

Initiatives on prevention of food waste in the retail and wholesale trades

Financed by Nordic Council of Ministers

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Summary

This project was initiated by the Nordic Council of Ministers and its waste prevention group. The project has been focusing on the following issues:

- Amounts of food waste from the retail and wholesale sector
- Causes for food waste generation
- Initiatives to reduce the amounts of food waste
- Recommendations for measures that could be taken to change the present situation

The results are based on a literature review and interviews with representatives from the retail and wholesale sector in the Nordic countries.

Amounts

In all countries there exists detailed information from retail and wholesale chains but from Denmark and Sweden these data have not been made available for the project as they are not public. In Norway detailed data have been made available through the ForMat project. In Finland some chains have provided data within the project and an estimation of the total value has been made. The data from Norway is considered representative of the composition of food waste and used as to estimate the composition in the other Nordic countries. The most common product groups present in the waste flows are; fresh fruits, vegetables, and fresh bakery products. At the bottom of the list there is canned, dried and frozen food, all with very long shelf lives.

Causes for food waste generation

The main reason observed in the interviews is that the food becomes “un-saleable”. All known causes for this are more or less linked to customers’ behaviour or to the shop-owners top priority goal to sell (which means to provide full shelves and a broad variety of products). Other reasons are related to how the shops are operated or how the food is handled in the shops.

Initiatives to reduce food waste

A number of initiatives have already been taken within the sector, for example optimisation of the selling of products, better management of orders, better handling of food and increased education of personnel. The interviews showed that one of the important obstacles in reducing food losses is the notion that customers expect full shelves with a great variety of “fresh” food. No one in the sector would introduce measures which might decrease the sales. Much would be won if the behaviour and desires of the customers could be changed.

Suggestions for actions

It is not efficient for authorities to develop regulations that directly interfere with the work being done in companies to limit food waste, but three types of actions should be given priority:

- Actions to be taken with the customer in mind. These actions should aim at changing the behaviour and the demands of the customers.
- Actions **to prevent** regulations and policies that might **increase** the amount of food waste in the retail sector.
- Actions that lead to the best treatment of food waste and facilitates donating of food etc.

Keyword

Food waste, retail and wholesale sector, prevention

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Preface

There is a heavily increasing discussion in society on food waste. Large amounts of edible food waste end up in composts, landfills or incineration plants instead of being consumed. Food waste has large environmental impact across its lifecycle. According to studies from the European Commission the food sector is one of the three sectors (with housing and transport) with the greatest environmental impacts in the EU, representing 30 % of its Global Warming Potential. Food waste has a double cost in terms of environmental impacts, as it combines the impacts due to the production of food that will never be eaten, with those caused by the collection and treatment of food waste. In terms of greenhouse gas emissions, the overall impact of food waste according to a recent European study is 3% of total EU 27 emissions in 2008.

Waste prevention is the highest priority in the waste hierarchy according to the revised EU Waste Directive. According to the directive member states must develop waste prevention programmes to be issued no later than December 2013.

The amounts of food waste have to decrease and it is important that we cooperate to reach results. I therefore welcome all Nordic initiatives in this area

There are already many activities in the Nordic countries to prevent food waste. All Nordic countries are at the same time preparing their waste prevention programmes where targets, indicators as well as necessary measurements shall be set up. By cooperating, sharing good examples and have fruitful discussions we can be even more successful and create Nordic value.

This project was initiated by the Nordic Council of Ministers and the Nordic Waste Prevention Group. The project focuses on the amounts of food waste in the retail and wholesale sector. Furthermore, it describes causes for food waste and initiatives that has been taken to reduce it. Finally it gives recommendations to measures that could be taken to change the present situation.

2011-06-29

Swedish Minister of Environment, Andreas Carlgren.

Summary

The project was initiated by the Nordic Council of Ministers and its waste prevention group. The background to the project is that waste prevention is the highest priority in the waste hierarchy according to the EU Waste Directive (2008/98/EG). One other reason is the heavily increasing discussions in society on food waste in general. The project has been focusing on the following issues:

- Amounts of food waste from the retail and wholesale sector
- Causes for food waste generation
- Initiatives to reduce the amounts of food waste
- Recommendations to measures that could be taken to change the present situation

The results are based on a literature review and interviews with representatives from the retail and wholesale sector in the Nordic countries. No new data generation for waste amounts has been applied, e.g. no weighing etc. has taken place – data shown in the report is previously found data or data shared to the project by the retailers/ wholesalers.

Amounts

There are some differences of principles in the available retail and wholesale food waste data from different countries. In all countries there is detailed information from each retail and wholesale chain but from Denmark and Sweden this data have not been made available for the project as they are not public. In Norway the situation is different and detailed data has been made available through the ForMat project. In Finland some chains has provided data within the project and an estimation of the total value has been made. We have estimated that the situation in the Nordic countries is more or less similar and consequently the data from Norway is considered representative and used to estimate the composition of food waste in the Nordic countries. The amounts seem to vary more since the characteristics of the retail- and wholesale sector differs in the different countries.

The most common product groups present in the waste flows are; fresh fruits, vegetables, and fresh bakery products. According to the interviews with representatives from the retail and wholesale sector the same types of products dominate in all the Nordic countries. Other important product groups are dairy products, fresh meat, fresh fish and ready-made food. These are all mentioned in the interviews as important but, but the ranking might vary between the countries. In the bottom of the list there is canned, dried and frozen food, all with very long shelf lives.

Causes for food waste generation

There are a number of causes for food waste generation from retail shops and the wholesale sector. The main reason observed in the interviews that the food turns “un-saleable”¹. When a product has turned “un-saleable” it is rejected by the customers. However, a product turning “un-saleable” is more a symptom of other problems, and it is more interesting to focus on reasons for why the food has turned “un-saleable” (e.g. “best before dates” expire due to the fact that customers pick the products with the longest “best before dates”). All known causes are more or less linked to customers’ behaviour or to the shop-owners top priority goal to sell (which means full shelves and a broad variety of products), so there is a delicate balance between selling food and preventing food losses (and minimising food loss is not always the optimum for the shop owner). This also causes food losses in different parts of the value chain (in the food manufacturing sector, in the retail and wholesale sector, in the producer step, and in the households). Causes mentioned in the interviews (without any ranking) are:

- Requirements on quality and freshness – for fruits and vegetables (and some other perishables) there is no formal “best before date” – but the look of the product is decisive. This also includes the beliefs that it will not be possible to sell “wonky” fruits and vegetables.
- Customers are expecting full shelves throughout the opening periods of shops, this “forces” the shops to order or produce more than will be sold. Some examples:
 - Shops overproduce fresh baked bread - for example answers in the interview indicate that often 7% more than the expected sales are produced in order to meet this demand from the customers.
 - Fruits and vegetables are exposed in large piles – with the results that fruits in the middle or the bottom of the pile will easily get damaged and must be disposed. Also if a fruit becomes rotten in the pile, the surrounding fruits are more likely to be rejected than if they are displayed one by one.

¹ Un-saleable is including food where the best before date/ expiry date is passed but also products (bread, fruits and vegetables) that are, in most cases, not date labelled. Even so also for those products, lack of freshness is the most important reason that the products are not sold.

Best before dates are used for most products in Sweden, Finland and Denmark. The term means that food stored in an appropriate manner, retains the specific properties normally associated with the product. The date is set by the producer and leaves a margin until the product is not suitable for consumption. It is allowed to sell the product after the “best before date” has expired – but most shops don’t. In Norway (and on certain products in the other Nordic countries) there is “not to be used after”/“Expiry date”/“last day of consumption” instead. This is a stricter date, meaning that the food is unfit for human consumption after this date. The product is not allowed to be sold after this date. In the report we use the term “best before date”.

Other reasons are how the shops are operated:

- Challenges related to ordering. Almost everyone interviewed said this was the largest cause for food losses. It is difficult to order the right amounts of food at the right time, especially fresh food and perishables. What the customers buy is dependent on the weather, the season, the offers of the week, and on the general mood of the customers. All this makes it difficult to order. This is a development issue prioritised by the shops and new improved ways to predict the customers' purchases and related information systems are being developed.
- Food producers are sometimes taking back products. This is usually not a cost for the shop, but nevertheless it is waste being generated. There are also some cases where the shop owner has the possibility to return unsold products to the wholesaler with no cost for the shop owner, and therefore the shop owner have no incitements to order more accurately.

Yet other reasons are more related to the actual handling of food in the shops:

- Handling of food in a wrong way – for example food not being stored at the right temperatures or in the wrong light, or avocados stored next to tomatoes (discharging ethylene causing the avocado to ripen faster and shortening the shelf life) . This is a common reason for food waste in the wholesale sector.
- Break-down of products due to wrong type of mechanic handling also occurs.

Initiatives to reduce food waste

A number of initiatives have already been taken within the sector. According to the interviews these are linked to for example:

- Optimise the selling of products. Put products with short shelf-lives on display and also price reduction or donating products with short shelf-life.
- Management of orders in relation to sale – better predicting of the needs of the customers. Good knowledge of the customer is essential.
- Better handling of food – for example keeping products stored and exposed under right temperature and light, optimal packaging-size, etc.
- Education of personnel –how and when to place orders, how to handle and store food, and knowledge of the best practise and the routines for treatment of food waste.

Obstacles

The interviews showed that one of the important obstacles in reducing food losses are the notion that customers expect full shelves with a great variety of “fresh” food. No one in the sector would introduce measures which might decrease the sales – therefore actions taken by the sector and by others need to be in line with this reality. Much would be won if the behaviour and desires of the customers could be changed – maybe even into customers demanding a change from the shops.

Suggestions for actions

It is not efficient for authorities to develop regulations that directly interfere with the work being done in companies to limit food waste, but three types of actions should be given priority:

- Actions to be taken with the customer in mind – such as information campaigns and information in the shops and actions to raise the status of the subject home economics in the schools. These actions should aim at changing the behaviour and the demands of the customers.
- Actions **to prevent** regulations and policies that might **increase** the amount of food waste in the retail sector. For example the now existing best before dates on eggs – that are set with a margin for food safety given the circumstances in countries where salmonella and warm storage gives the eggs a shorter shelf-life, the many varieties of different products, the use of optimal packaging instead of minimising packaging etc.
- Actions that lead to the best treatment of food waste, and which makes it easy for companies to choose the right options such as making it easy to donate food or use it as animal food and actions to increase the biological treatment of food waste. This is not waste prevention, but is a way to make better use of the food waste than today.

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1 Background

The project was initiated by Nordic Council of Ministers and its waste prevention group. The background to the project is the rapid increase in amounts of food waste in the society, and because waste prevention has the highest priority in the waste hierarchy according to the EU Waste Directive (2008/98/EG). According to the directive, member states must develop waste prevention programmes to be issued no later than December 2013. In the Green Book on Bio-waste (COM(2008)811), prevention of bio-waste is also a theme.

Food waste generation is an issue because a large environmental impact can be reduced by avoiding producing excess food, and reducing the amounts of waste that must be treated. Large quantities of food waste are generated by the retail and wholesale sector. A rough estimate is that about 7% of all food products being sold is disposed as waste (Hanssen & Olsen 2008, Ettrup & Bauer 2002). The food waste is obviously also cost to the sector, in terms of unsold food as well as costs for waste treatment. According to the interviews, much of the waste arises because the consumers expect full shelves and reject food with short shelf life period. The wastage of food of course also represents an environmental burden. Previous studies have shown that the carbon footprint can be reduced by approximately 2 kg carbon dioxide equivalents per kg food that is not wasted (Consumer Association Stockholm, 2008). In Norway the reduction potential is calculated to 550 000 tonnes of carbon dioxide equivalents, representing about 160 000 Norwegian medium-emission cars in one year by reducing unnecessary food losses from the stores. Some work has been done in the Nordic countries and this project aims at compiling the results from the different initiatives in order to get a common Nordic review.

2 Introduction

In this report status for the food waste from retail sector in the Nordic region in total, as well as in each of the Nordic countries, is described. To make the report more easily read the summaries, common findings and some country specific findings of common interest is placed in the main report and the country specific details (from literature and interviews) and results are presented in Appendix 1.

Overall in the report the compilations are done based on analysing data from literature sources and interviews. Some comments etc. have also been mentioned at various workshops etc. that the project team has been attending. No primary inventories data gathering have been carried out within the project. The data presented in the report has kindly been given to us by representatives from the sector.

Representatives from the sector have been interviewed. In order not to reveal any special chains the results from the interviews are presented in a compiled way for each country. The persons interviewed are listed in the reference list (Appendix 2) under “personal contacts”.

3 Method

3.2 Definition of food waste

The report is focusing on food waste from the retail and wholesale sector in the Nordic countries. Food waste, in general, can be said to be animal or vegetal waste from manufacture, distribution, sale and consumption of food. In the recent discussions about food waste, also the terms “unavoidable” and “avoidable” food waste have been used. The “unavoidable food waste” is animal or vegetal waste that originates from food but it is not likely that humans will eat it (bones, peelings etc.). “Avoidable food waste” often has the meaning “disposed food that could have been consumed if managed differently”. When surveying food waste from this sector it is difficult to separate these two categories – therefore the food waste amounts presented in this report is “total food waste”. This means for example that the bones from the pork chop are included. There is thus a need to clarify the terms and definitions, to have a better common understanding of what types of waste that is considered to be a lost resource when food is wasted. In other parts of the food waste chain the use of unavoidable and avoidable food waste is much more central since the avoidable food waste is the waste that is most easy to prevent. In the retail sector all food waste is in principle avoidable, and should as far as possible be prevented.

What is food waste prevention – in the report actions like donating food or using food waste as animal food are mentioned. In a strict definition only food being donated to humans is included in the definition of prevention of food waste, whereas use of food waste as animal feed is regarded as waste treatment (recycling).

3.1 The study

In the first phase of the project available literature etc. for each country has been studied and compiled. In the second phase of the project the project team has interviewed representatives from the sector. The persons that have been interviewed are shown in the reference list. In Appendix 3 the list of questions used in the interviews is presented. The findings and conclusions have been commented by the retail- and wholesale sector in each country. This has been done via e-mail and personal communication with some of the representatives.

