*, Vol. 34, No. 11: 1911–1919.

## 7.3 Wholesalers and transport

The next step in the chain concerns the logistics and distribution of the food. When the food has been produced and packaged in a way that consumers find appealing, wholesalers get involved and the food is being transported either to various storages, or directly to the customers or retailers. It involves activities such as logistics, transportation and warehousing. This step, while not being about processing the food itself, is complex and requires a great deal of attention to traceability to avoid FLW.

### ***Overall analysis of causes***

Logistics and supply chain management can influence the occurrence of FLW but can also be part of the solution to prevent it. The ever-increasing flow of fresh products that must be available everywhere and at all times, despite not being in season, is part of the fundamental problem leading to FLW in storage and distribution. Furthermore, many actors have simultaneously wanted to reduce additives that extend shelf life for health reasons.

One of the reasons for FLW in the logistics chain is overproduction, which then results in the product spoiling before it can be sold. FLW most often occurs because products are stored or transported at incorrect temperatures.<sup>[65]</sup> Even though waste at the wholesale level is relatively low, handling at this level can lead to waste in later stages. Lack of coordination between actors in the value chain means that food spoils before sale or is deemed to have too short a shelf life to be sold. Packaging can be damaged during storage and transport due to careless handling.<sup>[66]</sup> The lack of training of employees in wholesale and retail is a significant cause of FLW throughout the production chain.<sup>[67]</sup>

### ***Proposed measures***

***Supply and demand planning:*** With improved data analysis of sales data and seasonal variations, supply can be better adapted to actual demand, thereby reducing waste. By analysing previous losses, FLW can be reduced. This may involve ordering smaller quantities more frequently to ensure fresher stock. One approach developed to support production flow towards what is ordered

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65. CC De Moraes, FH de Oliveira Costa, CR Pereira, AL Da Silva and I Delai. 2020. Retail food waste: mapping causes and reduction practices. *Journal of Cleaner Production*, Vol. 256: 120124.

66. K. Liljestrand. 2017. Logistics solutions for reducing food waste. [International Journal of Physical Distribution & Logistics Management](https://doi.org/10.1108/IJPDLM-03-2016-0085), Vol. 47, No. 4: 318–339. <https://doi.org/10.1108/IJPDLM-03-2016-0085>

67. CC De Moraes, FH de Oliveira Costa, CR Pereira, AL Da Silva and I Delai. 2020. Retail food waste: mapping causes and reduction practices. *Journal of Cleaner Production*, Vol. 256: 120124.



instead of relying on forecasts is the so-called make-to-order system, which can be applied to reduce FLW.

**Collaboration and information sharing:** Implementing more efficient information sharing across the entire food supply chain can help in better predicting demand and managing inventory, reducing the risk of overproduction and spoilage. Collaborations can reduce lead times between wholesalers and "hospitality actors" and shops. In cases of overproduction, it is important to have good channels for how these products can be utilised as food directly or as inputs for new products.

**Temperature control:** Storage and transport of fresh products at the correct temperature need to be constantly monitored. Technical solutions are currently available to accomplish this.

**Organised warehouse:** A well-organised warehouse where all products are accounted for reduces the risk of food spoilage due to incorrect storage methods. There should be first-in, first-out (FIFO) systems to ensure product freshness and alarm systems for alerts about products approaching the date by which they must be moved to restaurants/institutional kitchens or retail.

**Packaging design:** It is important to note when FLW occurs due to packaging design, for example, with overly weak secondary packaging, so as to provide feedback to the food producer. Better visualisation of the damaged packaging helps with coordination and joint decision-making on how improvements can be made. To motivate changes in packaging design that reduce waste, a holistic approach involving a total cost analysis that takes into account the advantages and disadvantages for both wholesalers and shops is important.

**Education and training:** Improve the education of distribution employees through specific training or participation in workshops about how their practices affect FLW and what they can do to reduce it. At the same time, awareness needs to increase regarding how different stages affect each other's FLW, which is why joint workshops may be warranted.

## Case: Carlsberg

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With the help of data-driven harmonisation of systems and forecasting techniques, the Danish brewing company Carlsberg has adapted its production to demand and thereby reduced overproduction. Investments in new packaging technology and upcycling of waste products have contributed to further waste reduction. Between 2015 and 2020, Carlsberg reduced its FLW by 22%.

Carlsberg, a brewing company in Denmark, has in recent years implemented several initiatives to reduce FLW as part of its sustainability work. These initiatives began as economic measures but have now become an integral part of the company's long-term sustainability strategy.

One of the central projects is the implementation of new data systems that

map FLW and improve forecasts for production and distribution. By using these systems, Carlsberg can better adapt its production to demand, which reduces the risk of overproduction and, thus, FLW. In addition, the company has invested in new packaging technology and the upcycling of waste products, which contributes to reducing the amount of waste generated.

To reach its goal of halving FLW by 2030, Carlsberg has also focused on collaboration with partners and ROI calculations related to investments in FLW reduction. These measures have yielded results: between 2015 and 2020, the company managed to reduce its FLW by 22%, thereby achieving almost half of its goal.

In summary, Carlsberg's work shows how technical investments and data-driven decisions can lead to significant reductions in FLW and improved sustainability. By continuing these efforts, Carlsberg is well on its way to reaching its 2030 goal and contributing to a more sustainable future.

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[Read more](#)

## 7.4 Retail

Retailers include the actors selling food directly to consumers, and could include supermarkets, markets and grocery shops. Being an important interface towards the households, the retailers hold an important role in the value chain for the work with reducing FLW, not simply in the store, but also in other parts of the value chain. The retailers must ensure that the products are available for the consumers, while avoiding that food is being thrown away. Activities the retailers engage in include for instance selling, displaying and marketing the products, all of which might have an important impact on FLW.

### ***Overall analysis of causes***

Knowledge about why waste occurs in retail is relatively extensive. Internationally, many studies have been conducted, several of which are from the Nordic countries. Generally, food chains in many countries have gained increasing levels of power and can set conditions upstream in the value chain while having a significant influence on consumer behaviour.<sup>[68]</sup> Therefore, retail affects not only FLW in its own operations but also waste among suppliers and especially among consumers.

In recent years, retail has successfully worked to reduce waste in stores. It is increasingly common for products with short dates to be sold at discounted prices. Additionally, there are many initiatives to tackle the surplus that arises. Some stores have employed chefs who prepare lunch boxes using food that has a short shelf life remaining. In other stores, there has been an increase in donations. Although there is great benefit in donating food that is about to expire, retail needs to increasingly work with activities higher up in the waste hierarchy and simply work to prevent FLW altogether.

However, a study from 2023 showed that measures against FLW that are not perceived as economically profitable are not being implemented.<sup>[69]</sup> Improved ordering systems that reduce waste are economically profitable, as is selling products approaching their expiration date. Donating food can sometimes – though not always – reduce waste management costs.

It is considerably more difficult when FLW comes into clear conflict with satisfied customers and profitability maximisation. This includes measures such as limiting the product

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68. V. Kulikovskaja and J. Aschemann-Witzel. 2017. Food waste avoidance actions in food retailing: The case of Denmark. *Journal of International Food & Agribusiness Marketing*, Vol. 29, No. 4: 328–345. <https://doi.org/10.1080/08974438.2017.1350244>

69. K Koskela-Huotari, K. Svärd, H. Williams, J. Trischler, F. Wikström. 2023. Drivers and Hinderers of (Un)Sustainable Service: A Systems View. *Journal of Service Research*, Vol. 27, No. 1. <https://doi.org/10.1177/109467052311760>

range<sup>[70]</sup> and removing items with high waste and ceasing campaigns that attract buyers to a store. In short, profit maximisation almost always trumps sustainability in internal operations.

Campaigns are used to attract consumers and encourage additional purchases. When a shop has special offers, it does not want to risk running out and, therefore, orders with a margin, as customers may be disappointed if the campaign product is sold out. Campaigns also drive waste for non-campaign products. For example, when two types of mixed salad are sold at a special price, other salad mixes are likely not to sell as much.

Shops naturally want satisfied customers and try to fulfil as many of their consumers' needs as possible. Fresh in-store baked bread is offered even in the evening, leading to high waste figures. The desire to meet customer demand in full means that the product range is sometimes too large to avoid waste. Products are delivered in a certain quantity in a secondary package, which can be problematic for products with low turnover that do not sell before they become too old. Nevertheless, even the desire to sell more enables an unnecessarily wide range – from an FLW perspective – such as yoghurt flavours that come and go. The more varieties there are, the greater the difficulty in accurately predicting how much of each type should be ordered.

Consumers have high demands regarding the appearance of products, which means that many avoid fruits and vegetables that do not look perfect, leading to many fully edible goods being culled. The problem is exacerbated when consumers squeeze products, such as avocados and tomatoes, to determine the degree of ripeness, which leads to spoilage. In recent years, however, several retail chains in various trials have offered a range of imperfect goods at lower prices.

When shops receive goods, it sometimes happens that they do not meet the retailer's requirements. This can involve damaged packaging that becomes difficult to sell or fruit or vegetables that have become too ripe, where the retailer estimates that not everything can be sold before it spoils. The shop can then choose to return the goods to the wholesaler/producer, often at no cost. To reduce this so-called credit waste, wholesalers and retailers sometimes try to agree on a reduced price, with the retailer attempting to sell off parts of the delivered goods instead of returning them to be discarded. For some shops and goods, crediting is extensive,<sup>[71]</sup> and what the shops return essentially becomes food waste.

A common reason for waste is the lack of routines around information sharing among producers, distributors, and retailers. The ordering tools developed to

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70. K Koskela-Huotari, K. Svård, H. Williams, J. Trischler, F. Wikström. 2023. Drivers and Hinderers of (Un)Sustainable Service: A Systems View. *Journal of Service Research*, Vol. 27, No. 1. <https://doi.org/10.1177/109467052311760>

71. R. Ghosh and M. Eriksson. 2019. Food waste due to retail power in supply chains: Evidence from Sweden. *Global Food Security*, Vol. 20: 1–8.

help retailers order the right goods are working increasingly better, but the competence and engagement of shop employees also affect how well the tool functions. When products arrive at the shop, waste can be caused by staff lacking good routines for receiving, restocking, and rotating older products so that they are placed at the front. Sometimes, it is due to a lack of knowledge or lack of time to restock shelves from the back.<sup>[72]</sup> The causes of waste in shops also depend on the product category and product level being handled. Considerably more knowledge is needed to handle fruit and vegetables than jars of jam.<sup>[73]</sup>

There is also an economic trade-off between maintaining fewer working hours in the shop and using more staff time for measures that lead to reduced FLW. However, there is an untapped potential to invest more staff hours in the fruit and vegetable department, with economic profitability around waste reduction.<sup>[74]</sup>

Correct storage of fresh goods at an appropriate temperature is crucial for shelf life. More and more shops have invested in better refrigeration for storage in shops so that sensitive goods are displayed in refrigerated counters. This contributes significantly to waste reduction.

Certain business models can influence the occurrence of waste, for example, when food producers "rent" shelves in the shop and are responsible for filling and clearing them. When different suppliers share the space, no one wants to risk their variety being out of stock when the customer comes to shop, which leads to excessive supply relative to demand. In addition, many shops have marketed a wide selection of fresh bread up until closing time to lure customers to their shop. This business model also means that the shops themselves cannot limit the range and sell off bread with a short date. The model also provides low economic incentives for retail to reduce bread orders. In Norway, it is estimated that 200 loaves are thrown away every minute throughout the year.<sup>[75]</sup>

Retail seeks various ways to reduce bread waste; for example, different digital solutions have been developed to help shop staff with monitoring and ordering for bread baked in store. One of these solutions is from Link, introduced at the grocery chain Meny, which reduced bread waste by more than one million

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72. L. Mattsson and H. Williams. 2022. Avoidance of Supermarket Food Waste—Employees' Perspective on Causes and Measures to Reduce Fruit and Vegetables Waste. *Sustainability*, Vol. 14: 10031. <https://doi.org/10.3390/su141610031>
73. C. Teller, C. Holweg, G. Reiner, and H. Kotzab. 2018. Retail store operations and food waste. *Journal of Cleaner Production*, Vol. 185, No. 7: 981-997
74. L. Mattsson, H. Williams, and J. Berghel. 2018. Waste of fresh fruit and vegetables at retailers in Sweden—Measuring and calculation of mass, economic cost and climate impact. *Resources, Conservation and Recycling* Vol 130: 118-126.
75. Nofima. 2023. Press Release. Every minute, 200 loaves of bread are wasted in Norway. 2023. <https://nofima.com/press-release/every-minute-200-loaves-of-bread-are-wasted-in-norway-now-research-that-will-halve-that-number-begins/> (2024-08-14)

loaves<sup>[76]</sup> or 34%<sup>[77]</sup> in 10 months. They have also communicated to customers that they have a smaller selection of bread in the evenings.

### ***Proposed measures***

***Better forecasts and ordering:*** Ordering systems have developed significantly, but further development is necessary. FLW should be measured at the product level to enable appropriate measures, and waste in connection with campaigns should be analysed as a matter of priority. Communication with customers needs to explain that products with high waste figures are not in the range.

***Better storage:*** Investments in refrigerated counters make a major difference in reducing waste in retail.

***Engagement and leadership:*** When management focuses on the issue and includes it in the daily follow-up on how the business is going, it helps staff create and maintain engagement in the issue.

***Education and trust in staff:*** Educate staff on how to handle products to reduce waste, and appoint key individuals with extra responsibility and a mandate to reduce waste. This is especially important for departments where waste is particularly high, such as fruit and vegetables. Engage staff in suggesting measures to reduce waste. Give more mandate to staff to lower prices on goods with a short shelf life.

***Dynamic pricing:*** For products approaching their expiration date, the shop can implement price reduction to reduce the risk of waste. When excess fruit or vegetables have been ordered, price reductions can also be used to reduce waste. However, it is important that retail does not use the opportunity to give discounts for additional purchases, as there is then a high risk that the consumer will not have time to consume products with short dates. Therefore, special sections or shelves should be introduced for these products to make them easier to find and encourage consumers to buy them. Substantial discounts in the evening can also reduce waste of in-store baked bread.

***Right packaging for the right product:*** It is particularly important to keep track of how different packaging designs contribute to increased waste or prevent waste in the fruit and vegetable department. It is also about understanding customers and the sizes or quantities they need so that the range is adapted accordingly. For products that are sensitive to pressure, such as pears and avocados, packaging can provide protection and reduce waste in the shop.

***Stop or limit the occurrence of campaigns for fresh goods:*** As mentioned above, campaigns generate FLW both in shops and households. Above all, campaigns

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76. Link Retail. One million breads saved in 10 months, at the Norwegian grocery chain MENY. <https://linkretail.com/one-million-breads-saved-in-10-months-at-the-norwegian-grocery-chain-meny/> (2024-08-14)

77. European Supermarket Magazine. 2021. Norway's Meny Cuts Food Waste From Bread by 34%. <https://www.esmmagazine.com/fresh-produce/norways-meny-cuts-food-waste-bread-34-148333> (2024-08-14)

on products with a high environmental impact should be avoided, such as meat.

**Own kitchen:** In larger shops, an in-house kitchen can be considered where products with short dates are prepared and offered as lunch boxes.

**Offer food bags in existing digital forums:** Examples of this include ToGoodToGo and Karma.

**Collaboration with charity organisations:** Establish collaboration with charity organisations to donate surplus food that would otherwise be discarded.

**Shops can also take measures to reduce waste among consumers:** Stop quantity discounts: Quantity discounts are highly likely to drive FLW among consumers, as they buy more than they actually need.

**Stop or limit the occurrence of campaigns for fresh goods:** As mentioned above, campaigns contribute to consumers buying in excess. Although this area is relatively unexplored, the purpose of campaigns is to attract increased sales. The larger the quantities purchased, the greater the probability that some goods will spoil before they are consumed.

**Communication with consumers:** Help consumers reduce their FLW. Inform consumers about the difference between the "best before date" and "use by date" to avoid fully edible products being discarded as well as how they can determine how different products are safe to eat. Try to influence the behaviour of squeezing fruits and vegetables in the shop through information. Explain that the shop provides a limited range and does not have in-store baked bread in the evening in an effort to reduce the environmental impact.

## Case: REMA 1000

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Beginning in 2015, REMA 1000 – a Norwegian grocery chain – has managed to reduce its FLW by 38%. While REMA 1000 did not invent anything revolutionary, it has worked with a variety of measures that together have paid off. It introduced discounts on products approaching their best-before date, tested labels to help consumers interpret freshness and dates, and developed new packaging solutions that increase the shelf life of food products.

While REMA 1000 has stores throughout Norway, in Denmark, it began its journey to stop FLW as early as 2008 alongside the independent organisation *Stop Spild Af Mad*. Among the first measures was to completely abolish quantity discounts. Since 2015, the company has implemented at least nine strategies to combat FLW. Measures include discounts on goods approaching expiration, using keep-it indicators to monitor food freshness, assigning specific roles in-store to efficiently manage the fruit and vegetable department, and introducing "often good after" labelling. In 2022, REMA 1000 began selling in all its stores leftover bread from the day at half price after 10:00 PM. In addition, the company has donated significant amounts of food to charity; in 2021, it

saved 189 tonnes of food, which was sent to food banks. Moreover, the company is working on developing more sustainable packaging to extend the shelf life of food products.

Since REMA 1000 began its efforts, it has decreased FLW by 38%. However, the goal is to reduce its FLW by 50%. It recently introduced new tools and policies to further reduce its FLW. Among other things, it has signed a cooperation agreement with a supplier for the purpose of forecasting and to make better planned purchases to be able to achieve its ambitious goals.

### References:

REMA 1000. Mindre Matsvinn.  
[Read more](#)

## 7.5 Restaurants

After households and agriculture, food service establishments are the third largest generator of FLW in the EU, although the data are still too limited and exist in aggregate form.<sup>[78]</sup> This part of the value chain include actors that purchase food, prepare various meals and serve them to the customers. It could thus include both restaurants serving hot food, as well as cafes. In general, the more one can accurately measure and understand why food is wasted, the better the likelihood of employing appropriate measures for implementation. To do so, one must acknowledge the specific characteristics of restaurants and cafés. Thus, for these actors, it is a lot about balancing the time to measure and act against the already tight schedule in restaurant kitchens and specific demands in terms of food served.<sup>[79]</sup>

### ***Overall analysis of causes***

Several factors cause food to be discarded in restaurants. Like waste in public meal operations, FLW in restaurants is divided into three categories: what occurs in the kitchen (kitchen waste), in serving (serving waste), and what is thrown away from the plate (plate waste). Most waste occurs in the kitchen due to excessive purchases, overproduction, and mistakes in handling and preparation. The second most discarded category is plate

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78. I. Katsarova. 2016. Tackling Food Waste. The EU's Contribution to a Global Issue European Parliamentary Research Service, Briefing Paper.  
[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2016\)593563](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2016)593563) (2024-08-14)

79. K. Silvennoinen, S. Nisonen and O. Pietiläinen. 2019. Food waste case study and monitoring developing in Finnish food services. Vol. 97: 97-104.



waste.<sup>[80]</sup>

Lack of knowledge is a recurring cause accounted for in the literature. Employees' lack of experience with different methods and how to handle new menus and recipes affects both kitchen and serving waste. Being able to estimate consumption and make correct orders is also a challenge. Sometimes, FLW is not measured in a systematic and regular way, making it difficult to understand the importance of and where to implement measures to reduce FLW. Within the industry, people prefer not to talk about FLW because there is a belief that it can damage the restaurant's reputation.<sup>[81]</sup>

Customers' consumption in restaurants also differs from that at home. Restaurant customers are not only at the restaurant to be full but also have expectations about the quality and appearance of the food. The quality of ingredients and products matters; using frozen bread for serving often results in more waste compared to when fresh bread is served. This increases waste in the kitchen because the restaurant only wants to serve what meets customers' expectations regarding quality, both in terms of taste and appearance. Moreover, studies show that customers often do not notice their own FLW in restaurants because they see it as an exception to everyday consumption.<sup>[82]</sup> Lack of communication also has a negative impact on waste. For instance, the kitchen may not be informed when customers complain about the food or when they have opinions on portion sizes. Sometimes, the review of expiration dates on different products and those who are to prepare the food with necessary rotation on a first-in-first-out (FIFO) basis does not work as intended. In recent years, consumer demand for special diets has increased. When the kitchen must handle vegan, vegetarian, and meat diets along with requirements for gluten and lactose-free, etc., more waste occurs because it is more difficult to match the servings with the demand.

### ***Proposed measures***

***Planning and purchasing:*** Plan menus carefully based on expected demand and seasonal ingredients. Use historical data for reservations and consumption to predict the amount of food needed. Use systems to monitor and record FLW at different stages (preparation, serving, guest leftovers). Collaborate with local suppliers to get fresher ingredients that last longer. Negotiate flexible deliveries based on need in order to avoid surpluses or shortages. In some cases, there is an opportunity to buy larger surplus batches from wholesalers, which can reduce FLW at that stage.

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80. Wrap. 2013. Restaurants: Taking Action on Waste.

<https://www.wrap.ngo/sites/default/files/2020-10/WRAP-Restaurants.pdf> (2024-08-14)

81. V. Filimonau, E. Todorova, A. Mzembe, L. Sauer and A. Yankholmes. 2020. A comparative study of food waste management in full service restaurants of the United Kingdom and the Netherlands. *Journal of Cleaner Production*. Vol. 258: 120775.

82. D. E. Matzembacher, P. Brancoli, L. M. Maia, and M. Eriksson. 2020. Consumer's food waste in different restaurants configuration: A comparison between different levels of incentive and interaction. *Waste Management*, Vol. 114: 263-273.

**Storage:** Store food properly to extend shelf life. Use correct temperatures in refrigerators and freezers and use airtight containers for storage. Label and organise ingredients by purchase date to ensure that older products are used first (the FIFO principle). Use apps and software to track inventory and predict needs. Implement systems that help monitor the shelf life of food and send reminders about when and which products need to be used.

**Menu planning:** Management strategies can affect all three categories of waste in restaurants. Management systems for various kitchen activities, such as ordering, tidiness in the kitchen, documentation, how menus are planned, and how recipes are used and improved. Design menus with dishes that share many of the same ingredients in order to reduce variation and, thus, waste.

**Education:** Management is important for how employees are trained and can develop and learn about FLW, among other things. Educate staff in the correct handling, storage, and use of food to minimise waste. In addition, chefs should be encouraged to be creative with leftovers and surpluses. For example, create a “dish of the day” with ingredients that need to be used soon.

**Communication with guests:** Offer different portion sizes to cater to different needs in order to reduce the amount of food left on plates. Inform guests about the restaurant's efforts to reduce FLW. Offer them the possibility to take their leftovers home.

**Donations and composting:** Collaborate with charity organisations to donate edible food that would otherwise be discarded. Use composting for food waste that cannot be reused.

## Case: Karma

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*Karma is a Swedish company that connects consumers with businesses selling surplus food at reduced prices. It provides economic benefits for consumers while promoting sustainability. Through collaboration with Electrolux, Karma introduced smart refrigerators to improve FLW management and user experience. Today, the company has a wide reach – with over 1.4 million users and partnerships with over 9,200 companies – which has saved 1,200 tonnes of food and reduced CO<sub>2</sub> emissions by 1,800 tonnes.*

Karma is a Swedish company that has successfully contributed to reducing FLW by connecting consumers with restaurants, cafes, and grocery stores with surplus food to sell. Karma has created a platform where food that would otherwise be thrown away is instead sold at reduced prices. The company provides an app that offers users the opportunity to buy leftover food at discounted prices, which not only reduces FLW but also provides economic benefits for both consumers and sellers. Karma also introduced smart refrigerators in collaboration with Electrolux, making it easier for stores to sell

leftover food directly from the refrigerators, further improving user experience and FLW management efficiency.