4 Description of the retail and wholesale sector

4.1 Summary Nordic countries

Common to all Nordic countries is that the market is dominated by a few very large retail and wholesale chains. In each country the four largest chains have between 80-100 % of the market. Common is also that all the large chains has their own wholesale companies/branch that are distributing food to the shops. Certain products such as fresh dairy products, beer and beverages, fresh fish and fresh bakery products are however normally distributed outside this system. Table 1 presents the turnover and number of shops in each country.

Table 1 – Summary of retail and wholesale sector 2009

Country	Turnover 2009	Turnover 2009 [EUR]	Number of shops 2009
Denmark	105 billion DKK	13,7 billion	3104
Finland	14,5 billion EUR	14,5 billion	3892
Norway	134 billion NOK	13,7 billion	4007
Sweden	264 billion SEK	28,9 billion	6500

The names of the chains in each country and their market shares for 2009 are presented below (see Appendix 1 for sources):

Denmark

- COOP Denmark 36,9%
- Dansk Supermarked Gruppen 31,8%
- De Samvirkende Købmænd 26,5%
- Aldi og Lidl 4,8%

Finland

- S Group 43,2 %
- K Alliance 34,2 %
- Finland's local Store 10,2 %
- Others² 7,3 %
- Lidl 5,1 %

Norway

- Norgesgruppen 40,0%
- COOP 24%
- REMA 1000 20,3%
- ICA 15,7%

² For example Stockmann, Tarmo Lähikauppias –chain, kiosks and non-alliance grocery stores

Sweden

-	ICA	50,7 %
-	COOP	21,5 %
-	Axfood	15,9 %
-	Bergendahls	5,7 %
-	Lidl	3,8 %
-	Others	2,7 %

More details about the structure of the different chains etc. can be found in the country specific chapters in Appendix 1.

5 Waste amounts, types of food waste generated and treatment

5.1 Waste amounts

5.1.1 Studies available from outside the Nordic area

Several studies about the amount of food waste have been done in both Europe and the US over the last decades. Many of those are focusing on waste from households, and only a few of them have examined the retail and wholesale sector. Those studies are not too detailed (data are only from short sampling periods, a few number of retail shops and without differentiating between different product groups etc.). Table 2 gives a short overview of the estimated amounts of food waste in some non-Nordic countries in the retail and wholesale sector. Studies performed in the Nordic countries are listed under each country's chapter in Appendix 1. It is important to remember that the figures presented in Table 2 are generated with different methods, different objectives and different definitions. The impacts of each of these choices are substantial – if the measurements are done to find total food waste or just avoidable food waste for example it will have an impact on the amounts. If the findings are based on factors or on measurements will of course also have an impact, not the least on the reliability of the figure. Therefore it is extremely hard to compare them and judgements should always be made very carefully. They are presented here in order to give a general overview on what data that is available.

Table 2 – Overview of different food waste studies

Country	Amount of food waste	Method
UK	1,6 million tonnes waste/year	Based on estimations made by each chain. (Stuart 2009)
Austria	13,5 tonnes / year <i>and store</i>	The study is done by actual measurements on a sample of shops. (Salhofer et al 2008)
USA	2,5 million tonnes / year	Data from 1995, calculated by using factors. (Kantour 1997)
Japan	2,6 million tonnes / year	(Stuart 2009)

5.1.1 Overview of Nordic data on food waste from the retail and wholesale sector

There are some differences in the available data. In Denmark, Finland and Sweden there are detailed data from each retail and wholesale chain, but in Denmark and Sweden the data have not been available for the project as they are not public available. Some earlier investigations have been made in Denmark and Sweden, the data is presented in Table 3. Data from Norway is also included based on the findings in the ForMat project³.

For Finland data has been retrieved from the interviews within this project and the data is therefore not published elsewhere. The data provided is only a total amount and not divided in to different product groups. The total amounts estimated from this data are presented in Table 3.

More details about each country can be found in the country specific chapters in Appendix 1.

Table 3 – Available Nordic data on food waste

Denmark ¹⁶	Average amount of food waste per shop were 165 – 562 kg/mill DKK turnover (diverging with shop -size and -type). Based on a 3 weeks survey of 24 shops within 5 categories of retail shops (Ettrup & Bauer, 2002)
Denmark ¹⁷	Average amount of food waste per shop is 200 kg per week. The total generation of food waste from the retail sector is estimated to 40 000 - 46 000 tonnes per year (Miljøstyrelsen, 2002)
Finland	65 000 – 75 000 tonnes (including retail and wholesale) per year Estimations are based on interviews within this project.
Norway	43 000 tonnes per year in the retail sector Data measured in a number of shops and aggregated to Norwegian level (Hanssen & Olsen 2008)
Sweden	83 500 tonnes 2008 for the retail sector Calculated based on waste factors ⁴ (Background data to Avfall i Sverige 2008).

³ The ForMat project is a business-driven project. The aim of the ForMat project is to reduce the amount of edible food waste with 25% before 2016, through prevention. The ForMat project is economically supported by the Ministry of Environment and the Ministry of Agriculture and Food in Norway.

⁴ The waste factors used are from the report Avfall Sverige 2006:07 – and are factors for waste arising in shops, restaurants and large kitchens. The calculations are based on number of employees.

The general procedure for registration of food waste amounts is similar in all Nordic countries: all products that are discarded are registered via the bar-code and also the reason behind the discard is registered (sometimes the code for actual waste and other reasons such as thefts are the same though). The amount is registered in monetary terms. Only products that are sold by weight (e.g. fresh fruits, fresh meat and fresh fish) are registered by weight, sometimes with estimated weight and sometimes actual weight. The purpose of this very comprehensive registration is not primarily to quantify food waste for the retail sector, but to get statistics about product loss that might have a significant influence on the economic result of each retail shop and company, as this might have a significant negative impact on the economic results for the shop owner and the retail company.

In Norway, data from a representative number of retail shops are made available through the research project ForMat from one of the large retail companies. One reason for this difference in data availability between the countries may be that in Norway there is a large project going on in the business sector established jointly by the retail sector and the food industry and supported by the Government.

According to the interviews there are some differences within each country regarding level of detail of data etc. The reason for this is believed to be how data on food waste is being used within each organisation and how they work strategically with this issue. We estimate that the situation in the Nordic countries are roughly the same and therefore the data from Norway could be used as an estimate of which types of waste that is generated. The amounts seems to vary more since the size of the retail and wholesale sector differs and therefore also the amounts. Data presented in Figure 1 refers to food waste from Norway.

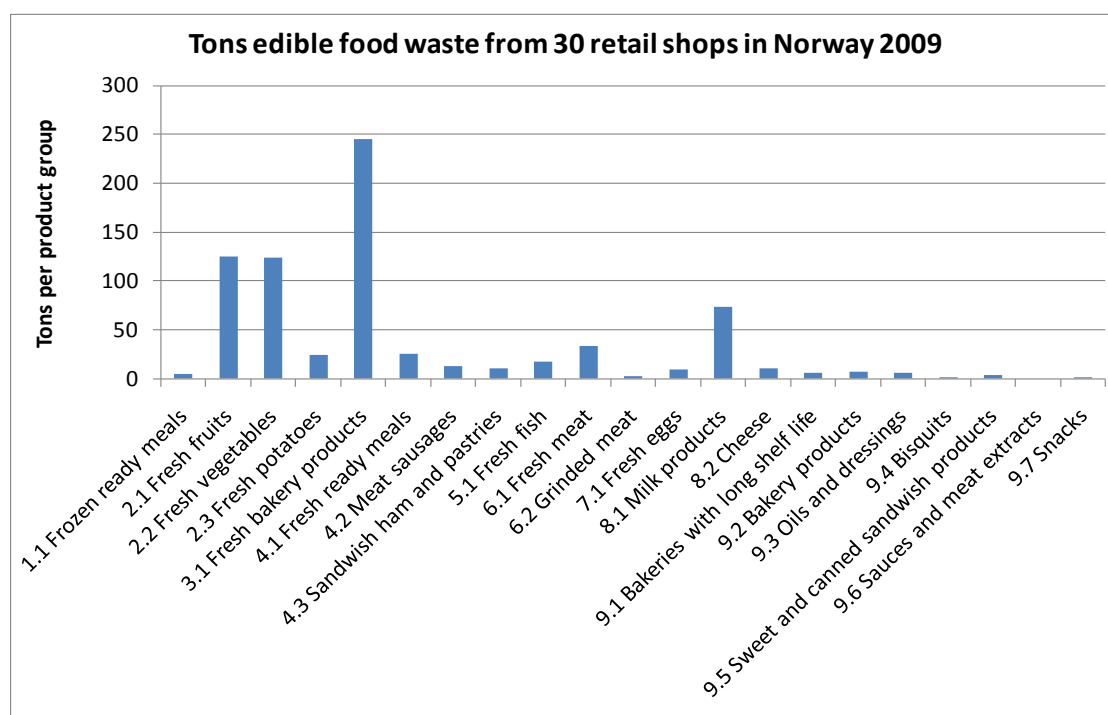


Figure 1 – Total tonnage of food waste from 30 retail shops in Norway (Hanssen & Schakenda 2010)

As can be seen in Figure 1 the most important product groups that are discarded are fresh fruits, vegetables and fresh bakery products. According to the interviews the same types of products dominate in all the Nordic countries. Other important product groups are dairy products, bread and meat which are also the same but the ranking varies between the countries. In the bottom of the list there is canned, dried and frozen food, all with very long shelf lives.

According to both interviews, and some other studies (for example Stuart 2009) another common aspect is that organic fruits and vegetables are more often being discarded. There is no clear reason for this, one might be that ecologic fruit and vegetables have a shorter lifetime but are treated as they have the same lifetime as ordinary products and therefore ordered in the same way. One other reason is that customers in surveys often explain how they want to buy organic food – but in the shop they tend to choose ordinary products instead leaving the shops with a surplus of organic food. (Sancturay & Friberg, 2010)

5.2 Overview of food waste management in Nordic countries

Biological waste treatment is increasing all over the world, but food waste is also to a large extent incinerated and used for instance for district heat production. The restrictions on landfilling of organic waste according to the landfill directive and national legislation in several countries, has directed the waste away from landfilling in the Nordic countries and many other European countries. In Figure 2 the current situation and a forecast for 2020 for bio-waste in EU-27 is shown (EU Commission, 2010), note that bio-waste includes "biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants".

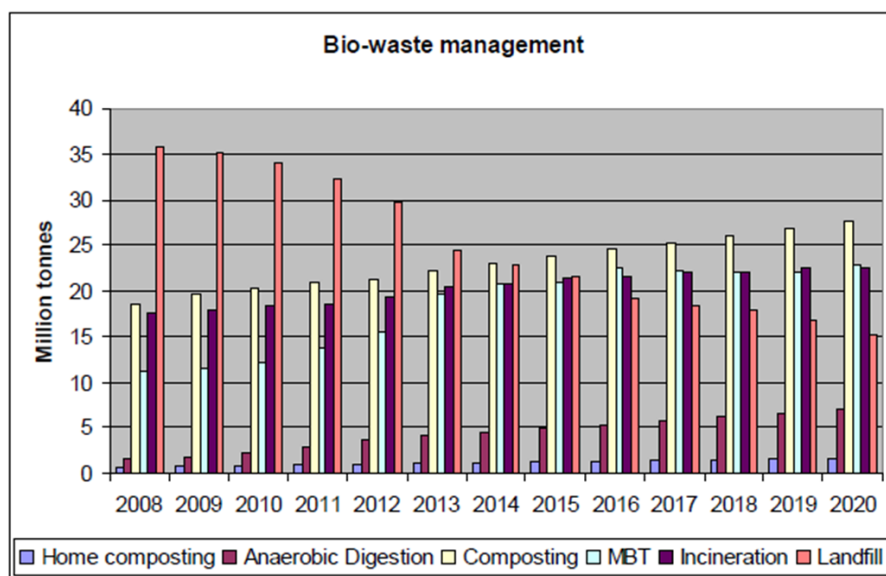


Figure 2 – Forecasted development of treatment of bio-waste in EU-27

In the Nordic countries the aim is to increase the biological treatment. For example, Sweden has had a national goal that in 2010 35 % of the food wastes from households, restaurants, large scale kitchens and shops shall be treated by biological methods. This goal will probably be updated to 45 % in 2015 and with the clarification that the waste should be treated so the plant nutrients are utilized. However there are some obstacles to send some certain food wastes to biological treatment - meat waste is subjected to the EU regulation No 1774/2002 about animal by-products which is laying down health rules concerning animal by-products not intended for human consumption. Since this is the case these wastes needs to be handled in a special way making sure that they are heated up when treated – this means that composting is not an option and that only some anaerobic digesters are suitable. This complicates the sorting and is identified as a problem in all countries.

The management of the waste from the retail- and wholesale sector varies between the Nordic countries, so does also the responsibility of the waste management. See Table 5 (the table is based on facts gained during the interviews and also on common knowledge in each country):

Table 5 – Handling of food waste in the Nordic countries

Country	Treatment	Responsibility of the waste
Denmark	Almost no food waste is sorted for biological treatment – but instead incinerated with energy recovery. Some stores have separate sorting, in these cases the bio-waste is normally used for animal feed. Biological treatment of food waste is only available in a few places, but it is only a viable solution if the treatment facility can handle packed food. Eco-labelling of stores (e.g. Svanen) is pushing towards sorting.	The retail- and wholesale sector has agreements with private waste companies to transport their waste. Waste for recycling is the responsibility of the retail sector, while waste for incineration is the responsibility of the local government, which direct the waste to a specific incineration plant.
Finland	Some part is sorted, varies a lot between the retail shops.	Generally super and hypermarkets and other big retail units are using private waste companies to transport their waste and have own agreements with the waste management companies. Smaller shops and stores are using municipal collection services
Norway	Food waste is mostly being treated with incineration with energy recovery together with other non-sorted waste fractions. However, an increasing amount is planned to go to biogas production in the future.	Food waste from the retail sector is under the responsibility of the private sector, with contracts between each retail company and different waste management companies.
Sweden	Food wastes are often sorted out when the municipality has biological treatment (e.g. at COOP 13% of the food waste is source separated (KF Verksamhetsberättelse 2009) There are some difficulties with packaged food waste since not all treatment plants can handle this.	Food waste is looked upon as the responsibility of the municipality (falling under “waste similar to household waste”). How strictly this is interpreted varies between the municipalities. Also the situation with different waste treatment in different municipalities makes it hard for the chains to give any guidelines to the different shops.