Since its launch, Karma has gained over 1.4 million users and collaborates with over 9,200 partners. The app has contributed to saving over 1,200 tonnes of food and reduced carbon dioxide emissions by approximately 1,800 tonnes. This clearly shows the power of using relatively simple means to connect businesses with consumers in an efficient and smooth solution that can have a significant positive impact on the environment.

By offering a user-friendly platform where consumers can buy high-quality food at discounted prices and thereby reduce FLW, Karma has become a positive example of how technology can be used to promote sustainability and create economic incentives for both consumers and businesses.

### References:

SEAL Awards. 2018.

[Read more](#)

[Read more](#)

[Read more](#)

## 7.6 Public Meals

Public meals include professionally prepared and cooked food. Such meals are being served to a heterogeneous population, including schools, elderly care and hospital care. The servings could be both in the setting of a restaurant or cantina, or at home for people receiving meals through public meal programmes.

### ***Overall analysis of causes***

FLW in public meal operations, as in restaurants, is often divided into three categories: what occurs in the kitchen (kitchen waste), in serving (serving waste), and what is thrown away from the plate (plate waste).

***Kitchen waste:*** This is the FLW that occurs in the kitchen in connection with the preparation, cooking, and storage of food. The food that is prepared and served is planned based on an estimate of how many will eat and their specific nutritional and energy needs. Kitchen waste is affected by the work in the kitchen itself and is lower than serving and plate waste. It is difficult to plan how much food will be eaten in preschools, schools, and nursing homes. How many students will reject today's menu and go to the café instead? Which of

today's dishes will be the most popular? The more dishes offered, the more raw materials need to be kept in stock, and the greater the risk that a less popular dish will be left over.

**Serving waste:** Waste that occurs in connection with food being served is called serving waste. Shouldn't the food run out, but should be enough for everyone in a school, nursing home, etc., it is inevitable that there will be food left over. Some of what is left over may be used the next day; other food is discarded. Forecasting is an effective way of reducing serving waste.<sup>[83]</sup> When food is not eaten up in schools or nursing homes, it may be because the estimate of the number of people present for that day does not match the actual number or that those who are supposed to eat have not eaten the portion they need, which has consequences for health and quality of life. In a Finnish study, FLW was measured in 51 operations, including schools, preschools, and workplace and student canteens, all of which used buffets to serve food. In all, 17.5% of the food produced became waste, and serving waste proved to be the most significant waste category (11.3%).<sup>[84]</sup>

**Plate waste:** Food is also left on plates when guests have not enjoyed it or simply too much ended up on the plate, so-called plate waste. For public meals, more places seem to offer buffets than other establishments.<sup>[85]</sup> Buffets increase the risk of guests taking too much food and having to discard the surplus; however, set portion sizes dished out by staff can mean that some guests do not manage to eat everything. Other reasons may involve problems keeping a buffet attractive throughout the serving time, which leads to overproduction.<sup>[86]</sup> In schools, the extent of FLW depends on children's age, crowding in the dining hall, and overproduction.<sup>[87]</sup> Staff work routines and knowledge are embedded in the social and material context, which means that one must consider the entire system in order to effectively identify and implement waste reduction measures. This includes understanding how the work environment, team dynamics, education, and physical resources interact and affect each other.<sup>[88]</sup>

In elderly care, as much food is prepared as the diet managers think the elderly should eat from a nutritional point of view. Nevertheless, for many reasons, the

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83. C. Malefors, N. Sundin, M. Tromp, and M. Eriksson. 2022. Testing interventions to reduce food waste in school catering, *Conservation and Recycling*, Vol. 177: 105997.
84. K. Silvennoinen, S. Nisonen and O. Pietiläinen. 2019. Food waste case study and monitoring developing in Finnish food services. [Waste Management](#), Vol. 97: 97–104.
85. L. Heikkilä, A. Reinikainen, J.M. Katajajuuri, K. Silvennoinen, H. Hartikainen. 2016. Elements affecting food waste in the food service sector, *Waste Management*, Vol. 56: 446–453.
86. K. Silvennoinen, S. Nisonen and O. Pietiläinen. 2019. Food waste case study and monitoring developing in Finnish food services. [Waste Management](#), Vol. 97: 97–104.
87. H. Steen, C. Malefors, E. Rööös, and M. Eriksson. 2018 Identification and modelling of risk factors for food waste generation in school and pre-school catering units. *Waste Management*, Vol. 77: 172–184.
88. B. Hennchen. 2019. Knowing the kitchen: Applying practice theory to issues of food waste in the food service sector. *Journal of Cleaner Production*, Vol. 225: 675–683.

elderly often have poor appetites and eat considerably less than planned. In elderly care, pre-prepared meal boxes are sometimes delivered to the kitchens of the elderly and can be perceived as containing too much food, resulting in significant FLW.

Much of the FLW occurs due to lack of engagement and time. Employees in the restaurant industry and elderly care environments often receive low wages, have little professional education, and are too rarely involved in enacting waste reduction measures. Furthermore, staff turnover is often high, making it difficult to maintain work with various routines for measuring and reducing waste. Today, an increasing number of large-scale kitchens follow up and measure preparation and plate waste, and many schools have managed to reduce FLW.

### **Proposed measures**

**Planning and purchasing:** Plan menus carefully based on expected demand and seasonal or local ingredients. Use historical consumption data to predict the amount of food needed. Implement a system to record FLW in different parts of the operation (preparation, serving, guest leftovers). Introduce data systems where the kitchen receives daily updates on the number of students present in school. Simple measurement methods are crucial because measurements are otherwise abandoned during hectic periods. In addition, continuous feedback is needed to maintain employee motivation. Measurement results can be visibly displayed in the kitchens to maintain motivation. Collaborate with local suppliers to get fresher ingredients that last longer.

**Storage:** Store food properly to extend shelf life. Use correct temperatures in refrigerators and freezers and use airtight containers for storage. Label and organise ingredients by purchase date to ensure older products are used first (the FIFO principle). Use apps and software to track what is in stock. Implement systems that help monitor food shelf life and send reminders when products need to be used.

**Menu planning:** Management strategies can affect all three categories of waste in the operation. Management systems need to be in place for various kitchen activities, such as ordering, tidiness in the kitchen, documentation, how menus are planned, and how recipes are used and improved. Design menus with dishes that do not result in significant waste.

**Education:** Management play an important role in making sure that employees are trained and can develop in their daily operations. Staff should be educated in the planning, correct handling, storage, and use of food in order to minimise waste. In addition, chefs should be encouraged to be creative with leftovers and surpluses and create dishes with ingredients that need to be used soon. To effectively reduce FLW, staff engagement and motivation are crucial. To control FLW over time, one needs to ensure that the chosen methods are integrated into the usual routines so that they are not perceived as time-consuming.

**Communication with guests:** Guests should be informed about the food, where it comes from, and the value of the food. Inform guests about efforts to reduce

FLW. Campaigns are effective tools for reducing plate waste in school canteens.

**Donation and composting:** Collaborate with charity organisations to donate edible food that would otherwise be discarded. Use composting for food waste that cannot be reused.

**Purchase of goods with cosmetic flaws:** Public kitchens can contribute to reducing waste upstream in the value chain of goods with cosmetic flaws, for example, "ugly fruits". A coordinated purchasing channel for public kitchens would facilitate this measure.

**Meal boxes:** Surplus food can be sold in meal boxes, for example to the staff.

## Case: **Eura**

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*The city of Eura in Satakunta, Finland, has embarked on a project aimed at reducing FLW and serves as an inspiring example of more sustainable food management in Finland. The measures undertaken have resulted in reduced FLW and demonstrated what can be achieved through improved collaboration and open communication.*

The city has implemented a number of changes in its operations by investing in FLW reduction. In 2022, it conducted a pilot project at one of the municipality's primary schools, Kiukainen, which yielded good results and generated great interest.

The school managed to reduce plate waste by 73% by, among other things, encouraging students to take only what they can eat and return for more if needed. Unnecessary food orders have decreased, and feedback on menu planning has increased. The project's success is about working with attitudes, engagement, and collaboration.

Informational material has been produced about FLW and its environmental impact, which has influenced the school community. Because of the project, increased and open communication and information sharing have improved communication between schools and the central kitchen, yielding concrete results. Furthermore, the involvement of teachers and students in food service has strengthened collaboration. The municipality now strives for even broader participation from other schools and food service locations within the municipality.

## References:

Eura's Food Waste Reduction Project: Achievements and Future Perspectives in Satakunta, Finland. 2024.

[Read more](#)

## Case: **Gothenburg Model**

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*The Gothenburg model has contributed to extensive reduction in kitchen and serving waste, thanks to comprehensive training of kitchen staff and the practical and simple tools with which they are provided. The foundation of this success has been about continuously measuring and following up on causes and making changes.*

The Gothenburg model is a method developed on behalf of the Måltid Göteborg Group to reduce FLW in the public kitchens of Gothenburg. The model was introduced in January 2017 and has proven to be a powerful method for reducing both serving and kitchen waste. In just two years, the city of Gothenburg managed to halve its FLW from about 30 grams per portion to 15 grams per portion, corresponding to a reduction of over one million portions per year.

The implementation of the Gothenburg model involved extensive training of kitchen staff. Over 500 kitchens and 1,143 employees were trained, resulting in a significant reduction in FLW. A key to success was creating concrete, practical instructions that were easy to follow. The model included measures such as better menu planning, portion calculation, adapting meals to attendance, and proper storage of leftovers.

The model emphasises the importance of regularly measuring FLW to be able to follow up and adjust measures. By the end of the project, 95% of kitchens measured their FLW daily. This systematic measurement made it possible to identify and address specific problem areas. For example, it turned out that serving waste accounted for 80% of total FLW, while kitchen waste accounted for 20%.

Not only has the Gothenburg model had a positive impact locally, it has also inspired other municipalities and institutions around Sweden. The National Food Agency now plans to develop a national initiative based on this model, which will further spread these effective methods to reduce FLW across the country. The goal is to include more aspects, such as plate waste, and to adapt the methods

for different types of public meals.

By reducing FLW, Gothenburg has not only contributed to a more sustainable environment but has also made significant economic savings. This shows how systematic and well-organised food management can lead to significant improvements both economically and environmentally.

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Göteborgs Stad. 2022. Göteborgsmodellen för mindre matsvinn.

[Read more](#)

Livsmedelsverket. 2020. Handbok för minskat matsvinn – för verksamheter inom vård, skola och omsorg.

[Read more](#)

E. Backlund and K. Östergren. 2020. Implementering och resultat av Göteborgsmodellen för mindre matsvinn. RISE Rapport 2020:24.

[Read more](#)

## 7.7 Households

The largest proportion of FLW in wealthy countries occurs in households. This include all the individuals and families that buy food from retailers to prepare the meals at home. The FLW in this stage of the chain is particularly problematic from an environmental perspective because food has a higher environmental impact after processing, packaging, and distribution than earlier in the value chain.

### ***Overall analysis of causes***

FLW in households is a complex and multifaceted problem<sup>[89]</sup> that arises from a mix of personal values, knowledge, cooking experience, and interaction with situations and contexts.<sup>[90]</sup> One explanation for the perceived lack of value in food may be that it has long been relatively

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89. K. Schanes, k. Dobernig, and B. Gözet. 2018. Food waste matters—A systematic review of household food waste practices and their policy implications. *Journal of Cleaner Production*, Vol. 182: 978–991.