In Norway, Finland and Denmark sending mixed waste to incineration is still quite cheap compared to biological treatment, and it is discussed if stricter and more uniform regulations would increase the amount of food waste being sorted out for biological treatment. The option of sending food waste to animal food production is less favourable

for the shop-owners compared to biological treatment - the reason being that more work is needed from the personnel to be able to send it as animal food (since separate packaging and keeping the fractions that can be used as animal food separated is needed). In Sweden it is common that different municipalities have different food waste management systems. Since the wastes from the shops are considered to be the responsibility of the municipalities the shop owners are directed to the present system in the municipality. The persons interviewed in Sweden have stated this as a problem since it is hard to make guidelines for the whole chain when the system differs in different municipalities. However it is interesting to see that there might have been some benefits since the out-sorting of food waste is widely spread in Sweden compared to the other countries where the responsibility lays on the shop owner. There are no total figures regarding how big part of the sector that has source separation.

6 Waste generation – why do waste arises?

6.1 Literature study

Why does food waste arises? There are of course a number of reasons for this – being more or less the same irrespective of which country that is surveyed. The most common reason is that the food is “un-saleable”⁵ either the food is out-dated or it is not looking fresh enough to sell. However, in that context it is a crucial question is why the food has turned “un-saleable” (for example customers usually pick the products with the longest “best before dates” and avoid those with short “best before date” or the apple looking the most fresh). All known reasons are all more or less linked to customer’s behaviour or to the shop-owner’s priority to sell, so there is a delicate balance between selling food and preventing food loss (and minimising food loss is not always the optimum for the shop owner). The reasons also cause food waste in different parts of the value chain (in the retail and wholesale sector, in the producer step and in the households). The most important reasons for the different parts of the value chain are described below:

Producers:

- Right to return un-sold products. The wholesaler takes back all the unsold goods, and the retailer does not have to pay for this – this does not give any incitements for the retailer to order the right amount of food. On the other hand this is often combined with frequent visits in the store by the wholesaler in order to adjust the ordered amounts. (Naturvårdsverket 2008, Stuart 2009)

⁵ Un-saleable is including food where the best before date/ expiry date is passed but also products (bread, fruits and vegetables) that are, in most cases, not date labelled. Even so also for those products, lack of freshness is the most important reason that the products are not sold.

Best before dates are used for most products in Sweden, Finland and Denmark. The term means that food stored in an appropriate manner, retains the specific properties normally associated with the product. The date is set by the producer and leaves a margin until the product is not suitable for consumption. It is allowed to sell the product after the “best before date” has expired (except in Denmark) – but most shops don’t. In Norway (and on certain products in the other Nordic countries) there is “not to be used after”/“Expiry date”/“last day of consumption” instead. This is a stricter date, meaning that the food is unfit for human consumption after this date. The product is not allowed to be sold after this date. In the report we use the term “best before date”.

- Requirements on how different food should look like (for example bent cucumbers, size of apples etc.). Those rules were initially set by EU but even though they are to some extent not valid anymore⁶ the sector still sets this demands on how the food should look in order to be accepted by the shop. (Stuart 2009)

Retail- and wholesale sector:

- Ordering/ Personnel
 - Limited possibilities to order goods in small quantities and only one product per supplier (Naturvårdsverket 2008),
 - The right to return unsold/damaged products without cost for the retailer generates wastes in the wholesale sector (Åhnberg & Strid, 2010)
 - In the wholesale sector large quantities of food can be rejected due to one bad item (Salhofer et al 2008, Taste the waste 2010)
 - Lack of knowledge among the personnel regarding ordering, it takes a long time to learn how to calculate the right amounts to order. Knowledge of the customer is crucial. (Naturvårdsverket 2008)
 - Lack of knowledge on how different products should be handled – especially fruit and vegetables are sensitive to storage etc. (Andersson et al 2010, Stuart 2009)
- Customers
 - Best before-dates – customers choose goods with long best-before dates even if it is intended to be consumed the same day (Andersson et al. 2010, Hansen & Olsen 2008, Naturvårdsverket 2008, Salhofer et al. 2008, Stuart 2009, Taste the waste 2010)
 - Customers are expecting full shelves and a wide range of products to be exposed (Andersson et al 2010, Naturvårdsverket 2008, Stuart 2009, Taste the waste 2010)
 - Customers' expectations on appearance of products – especially meat is sensitive to this – a change in colour (in Sweden red meat is expected) makes customers choose another product. (Andersson et al 2010, Naturvårdsverket 2008)
 - Variation in demand (which makes it hard to order the right amounts) (Andersson et al 2010, Naturvårdsverket 2008, Stuart 2009, Taste the waste 2010)

Households:

- Discounts for big amounts (buy 3 pay for 2) (Lundqvist 2010, Stuart 2009)
- The price per kg is often much cheaper for big amounts,
- Small portions of food are seldom for sale

⁶ There are still requirements for: apples, citrus fruit, kiwi fruit, lettuces and endives, peaches and nectarines, pears, strawberries, sweet peppers, table grapes and tomatoes. These account for 75% of the EU trade. Items not meeting the requirements can be sold but must be labelled.

The requirements not existing anymore are Apricots, artichokes, asparagus, aubergines, avocados, beans, brussels sprouts, cauliflowers, cherries, courgettes, cucumbers, cultivated mushrooms, garlic, hazelnuts in shell, headed cabbage, leeks, melons, onions, peas, plums, ribbed celery, spinach, walnuts in shell, watermelons and witloof chicory

One interesting thing to notice is that the statements regarding customers' behaviours in all sources above have been mentioned by the shops themselves - if the customers were asked the answers may be different.

6.2 Results from interviews

As stated earlier in the report, it has not been possible to get complete data on actual amounts of food waste from the retail and wholesale sector within this project. However, several interviews have been carried out and several conclusions can be drawn from these. Since the statements regarding customer behaviour and demands are only taken from the respondents, it would be valuable if these statements were confirmed by direct studies on customers' behaviour.

Also found in the interviews is that the food is "un-saleable" is the most important reason for food waste arising (meaning that the date limit has expired both "best before date" and "not to be used after" date or that the product is not fresh enough to be sold.) However – the product turning "un-saleable" is just a symptom (as described earlier). The reasons behind it are of particular interest to analyse. All the listed below reasons have been mentioned by persons interviewed in the project. Many of them are mentioned by most of the respondents. However, the interviews have been made with the promise to not to reveal anyone's opinions and therefore the reasons are listed in a "general" way. The persons interviewed are listed in Appendix 2.

One important reason for food turning "un-saleable" causing food waste is of course the behaviour and demands of the customers. Reasons mentioned are:

- Requirements on quality and freshness – for fruits and vegetables (and some other perishables) there is no label with expiring date ("best before date" or "not to be used after" date) – but the appeal of the product is not fresh enough. This also includes the beliefs that it will not be possible to sell "wonky" fruits and vegetables.
- Customers are expecting full shelves throughout the opening periods of shops, this "forces" the shops to order or produce more than will be sold. Some examples:
 - Shops overproduce fresh baked bread – for example answers in the interview indicate that often 7% more than the expected sales are produced in order to meet this demand from the customers.
 - Fruits and vegetables are exposed in large piles – with the results that fruits in the middle or the bottom of the pile will easily get damaged and must be disposed. Also if a fruit becomes rotten in the pile, the surrounding fruits it is more likely to be than if they are displayed one by one.

Other reasons are how the shops are operated:

- One very important issue is the challenges related to ordering. Almost everyone interviewed said this was the most important "real" cause for food losses. It is difficult to order the right amounts of food at the right time, especially fresh food and perishables. What the customers are actually buying is depending on the weather, the season, the offers of the week, and on the general mood of the

customers. All this makes it difficult to order the right amounts of the right products. This is development issue prioritised by the shops and new improved ways to predict the customers' purchases and related information systems are being developed. One other issue related to ordering is the possibility to order smaller amount of different items in order to make the predictions more accurate.

- Food producers are sometimes taking back products. This is usually not a cost for the shop, but nevertheless it is waste being generated. There are also some cases where the shop owner has the possibility to return unsold products to the wholesaler with no cost for the shop owner, and therefore the shop owner have no incentives to order more correctly.

Yet other reasons are more related to the actual handling of food in the shops:

- Handling of food in a wrong way – for example food not being stored at the right temperatures or in the wrong light, or avocados stored next to tomatoes (discharging ethylene causing the avocado to mature faster and shortening the shelf life). This is a common reason for food waste in the wholesale sector.
- Break-down of products due to wrong type of mechanic handling also occurs.

There are some issues causing food waste that are directly related to the date labelling.

- The “best before dates” are set by the producers with a large marginal – with longer best before dates the shelf lives of the products will be longer and hence the food losses will decrease. But customers want to buy fresh food and are suspicious towards too long best before dates (one reason for this scepticism is the debate on additives and why they are added) therefor the trend is going in the other direction – with shorter and shorter shelf-lives.
- There are also examples where the “not to be used after”-dates are set with a too long marginal. One example mentioned is eggs where EU regulations forces Nordic producers to set very short best before dates because in southern Europe eggs are stored differently and also have the risk for containing salmonella. Since this is not the case in the some of the Nordic countries, it is an argument that a longer shelf-life would save a lot of eggs going to waste in these countries.

There are also arguments that there is no need for a best-before-date, and that we only need a “not consume after” date as a mark for when the products actually turn potentially dangerous – the opposite situation occurs in Norway where there is a discussion to implement “best before dates” instead since they are more flexible. In Sweden there is a discussion if it would be better to use “at least preservable until” to make it clearer that it is possible to eat the food after this date. Either way it is clear that the meaning of best before dates needs to be more clearly explained to the customers (Consumer association Stockholm 2009).

More specific in the wholesale sector there are some different reasons for food being wasted. The wholesalers are distributing food products to the shops (their customers) and food waste is being generated due to miscommunication or wrong delivery or returned products from the customers. Another reason for generation of food waste from the wholesale companies is their internal rules on “best before dates”. Wholesalers have prior

“best before dates” because they sell to other shops, which will need to have a certain shelf time in their own stores as well. The wholesalers have taken initiatives to keep these products that has past the “internal best before date” from being wasted, these initiatives are described in chapter 8.2.1. Food being wasted in the wholesalers are also damaged products due to mishandling (mishandling can both lead to physical damage and bacterial damage on the products), not sufficient transport packaging etc. The wholesalers also suffer from the fact that some products are arriving mislabelled etc.

What is clear from the interviews is that most waste is generated due to human factors, either consumer related or related to the personnel in the shop. This means that most things are not possible to regulate via law but affected by information campaigns etc. There are a few exceptions on this – the eggs are one.

7 Initiatives and actions taken to reduce food-waste

There are a number of initiatives, or planned initiatives to reduce the amount of food waste. Here we have divided them in to “general” – meaning initiatives that we think have an impact on the retail and wholesale sector but not necessarily originate from this sector. “Sector specific” means initiatives that are/should be taken within the sector itself. Closely linked to initiatives are policy instruments that could help the process of reducing food waste. The policy instruments are either set by the government to influence the sector (or others) to reduce the waste amounts or by the sector to influence the households (or others).

7.1 General

7.1.1 Initiatives/ actions

Some initiatives taken in society at large have been noticed:

- The Netherlands have a “sustainable food production policy” amended in 2008 by the minister of agriculture. For example, it is argued for a decrease in food loss and mentioned that it is important to make people aware of the food’s value. They also set a target for reducing food-waste throughout the chain by at least 20% by 2015 (Policy document on sustainable food, June 2008)
- In Sweden a target for reducing food waste is discussed and a group - SaMMa (co-operation for reducing food waste) has recently been formed with participants from different parts of society (e.g. Naturvårdsverket, Consumer Association Stockholm, IVL, SLU, SIWI, Svensk Dagligvaruhandel, Livsmedelsverket, Lantmännen and more). The aim of the group is to work for prevention of food waste using the options possible for each party.
- Norway – The joint business project ForMat is supported by the Ministries of Food & Agriculture and Environment, which shows a great interest in this issue.

- Joint declaration on food waste – It has been elaborated by Silvia Gaiani and Professor Andrea Segrè, Dean of the Faculty of Agriculture of the University of Bologna and presented at the European Parliament where we organized a conference on “How to Transform Food Waste into a Resource.” The declaration intends to be a commitment to reduce food waste by 50% by 2025 and we ask the EU to take a proactive role in that. Paolo de Castro, Chair of the Agricultural and Rural Committee of the European Commission, is willing to sign it.
- UN initiative to half the food waste by 2025 (EEA 2010)
- In Denmark the “Brug mere, spild mindre”-campaign by the Ministry of Environment has focused on reduction of food waste in the autumn 2010 giving 5 good advices on how to reduce food waste www.brugmerespildmindre.dk

There are also some initiatives mainly focusing on what households can do but that also will affect the retail and wholesale sector, since the customers have a large impact on the generation of food waste in the sector (expectations, best before dates etc.):

- In Denmark “Stop spild af mad” (www.stopspildafmad.dk) has gained major attention. The organisation is a consumer movement founded to raise public awareness about the food waste subject and hopefully to eliminate avoidable food waste in Denmark.
- In UK the campaign “love food hate waste” (www.lovefoodhatewaste.com), initiated by WRAP is a campaign aiming to raise awareness of the need to reduce food waste. The campaign shows that by doing some easy practical everyday things in the home we can all waste less food, which will ultimately benefit our purses and the environment too. WRAP has also done several studies regarding food wastes mainly from households.
- In Finland the objective of the “Foodspill”-project (www.mtt.fi/foodspill) is to study the amount of food waste, its sources and related environmental impacts, and means of reducing the amount. Special focus is on food waste that can be avoided in households and food service institutions. The amount and reduction options of food waste generated in food industry and retail sector will also be assessed.