90. J. Aschemann-Witzel, L. Randers, and S. Pedersen. 2022. Retail or consumer responsibility?—Reflections on food waste and food prices among deal-prone consumers and market actors. *Business Strategy and the Environment*. <https://doi.org/10.1002/bse.3202>



cheap.<sup>[91]</sup> In recent decades, households have assigned an increasingly smaller part of their disposable income on food.<sup>[92]</sup> Low prices may have influenced consumers against valuing food enough to take good care of it.

At the same time, there has long been a strong focus on low comparison prices, both from retailers and consumer organisations. This has led, among other things, to many people buying more in bulk packs, which is cheaper per kilogram of food. The result is clear: we buy more than we need, which leads to FLW.

Packaging design plays a significant role in the waste generated in the household. In a pioneering study, the of waste in households due to packaging was estimated to be around 50%.<sup>[93]</sup> There is great potential to reduce FLW if consumers become more aware of the role of packaging and there is improvement around design.<sup>[94]</sup> The two important ways of doing this is through the quantity per package and communication around date marking. The environmental impact of packaging needs to be balanced against the environmental impact of the FLW it prevents.

The focus of authorities on information campaigns or increasing awareness about FLW has failed to produce any meaningful results, as information and awareness alone do not target the daily practices of households that generate FLW. More knowledge about the problem has not led to changes in the practice itself, which is interconnected with the context and other activities in everyday life.<sup>[95]</sup> Hebrok and Heidenstrøm (2019) highlighted five practices that seem to be particularly significant in generating FLW: (1) lack of planning for purchases and meals; (2) storage that causes FLW; (3) deficiencies in assessing food quality and safety; (4) deficiencies in perceptions of food value; (5) difficulty finding opportunities for use and portion sizes.<sup>[96]</sup>

Too few consumers take the time needed to plan what to serve, what to purchase, and how to handle leftovers.<sup>[97]</sup> Even with good planning, there are factors that can affect whether there is waste or not. Some families strive to

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91. J. Aschemann-Witzel, I. de Hooge, P. Amani, T. Bech-Larsen, and M. Oostindjer. 2015. Consumer-Related Food Waste: Causes and Potential for Action. *Sustainability*, Vol. 7: 6457–6477. <http://doi.org/10.3390/su7066457>
  92. Jordbruksverket. 2017. Jordbruket i siffror. <https://jordbruketisiffror.wordpress.com/2017/05/08/hushallen-lagger-mer-pengar-pa-mat-samtidigt-som-matens-andel-av-den-totala-konsumtionen-minskar/> (2024-08-14)
  93. H. Williams, J. Trischler, F. Wikström, and Z. Rowe. 2020. Avoiding Food Becoming Waste in Households – The role of packaging in consumers’ practices across different food categories. *Journal of Cleaner Production*, Vol. 265.
  94. A. Halloran, J. Clement, N. Kornum, C. Bucatariu, and J. Magid. 2014. Addressing food waste reduction in Denmark. *Food Policy*, Vol. 49, Part 1: 294–301.
  95. M. Hebrok and N. Heidenstrøm. 2019. Contextualising food waste prevention—Decisive moments within everyday practices. *Journal of Cleaner Production*, Vol. 210: 1435–1448.
  96. M. Hebrok and N. Heidenstrøm. 2019. Contextualising food waste prevention—Decisive moments within everyday practices. *Journal of Cleaner Production*, Vol. 210: 1435–1448.
  97. M. Canali, P. Amani, L. Aramyanl, M. Gheoldus, and G. Moates. 2017. Food waste drivers in Europe, from identification to possible interventions. *Sustainability*, Vol. 9, No. 1: 37. <https://doi.org/10.3390/su9010037>

eat healthier and therefore buy more fresh fruit and vegetables than they actually consume. A relatively common phenomenon is that the person cooking the food may have an attitude that the table should never run out of food. This means that they often prepare more than is needed, which increases the risk of FLW. This is especially true when hosting guests.

It is sometimes difficult to plan meals for an entire family where both needs and taste preferences can look very different as well as change over time. In many families with small children, it can be a challenge to get them to eat the same foods as adults. Furthermore, teenagers tend to acquire new insights, and their interests can change how they want to eat if, for example, they embark on strength training and want to eat a lot of protein or when someone becomes aware of deficiencies in our animal handling and wants to be vegan. If in addition some in the family are sensitive to lactose or gluten and everyone works a great deal and has different commitments in the evening, it become complex and perhaps stressful to develop strategies for reduced FLW. If different dishes are cooked to satisfy everyone's preferences, there is increased risk that food in opened packages and leftovers are forgotten in the overcrowded refrigerator. Individuals testify that leftovers sometimes end up in the freezer and are forgotten until they are discarded during the next freezer cleaning. Others have neither the desire nor the energy to take care of the leftovers, which are thrown directly into the garbage or compost bag. Some give the leftovers to their pets, which reduces the incentives to reduce FLW.

Some families live an "every-other-week life", making it challenging to plan and adjust between weeks. One parent may suddenly have three flavours of yoghurt to consume or too many bananas that were not consumed when the children were there. Adjusting cooking to larger quantities one week and then cooking for a single person can be challenging, as much of the shopping and cooking are based on habit. Even when children move out, many testify to a long adjustment period to learn the new conditions. However, despite the difficulties of keeping together different wishes in a family, it is usually single households that throw away the most per capita.<sup>[98]</sup>

Another common reason for food being discarded is that consumers misinterpret the best-before date and discard products as soon as the date has passed. Too few have the knowledge and courage to use their senses to determine whether the food is edible. Knowledge about when food is edible is usually a better attribute among older generations, who also throw away less food per person on average.

### ***Proposed Measures***

***Planning:*** Planning the week's meals, checking what is already at home, and then creating a shopping list of what to buy are all central to reducing FLW.

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98. J. Jörissen, C. Priefer, and K.-R. Bräutigam. 2015. Food waste generation at household level: Results of a Survey among Employees of Two European Research Centers in Italy and Germany. *Sustainability*, Vol. 7, No. 3: 2695–2715. <https://doi.org/10.3390/su7032695>

The right amount from the store: If more food is bought than needed, the risk is obvious that some will be discarded. Buy the amounts that are actually used. It may be better to buy smaller package sizes even if they are more expensive per kilo because food that is not used and is discarded also means wasted money. One should avoid having too much fresh food at home, as these have a shorter shelf life. Proximity to stores also plays a big role in being able to buy smaller amounts more often.

**Buying products with a close expiration date:** Buying products with a close expiration date and at a reduced price helps the store reduce its waste and is good for the wallet, provided there is some flexibility in cooking so that the waste is not moved from the store to the household.

**Proper storage of food:** When food is stored properly, its shelf life is extended. Many foods last much longer at 4 degrees in the refrigerator than at 8 degrees. At the same time, some fruits and vegetables are damaged by overly low temperatures. It is important to acquire information about optimal storage temperature. It is easy for food to be left for too long in both the refrigerator and freezer. It is an important routine to regularly go through and use what is there.

**Eating what has been bought:** The amount of food cooked can be adjusted so that it always runs out, and bread and salad can be used as additions so that everyone is satisfied. Alternatively, there are ways of making use of leftovers. It is often the case that more vegetable parts can be used, for example, broccoli stems. Many parts of fruits and vegetables that are discarded can instead be used in cooking.

**Use of leftovers:** Plan to use generated leftovers for new meals. Vegetables that are starting to look unappealing can be used in stews; fruits can be used for smoothies; and much can be mixed in an omelette. Today, there are plenty of websites or apps that offer recipes based on ingredients you have at home. Store leftovers in a good place in the refrigerator so that they become visible and are not easily forgotten. If there are some leftovers during a week, a leftover day can be introduced when all leftovers are brought out.

**Curiosity:** Curiosity about what is discarded and why might be important. Noting and measuring one's waste certainly arouses thoughts about which behaviours should be changed to reduce waste. The same is true in terms of reflecting on the value of food from an economic and resource perspective as well as in terms of the work effort behind getting the food. If there is respect for food, respectful behaviour often follows automatically. Knowledge is of course invaluable, primarily in terms of understanding the difference between the "best before" and "use by" dates, and one can taste and smell products with "best before" dates to determine whether the food is safe to eat.

**Waste:** FLW that still occurs should be submitted to the municipality's collection of organic waste or composted so that the nutrients in the food can return to the soil.

## Case: **Frísskápur**

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*"Frísskápur" is a norm-breaking initiative in Iceland that reduces FLW and strengthens community cohesion. It offers shared refrigerators where anyone can collect or donate food at any time. With over 7,700 engaged members on Facebook, the initiative contributes to reducing FLW and promoting sharing and a sense of community.*

*Frísskápur* is an Icelandic initiative aimed at reducing FLW whilst strengthening the local community. The initiative is part of a larger international community called FREEdge. The Icelandic initiative was started by Kamila Walijewska and Marco Pizzolato, who had previously been involved in other food-related sustainability projects. During the pandemic, they saw an increased need to manage FLW locally and, therefore, created Fredge, a communal refrigerator placed outside Andrými in Reykjavik, where anyone could come and collect or donate food at any time.

*Frísskápur* functions as a place where fresh produce, packaged goods, and even homemade dishes (properly labelled with dates and contents) can be shared. By providing a place for both individuals and local businesses to donate surplus food, *Frísskápur* contributes to reducing the amount of food that would otherwise have been discarded. The initiative has quickly become popular and received a positive reception, with over 7,700 members on a dedicated Facebook page that acts as the hub for the refrigerators, where active members can post and share updates when new items are available for collection.

This initiative inspires awareness and responsibility regarding FLW and promotes a culture of sharing and sustainability. Kamila and Marco hope that similar projects will emerge across Iceland, which would help reduce FLW on a larger scale and create stronger communities. Their work demonstrates how local and community-driven solutions can play a crucial role in reducing FLW.

### **References:**

Iceland Review. 2021. "We Take Food for Granted": New Community Fridge Opens in Reykjavík.

[Read more](#)

Grapevine.is. 2022. Making Food Waste a Thing of The Past.

[Read more](#)

## Case: **Fiksuruoka**

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*"Fiksuruoka" is a Finnish company that purchases surplus food from various producers and resells it online to consumers, delivering it to their doorstep. The aim is to make it easy for consumers to reduce FLW, and the company has contributed to reducing millions of kilograms of FLW.*

The founder of *Fiksuruoka* worked in logistics for many years and began thinking about how to address the significant level of FLW in all sectors. The founder focused on consumers and wanted to make it as easy as possible for them to reduce FLW. *Fiksuruoka* purchases products from wholesalers and food manufacturers. The purchased products are typically those that would otherwise be discarded because (1) there is an approaching best-before date, (2) the product may have been removed from the range, or (3) the packaging may have changed in some way. The company then offers the products in an online shop, where customers choose and pay. The order is then delivered to the customer's doorstep.

Together with its customers, *Fiksuruoka* has reduced FLW by 4.5 million kilograms. In four years, the company grew to a turnover of €12 million.

### **References:**

Fiksuruoka Brings Surplus Food to People's Doorsteps. 2021.

[Read more](#)

# Information Gathering

To address the subject in focus, information was gathered through multiple means, including a literature review of scientific research, report analyses, as well as interviews with experts in the field.

## 8.1 Literature review

We started with a literature review to get an overview of research published in peer-reviewed scientific journals. The process used was inspired by the PRISMA method, which includes planning, carrying out the review, and reporting the results.