7.1.2 Policy instruments

The fact that food waste now is a prioritised waste stream in many countries makes it relevant to look at possible measures that could be taken from a governmental point of view in order to speed up the decrease. In reports (EU 2010, Naturvårdsverket 2008 and Stuart 2009) studied within this project and at seminars etc. visited the following actions are mentioned:

- National information campaign – to the consumers but also to the sector itself. The campaign should focus on the following:
 - General information to the food chain regarding food waste and its influence on the environment as well as economic issues.
 - Information material with advices etc. For example “what to do with left-overs”
 - Information in connection with supervision.
- Engagement of different authorities

- Establish requirements for reporting of measures taken to reduce food waste – for example can the environmental legislation be used.
- Influence wholesalers and suppliers so that their contract with so-called “full refund” of the stores are designed to give stores incentives to reduce food waste as a result of returned unsold goods.
- Influence the packaging industry to develop more suitable packaging solutions, for example make transport packaging more standardised.
- Economic incitements like taxes on food waste from businesses or on food that is returned to the wholesaler.
- Call on the sector to avoid or even ban “volume discounts” (buy 3 for 2) on fresh products.

To be noted is that there might also be regulations/instruments that might increase the amount of food waste. For example:

- The food cannot be sold if the packaging is mis-marked, even though the product inside is fresh/ rightly produced.
- The labelling demands using “best before date”. Maybe “durable until” would be better and make it clearer to the customer that the product could be consumed also after this date.
- A suggested best-before date or production date on fruit and vegetables.
- The short best before dates on eggs.

7.2 Sector specific

7.2.1 Initiatives/ actions

In the literature several actions that could be taken or are already taken by the sector itself are listed. Several of these comments are also made on seminars and workshops attended by the project group:

- “Un-saleable food”:
 - Expose the goods with the shortest shelf life left (Naturvårdsverket 2008, Stuart 2009)
 - Discount when “best-before date” is getting closer. This is also mentioned as a draw back in some shops – being afraid that they will not sell goods full-priced, or get a “stamp” that they are a sloppy shop. (Andersson et al 2010, Naturvårdsverket 2008, Stuart 2009)
 - Sell products that are soon turning “un-saleable” to restaurants etc. or use it in the shop to cook ready-cooked food. (Naturvårdsverket 2008, Stuart 2009)

- Donate food that is soon turning “un-saleable” to charity etc. When a single shop takes this initiative it is an action that also is associated with some problems due to the fact that the shop is continuously responsible for the food – meaning that if the food is bad the shop might be facing problems. This can be avoided by making this handling more centralised, via “food banks” like in for example Denmark (Danska Fødevarebanken), Sweden (Allwin) and a number of other European countries as well as in USA. (Salhofer et al 2008, Stuart 2009)
 - Information to customers. One example is “Eat soon” – a concept developed by ICA (Sweden) in order to make the consumer aware that if you will cook this today – you might buy this item (with short date). (Consumer association Stockholm 2009)
- Handling of food:
 - Handle food properly – right temperature, storage etc. (Naturvårdsverket 2008)
 - Common and more standard marketing/appearance of crates used to deliver fruit and vegetables would make the personnel’s work easier. (Andersson et al 2010)
 - Use smart packaging and technical assistance. To optimise the packaging rather than to minimise it as well as improving the automatic order systems used. (Naturvårdsverket 2008, Williams & Wikström 2011)
 - Make the handling at the central storages more effective – maximising the time for the product in the shop. (Andersson et al 2010)
- Control of orders:
 - Plan and optimise purchases, assortment and also amounts (for example: don’t offer halal meat in areas where no Muslims live etc.) (Andersson et al 2010)
 - Keep control of stock and sales statistics (Andersson et al 2010, Naturvårdsverket 2008)
 - Good knowledge of the customers is essential. (Stuart 2009)
 - Information to the personnel and goals for decreasing the wastage. (Andersson et al 2010, Naturvårdsverket 2008)
- Personnel:
 - Education of personnel. Both information to the personnel about the impact (environmental and economic) but also education in the art of ordering the right amounts. (Andersson et al 2010, Naturvårdsverket 2008, Stuart 2009)
 - Small areas of responsibility for the personnel might make it easier to have good knowledge and good control over the ordering (especially in larger shops) (Andersson et al 2010)

- Technical improvements:
 - Store at the right temperatures and right light. Lowering the temperature in the fridge/freezers does increase the freshness of the products. Fruit and vegetables should be stored at optimum temperatures. (Lindberg et al 2010, Lindberg et al 2008, Naturvårdsverket 2008, Stuart 2009)
 - Doors on the fridges not only saves energy but also some investigations have shown that the shelves look more filled to the customer. (Lindberg et al 2010, Lindberg et al 2008)
 - Cages and shelves – using the right type of cages when handling e.g. fruits and vegetables are important. One idea is to use “separate display” – with the fruit not in a heap but in separate “cages”. (Andersson et al 2010)
 - Packaging – for example there are techniques for packaging meat in vacuum that extends the life span of the product (Hanssen 2010, Williams & Wikström 2011)
 - Electronic selection/delivery system in-store (Naturvårdsverket 2008)

No found investigations have been made to try to estimate the potential in each of all these options. The exception is for lowering the temperature – where investigations have shown that half the temperature doubles the shelf life of the product (e.g. milk) (Consumer Association Stockholm 2009b) and for the decreased environmental impact due to less food waste shown in Williams & Wikström 2011.

7.2.2 Results from interviews

Reducing food waste is of high priority for the trade sector in all the Nordic countries and a number of actions has already been taken or are about to happen. Many of the actions are mentioned already in the literature overview and all those actions should be appreciated. Below we discuss some common findings in the Nordic countries, we have also lifted some country specific issues that we think are of interest for all the Nordic countries. In order not to reveal any special chains the results from the interviews are presented in a compiled way, the persons interviewed is listed in the reference list in Appendix 2 under “personal contacts”.

The main focus of the sector is, understandable enough, to sell and to sell as much as possible and this is not always compatible with the aim to reduce food waste. Therefore for example the suggestion to stop with “buy 3 for 2”-offers (which doesn’t create food waste in the shop but more likely generates food waste in the households) at least for fresh products has not been accepted by most of the persons interviewed. Some persons interviewed said that if this is asked for by the consumers and a market option could be seen then it would be considered but not otherwise. The option of having similar offers like “buy one now get one later” (like Tesco in UK) is more accepted – but on the other hand this might make it harder for the shops themselves to order the right amounts.

The sector also has great impact on other parts of the food-value chain – and therefore also the possibilities to take action to reduce food wastes both in production and in the households. One example for households is the possibility to buy smaller packaging and

the possibilities to buy fresh fruits and vegetables cut in halves (on the contrary today often the packaging size is getting larger and larger making it impossible for a single household to finish the food before it goes bad). Smaller packaging are often today significantly more expensive (cost/ kg) than larger packaging and since the cost/kg always is displayed many people choose the larger packaging just to get cheaper food. To some extent the same argumentation is valid also for the shops themselves – the possibility for the shop to order smaller amounts of different products will help the shop to a broad selection of commodities not creating waste of those commodities that were not sold.

One might then argue that the total waste amount including packaging waste will increase – but the fact is (Williams & Wikström 2011) that it is shown that the environmental impact saved when not throwing away food is much larger than the environmental impact from the increased packaging. So optimal packaging should be the key-word.

Regarding the wholesalers and their struggle to get every item out in the shops with as long shelf life as possible – there are different systems of keeping track of the food in warehouses. Different chains have different standards, but all common is the fact that they all try to distribute the products that first arrived first. In the connection to this it is also mentioned that close deliveries makes it easier to order the right amounts (this is valid both for wholesalers and retailers).

Donation of food is one thing that many of the persons interviewed has lifted as a thing that they want to do as an action to prevent food waste (food-bank). However there have been some obstacles towards organisation of food banks in Sweden and Denmark so far. The difficulties being linked to:

- Organisation of the food bank – getting the right type of food to the right place, within a certain time. One way of extending the life of fresh products from the stores is to freeze them before donating it – in Norway it is now allowed to do this which will of course help in this issue.
- Stable availability of food
- Management of food in the new value chain – the responsibility of the food is a key issue. In Sweden the responsibility is now being clearer described by the EPA and the National Food Administration. Instead of working with food-banks one option for the shop is to establish a kitchen on their own as for example made at ICA Malmborgs in Lund, Sweden.

The project has also noted some mismatches between consumer politics and waste politics, for example there were consumer organisations claiming the need for dates of production (or harvesting) for fruits and vegetables – which would most likely make the customer always pick the ones that are most recently harvested (in the same way that the customers choose the products with the longest “best before” date – causing more waste.

The policy instruments are very closely linked to the initiatives already mentioned above, such as for example discount on products that are close to best before date. In this chapter we also present some comments from the sector on general policy instruments.

Most persons interviewed are positive towards a common campaign as for example the one WRAP has run in Great Britain (Love food - hate waste). The initiative should preferably come from the authorities or someone like that and it has also been pointed out that the initiatives should be voluntary.

No one wants to have stricter regulations of any kind. There have also been voices saying that not even a demand to measure and give the authorities data for food waste is wanted. There is also a difficulty to have strict regulations since much of the waste is arising from “behaviour” of both customers and shop personnel.

One good example of a voluntary agreement is the ForMat project – where many of the chains has joined and together with the authorities has set up goals for decreasing the food waste from the sector. In this way highlighting the issue and working under a common project is probably of great importance.

Main obstacles and driving forces to reduce food waste

The main obstacles in reducing food waste found in the interviews are the customers expected need for full shelves with a great variety and “fresh” food. No one in the sector would do anything to decrease the sales – therefore all actions taken by the shop needs to be in line with meeting the demand from the customers. Much would be won if the behaviour and wants of the customers could change – maybe even in to having customers demanding a change from the shops. This is a difficult behaviour/opinion to try to change (both from the customers but also to make the shop-owners more brave in a sense that they will allow themselves to have empty shelves by the end of the day or having less varieties of each product) but it needs to start somewhere. One important question is if the customers should expect to have a full variety of for instance bread types throughout the whole day until the closing time, as this will end up in a lot of waste. Reduction of varieties to a few key bread types before closing time have been proposed in Norway as an option to reduce the large amounts of waste from fresh bakery products.

Other things such as better logistics are also mentioned but is said to be easier to deal with.

8 Discussions and conclusions

It is generally hard to get a good overview of total food waste from the retail sector in the Nordic countries, partly due to lack of data and partly due to lack of willingness to publish data. However, the Norwegian data set is probably relatively representative for the whole region, and can be used as an estimate of the total situation at least regarding what types of food products that are most commonly turning into food waste – i.e. the composition of the food waste. The most important product groups with respect to tonnage are fresh bakery products, fresh fruit and fresh vegetables. With regard to value, fresh meat, fresh ready meals and fresh dairy products are also of importance. This is shown in the Norwegian study and also mentioned by the respondents in the other countries. When it comes to amounts the estimation cannot be made based up on the Norwegian study – based on the figures in Table 1 and 3 the situation seems to be alike in Norway and

Denmark but that more waste per Euro of turnover is generated in Finland and less in Sweden. Since the figures in table 3 is presented with a high insecurity this must only be looked upon as a rough estimate. There might be a number of reasons for this one being the characteristics of the sector for example the Norwegian retail sector is overrepresented by a large number of smaller shops, which might result in higher amounts of food waste than in countries with relatively larger share of big shops.

What can the sector itself do to reduce food waste within the sector and also linked to others:

Of course decreasing the amount of food waste is high on the agenda for the retail and wholesale sector – producing waste is also losing money and some of the retail companies have developed sophisticated programs to get this in focus and to limit it. However, it will always be in balance with factors that increase turnover and in next hand net income and a certain loss will always be calculated for. Nevertheless there are a number of initiatives going on within the different companies to reduce the amounts of food waste; many of them are linked to ordering but also some to customer behaviour and education. All of these actions are listed in previous chapters.

The main reason is the fact that “best before dates” expires or fresh food not being so fresh anymore and therefore the food cannot be sold. However, a product going out of date is more a symptom on real problems, and it is more interesting to focus on reasons for why the “best before date”/freshness has been passed (e.g. “best before dates” expire due to the fact that customers pick the products with the longest “best before dates”). All known reasons are all more or less linked to customer behaviour or to the fact that the top priority of the shop-owner is to sell and that there is a delicate balance between selling and preventing food loss (and minimising food loss is not always the optimum for the shop owner). Things to do to reduce this kind of wastes are all listed in previous chapters.

What can authorities/society do to reduce food waste in the sector (and elsewhere in the food chain?)