First, we planned the review with a focus on providing the baseline for the search. We defined our goal as follows: to find articles from Nordic countries about ways to prevent food waste. We conducted searches on the Scopus database on 1 February 2024. We chose Scopus as it covers many relevant journals in the area of interest and allows for complex searches. It also allows for searches that include "AND" and "OR" and searches of a variety of spellings/wordings, such as "sustainab", which would include variants of sustainability, sustainable, and similar words. Using this, we chose keywords for our search, as shown in the search string below, focusing on articles written in English about FWL in a Nordic context:

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TITLE-ABS-KEY ( "food waste" AND "Sweden" OR "Norway" OR "Iceland" OR "Finland" OR "Denmark" OR "Faroe Island*" OR "nordic*" ) AND ( LIMIT-TO ( SUBJAREA , "ENVI" ) OR LIMIT-TO ( SUBJAREA , "SOCI" ) OR LIMIT-TO ( SUBJAREA , "BUSI" ) OR LIMIT-TO ( SUBJAREA , "ECON" ) OR LIMIT-TO ( SUBJAREA , "ENGI" ) OR LIMIT-TO ( SUBJAREA , "ENER" ) OR LIMIT-TO ( SUBJAREA , "PSYC" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) )
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The second stage of the literature review encompassed the actual search and reading of the identified articles. This stage also included a selection process to exclude results deemed irrelevant to the purpose of the literature review. The initial search yielded 200 articles after the removal of duplicates and clearly irrelevant results. The subsequent step in the process involved reviewing the title

and abstract of all articles to identify those aligned with the purpose of the literature review. Following this step, 85 articles remained.

The next stage in the process was to conduct a content analysis and present the results. To this end, the introduction, purpose, and conclusions of all the remaining articles were read, after which the full text was perused to identify various measures and classify them according to different stages in the value chain, as shown in Table 1 below.

Table 1 – Studies addressing various stages of the value chain and their county setting

	Number of studies	Sweden	Norway	Denmark	Finland	Iceland	Several countries or unspecified
Primary producers	7	3	3	1	3	0	0
Food producers	2	1	0	0	0	0	1
Wholesalers/transport	1	1	0	0	0	0	0
Retail	17	12	0	3	1	0	1
Restaurants	8	3	2	0	6	0	0
Public meals	15	11	1	3	0	0	0
Households	24	4	6	8	7	0	5
Other relevant areas	11	5	1	2	2	1	2



As illustrated in the table above, a majority of the articles were found within the categories of "retail", "public meals", and "households". To strengthen the scientific foundation for the other areas, a qualitative search was conducted in which additional articles deemed to be of interest were included. They were identified through a process known as "snowballing", wherein the authors' own insight and understanding of the field were utilised to identify potentially omitted results. Furthermore, additional articles were continuously identified throughout the project's implementation, for instance, in reports and through interviews, which were subsequently incorporated into the reporting.

## **8.2 Reports and case studies**

In addition to the scientific articles, a review was conducted of a substantial number of reports produced within the field. A search was carried out on the websites of different authorities for various reports concerning food waste in general and preventive measures in particular. These authorities were identified partly by referring to the participants at the Nordic Food Waste Summit in April 2023 and their organisational affiliations and by inquiring as to whether any additional actors should be included in the search. Following this inquiry, several organisations were added, notably interest groups. The initial website search was broad, using the search term "food waste". All identified reports were initially included, subsequently focusing on reports produced after 2015. Only reports written in English, Swedish, Danish, or Norwegian were selected for further analysis. These were then perused for classification according to type and focus. Additionally, we noted whether the reports contained cases to learn from and whether any effects of the measures had been quantified.

Beyond the initial website search, a considerable number of additional reports were acquired because of discussions during interviews and inquiries to individuals active in the field. This included various types of surveys or reports from interest groups and research collectives.

Based on the reports, a need was identified to pinpoint exemplary cases that illustrated the implemented measures and, where applicable, their effects. The aim was to obtain a distribution of illustrative cases representing different parts of the value chain, demonstrating various types of measures, and a spread across countries. Where possible, cases with verified results were also desirable.

## **8.3 Interviews**

The interviews served multiple purposes: to validate and supplement the reports and written material identified via websites; to gain insight and understanding of the knowledge and comprehension held by the interviewees and their organisations and their reflections on the field; and to identify exemplary cases of preventive measures that had been implemented.

Initially, interviewees were identified by referencing a list of participants from the Nordic Food Waste Summit in April 2023. These primarily included individuals from authorities in the various countries. This was subsequently expanded by identifying key personnel associated with, for example, research institutes or interest organisations in the different countries. The intention was to conduct the interviews primarily with authorities and organisations working with food waste in the various countries, thus complementing the search of reports on the websites of these authorities.

The interviews included questions about the organisations' work on food waste issues, their food waste efforts in different parts of the chain, challenges and opportunities, as well as perceptions of the effects of various measures. The interviews concluded with an inquiry about other contact persons for either interviews or specific measures. Through this process, additional interviewees were added often from other organisations. This included, among others, interest organisations linked to food waste and researchers who had been involved in practical work in various ways.

In total, 13 individuals were interviewed, eight of whom represented authorities, three were from research institutes or universities, and two were from interest organisations. Following the completed interviews, follow-up questions were sent out based on what had emerged in order to achieve comparability in certain cases where relevant. They were primarily sent to interviewees in applicable cases.

# Concluding Remarks

During the course of this report, we have been struck by the wealth of knowledge available and the numerous well-developed policy proposals that have been formulated and presented to decision-making bodies in the Nordic countries. While there remains a need to develop further knowledge and disseminate best practices, achieving the goal of halving food waste by 2030 necessitates interventions at the highest political level.

We have proposed economic and legal policies that we believe will be necessary to provide stakeholders with sufficient incentives to implement measures to the extent required. There is also a need for more long-term resources to lead the work at the national level, particularly regarding coordination efforts between various actors.

We are aware that some policy measures may be perceived as politically sensitive. Nevertheless, we assess that many can gain acceptance through effective communication, especially if vulnerable groups will not be adversely affected and could benefit. After all, most of the Nordic populations are seriously concerned about climate change and desire action in this regard. We earnestly pass on this call to action to our elected representatives.

# Appendix I

Throughout the course of this work, various reports and materials have emerged that contribute knowledge and perspectives on the causes of food waste and how we can reduce it. To ensure these do not fall by the wayside, a compilation of these reports is presented here, with a focus on overviews, collection of cases, guiding principles, and handbooks. The list below has not been systematically compiled and is not representative of countries or actors; rather, it aims solely to disseminate good examples of work done, which can serve as inspiration for different initiatives.

## Overviews

Several overviews have been published in the different countries, some of which are not available in English. Here, we highlight some examples that spans across different levels of the value chain and offer concrete recommendations for action.

### ***Monitoring Food Waste and Loss in the Nordic region, 2021***

An overview of the work with monitoring and reporting in the Nordic countries, following the new requirements from EU implemented in 2020. The report identifies various approaches to monitoring and reporting (e.g. top-down vs bottom-up) and explores the driving forces related to key dimensions. The report provides a comprehensive overview, including recommendations for further action. Read more: <https://norsus.no/wp-content/uploads/temanord2021-504.pdf?v=1>.

### ***Matsvinnsutvalget - Anbefalinger til helhetlige tiltak og virkemidler, 2023***

An excellent overview of the area, with a practical and system-oriented perspective was published in late 2023 by Matsvinnutvalget. The report "Anbefalinger til helhetlige tiltak og virkemidler" offers a comprehensive overview, including background in relation to various industries/actors in the value chain, as well as recommendations and consequences from various perspectives. Read more: <rapport-fra-matsvinnutvalget-anbefalinger-til-helhetlige-tiltak-og-virkemidler-31.12.23.pdf> ([regjeringen.no](https://regjeringen.no)).

### ***Food Waste in the Service Sector, Key concepts, measurement methods and best practices, 2020***

In Finland, several studies on food waste in public meals have been conducted, with experiences compiled in the 2020 book: "Food Waste in the Service Sector, Key concepts, measurement methods and best practices" by Kirsi Silvennoinen, Sampsa Nisonen, Oona Pietiläinen, Routledge Handbook of Food Waste, 1st Edition, First Published 2020. e-book ISBN: 9780429462795.

### ***Redistribution in the Nordic Region, 2016***

A Nordic project has focused on how food redistribution is organized and conducted, as well as how these operations can be improved while ensuring food safety. Nordic Council of Ministers. 2016. Food Redistribution in the Nordic Region Phase II: Identification of best practice models for enhanced food redistribution. TemaNord 2016:502. Read more: <https://library.oapen.org/bitstream/handle/20.500.12657/32730/1/607492.pdf>.

## **Collection of cases**

Cases can serve as inspiration for action. While these cases are sometimes scattered across various publications, there are a few collections of cases that deserve attention for covering a wide range of the value chain. These collections illustrate various actions that can be taken to reduce food waste, with a particular focus on preventative measures.

### ***Case catalogue from One\Third, 2022***

The case catalogue from One\Third presents a collection of case studies demonstrating how different Danish companies and organizations have implemented innovative solutions to reduce food waste. It highlights practical examples from across the food supply chain, including primary production, retail, and the service sector. By sharing their experiences and successes, the catalogue aims to inspire other actors to follow suit and contribute to more sustainable food management.

<https://onethird.dk/wp-content/uploads/2022/02/casekatalog.pdf>.

### ***Good Examples from Sweden on Reducing Food Waste, 2021***

The Swedish Environmental Protection Agency presents a short overview of 21 different good examples of projects focusing on food waste, including national, international and local examples.

[https://www.naturvardsverket.se/contentassets/97d8bccd2e974e9d99fde98d8071ab86/good\\_examples\\_from\\_sweden\\_on\\_reducing\\_food\\_waste.pdf](https://www.naturvardsverket.se/contentassets/97d8bccd2e974e9d99fde98d8071ab86/good_examples_from_sweden_on_reducing_food_waste.pdf).

## **Guiding principles and handbooks**

Across all countries, several principles and handbooks have been published, sometimes as a result of a comprehensive report or study. Please also refer to the overviews outlined in this appendix. Some of the readings below are focused on a specific sector, others are more general in their scope.

### ***10 prinsipper for å redusere matsvinn sammen***

In collaboration with various food industry companies, NORSUS and Matvett, under the auspices of the BREAD research project, have developed 10 principles for actors to incorporate innovation processes to reduce food waste.

<https://www.matvett.no/bransje/10-prinsipper-for-a-reducere-matsvinn-sammen>.

### ***Stoppa matsvinnet! – en förpackad lösning, 2023***

Researchers Wikström and Williams have documented the significant role packaging plays in both preventing and causing food waste in their book. Their insights from 15 years of research are compiled in a popular science format in the book: Wikström and Williams. 2022. Stoppa matsvinnet! – en förpackad lösning. (Stop Food Waste - A Packaged Solution). Fri Tanke, Sweden. ISBN: 978-91-8913-978-7.

### ***Handbok för minskat matsvinn - För verksamheter inom kök, restaurang och butik, 2023***

The Swedish Food Agency have published several handbooks containing practical advises for reducing food waste across a range of sectors. A recent publication focuses on kitchens, restaurants and retail in the private sector:

<https://www.livsmedelsverket.se/om-oss/publikationer/handbocker-och-verktyg/handbok-for-minskat-matsvinn-for-verksamheter-inom-kok-restaurang-och-butik?pub=show>.

Additionally, there are several other handbooks available, including those focused on the public sector, where the Göteborgsmodellen is commonly referenced as a point of departure:

<https://www.livsmedelsverket.se/globalassets/publikationsdatabas/handbocker-verktyg/handbok-for-minska-matsvinn.pdf>.

# Appendix 2

This appendix contains a table that presents the literature from our review. The table includes information such as the author(s), title, and area of focus, along with key takeaways from each source.

Sector	Year	Authors	Title	Journal	Key take-aways
Primary Production	2023	Drangert J.-O.; Hallström J.	From pigs to incineration and beyond: The evolution of organic waste and food management in Sweden in the period 1800 – 2000 and future prospects	City and Environment Interactions	Practitioners and policymakers should focus on developing sustainable urban strategies that address both historical lessons and modern challenges. By promoting circular economy principles and engaging multiple stakeholders, cities can enhance food security and sanitation management in a sustainable manner.
	2023	Röös E.; Wood A.; Säll S.; Abu Hatab A.; Ahlgren S.; Hallström E.; Tidåker P.; Hansson H.	Diagnostic, regenerative or fossil-free - exploring stakeholder perceptions of Swedish food system sustainability	Ecological Economics	Practitioners and policymakers should focus on identifying common ground among stakeholders and building trust through collaborative and inclusive approaches. By addressing less controversial issues first, they can pave the way for larger systemic changes in the Swedish food system.