It is thus probably not efficient for authorities to develop regulations that directly interfere with the work being done in companies to limit food waste, but three types of actions should be given priority:

- Actions towards consumers - the reason why consumers are listed as a possible action is that the power of the consumers has a big impact on the retail and wholesale sector, and raising the awareness and the knowledge among the customers will help to reduce the amount of food waste in the shops). Actions that could be taken are:
 - Nordic authorities should be actively collaborating with the food and retail sector to campaign towards avoidable food waste, to make the inhabitants more conscious about the problem and how to prevent food waste through better routines and planning. There could be an umbrella program in the Nordic region where good ideas and good material are exchanged, but campaigns should be carried out nationally. This should not be a focus on the retail sector as such, but on the whole value chain of food products.
 - Raise the status of “home economics” in schools and increase the hours spent on this subject. A perfect way to teach food planning, storage and preparation of leftovers.
- Actions to prevent regulations and politics that might increase the amount of food waste in the retail sector. This is important since the findings in the report shows that it is quite common that regulations and politics sometimes are acting in a way that will increase the food waste. Actions to be taken are:
 - Not develop too strict regulations on definition of expiry dates for products, but encourage the food producers to find the optimal shelf life based on knowledge of products and the distribution chain. The Nordic authorities should work in common towards the EU to adjust the expiry date regulations for eggs to Nordic conditions.
 - Better packaging will probably contribute to less food waste, and authorities should not develop politics and regulations that encourage packaging minimisation without focus on food waste. Packaging regulations should focus on packaging *optimisation*, where the food producers and the retail sector should identify the best solution to protect the food.
 - For many products, it is today a big difference in price per kg between large units and smaller units. It should be considered by the industry to have more fair prices for products packed in smaller units, as there should be more focus on the right unit size related to households with 1-2 persons (close to 1 million households with 1 person in Norway).
 - The environmental protection agencies should work together with other authorities (like National food administration) in order to avoid initiatives from those parties that might even increase food waste (for example in Denmark there was a general debate to introduce “production dates” on fruit and vegetables – which would dramatically increase the amounts of food being wasted, simply because people would always take the freshest

- products). One good example is the network SaMMa in Sweden where all kinds of organisations with the interest in minimising food waste has joined together trying to focus the work to prevent food waste and co-operating in making it an important issue.
- Try to make some type of impact assessment when introducing instruments in other areas there should be discussed if the new instrument would increase food waste. (E.g. in Norway a system of green/yellow/red marking indicates if something has gone wrong in the freezing-chain – which is good from the point of food safety – but the problem is that it doesn't indicate what has gone wrong or if the product needs to be thrown away. This might cause food to be thrown away just to stay on the safe side.) Electronic supervising/ controlling should not be implemented if not waste issue is taken into account.
 - The question of food prices has also been brought up – some movements think that we would throw away less food if food was more expensive. This is a sensitive question of course with people not affording food. In general we spend about 12% of our incomes on food.
- Better waste treatment – this is not waste prevention, but still important and to some extent a way to make the food waste more useful. Actions to be taken are:
 - Collaborate in establishment of Food Banks, and make it easy to donate food safely to Food Banks or the like
 - Promote establishment and cost-effective production of biogas from food waste
 - Open up for use of well sorted and safe food waste to feed pigs and poultry where this is preferred by the retail sector.

What can NGO's, households do to prevent food waste in the sector

The NGOs and the households can have an impact on the retail and wholesale sector especially when it comes to the “consumer power”. For example the Consumer association Stockholm have this high on the agenda but also other “regular” customers could do more – asking for wonky fruit or buying products with short shelf life if they are going to use the products soon. Also there is a need to find a right balance in Consumer politics towards promoting too many varieties in the shops (on behalf of consumers) and food waste. Too many varieties of products in shops make it more difficult to manage the inventory of products in the shops, probably leading to more food waste. Consumer politics should not be a driving force towards too high variety.

There are of course a number of other things that can be done by for example households to reduce the amount of food waste – it is out of the scope of this report to describe them all.

9 Recommendation on future steps to be taken

Apart from the actions mentioned in before there are two areas where further research/ investigations are needed:

- Regarding the actual behaviour of the customers – what s true and what is not when it comes to customer behaviour – can the customer accept less variety or empty shelves or will this make them to go to another shop.
- The actual amounts of food waste need to be reported in the all countries on a regular basis. Without those amounts the true environmental impact and the best way to prevent the waste will not be known.

APPENDIX 1 – COUNTRY SPECIFIC INFORMATION

1. RETAIL AND WHOLESALE SECTOR – COUNTRY SPECIFIC DETAILS

1.1 Denmark

This overview of the Danish retail sector is based on an article from Dansk Handelsblad. The Danish retail market is dominated by three umbrella companies having a market share of about 95 %. German discount chains hold the remaining 5 %. The retail companies have large private labels taking responsibility for some of the food distribution from producers to the shops, through their own grocery and distribution companies. Products such as fresh dairy products, beer and beverages, fresh fish and fresh bakery products are normally distributed outside this system.

The market shares in 2009:

- | | |
|-----------------------------|-------|
| - COOP Denmark | 36,9% |
| - Dansk Supermarked Gruppen | 31,8% |
| - De Samvirkende Købmænd | 26,5% |
| - Aldi og Lidl | 4,8% |

The total turnover for the retail sector in Denmark was estimated to 105 billion DKK in 2009. There was in total 3104 retail shops in Denmark in 2009, which represented a reduction of 53 from 2008. The distribution of shops between the retail companies in 2009 was as follows:

- | | |
|-----------------------------|---------------------------------|
| - COOP Denmark | 1200 shops and 35.000 employees |
| - Dansk Supermarked Gruppen | 531 shops and 30.000 employees |
| - De Samvirkende Købmænd | 1500 shops and 22.000 employees |
| - Aldi og Lidl | Aldi 244 and Lidl 71shops |

The Wholesale sector in Denmark is dominated by the three big umbrella retail companies COOP, Dansk Supermarked and De Samvirkende Købmænd (SuperGros, Reitan Distribution). In this study the wholesale in the three big umbrella retail companies are treated with each retail company. The smaller wholesalers, delivering food to small scale food selling companies (eg. bakeries, restaurants etc.) are treated separately.

The structure of the retail and wholesale sector in Denmark is briefly described in the following.

COOP Danmark

COOP Danmark is the largest retail company in Denmark, established in 1866. Some key data about the retail umbrella company is given in the table below.

Ownership	Owned by the consumers through memberships in local cooperative organisations (1,7 million members). The retail company COOP Denmark is 100% owned by the member organisation FDB.
Retail chains under umbrella	COOP Danmark has a market share of 36,9 % of the retail market and a total turnover in 2008 42 billion DKK.. The main chains under the COOP umbrella are: <ul style="list-style-type: none"> - Brugsen (according to shop turnover there are different names; SuperBrugsen, Dagli'Brugsen and LokalBrugsen) - Kvickly - Fakta - Irma
Private labels	COOP has a number of private label products: <ul style="list-style-type: none"> - COOP Änglamark (Organic and allergy-safe products) - COOP –Xtra (Low price concept)
Structural control of chain	COOP Danmark is functioning as wholesale for the various chains under the COOP umbrella, with responsibility for the logistic (storage and distribution)

Dansk Supermarked Gruppen.

Dansk Supermarked gruppen is the second largest retail company in Denmark, established in 1960. Some key data about the retail umbrella company is given in the table below.

Ownership	Privately owned company, founded by Herman Salling, today jointly owned by: <ul style="list-style-type: none"> - Salling Family (33 %) - AP Møller (67 %)
Retail chains under umbrella	Dansk Supermarked gruppen has a market share of 31,8 % of the retail market and a total turnover in 2009 57 billion DKK (incl. Earnings abroad). The main chains under the Umbrella are: <ul style="list-style-type: none"> - Føtex - Netto - Bilka
Private labels	Dansk Supermarked gruppen has a number of private label products: <ul style="list-style-type: none"> - Princip! (luxury goods) - Minimum (Low calorie products) - Care (low environmental impact washing powder)
Structural control of chain	Dansk Supermarked gruppen is functioning as wholesale for the various chains under the Dansk Supermarked umbrella, with responsibility for the logistic (storage and distribution)

De Samvirkende Købmænd

De Samvirkende Købmænd was established in 1907. Some key data about the retail umbrella company is given in the table below.

Ownership	De Samvirkende Købmænd is also called the independent supermarkets. It consists of a mosaic of single shops owned by independent traders and shops owned by the investor KFI and Dagofa-group (which also is main owner in the wholesaler SuperGros.). The shop owner decides if his/hers shop should be a part of the chain co-operation.
Retail chains under umbrella	De Samvirkende Købmænd has a market share of 26,5 % of the retail market in Denmark and a total annual turnover in 2009 of 28 billion DKK. The main chains under the Umbrella are:: <ul style="list-style-type: none"> - SuperBest - Spar - REMA 1000 - Kiwi.
Private labels	The various chains in under the umbrella De Samvirkende Købmænd has a number of private label products including: <ul style="list-style-type: none"> - SuperBest - Best Discount (Low price concept) - Spar - Gul Pris (Low price concept) - REMA 1000 - Landlord covering a spectre of product categories
Structural control of chain	Most of the shops in De Samvirkende købmænd are privately owned franchise. And some are owned by larger operators like KFI and Dagrofa, whom are also shareholder in one of the wholesale companies under De Samvirkende Købmænd. There are two privately owned wholesale companies under the umbrella: <ul style="list-style-type: none"> - SuperGros - Reitan Distribution These wholesalers are handling the logistics for all the chains in De Samvirkende Købmænd.

Aldi and Lidl

Aldi was established in Denmark 1977 and Lidl in 2005. Some key data about the retail umbrella company is given in the table below.

Ownership	Aldi and Lidl are privately owned German discount retail chains. They are to a high extent managed from the top in Germany and Denmark. Lidl and Aldi has a total market share of 4,8 % on the Danish retail market.
Private labels	Aldi are mainly selling private labels, all focused on discount prices. Lidl Denmark has a higher number of branded products than Aldi (fair-trade and organic products), but is still mainly focused on private labelled discount brands.

INCO

INCO was established in 1922 as a wholesaler. Some key data about the wholesaler is given in the table below.

Ownership	INCO are owned by the customers. Customers purchasing for a minimum of 100.000 DKK are invited to take part in general assembly, and will have a share of the turnover.
Organisation	INCO has two different business concepts located in different parts of Denmark: <ul style="list-style-type: none"> - Cash and carry – walk in engross shop - Distributed wholesale The annual turnover in 2009 was 1,9 billion DKK.
Product groups	INCO has wholesale of: <ul style="list-style-type: none"> - Meat - Fish - Frozen food - Dairy - Fruit and vegetables - Non-food - Beverages incl. Liquor

Grønttorvet

Grønttorvet was established in 1958 as a wholesaler of fruit, vegetables and flowers. Some key data about the wholesaler is given in the table below.

Ownership	Grønttorvet is a co-operative owned by the members. There are currently 155 members.
Organisation	Grønttorvet has 128 privately owned companies operating on their premises, and the estimated total turnover is 4 billion DKK. The daily operation, quality assurance, food safety etc. are conducted by a staff of 27 employees.
Product groups	Grønttorvet has wholesale of: <ul style="list-style-type: none"> - Fruit - Vegetables - Flowers - Products related to the above

1.2 Finland

Chain stores and centralised sourcing and logistics are typical for the daily consumer goods trade. The three largest alliances hold 87.6% of the retail market. This is the trend as the trade wants to reach large volumes to achieve efficiency in Finland, country which is vast and sparsely populated. Foreign competition and the EU expansion to the Baltic countries have linked Finland to the EU's internal markets also in daily consumer goods.

The market shares in 2009 (Finnish Grocery Trade 2010-2011):

S Group	43,2 %
K Alliance	34,2 %
Finland's local Store	10,2 %
Others	7,3 %
Lidl	5,1 %

The distribution of shops in 2009, in total 3892 retail stores (Finnish Grocery Trade 2010-2011):

S Group	943
Kesko	1030
Finland Local Store	768
Lidl	133

The structure of the retail sector in Finland is briefly described in the following (the compilation is based on information found on the web-pages of each chain).

S Group

Ownership	The S Group comprises of cooperative enterprises, such as SOK and its subsidiaries
Retail chains under umbrella	<p>National chain brands of the S Group are Prisma, S-market, Sale and Alepa, Kodin Terra, ABC, Sokos and Emotion, Sokos Hotels, Radisson SAS Hotels, Holiday Club Hotels, Rosso, Rosso Express, Fransmanni, Amarillo, Sevilla, Torero, Buffa, Memphis, Night, Public Corner, Coffee House, Presso, S-Rautamarket, Agrimarket and Multasormi. ³</p> <p>Wholesale Inex: Intrade Partners Oy is a SOK's subsidiary which handles the procurement and logistics of food and utility goods for the S Group's chains.¹</p>
Private labels	Rainbow, X-tra
Structural control of chain	S Group provides services for the supermarkets, service stations, fuel trade, department stores, speciality shops, hotels, restaurants, automobile, hardware and agriculture business. The S Group has over 1,600 outlets in Finland. The S Group is also involved in supermarket, hotel, restaurant and automobile business in the Baltic region. Net sales in 2009 amounted to EUR 6452 million (daily consumer goods).

Kesko food LTD

Ownership	<p>Non-financial corporations and housing corporations 28 %</p> <p>Financial and insurance corporations 5 %</p> <p>General Government 7 %</p> <p>Households 28 %</p> <p>Non-profit institutions serving households 6 %</p> <p>Rest of the world 0,5 %</p> <p>Nominee registered 25 %</p>
Retail chains under umbrella	<p>Kesko Food has four store chains for daily consumer goods – K-Citymarket, K-Supermarket, K-Market and K-Extra – with a total of some 1,000 stores. Kesko Food works in close chain cooperation with K-shopkeepers. Kesko Food manages and develops Kesko's grocery stores and is responsible for their marketing, procurement and logistics services, shop network and shopkeeper's resources. Wholesale: Kespro Ltd offers delivery sales and wholesale services to corporate customers.</p> <p>In the Baltic countries, Kesko Food has entered into a 50/50 joint venture with ICA Baltic AB, part of the Swedish Group ICA. The joint venture, Rimi Baltic AB, is active in the daily consumer goods business and has some 180 Rimi hypermarket, Rimi supermarket, Säästumarket and SuperNetto grocery stores in Estonia, Latvia and Lithuania.^{1,4}</p>
Private labels	Pirkka, Euroshopper
Structural control of chain	Kesko Food Ltd operates in the daily consumer goods markets, offering versatile shop services to consumers and corporate customers in Finland and in the Baltic countries. Kesko Food's net sales in 2009 amounted to EUR 3798 million.

Finland local store, Suomen Lähikauppa oy

Ownership	IK Investment Partners 66.0% Osuuskunta Tradeka-yhtymä 15.76% Wihuri Oy 15.76% Operating management 2.48%
Retail chains under umbrella	Finland Local Store has three retail chains: SIWA, Valintatalo and Euromarket
Private labels	Eldorado, First price
Structural control of chain	These stores operate all over Finland and the net sales in 2009 amounted to EUR 1300 million.

Lidl

Ownership	Owned by a German family
Retail chains under umbrella	Lidl focuses on low-price shops.
Private labels	Lidl has many private labels
Structural control of chain	Number of stores is 133 in 2009

1.3 Norway

This overview of the Norwegian retail sector is based on a report from NILF (Kjuus 2010). The Norwegian retail market is well structured with four dominant umbrella companies having a market share of about 100%. The retail companies have taken responsibility also for most of the food distribution from producers to the shops, through their own grocery and distribution companies. The only products that normally are distributed outside this system today are fresh milk products, beer and beverages, fresh fish and fresh bakery products, which still are mainly distributed directly by the producers.