	2021	Joensuu K.; Hartikainen H.; Karppinen S.; Jaakkonen A.-K.; Kuoppa-aho M.	Developing the collection of statistical food waste data on the primary production of fruit and vegetables	Environmental Science and Pollution Research	Practitioners and policymakers should focus on developing efficient monitoring methods and supporting farmers in data collection to reduce food waste in primary production. By integrating these methods into annual surveys and simplifying the process, significant progress can be made toward achieving global food waste reduction goals.
	2020	Falagán N.; Terry L.A.	1-Methylcyclopropene maintains postharvest quality in Norwegian apple fruit	Food Science and Technology International	Confirms that postharvest treatment with 1-MCP has great potential to maintain the quality of Norwegian apple cultivars during cold storage and subsequent shelf life, making it a valuable tool for fruit producers and distributors.
	2018	Hartikainen H.; Mogensen L.; Svanes E.; Franke U.	Food waste quantification in primary production – The Nordic countries as a case study	Waste Management	Introduced the term 'side flow' (SF) to describe food waste in primary production. This term includes food that ends up as animal feed, which is not typically included in other food waste definitions. Practitioners should adopt broader and more inclusive definitions of food waste, such as the SF term, to gain a more accurate understanding of waste in primary production. This can inform strategies to minimize waste and improve sustainability in the food supply chain.
	2017	Kuisma M.; Kahiluoto H.	Biotic resource loss beyond food waste: Agriculture leaks worst	Resources, Conservation and Recycling	Practitioners and policymakers should focus on increasing the efficiency of biotic resource use, particularly in animal production, and leverage circular economy practices to reduce losses and enhance sustainability. Implementing recycled nutrients and minimizing external inputs are crucial strategies for improving resource use efficiency and ensuring food security.



	2015	Strazza C.; Magrassi F.; Gallo M.; Del Borghi A.	Life Cycle Assessment from food to food: A case study of circular economy from cruise ships to aquaculture	Sustainable Production and Consumption	Highlights the application of industrial symbiosis within the circular economy, specifically recycling food waste from cruise ships for aquaculture feed. This approach shows potential environmental benefits, with Life Cycle Assessment (LCA) indicating lower burdens for recycled food waste feed compared to conventional feed. Traditional feed, particularly in the UK, has a higher carbon footprint and energy demand, while Norwegian feed impacts water scarcity more. Bottlenecks in supply chains vary; crop-derived products in Norway have a significant water footprint impact. Turbo-drying technology onboard cruise ships is effective for processing food waste into aquaculture feed.
Producer	2022	Pålsson H.; Sandberg E.	Adoption barriers for sustainable packaging practices: A comparative study of food supply chains in South Africa and Sweden	Journal of Cleaner Production	Practitioners and policymakers should focus on understanding and addressing the identified adoption barriers to enhance the implementation of sustainable packaging practices. By using the propositions and process view, companies can develop targeted strategies to overcome obstacles and realize the potential benefits of sustainable packaging in reducing food waste and improving logistics efficiency.
	2020	Guimarães A.; Ramos Ó.; Cerqueira M.; Venâncio A.; Abrunhosa L.	Active Whey Protein Edible Films and Coatings Incorporating Lactobacillus buchneri for Penicillium nordicum Control in Cheese	Food and Bioprocess Technology	Practitioners and policymakers should consider incorporating LAB with antifungal properties, like L. buchneri UTAD104, into edible films and coatings. This approach can enhance the safety and shelf life of cheese by effectively preventing fungal contamination and mycotoxin production.
Wholeseller	2023	Weber L.; Bartek L.; Brancoli P.; Sjölund A.; Eriksson M.	Climate change impact of food distribution: The case of reverse logistics for bread in Sweden	Sustainable Production and Consumption	Practitioners and policymakers should aim to improve the efficiency of bread transport by optimizing routes and embracing collaborative logistics. Additionally, efficient waste management practices that focus on recovery and valorization can further contribute to sustainability without significantly increasing climate impacts from transport.

Retail	2022	Lehtokunnas T.; Pyyhtinen O.	Food, excess, wastage and waste: An ethnography of the practices of framing food products in the Finnish retail sector	Geoforum	Practitioners and policymakers should focus on understanding the complex, situational, and practical aspects of food waste generation in retail settings. Emphasizing the management of diverse valuation processes and developing nuanced strategies to handle surplus food can help in reducing food waste and advancing circular economy practices.
	2021	Møller Christensen F.M.; Solheim-Bojer C.; Dukovska-Popovska I.; Steger-Jensen K.	Developing new forecasting accuracy measure considering Product's shelf life: Effect on availability and waste	Journal of Cleaner Production	Practitioners should adopt forecast accuracy measures that consider the shelf-life and asymmetrical impacts of over- and under-forecasting for FFPs. This approach can lead to improved inventory freshness, reduced waste, and more efficient inventory management, even if it results in a slightly lower fill-rate.
	2020	Rosenlund J.; Nyblom Å.; Matschke Ekholm H.; Sörme L.	The emergence of food waste as an issue in Swedish retail	British Food Journal	Practitioners should focus on collaborative efforts, data utilization, and media engagement to tackle food waste. Additionally, policymakers should support these efforts through preventive measures, incentives, and education to create a more sustainable food system.
	2019	Ghosh R.; Eriksson M.	Food waste due to retail power in supply chains: Evidence from Sweden	Global Food Security	Practitioners and policymakers should understand the implications of Take Back Agreements and support efforts to create fairer trading practices. By advocating for policy changes and promoting transparency, the food supply chain can work towards reducing waste and ensuring more sustainable practices.
	2019	Brancoli P.; Lundin M.; Bolton K.; Eriksson M.	Bread loss rates at the supplier-retailer interface – Analysis of risk factors to support waste prevention measures	Resources, Conservation and Recycling	Practitioners and policymakers should reassess and modify trading practices such as Take Back Agreements, promote sustainable business models, and collaborate to reduce bread waste in the supply chain. By addressing the identified risk factors and implementing waste prevention measures, the industry can work towards a more sustainable and efficient food system.

	2018	Mattsson L.; Williams H.; Berghel J.	Waste of fresh fruit and vegetables at retailers in Sweden – Measuring and calculation of mass, economic cost and climate impact	Resources, Conservation and Recycling	Practitioners should prioritize waste management efforts on specific fresh fruit and vegetable categories that contribute most to waste. By investing in enhanced waste management practices, retailers can achieve economic savings and reduce their environmental footprint, thereby supporting sustainable food supply chains.
	2017	Kulikovskaja V.; Aschemann-Witzel J.	Food Waste Avoidance Actions in Food Retailing: The Case of Denmark	Journal of International Food and Agribusiness Marketing	Practitioners and policymakers should focus on a diverse range of food waste avoidance actions, tailored to different food categories and customer segments. By effectively implementing these actions and influencing consumer behavior, retailers can play a crucial role in reducing food waste and promoting sustainable consumption practices.
	2017	Rohm H.; Oostindjer M.; Aschemann-Witzel J.; Symmank C.; Almli V.L.; de Hooge I.E.; Normann A.; Karantininis K.	Consumers in a sustainable food supply chain (COSUS): Understanding consumer behavior to encourage food waste reduction	Foods	that practitioners should focus on educational and marketing strategies to increase consumer acceptance of suboptimal foods. By implementing these strategies, the food sector can reduce waste, improve resource efficiency, and contribute to a more sustainable food system.
	2017	Eriksson M.; Ghosh R.; Mattsson L.; Ismatov A.	Take-back agreements in the perspective of food waste generation at the supplier-retailer interface	Resources, Conservation and Recycling	Practitioners should focus on realigning incentives and costs related to waste management with the organizations generating the waste. Policy measures and targeted interventions in high-risk areas, like the supplier-retailer interface, can significantly reduce food waste in the supply chain.
	2017	Brancoli P.; Rousta K.; Bolton K.	Life cycle assessment of supermarket food waste	Resources, Conservation and Recycling	Practitioners should focus on high-impact waste fractions, implement alternative waste management practices, and adopt holistic waste measurement approaches. By doing so, supermarkets can significantly reduce their environmental footprint and contribute to a more sustainable food supply chain.

	2017	Kliaugaitė D.; Kruopienė J.	Food waste generation and prevention measures in the retail sector: A comparative study; [Lietuvos mažmeninės prekybos sektoriuje susidarančių maisto atliekų įvertinimas ir prevencijos priemonės: Lyginamasis tyrimas]	Environmental Research, Engineering and Management	Practitioners should focus on collecting detailed data, learning from neighboring countries, and implementing targeted strategies to minimize food waste. Enhanced transparency and collaborative efforts are crucial for addressing the food waste issue effectively.
	2016	Eriksson M.; Strid I.; Hansson P.-A.	Food waste reduction in supermarkets - Net costs and benefits of reduced storage temperature	Resources, Conservation and Recycling	Lowering storage temperatures should be done selectively for high-impact products to ensure that the benefits outweigh the increased energy costs. Conducting detailed cost-benefit analyses and adopting targeted strategies can help supermarkets achieve greater sustainability and reduce their environmental footprint.
	2015	Tjärnemo H.; Södahl L.	Swedish food retailers promoting climate smarter food choices-Trapped between visions and reality?	Journal of Retailing and Consumer Services	There is a significant opportunity to enhance food retailers efforts by addressing meat consumption. By educating consumers and offering a broader range of sustainable food options, retailers can play a pivotal role in reducing the environmental impact of the food system.
	2015	Scholz K.; Eriksson M.; Strid I.	Carbon footprint of supermarket food waste	Resources, Conservation and Recycling	Practitioners should focus on reducing food waste by targeting high-impact products and implementing efficient waste management strategies. Collaboration with suppliers and support from policymakers can further enhance efforts to achieve sustainability goals and reduce the carbon footprint of wasted food.
	2014	Eriksson M.; Strid I.; Hansson P.-A.	Waste of organic and conventional meat and dairy products - A case study from Swedish retail	Resources, Conservation and Recycling	Retailers must implement measures to manage and reduce the waste associated with organic products. Increasing turnover, stocking longer shelf-life items, and adjusting ordered volumes can help mitigate the higher waste levels observed in organic products.

	2012	Eriksson M.; Strid I.; Hansson P.-A.	Food losses in six Swedish retail stores: Wastage of fruit and vegetables in relation to quantities delivered	Resources, Conservation and Recycling	Practitioners should focus on managing pre-store waste, improving waste recording practices, and collaborating with suppliers to minimize waste. By adopting a data-driven approach and targeting the main contributors to waste, retailers can effectively reduce the environmental and economic impacts of food wastage.
	2011	Gustavsson J.; Stage J.	Retail waste of horticultural products in Sweden	Resources, Conservation and Recycling	Practitioners should prioritize reducing waste in high-impact horticultural products and explore innovative methods beyond packaging to achieve this goal. Collaboration with stakeholders and support from policymakers can further enhance efforts to create a more sustainable food system.
Restaurants	2021	Erälinna L.; Szymoniuk B.	Managing a circular food system in sustainable urban farming. Experimental research at the turku university campus (finland)	Sustainability (Switzerland)	Practitioners and policymakers should focus on reducing food waste, recycling nutrients, and adopting circular economy principles to create sustainable food systems. The successful implementation of these strategies in Turku provides a model that can be replicated globally, contributing to broader sustainability goals.
	2019	Malefors C.; Callewaert P.; Hansson P.-A.; Hartikainen H.; Pietiläinen O.; Strid I.; Strotmann C.; Eriksson M.	Towards a baseline for food-waste quantification in the hospitality sector-quantities and data processing criteria	Sustainability (Switzerland)	Practitioners and policymakers should prioritize the collection of standardized, high-quality data on food waste. By targeting high-waste areas and implementing precise tracking measures, the hospitality sector can significantly contribute to the goal of halving food waste by 2030.
	2019	Eriksson M.; Malefors C.; Callewaert P.; Hartikainen H.; Pietiläinen O.; Strid I.	What gets measured gets managed – Or does it? Connection between food waste quantification and food waste reduction in the hospitality sector	Resources, Conservation and Recycling: X	Practitioners in catering should focus on using automated quantification tools and targeting high-waste units to achieve the most significant reductions in food waste. By tracking detailed data and prioritizing areas with the greatest potential for improvement, the industry can enhance its overall efficiency and sustainability.