The market shares in 2009:

- Norgesgruppen 40,0%
- COOP 24%
- REMA 1000 20,3%
- ICA 15,7%

The total turnover for the retail sector in Norway was estimated to 344,8 billion NOK in 2009, where the retail shops had a turnover of about 134 billion NOK. A total of 91 000 persons were employed in the retail sector, which contributed to about 8% of the GNP in 2008 in Norway. The average number of employees per retail shops was about 9,6 in 2009. There was in total 4007 retail shops in Norway in 2009, which represented a reduction from 5239 shops in 1995 or about 24%. The distribution of shops between the retail companies in 2009 was as follows:

- NorgesGruppen 1960 shops
- COOP 853 shops
- REMA 1000 472 shops
- ICA Norge 711 shops
- Others 11 shops

REMA1000 is the only retail company which has increased their number of shops in the period 1995-2009, from 228 to 472, or about 107% increase.

The structure of the retail sector in Norway is briefly described in the following.

Norgesgruppen.

Norgesgruppen is the larger Norwegian retail company, established in 1994. Some key data about the retail umbrella company is given in the table below.

Ownership	Private limited company (allmennaksjeselskap), owned by <ul style="list-style-type: none"> - Joh. Johannson Family (69%) - Br. Lorentzen (8,5%) - PETT-group (6%) - AKA Ltd (5%) - Others (12%)
Retail chains under umbrella	The main chains under the Umbrella are, with percent of total turnover 2009 in NorgesGruppen (53 billion NOK) <ul style="list-style-type: none"> - KIWI (33,7%) - Meny (21 %) - Spar (14,4 %) - Bunnpris (9,2 %) - Joker (7,9 %) - Ultra/Centra/Jakobs (4,7%)
Private labels	NorgesGruppen has a number of private label products, which are all organised through the 100% owned company UNIL AS
Structural control of chain	<ul style="list-style-type: none"> - NorgesGruppen is a major actor also in the service and fast food sector in Norway, with ownership in MIX, Deli de Luca and Fresh - NorgesGruppen has its own grocery company ASKO with a turnover of 21,4 billion NOK in 2009. - NorgesGruppen is a major owner in the BAMA group, who is the larger distributor of fruits and vegetables in Norway

COOP Norge

Ownership	Owned by the consumers through memberships in local cooperative organisations (1,2 million members). The retail company COOP Norge Ltd is 100% owned by the member organisation COOP NKL SA.
Retail chains under umbrella	The main chains under the COOP umbrella with share of total turnover (32,3 billion NOK in 2009) are: <ul style="list-style-type: none"> - COOP Mega (28,9%) - COOP Prix (28,9%) - COOP Obs (22,3%) - COOP Marked (14%) - COOP Extra (3,2%) - COOP SmartClub (2,9%)
Private labels	COOP has four private label concepts: <ul style="list-style-type: none"> - COOP –serie (Low price copies) - X-tra (Low price concept) - COOP Taste difference (High quality products) - COOP Änglamark (Organic and allergy-safe products)
Structural control of chain	COOP Norge Ltd is 100% owner of several production companies in the Norwegian Food sector: <ul style="list-style-type: none"> - COOP Norge Kaffe Ltd (coffee) - Røra Fabrikker Ltd (marmalade and juice) - Goman Bakerier Ltd (bakery products) COOP Norge has also ownership in other companies, like Norggrønt Ltd who is responsible for distribution of fruits and vegetables to the COOP shops. COOP Norge Ltd has its own grocery department which is responsible for all distribution from most suppliers to their shops.

REMA 1000

Ownership	REMA 1000 is 100% owned by the Reitan Group Ltd, which again is 100% controlled by the Reitan Family.
Retail chains under umbrella	REMA 1000 has only one retail chain concept, the REMA 1000 shops which are spread out over the whole country. Total turnover in 2009 was 27,2 billion NOK.
Private labels	REMA 1000 has three main own private labels: <ul style="list-style-type: none"> - Landlord covering a spectre of product categories - Godehav for seafood - Solvinge for poultry products and eggs. In addition, REMA 1000 has long term strategic relations and contracts with a number of producers, for exclusive distribution of their products in REMA 1000 shops.
Structural control of chain	REMA 1000 has its own production company, which is involved as owner in several food producing companies, like <ul style="list-style-type: none"> - Grans Bryggeri Ltd (beer and beverages; 50%) - Staur Foods (50%) - BARE (fruits and vegetables; 20%) - MaxMat (75%). In addition, REMA 1000 has long term contracts with food industries (see below). REMA1000 has its own distribution department that is responsible for distribution of most products from producers to shops. REMA 1000 is also owner of chains in the service market, like Narvesen and 7-Eleven.

ICA Norge AS

Ownership	ICA Norge Ltd is a 100% owned company by ICA Ltd, which again is a joint venture between Hakon Invest AB (40%) and Royal Ahold DV from the Netherlands (60%). Hakon Invest Ltd is owned partly by ICA Shop-owners Federation (67%) and other private shareholders (33%).
Retail chains under umbrella	ICA Norge Ltd has four main retail chains under its umbrella, which had a total turnover of 21,1 billion NOK in 2009: <ul style="list-style-type: none"> - RIMI (37,5%) - ICA Nær (23,2%) - ICA Supermarket (22,6%) - ICA Maxi (15,1%)
Private labels	ICA has a clear strategy to develop own private labels, where the dominating in the food market are <ul style="list-style-type: none"> - ICA products - Euroshopper.
Structural control of chain	ICA Norge Ltd has its own fully controlled grocery department being responsible for distribution of most products from producers to the shops. ICA Norge has only ownership interests in two companies in the fruits and vegetable sector (Toten Potet and Interfrukt).

1.4 Sweden

The retail sector in Sweden is dominated by three large chains (ICA, COOP and Axfood) – there are some other growing chains as well. The total turnover for the retail sector in Sweden was estimated to 600 billion SEK in 2009, where the retail shops had a turnover of about 44% (the remaining 66 % is goods that are not purchased often i.e. not food). The retail companies have, like in the other Nordic countries, taken responsibility also for most of the food distribution from producers to the shops, through their own grocery and distribution companies.

Market shares 2009:

- ICA	50.7 %
- COOP	21.5 %
- Axfood	15.9 %
- Bergendahls	5.7 %
- Lidl	3.8 %
- Others	2.7 %

In Sweden there are approximately 6500 shops (Livsmedelssverige, 2010). The different groups rarely co-operate, for example they all have their own lager, wholesaler and brands. The distribution of shops between the retail companies in 2008 was as follows:

- ICA	1369
- COOP	692
- Axfood	944 (+VI butikerna 72)
- Bergendahls	176
- Netto	100
- Lidl	153
- Other	3000

The structure of the retail sector in Sweden is briefly described in the following (The information is compiled from information found at the websites of the companies and on Livsmedelssverige.se).

ICA Sverige

Ownership	ICA AB is a joint venture owned by 40 % of the Swedish Hakon Invest AB and to 60 % of the Dutch Royal Ahold N.V.
Retail chains under umbrella	ICA Sverige has five main retail chains under its umbrella, which had a total turnover of 59 003 billion SEK in 2009: <ul style="list-style-type: none"> - ICA To Go (at Statoil petrol stations) - ICA Nära (small, local shops) - ICA Supermarket (middle sized shops) - ICA Kvantum (large shops with manual service) - ICA Maxi (large shops with a wide range of durable goods)
Private labels	ICA has four main own private labels for food products: <ul style="list-style-type: none"> - ICA - ICA I love ECO (Organic) - ICA Gott Liv (Healthy food) - Euro shopper (low price) ICA also has own brands for cleaning products, certain clothing and cookware.
Structural control of chain	Every ICA-shop has their own responsibility for economy and personnel. ICA has a parent company that acts as a wholesaler but also as a consultant – selling for example education to the shops.

COOP Sverige

Ownership	COOP Sverige AB is owned by the members via the economic union KF. About half of the shops are centrally owned by COOP Sverige AB, the other half is owned directly by 48 different cooperate unions. 130 stores are also run by franchisees.
Retail chains under umbrella	COOP has six main retail chains under its umbrella, which had a total turnover of 32 921 billion SEK in 2009: <ul style="list-style-type: none"> - COOP Nära (small, easy accessible shops) - COOP Konsum (middle sized shops) - COOP Extra (shops with a low price profile) - COOP Forum (large shops with a wide range of durable goods) - COOP Bygg (hypermarket with construction- and garden goods) - Mataffären (Internet based shop)
Private labels	COOP has four main own private labels: <ul style="list-style-type: none"> - COOP Änglamark (Organic and allergy-safe products) - COOP Prima (high quality products) - COOP (low price copies) - COOP Extra (low price) COOP also has private labels for cookware, light bulbs, furnishings, home electronics and household appliances.

Axfood

Ownership	Formed in 2000 by stores that did not want to be included in ICA. Axfood's main owner is Axel Johnson AB with 46% of the stock share.
Retail chains under umbrella	Axfood has four main retail chains under its umbrella, which had a total turnover of 32 378 billion SEK in 2009 (% of total turnover within brackets): <ul style="list-style-type: none"> - Tempo (easy accessible shops) - Hemköp (middle sized shops) - Willys (larger shops with a low price profile) (54%) - Pris Extra (large) (2%) Axfood also owns two wholesale companies: <ul style="list-style-type: none"> - DAGAB (17%) - Axfood Närlivs (9%)
Private labels	Axfood has six main own private labels: <ul style="list-style-type: none"> - Garant (low price copies) - Garant Ekologiska varor (organic) - Aware (fair trade) - Willys(low price copies) - Hemköp(low price copies) - Eldorado (low-price) Axfood also has private labels for batteries/light bulbs and cookware
Structural control of chain	Axfood is listed on the OMX. The main shareholder is Axel Johnson AB with approximately 46 percent of the shares.

Bergendahls

Ownership	The fastest growing chain in Sweden at the moment. Allowing completely separate shop concepts.
Retail chains under umbrella	Bergendahls has seven main retail chains under its umbrella, which had a total turnover of 9 billion SEK in 2009: <ul style="list-style-type: none"> - City Gross - AG's - EKO stormarknad - Matöppet - Vinn Stormarknad - MaxiMat - Östenssons

Lidl

Ownership	Owned by a German family via a trust
Retail chains under umbrella	Lidl focuses on low-price shops.
Private labels	Lidl has a number of own labels
Structural control of chain	Lidl is controlled by the German mother company.

Apart from the ones described above there are also a number of shops that are not so large – one example of a chain is Netto, which was established in Sweden in 2002 and now have about 100 shops and 1-2 % of the market share. NETTO is owned by Dansk Supermarked AS. The idea is to sell low-price close to where people live. Due to the low-price concept NETTO is marketing approximately 1200 goods.⁹

2 Available data (amounts and what types of food waste is generated and how is it treated) – country specific

2.1 Denmark

2.1.1 Waste amounts -literature

A review of the available data from Denmark indicates some deficiencies. Better and more current data on the amounts of food waste generated by the retail sector is required, as the existing data is between 8-20 years old, while there is no national data covering food waste from wholesalers at all.

The publications "Kortlægning af affald i dansk dagligvarehandel" (1) and "Håndtering af organisk affald i dagligvarehandlen" (2) has the newest and most accurate quantified data on food waste from the retail sector.

Denmark (1) 3 weeks survey of 24 shops within 5 categories of retail shops	Average amount of food waste per shop were 165 – 562 kg/mill DKK turnover (diverging with shop - size and -type). No overall average given.
Denmark (2) Key figures (calculated)	Average amount of food waste per shop is 200 kg per week. The total generation of food waste from the retail sector hence is estimated to 40.000-46.000 tonnes per year

Data indicates that supermarkets with a production and sale of fresh baked bread generate more food waste, whereas supermarkets with in-store butchers are not producing

significant amounts of additional food waste compared to stores with external butcheries. It is the shop's number of food product groups that is the biggest determining factor for the generation of food waste in the retail sector (Kjær & Werge, 2010). The Danish EPA has planned a major study of the food waste amounts and fractions from retail and households. The study will be conducted in 2011.

2.1.2 Waste handling - literature

Food waste from the retail and wholesale sector is normally collected and handled as mixed municipal waste. The municipalities are the responsible authorities handling the collection of food waste. If the food waste is sorted out at source the retail company is liberated to use a waste transportation and handling service of their own choice and will not be subjected to use the municipal collection systems. The generated meat waste is subjected to the EU regulation No 1774/2002 laying down health rules concerning animal by-products not intended for human consumption.

2.1.3 Waste amounts – interviews

Specific data on food waste is almost none existing in the Danish retail sector. All of the companies stated that separate sorting and register of food waste data would be a huge task for the retail companies. Some of the companies replied that data might exist in small scale, on shop level or as parts of minor projects conducted in some part of a chain, but nothing coordinated and quality assured, and nothing that would be available for the public.

The Danish retail companies are not collecting sales data on a product group level (neither ton or volume) as it is known from the other Nordic countries. One of the companies said that the data exist, but not group together and it would be a massive task to withdraw and compile the data.

In the Danish retail sector registration of waste is done in a mixed MSW fraction (containing food waste), other fractions such as glass, cardboard etc. are sorted separately. In some municipalities the stores are required to sort out the biodegradable fraction, which in that case is a matter for the specific shop in the municipality. The weight of the biodegradable fraction from is unknown for the interviewed representatives, but might be available from the municipalities collecting the bio waste. Amounts of wasted products are registered, but not specifically on food waste and not at a detail level like type of product (e.g. tomatoes, cucumber etc.). All the companies are keeping account of sales data and these data are used as indicators on waste amounts, and are available together with total turnover on different product groups, but the data are considered a trade secret and hence are confidential.

All of the retail companies report that they have a clear focus on all of their waste generation, simply as part of being a good retailer. Food waste is products not sold hence money not earned. On the other hand some wastes are calculated for in order to keep the shelves full. One of the companies put it like this; *products sell products*, meaning customers buy more products when the shelves are full.