	2019	Silvennoinen K.; Nisonen S.; Pietiläinen O.	Food waste case study and monitoring developing in Finnish food services	Waste Management	Practitioners should implement detailed monitoring systems, focus on reducing overproduction, and engage staff in waste measurement processes. By adopting best practices and leveraging insights from waste data, the industry can significantly reduce food waste and improve sustainability.
	2018	Eriksson M.; Persson Osowski C.; Björkman J.; Hansson E.; Malefors C.; Eriksson E.; Ghosh R.	The tree structure – A general framework for food waste quantification in food services	Resources, Conservation and Recycling	Adopting a standardized framework for food waste quantification can significantly improve waste management practices in the food services industry. By focusing on problem areas and ensuring data comparability, practitioners can make informed decisions to reduce food waste and enhance sustainability.
	2017	Laakso S.	Creating New Food Practices: A Case Study on Leftover Lunch Service	Food, Culture and Society	Practitioners should consider implementing leftover lunch services to reduce food waste and support social sustainability. By integrating these services into daily routines and expanding their reach, the sector can play a crucial role in addressing food wastage and food insecurity.
	2016	Heikkilä L.; Reinikainen A.; Katajajuuri J.-M.; Silvennoinen K.; Hartikainen H.	Elements affecting food waste in the food service sector	Waste Management	Practitioners should focus on integrating food waste management into their overall management practices. By adopting a holistic approach and utilizing the eight-factor model, they can effectively reduce food waste and its associated ecological and economic impacts.
	2015	Silvennoinen K.; Heikkilä L.; Katajajuuri J.-M.; Reinikainen A.	Food waste volume and origin: Case studies in the Finnish food service sector	Waste Management	Practitioners should focus on reducing waste in buffet services and overproduction. Engaging staff in tracking and reducing waste, optimizing production, and reevaluating service practices are key strategies to minimize food waste and enhance sustainability.

Public Meals	2023	Dawkins E.; André K.; Leander E.; Axelsson K.; Gerger Swartling & Å.	Policy for sustainable consumption – an assessment of Swedish municipalities	Frontiers in Sustainability	Practitioners in municipal governments should focus on developing comprehensive policy approaches, enhancing strategic planning, and addressing resource and knowledge constraints. By adopting innovative engagement methods and leveraging supportive national strategies, municipalities can more effectively promote sustainable food consumption.
	2023	Eriksson M.; Christensen J.; Malefors C.	Making food waste illegal in Sweden – Potential gains from enforcing best practice in the public catering sector	Sustainable Production and Consumption	Practitioners and policymakers should focus on implementing and enforcing best practices for food waste reduction, supported by clear benchmarks and the Environmental Code. By adopting these strategies, significant progress can be made towards a more sustainable food system.
	2023	Sundin N.; Malefors C.; Danielsson M.; Hardiyanti M.; Persson Osowski C.; Eriksson M.	Investigating goal conflicts in menu planning in Swedish school catering on the pathway to sustainable development	Resources, Conservation and Recycling	Practitioners in school catering should focus on serving popular and nutritious meals, including plant-based options, to reduce food waste and increase sustainability. By challenging preconceptions and adapting lunch menus, schools can make significant progress towards achieving their food waste reduction goals.
	2022	Persson Osowski C.; Osowski D.; Johansson K.; Sundin N.; Malefors C.; Eriksson M.	From Old Habits to New Routines—A Case Study of Food Waste Generation and Reduction in Four Swedish Schools	Resources	Practitioners should, particularly in schools, focus on identifying the specific causes of food waste in their institutions and implement customized, effective waste reduction strategies. By adopting better planning, reducing options, and creating supportive environments, schools can significantly reduce their food waste and its associated environmental impacts.
	2022	Malefors C.; Sundin N.; Tromp M.; Eriksson M.	Testing interventions to reduce food waste in school catering	Resources, Conservation and Recycling	Practitioners in the food service sector, particularly in school canteens, should implement a combination of forecasting tools, awareness campaigns, and waste tracking systems to effectively reduce food waste. By tailoring these interventions to the specific needs and context of each canteen, they can achieve greater sustainability and significantly lower food waste levels.

	2022	Malefors C.; Secondi L.; Marchetti S.; Eriksson M.	Food waste reduction and economic savings in times of crisis: The potential of machine learning methods to plan guest attendance in Swedish public catering during the Covid-19 pandemic	Socio-Economic Planning Sciences	Practitioners in public catering should focus on implementing and continuously improving forecasting models to predict guest attendance and optimize meal planning. By doing so, they can reduce food waste, achieve economic savings, and enhance the sustainability and resilience of the food system.
	2020	Hansen K.V.; Derdowski L.A.	Sustainable food consumption in nursing homes: Less food waste with the right plate color?	Sustainability (Switzerland)	Practitioners in nursing should consider using colored plates to reduce food waste and improve the health of residents with dementia. Policymakers can support these efforts by providing the necessary resources and guidelines, leading to significant economic, environmental, and health benefits.
	2020	Plummer P.; Van Poeck K.	Exploring the role of learning in sustainability transitions: a case study using a novel analytical approach	Environmental Education Research	Practitioners and policymakers involved in sustainability transitions should focus on the role of learning and the integration of educative practices to disrupt existing norms and attitudes. By using the novel analytical tools provided, they can better understand and enhance the learning processes that drive sustainability initiatives.
	2020	Eriksson M.; Malefors C.; Bergström P.; Eriksson E.; Osowski C.P.	Quantities and quantification methodologies of food waste in Swedish hospitals	Sustainability (Switzerland)	Practitioners in the healthcare sector should focus on maintaining standardized food waste quantification practices and leveraging the data to implement best practices. By doing so, hospitals can significantly reduce food waste and contribute to a more sustainable food system.
	2020	Socci M.; Clarke D.; Principi A.	Active aging: Social entrepreneurship in local communities of five European countries	International Journal of Environmental Research and Public Health	Practitioners and policymakers should focus on encouraging and supporting senior social entrepreneurship as a means to address various social problems. By leveraging the experience, knowledge, and motivation of older adults, communities can benefit from innovative solutions and enhanced social cohesion.



	2019	Lassen A.D.; Christensen L.M.; Spooner M.P.; Trolle E.	Characteristics of canteens at elementary schools, upper secondary schools and workplaces that comply with food service guidelines and have a greater focus on food waste	International Journal of Environmental Research and Public Health	Practitioners in the food service sector should focus on promoting organic food procurement and implementing meal policies to improve compliance with nutritional guidelines and reduce food waste. Tailoring support to address specific canteen characteristics can further enhance the effectiveness of these initiatives.
	2018	Eriksson M.; Lindgren S.; Persson Osowski C.	Mapping of food waste quantification methodologies in the food services of Swedish municipalities	Resources, Conservation and Recycling	Practitioners in public meals should focus on adopting standardized food waste quantification practices. By doing so, they can help establish a national benchmark, facilitating more effective monitoring and reduction of food waste across Sweden's public sector catering facilities.
	2018	Steen H.; Malefors C.; Röös E.; Eriksson M.	Identification and modelling of risk factors for food waste generation in school and pre-school catering units	Waste Management	Practitioners in the public sector food service should focus on implementing structured lunch breaks, improving estimation accuracy for food requirements, and addressing environmental factors in dining halls to reduce food waste. By targeting these key risk factors, significant progress can be made in reducing food waste and achieving a more sustainable food system.
	2017	Eriksson M.; Persson Osowski C.; Malefors C.; Björkman J.; Eriksson E.	Quantification of food waste in public catering services – A case study from a Swedish municipality	Waste Management	Practitioners in public catering should focus on detailed waste quantification and tailored interventions to effectively reduce food waste. Policymakers should support these efforts to enhance the sustainability of the food supply chain.
	2015	Jensen J.D.; Thorsen A.V.; Damsgaard C.T.; Biltoft-Jensen A.	Cost of new nordic diet school meals	British Food Journal	Practitioners and policymakers involved in school meal programs should focus on increasing flexibility in meal scheduling, reducing the percentage of organic ingredients, and controlling portion sizes to reduce costs and food waste. Implementing these strategies can make school meal programs based on the New Nordic Diet principles more sustainable and cost-effective.

Households	2024	Tsalis G.; Boutrup Jensen B.; Aschemann-Witzel J.	The relationship between retail price promotions and household-level food waste: Busting the myth with behavioural data?	Waste Management	Practitioners and policymakers should focus on empirical evidence when addressing the impact of price promotions on food waste. By promoting environmental awareness and improving consumer food handling skills, significant progress can be made towards reducing household food waste and achieving sustainability goals.
	2023	Lehtokunnas T.	The circular economy futures in the making: Transformativity and object ontologies in food waste practices in Finnish households, supermarkets and biogas plants	Futures	Practitioners and policymakers should recognize the diverse and dynamic nature of food waste practices and their potential to shape multiple circular economy futures. By fostering habitual, planned, and experimental practices, stakeholders can drive societal transformations toward a more sustainable and circular economy.
	2023	Moshtaghian H.; Bolton K.; Rousta K.	Public preferences for nutritional, environmental and food safety characteristics of upcycled foods in Sweden	International Journal of Food Science and Technology	Practitioners and policymakers should focus on promoting the environmental and food safety benefits of upcycled foods while educating consumers about their nutritional value. Tailoring communication strategies to different age groups can enhance the acceptability and adoption of upcycled foods, contributing to a more sustainable food system.
	2023	Clement J.; Alenčikienė G.; Riipi I.; Starkutė U.; Čepytė K.; Buraitytė A.; Zabulionė A.; Šalaševičienė A.	Exploring Causes and Potential Solutions for Food Waste among Young Consumers	Foods	Practitioners and policymakers should focus on educational and practical interventions to address the specific determinants of food waste among young consumers. By targeting special occasions, improving food quality assessment, enhancing kitchen practices, and modifying shopping habits, significant progress can be made in reducing food waste and promoting sustainable consumption behaviors.

	2023	Torán-Pereg P.; Mora M.; Thomsen M.; Palkova Z.; Novoa S.; Vázquez-Araújo L.	Understanding food sustainability from a consumer perspective: A cross cultural exploration	International Journal of Gastronomy and Food Science	Practitioners and policymakers should focus on culturally tailored strategies and products to promote sustainable consumption habits. By understanding and addressing the specific demands and expectations of consumers in different cultural contexts, more effective and engaging approaches to sustainable diets can be developed.
	2022	Heidenstrøm N.; Hebrok M.	Towards realizing the sustainability potential within digital food provisioning platforms: The case of meal box schemes and online grocery shopping in Norway	Sustainable Production and Consumption	Practitioners and policymakers should focus on co-designing digital food provisioning services with consumers to ensure they align with real-life practices and values. By enhancing convenience, efficiency, and user interfaces, these services can better realize their sustainability potential and contribute to a more sustainable food system.
	2022	Marshall M.	The refrigerator as a problem and solution: Food storage practices as part of sustainable food culture	Food and Foodways	Practitioners and policymakers should focus on re-evaluating and promoting sustainable food storage practices, educating consumers on the environmental impacts of refrigeration, and integrating effective historical practices into modern life. This approach can help foster more sustainable food systems and reduce the environmental impact of household food storage.
	2022	Stancu V.; Lähteenmäki L.	Consumer-related antecedents of food provisioning behaviors that promote food waste	Food Policy	Practitioners and policymakers should focus on addressing impulsive buying and disgust sensitivity while promoting frugal and environmental identities to reduce household food waste. Implementing targeted interventions and educational campaigns can significantly contribute to more sustainable food consumption behaviors.
	2022	Silvennoinen K.; Nisonen S.; Katajajuuri J.-M.	Food waste amount, type, and climate impact in urban and suburban regions in Finnish households	Journal of Cleaner Production	Practitioners and policymakers should focus on implementing robust methodologies for measuring household food waste, collaborating with local waste management entities, and developing targeted interventions based on comprehensive data to effectively reduce food waste and its environmental impact.