There are no specific public available data on food waste from the retail sector, hence no table.

The interviewed wholesalers in Denmark report that they are not sorting food waste separately, but much of their waste is food waste and one of the wholesalers estimate that they generate 15-20 tons of waste per month (including packaging) but most of it being food waste. The biggest food waste groups are fresh food: Vegetables and fruits, bread, and dairy products. Cold stored products, fresh meat and fish products come next.

2.1.4 Waste handling - interviews

For both wholesalers and all the retail companies interviewed, the food wasted generated in the stores are treated and kept in the stockroom or backyard of the store in containers with the rest of the Municipal solid waste (MSW). There are reported to be problems with people breaking in to the containers searching for food. These visits from 'dumpster divers' leads to food waste being spread around on the ground attracting rats etc. therefore, most of the waste containers are kept inside locked sheds or in the stockrooms. One of the wholesalers report that they have some containers for bio waste (including food waste, but this includes flowers and other green waste).

Food waste in the Danish retail sector is treated with the rest of the mixed MSW fraction (there is a sorting in other fractions such as glass, cardboard etc.). In some municipalities the stores are required to sort in a biodegradable fraction. In these stores, the staff of the supermarket is sorting the biodegradable fraction from the MSW and the waste is kept in separate containers. In general MSW (including food waste from the retail sector) is incinerated in Denmark. There are possibilities for bio energy, but that is the exception from the rule. All of the companies spoken to are constantly working on improving their performance and minimizing their waste, but none of them have quantitative goals set up for minimizing the amount of food waste. Food waste are not an issue handled separately in either of the companies, but they all report that they are trying to minimize the amounts, reasons being both economic, ethical and environmental awareness. Some of the chains have taken specific actions, which could have some effect on the amounts of food waste generated. These actions are elaborated in a following section.

2.2 Finland

2.2.1 Waste amounts - literature

There has not been data available from Finnish retail sector because the food waste has been a sensitive and strategic business issue. However the amount of food waste is to be studied in FOODSPILL project during 2010-2012. In literature there is very little information. Helsinki Metropolitan Area Council has published report from material efficiency (Huuhtanen 2006). The aim of the project was to evaluate and estimate waste from services and industry. This report found out that the amount of food waste in grocery retail stores can be reduced most effectively by sale-pricing products. The report is not very extensive, because only four grocery stores were studied during one week. In addition the results were basically only recommendations and the amount of waste was not been published in kilos.

S Group has published that their food waste was 27 million kg in 2008 (Taloussanomat 2009). Overall it is hard to find any published information about the amount of food waste in the Finnish retail sector.

According to Huuhtanen 2006 the result was that groceries discard food products that can be divided into the following categories:

Bread and grain product	35 %
Fruits and vegetables	34 %
Meat and fish	12 %
Dairy products	12 %
Convenience food	3 %
Canned food and dried food	3 %
Frozen food	1 %

2.2.2 Waste handling – Literature

Finnish waste legislation is largely based on EU legislation, but in some cases includes stricter standards and limits than those applied in the EU as a whole. Finland also has legislation on some issues related to wastes that have not yet been covered by EU legislation.

Enterprises bear the primary responsibility for managing any wastes generated during their activities or otherwise in their possession. Municipalities organise the collection, transportation, recovery and treatment of the household wastes, wastes generated in industrial, commercial and service premises that are comparable in their quantity and quality to everyday household wastes (not including hazardous wastes) are often also handled by the municipality, particularly waste from smaller firms. The enterprises are obliged to classify, sort, and store their wastes, including hazardous wastes, to facilitate their collection and appropriate processing.

The retail chains are able to use also other operators, transport companies etc. Generally super and hypermarkets and other big retail units are using private waste companies to transport their waste. That is why authorities do not know about the amounts of waste generated from the retail chains as whole. Smaller shops and stores are using municipal collection services and it has been published also one study about food waste generated from retail sector. The result was that 52 % of unsorted solid waste was organic food waste.

The Ministry of the Environment supervises and controls the way Finnish waste legislation is put into practice. The Finnish Environment Institute conducts research and training, publishes new ideas and methods, and monitors all developments related to waste issues, while also participation in drawing up new legislation and guidelines related to waste. Regional environment centres guide, encourage and monitor the implementation of the Waste Act in their own regions. Local authorities organise the collection, recovery and disposal of household refuse and other similar waste, and supervise waste management in general in their own area. They also set local regulations on waste management, ensure that

advice on waste matters is freely available, and issue waste permits to smaller firms and operations. (Finland's environmental administration, 2011)

2.2.3 Waste amounts – interviews

The amount of food waste is strategic element for food retail chains. Due to this fact most of the Finnish retail chains are not willing to reveal or publish any information about the food waste. Moreover the Finnish retail sector does not have willingness to participate or organize waste campaigns for customers, not even at the moment. However when interviewed some representatives told percentage of all food waste in their chain: 1 – 2 % from total food sale. The information of food waste amounts from interviews is in table 3.

The amount of food waste and the number of food items is registered very strictly and is followed at country and product group level. Every abandoned item is weighed and the reason for the loss is documented in the order system program. All chains do this registration regularly. The data on food waste is used the planning of the logistics systems and other activities in the organization. The data enable to make more exact orders and to assure that the food is in the right place at the right time, in the stores instead of in the warehouses for example. The logistic system must be efficient enough so that the products are in the groceries and stores during the selling dates, instead of in the warehouses.

According to the respondents the biggest food waste group is fresh food or food with a short expiring date: bread, vegetables, fruits and milk products. Cold stored products, fresh meat and fish products come next. The waste amount of bread and vegetables is biggest, but not more than 10 % from this category sale. One large retail chain have announced their total amount of food waste (S-group, 27 million kg, 2008, Taloussanommat 2009), and they claimed that it has been relatively decreased in the last 5 years.

2.2.4 Waste handling - interviews

Chains advise their stores that the organic and mixed waste has to be sorted and the packed organic waste have to be taken out from their packages, however the final responsibility remains on the individual store. The waste is handled and sorted according to all laws and requirements. Organic waste is sorted when possible and if it does not take too much time. One solution is waste stations or biogas plants that are capable of handling packed food waste. One chain tells that 89 % of their stores sort bio waste from other waste and after they transport it to energy or compost plan.

Altogether, part of the food waste is sorted into organic waste and a part is discarded as mixed waste. The working methods, however, vary a lot in the retail shops. Packed food is usually discarded as mixed waste, because it is laborious and expensive to unpack the food. In the Helsinki metropolitan area the organic waste is composted and the end product is used for landscaping. In 2013 a new waste treatment plant will be opened and there also packed organic waste can be treated. Now there is only one waste treatment plant where packed organic waste can be exploited. This facility is in Forssa, some 100 km from Helsinki.

From 4.3.2011 there will be new regulations (EU) and after that the Finnish authorities are going to be more strict about the regulations concerning handling of raw meat and fishery products. They will request companies to transport their waste to the appropriate waste treatment plants. Anyway this is not going to concern small shop (under 50 kg/week biowaste) or shops locating distant areas.

2.3 Norway

2.3.1 Waste amounts - literature

In Norway there are two large projects going on to prevent food waste in the value chain; a business-driven project called ForMat and the Food Waste Research project with Ostfold Research as project owner together with Nofima Mat and SIFO. The aim of the ForMat project is to reduce the amount of edible food waste with 25% before 2016, through prevention. The ForMat project is economically supported by the Ministry of Environment in Norway.

Within ForMat several activities and measurements has been (and will be) carried out. Regarding waste amounts the study was made in close cooperation with the largest retail company in Norway – Norgesgruppen. Data for food waste has been gathered from 10 pilot shops in the first 6 months of 2007 as a pilot project for Norgesgruppen, where the bar code of all food items that for different reasons had to be wasted, were read and registered in a central data base (Hanssen & Olsen 2008). Data for single products were aggregated in 11 product groups which were selected on the basis of importance related to food waste and total turnover in the shops. Food waste data were related to turnover of product groups both on an economic basis and on a mass basis, where the mass per economic ratio for the most important products recorded as waste in each product group was used to estimate total turnover in tons of product. Data from the 10 retail shops have been extrapolated to total figures for the whole retail group based on data about turnover of products in each shop, in relation to total turnover in the whole company. As Norgesgruppen has a recorded market share of 40% of the total retail sector in Norway and is represented with all types of retail shops, figures has also been estimated for the whole retail sector, assuming that Norgesgruppen is representative for the whole sector. The estimated amount of food loss from the retail shops in Norgesgruppen is presented in Figure A1.

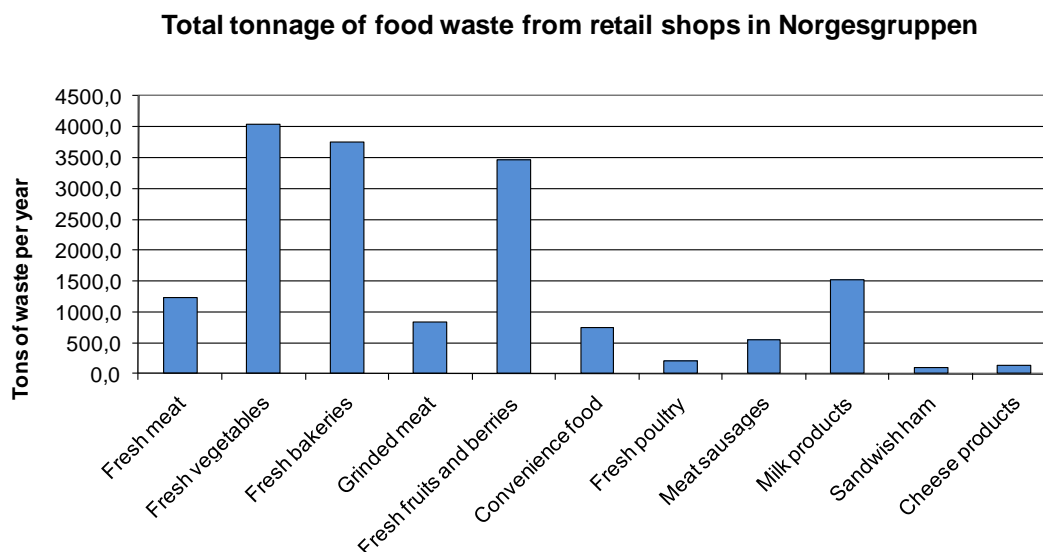


Figure A1 – Total tonnage of food waste from retail shops in Norgesgruppen (from Hanssen & Olsen 2008)

Fresh vegetables were found to be the product group generating the most waste per year, about 4000 tonnes food loss per year, with bakery products as the second with 3700 tons per year and fruits and berries the third with about 3500 tonnes per year. In total, it is estimated that the whole Norgesgruppen retail company generated about 18 400 tonnes of food waste from their retail shops in 2007, giving a total figure from the whole retail sector of about 43 000 tonnes food in Norway (Hanssen & Olsen 2008)

2.3.2 Waste handling - literature

There are no exact data available on how food wastes from shops are treated in Norway at the moment, but most food waste is treated in three main ways:

- Incineration with energy recovery
- Production of bio substrate for bio gas production
- Well sorted bakery products are used for animal feeding.
- In addition, some food that is still in good condition is donated to charity organizations.

There is a clear strategy for the retail sector to increase biogas production with basis in available food waste from retail shops and grocery shops. It is also an on-going project to organize food donations through a food bank in Oslo.

2.3.3 Waste amounts – interviews

There are differences with regard to how food waste is registered and managed in the different retail and grocery companies in Norway. Two of the retail companies have very well developed systems for registration of food that are not sold, but that have to be managed in other ways either internally, externally or that ends up as food waste. This is

done for each product that is identified according to a unique EPD-number several times a week, and according to well described and managed routines in each retail shop. In this system, also the reason for why the product had to be taken out of the sale area is registered, and with information if the product have been used for internal use (in the canteen or for production of salads or ready-made meals for sale).

The purpose of this very comprehensive registration of products that are not sold but ends as waste is of course not primarily to quantify food waste for the retail sector. The system has been developed and implemented to get statistics about product loss that has a significant influence on the economic result of each retail shop and company, as this might have a significant negative impact on the economic results for the shop owner and the retail company. In the retail companies that have implemented such systems, data about “food waste” is thus used every week throughout the year as input to how the retail shop can be best managed to prevent food loss. This is mostly used to optimize ordering routines and to balance ordered volumes of products with the volume each shop is able to sell before the time to expiring date is too short to sell the product. It is thus a clear connection for the retail and grocery companies to minimize amount of food waste generated from their own companies, as this will have a direct and significant impact on the economic result for each shop.

Those figures have only been used for internal purposes and have not been used in companies to estimate total amount of food waste being generated in the retail sector in Norway until Norgesgruppen asked Østfoldforskning to do a joint pilot study to estimate their total food waste in 2008 (Hanssen & Olsen 2008). Through this project and followed up by the ForMat project in 2010, figures from a number of shops in the retail sector has been made available for research, and have made it possible to develop rather representative figures for the retail and grocery sector in Norway. These figures will also be followed over a number of years, to analyse if there are some trends in amount of food waste from the retail sector.

Also retail shops from other retail companies use the same type of systems for registering unsold products ending up as food waste. In those companies, the system for registration and management is used by local shop managers, but has not been implemented in a systematic way for the whole company. The purpose of the systems is however the same, to prevent food loss and food waste through better shop management.

2.3.4 Waste handling - interviews

According to representatives from the retail chains, data on amounts of food waste as well as other types of sorted waste fractions are available in aggregated figures for each of the retail companies. There is however not available data showing how food waste from the retail sector are treated in Norway. This varies according to local conditions and availability of waste treatment alternatives, and is normally part of the contracts between the retail and grocery companies, and waste service companies. In some retail companies, those contracts are negotiated on a national level, whereas others have local contracts.

There is a clear strategy for the retail sector to increase amount of food waste that is treated for biogas production and where the biogas primarily should be used in the transport sector. It is also an on-going project to organize food donations through a food bank in Oslo.