	2022	Salonen A.S.	Ordinary overflow: Food waste and the ethics of the refrigerator	Food and Foodways	Practitioners and policymakers should consider the multifaceted role of refrigerators in food waste generation. By focusing on the ethical and cultural dimensions, as well as the material aspects, more comprehensive and effective strategies can be developed to reduce household food waste.
	2022	Salonen A.S.	Creator, saviour, garburator: (Re)imagining the human role in the world through a case of food waste	Social Compass	Practitioners and policymakers should focus on rethinking and reshaping the roles humans play in the food system. By promoting a view of humans as part of the ecological system and challenging anthropocentric notions, more sustainable and ecologically integrated practices can be developed to address food waste and enhance overall sustainability.
	2021	Sundin N.; Rosell M.; Eriksson M.; Jensen C.; Bianchi M.	The climate impact of excess food intake - An avoidable environmental burden	Resources, Conservation and Recycling	Practitioners and policymakers should consider the climate impact of metabolic food waste in their strategies to improve sustainability and public health. By recognizing the hidden costs of excess food intake and promoting healthier eating patterns, significant environmental and health benefits can be achieved.
	2021	Kymäläinen T.; Seisto A.; Malila R.	Generation z food waste, diet and consumption habits: A finnish social design study with future consumers	Sustainability (Switzerland)	Practitioners and policymakers should focus on leveraging social influences, engaging companies, and developing context-aware and comprehensive sustainability solutions to encourage sustainable food behaviors among Generation Z consumers. By addressing both environmental and financial aspects, these interventions can effectively promote sustainability and climate change mitigation.
	2019	Svanes E.; Oestergaard S.; Hanssen O.J.	Effects of packaging and food waste prevention by consumers on the environmental impact of production and consumption of bread in Norway	Sustainability (Switzerland)	Practitioners should prioritize reducing bread waste through improved agricultural practices, innovative packaging solutions, and consumer education. Policymakers should support these efforts to achieve a more sustainable food system.

	2019	Grasso A.C.; Olthof M.R.; Boevé A.J.; van Dooren C.; Lähteenmäki L.; Brouwer I.A.	Socio-demographic predictors of food waste behavior in Denmark and Spain	Sustainability (Switzerland)	Practitioners and policymakers should focus on targeted interventions and educational campaigns that address the specific socio-demographic factors influencing food waste behavior. By doing so, they can effectively reduce household food waste and promote sustainability.
	2019	Hebrok M.; Heidenstrøm N.	Contextualising food waste prevention - Decisive moments within everyday practices	Journal of Cleaner Production	Practitioners and policymakers should adopt a more contextual and practice-oriented approach to food waste prevention. By targeting specific household practices and implementing measures at critical moments, more effective and sustainable reductions in food waste can be achieved.
	2018	Aschemann-Witzel J.; de Hooge I.E.; Almlí V.L.; Oostindjer M.	Fine-Tuning the Fight Against Food Waste	Journal of Macromarketing	Practitioners and policymakers should focus on developing segmented and behavior-specific strategies to effectively reduce consumer food waste. By addressing the distinct lifestyle patterns that influence food waste, tailored interventions and educational campaigns can be more effective in promoting sustainable consumption practices.
	2018	Østergaard S.; Hanssen O.J.	Wasting of fresh-packed bread by consumers-influence of shopping behavior, storing, handling, and consumer preferences	Sustainability (Switzerland)	Practitioners and policymakers should focus on improving bread packaging, promoting effective waste reduction strategies, and designing targeted interventions based on consumer demographics. By addressing these key areas, the food industry can reduce bread waste, enhance sustainability, and meet consumer needs more effectively.
	2018	Fox D.; Ioannidi E.; Sun Y.-T.; Jape V.W.; Bawono W.R.; Zhang S.; Perez-Cueto F.J.A.	Consumers with high education levels belonging to the millennial generation from Denmark, Greece, Indonesia and Taiwan differ in the level of knowledge on food waste	International Journal of Gastronomy and Food Science	Practitioners and policymakers should focus on developing targeted, culturally sensitive educational campaigns to raise awareness about food waste. By leveraging the concern millennials have for food waste and highlighting the personal impact of their actions, significant progress can be made in reducing food waste and promoting sustainable consumption behaviors across different countries.

	2017	Hanssen O.J.; Vold M.; Schakenda V.; Tufte P.-A.; Møller H.; Olsen N.V.; Skaret J.	Environmental profile, packaging intensity and food waste generation for three types of dinner meals	Journal of Cleaner Production	Practitioners and policymakers should focus on improving the efficiency of ingredient production, optimizing packaging, and reducing food waste to enhance sustainability in the food system. Educating consumers about the environmental impacts of their food choices and promoting sustainable practices are also crucial for achieving significant reductions in energy use and green house gas emissions.
	2016	Edjabou M.E.; Petersen C.; Scheutz C.; Astrup T.F.	Food waste from Danish households: Generation and composition	Waste Management	Practitioners and policymakers should focus on targeted reduction strategies, educational campaigns, and infrastructure support to reduce household food waste. By addressing the specific needs of different household types and promoting effective waste management practices, significant progress can be made towards achieving sustainability goals.
	2016	Hanssen O.Jø.; Syversen F.; Stø E.	Edible food waste from Norwegian households - Detailed food waste composition analysis among households in two different regions in Norway	Resources, Conservation and Recycling	Practitioners and policymakers should focus on targeted strategies to reduce food waste, especially in high-waste categories and urban areas. Educational initiatives and localized waste management practices can further enhance efforts to minimize food waste and promote sustainability.
	2015	Miliute-Plepiene J.; Plepys A.	Does food sorting prevents and improves sorting of household waste? A case in Sweden	Journal of Cleaner Production	Practitioners and policymakers should focus on promoting environmental awareness, ensuring the convenience of waste sorting systems, and considering economic variables when designing waste management strategies. By doing so, it is possible to achieve significant reductions in household waste generation and improvements in recycling rates, contributing to overall sustainability goals.

	2014	Silvennoinen K.; Katajajuuri J.-M.; Hartikainen H.; Heikkilä L.; Reinikainen A.	Food waste volume and composition in Finnish households	British Food Journal	Practitioners and policymakers should focus on developing targeted strategies and educational initiatives to reduce food waste in households. By promoting better storage practices, addressing common causes of waste, and providing support to high-waste groups like single-person households, significant progress can be made towards reducing household food waste and enhancing sustainability.
Other	2022	Sundin N.; Persson Osowski C.; Strid I.; Eriksson M.	Surplus food donation: Effectiveness, carbon footprint, and rebound effect	Resources, Conservation and Recycling	Practitioners and policymakers should focus on promoting food donation as an effective strategy for managing surplus food, while also implementing measures to minimize rebound effects. By supporting food redistribution networks and integrating them with other waste management practices, significant environmental and social benefits can be achieved.
	2022	Lin T.-Y.; Chiu Y.-H.; Xu W.-Z.	Environmental efficiency and sustainability of food production and consumption in the EU	Sustainable Production and Consumption	Practitioners and policymakers should focus on collaborative efforts, consumer education, and targeted policy interventions to improve the environmental efficiency of food production and consumption in the EU. By addressing both greenhouse gas emissions and food waste, significant progress can be made towards achieving a more sustainable and efficient food system.
	2022	Friman A.; Hyytiä N.	The Economic and Welfare Effects of Food Waste Reduction on a Food-Production-Driven Rural Region	Sustainability (Switzerland)	Practitioners and policymakers should consider both the economic benefits and trade-offs of food waste reduction. Implementing compensation mechanisms and support measures for the agricultural sector can help mitigate negative impacts, while ensuring that policies align with the principles of a just transition. By adopting integrated and balanced approaches, significant progress can be made towards reducing food waste sustainably.

	2022	Mesiranta N.; Närvänen E.; Mattila M.	Framings of Food Waste: How Food System Stakeholders Are Responsibilized in Public Policy Debate	Journal of Public Policy and Marketing	Practitioners and policymakers should adopt a multifaceted approach to food waste reduction, leveraging the identified framings to engage all relevant stakeholders in collaborative and context-specific strategies. By recognizing the flexible and open-ended nature of food waste as a boundary object, comprehensive and sustainable solutions can be developed to address this global sustainability issue.
	2022	Szulecka J.; Strøm- Andersen N.	Norway's Food Waste Reduction Governance: From Industry Self-Regulation to Governmental Regulation?	Scandinavian Political Studies	That practitioners and policymakers should foster initial industry-led initiatives for food waste reduction, supported by societal and political pressure. They should also be prepared for a potential shift towards binding regulations to ensure sustained progress in reducing food waste. By adopting a co-regulation approach, effective and comprehensive solutions can be developed to address the significant issue of food waste in Europe.
	2021	Johansson N.	Why is biogas production and not food donation the Swedish political priority for food waste management?	Environmental Science and Policy	Practitioners and policymakers should consider a more balanced approach to food waste management that integrates environmental, economic, and social perspectives. By promoting food donations and biogas production as complementary strategies, significant progress can be made towards sustainability and reducing food insecurity.
	2020	Brancoli P.; Bolton K.; Eriksson M.	Environmental impacts of waste management and valorisation pathways for surplus bread in Sweden	Waste Management	Practitioners and policymakers should prioritize reducing bread production and explore alternative uses for surplus bread, such as animal feed and donation. Leveraging the established return system and integrating multiple waste management strategies can enhance sustainability and achieve significant environmental savings in the management of surplus bread.



	2020	Bergström P.; Malefors C.; Strid I.; Hanssen O.J.; Eriksson M.	Sustainability assessment of food redistribution initiatives in Sweden	Resources	Practitioners and policymakers should focus on maximizing the environmental and social benefits of food redistribution while addressing financial sustainability through supportive measures. By adopting a holistic approach and fostering collaboration, significant progress can be made in reducing food waste and enhancing sustainability through effective food redistribution practices.
	2018	Johansson N.; Corvellec H.	Waste policies gone soft: An analysis of European and Swedish waste prevention plans	Waste Management	Practitioners and policymakers should shift their focus to high-impact waste streams, implement more stringent regulatory measures, and ensure that waste prevention responsibility lies with governmental actors. By adopting a holistic approach and addressing the drivers of waste generation, significant progress can be made in preventing waste and achieving sustainability goals.
	2016	Martinez-Sanchez V.; Tonini D.; Møller F.; Astrup T.F.	Life-Cycle Costing of Food Waste Management in Denmark: Importance of Indirect Effects	Environmental Science and Technology	Practitioners and policymakers should focus on food waste prevention while promoting the responsible use of savings generated from prevention measures. By adopting a holistic approach that includes both economic and environmental assessments, effective and sustainable food waste management strategies can be developed.
	2014	Halloran A.; Clement J.; Kornum N.; Bucatariu C.; Magid J.	Addressing food waste reduction in Denmark	Food Policy	Practitioners and policymakers should focus on enhancing communication, developing efficient packaging, and improving food label interpretation to reduce food waste. Emphasizing systems thinking and fostering public-private partnerships can lead to more sustainable and effective food waste management practices.

# About this publication

## Breaking Barriers: Empowering Effective Food Waste Solutions in the Nordic Countries

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Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland.

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Nordic co-operation promotes regional interests and values in a global world. The values shared by the Nordic countries help make the region one of the most innovative and competitive in the world.

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