2.4 Sweden

2.4.1 Waste amounts - literature

The official waste statistics figures (reported to EU) by Swedish Environmental Protection Agency states the following figures for food waste (background data to Avfall i Sverige 2008):

	Waste amounts [tonnes]
Retail wholesale sector – super markets	74 000
Retail wholesale sector – smaller shops	9 500

These amounts are calculated using waste factors from Avfall Sverige (Waste Management Sweden). The waste factors are developed out of a small survey and do not make any difference between avoidable or unavoidable food waste. The factors make a difference between the size of the shop – more wastes are thrown away in smaller shops.

Preparing these figures SMED⁷ has also conducted several studies to increase the quality of data (Stenmarck 2007, Stenmarck & Gottberg 2009). In the future the aim is to have a good control of this waste flow and also to be able to divert between avoidable and unavoidable food waste. Within the total waste generation study made regarding 2010 there is going to

⁷ SMED is a consortium formed by IVL Swedish Environmental Research Institute, Statistics Sweden, Swedish University of Agricultural Sciences and Swedish Meteorological and Hydrological Institute, with a primary aim to gather and develop Swedish competence within emission statistics related to the national abatement efforts within the areas emissions to air and water, waste/waste management, and hazardous substances/toxic chemicals.

be an extra focus on food waste. The categories being most thrown away are fruit and vegetables, meat and bread. (Naturvårdsverket 2008)

The wholesale business is not as examined as the retail business; all the large chains are to a certain extent also their own wholesaler.

At SLU (Swedish University of Agricultural Sciences) a new research project "Decreased amounts of food wastes in retail shops – measures and effects on economics and the environment" just started with the foremost aim to calculate the environmental impacts of the food losses in the retail-business. The project has however done measurements in six stores during October 2010. The data from this project are not yet available.

2.4.2 Waste handling - literature

Sweden has a national environmental quality objective that 35% of *all* food waste should be treated with biological treatment in 2010. This goal has not been achieved – today 178 770 tons food waste is treated by anaerobic digestion or composting (according to Avfall Sverige 63 000 tons food waste and green waste being home composted (Svensk avfallshantering 2010)). The total amount of food waste from the service sector is 377 000 tons (Naturvårdsverket 2010).

In the wholesale and retail sector large amounts of food waste still goes to incineration mixed with other wastes. A major reason to this is the packaging but also other factors such as the cost for handling separate waste streams as well as possibilities to get the waste collected are influencing.

2.4.3 Waste amounts – interviews

The normal way to register food waste is not always by weight, monetary value is the reason why it is registered and therefore used in many chains as the way of registration. The level of detail varies also – in most shops the wastes are registered with the barcode giving very detailed data. Fruits and vegetables are more sometimes just estimated (but on the other hand the weight is the "unit" and therefore of greater purpose for this project's cause) at some chains however these wastes are actually weighed and the true weight is registered. There are two different kinds of waste flows – one being food that has been in the store but not sold and therefore sorted out. The other one is waste arising from food transported to the store (Åhnberg, Strid 2010) this amount is in some cases bigger than the loss of the food that has been in the store.

Data for food waste is used in order to make the shops leaner and productive – for sure no one wants to have more food waste than necessary – on the other hand some wastes are calculated for in order to keep the shelves full.

No exact figures have been given the project. However in the yearly report ICA notes that 3 724 tonnes of food waste is sorted out from the central storages (all of this being sent to biological treatment). COOP on the other hand sends 5 823 tonnes of organic waste to biological treatment (from both shops and central storage), not all COOP shops have separation of food waste so this should not be considered as a total amount. These figures

are only amounts sorted out, nothing is said about the amount of food waste in the mixed fraction.

2.4.4 Waste handling - interviews

All the chains work to increase the amount of food waste to biological treatment. The success depends mostly on the waste handling system offered by the municipality. Since waste from the retail sector legally has the same status as waste from households the municipality is the one responsible for taking care of the waste. This might change during 2011 and that will also change the possibilities for the sector to influence the waste handling. Since bio-gas now is a valuable product there are also voices that claims that one should get paid for leaving food waste to the bio-gas plant. How this discussion ends up is yet to be seen.

All the persons interviewed states that they have goals to minimise the amount of food waste – because this is for sure an economical issue. However some waste will always be calculated for in order to keep the shelves full. Some shop owners states that the more the actual waste amounts are communicated to the staff and worked with, the more the amounts decreases.

3 Waste generation – why do waste arises, country specific

3.1 Denmark

The retail companies report that the majority of the food waste is being generated in the supermarkets and to a minor extent in the warehouses and the logistic between store and warehouse. The number one reason for the generation of food waste in the retail sector is the consumers' standards for the look/appearance of the food products. Consumers expect food products to look in a certain way, and discard all the products not fitting that perfect image. Other reasons for food being wasted is lower sales than expected, "best before dates" expired, and low quality of products due to wrong storage or handling of the products /damaged goods (again mainly in the shops). Producer or authority driven withdrawals of products are another source for generation of food waste in the retail sector. Withdrawals of products are normally due to food safety precautions / health issues, which is a number one priority for the retail sector. One of the companies mention that there are many examples of food products being withdrawal by the producers, and thereby wasted in the supermarkets, simply because of new packaging design, or a new recipe (e.g. less fat) from the producer, requiring all the food produced after the old recipe to be withdrawal and wasted.

There are some different reasons for food being wasted in the wholesale companies. The wholesalers are distributing some of their food directly to their customers, and food waste is being generated due to miscommunication or wrong delivery or returned products from the customers. Another reason for generation of food waste from the wholesale companies is their internal rules on "best before dates". Wholesalers have prior "best before dates"

because they sell to other shops, who will need to have a certain shelf time in their own stores as well. The wholesalers have taken initiatives to keep these products that has past the “internal best before date” from being wasted, these initiatives are described in chapter 8. Food being wasted at the wholesalers is damaged products due to mishandling (mishandling can both lead to physical damage and bacterial damage on the products). All the companies interviewed report that food waste generation has a high priority both for economic and ethical reasons.

3.2 Finland

In the retail sector the food waste is mainly generated in the stores, not in the transportation or in the warehouses.

The responders do not see all food waste as waste at all and they consider it as unavoidable costs, due to the fact that consumers want to have a broad variety of different products to choose among everything should be as fresh as possible. For example vegetable- and fruit stands need to keep looking fresh and attractive all the time and this will cause some inevitable waste. Consumer behaviour is an important factor in the food waste issue, and attitude changes are required in order to decrease the amount of food waste.

Consumers want a broad selection of food items and traders want to fulfil their needs. For instance stores are required to supply fresh food all day long, but in the evening anyway some part of this food is thrown away. Most remarkable reason for throwing away food is the expiration of the last selling date on the food item. Break-down of packages is only a minor reason for food waste.

In business aggressive price campaigns, advertisements or commercials of the competitors are the issues that matter every day. Trends, knowledge, experience influence the predictions that are made by the actors in the food supply chain. At the end of every selling day the success in the business operation can be defined by the availability of products on the shelves. In this sentence food waste is not a very important issue.

The ordering system is important, the statistics give information about the products and the amounts of waste. In addition exceptions, like big events or festivals in the town etc. have to be taken into account.

When the rhythm of the ordering is short it is possible to decrease products in the warehouse and consequently also decrease the amount of losses. The education of the staff is very important, for instance especially in the metropolitan area of Helsinki it is more difficult to get permanent staff and if the personnel is changing frequently, there is a lack of experience on how the products should be handled and on the rhythm of ordering. Seasonal variations and changes in the weather are other issues making predictions difficult.

3.3 Norway

According to the analyses of food waste from the ForMat project, which is supported by the interviews with the representatives from the retail sector done in this project, most food waste generated in the retail shops is due to loss of freshness and quality (fresh bakery products, fresh fruits and vegetables) or expiring date (meat products, seafood products and dairy products). Managing the inventory of food products in relation to expiring dates and the consumer's attitudes to fresh products is thus the main reason for generation of food waste in the retail chain from grocery companies to retail shops (92% of food loss). Food loss due to breakage of packaging or damage of products in handling in transport and storage do only contribute to about 8% of the real food loss in retail chains (see Figure A2).

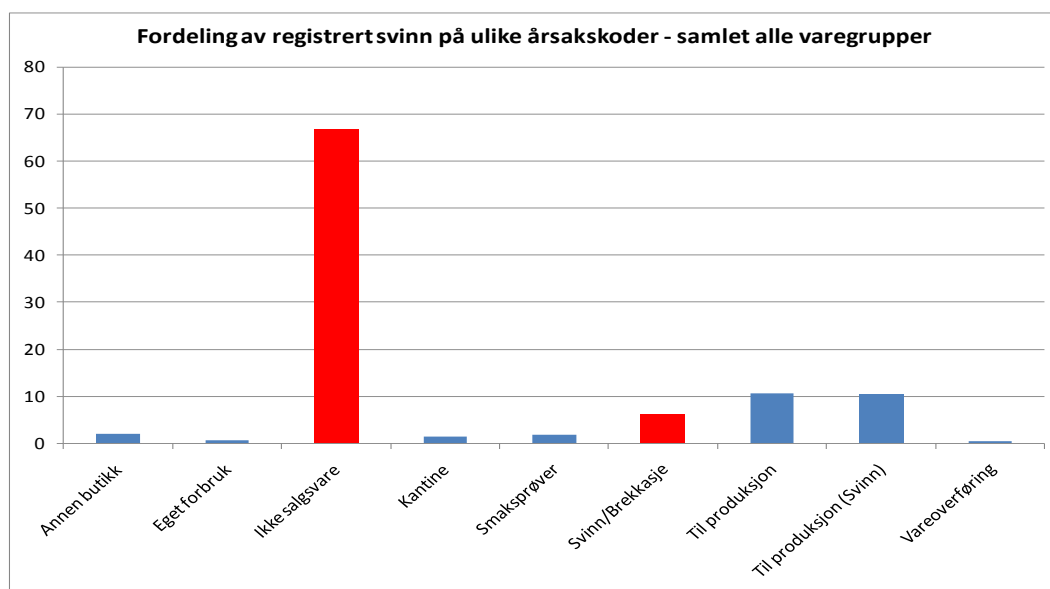


Figure A2 – Registered causes for food waste generation in retail shops in Norway 2009 (from Hanssen & Schakenda 2010). The legend from left to right: other stores, own use, not sellable, canteen, taste samples, loss, to production, to production (loss), product transfer

Prevention of food waste is one of two most prioritised working areas for the retail sector in Norway in 2010 regarding environmental strategies. The second area is packaging optimisation, and both areas are highly integrated in the work being done through Environmental Forum of the Retail Sector in Norway, which is an organisation established and owned by the four big retail companies. The same is the situation for the Federation for Norwegian Grocery Companies (NCF) which is owned by the retail companies Norgesgruppen and ICA. Both organisations are heavily involved in the work with food waste prevention through the ForMat project, and participate in the steering committee as well as in the four working groups in ForMat. DMF is leading the working group on Prevention Strategies for Food Waste where a number of large food producing companies participate in the work together with persons from the retail sector and R&D institutes and the Food & Drink Industry. The purpose of this group is to develop a strategic framework document on how to contribute to the goal of 25% food waste reduction in Norway before 2015 through joint actions in the value chain of food products. Priority is given to the food

product groups that contribute mostly to food waste in Norway, i.e. fresh bakery products, fresh fruits and vegetables, fresh meat products and fresh fish and ready meal products.

3.4 Sweden

The persons spoken to all sets “best before dates” expiring as the most important reason for food waste arising. The reason that date expiries are mainly the ones described already in the common literature chapter above. These are all products that should have been sold and are out on the shelves for a certain time. There are also quite a lot of wastes that are generated for other reasons, much of it already when products are arriving to the shop (damaged goods).

Reducing food waste is a highly prioritised issue for all chains spoken to. Both because of economic reasons but also due to ethics.

4 Initiatives to reduce food-waste, country specific

4.1 Denmark

All of the Danish retailers and wholesalers stated that the most effective way of decreasing food waste is prediction, planning, co-operation with suppliers, staff education and internal control. Below some of the ideas are presented.

Technical improvements to reduce food waste

The companies all report that technical solutions are used to strengthen the control of the logistic to and from their warehouses. Close control with temperature is also an issue helping the both wholesale and retail companies to reduce the food waste.

One of the companies report, that they have installed electronic sales systems in some stores. This system automatically orders new products, when products are sold, thereby minimizing the risk of fault purchasing which could result in more food waste. This system is only in function on certain product groups.

In some stores electronic shelves are used to report when a product is approaching the “best before date”. These shelves make it easier for the stores to regulate the prices and sell the products, before they end up as waste.

The discount chains have a continuous focus on the shortest possible time span from warehouse to consumer, making technical solutions less necessary. The focus is on better logistics.

Full shelves are selling more products than half empty shelves. A low tech solution to the problem with keeping full shelves at all time is practiced by one of the discount chains. They use mirrors on the display stands in the fruit and vegetables displays, which make the shelf look full. The effect of this is unknown.

New ideas to reduce food waste

The large retail companies in Denmark have central warehouses where the food is distributed from, and a lot of the fight against food waste is a struggle to minimize the time the food is in the warehouses and in the logistic chain. A general agreement in the Danish retail sector is that the biggest suppliers of bread, beverages etc. are delivering directly to the stores instead of the company warehouses. This saves valuable “shelf time” in the stores, leading to a reduction in food waste.

One of the companies report to have general rules on the minimum shelf time, for each food product in their stores. These rules are applied to all the suppliers of food products, giving the stores more time to sell the products.

One company has focused on strengthening the relationship to strategic suppliers. The retail company is sharing some of the sales figures with the key suppliers during specific campaigns, this leads to valuable knowledge for purchase during future campaigns.

Other ideas include removal of all volume discounts such as “buy 2 get 3”, this is practised by one of the discount chains in Denmark. The effect on the generation of food waste is unknown at the moment. Volume discount are in general more popular in the bigger supermarkets and are rarely used in the discount chains. One of the retail companies are considering the “Tesco model” for volume discounts, where the consumer can get the volume discount even though the products are sold on different days, e.g. Volume discount on 10 bananas: With the Tesco model the consumer can buy 5 bananas Monday and another 5 Friday and still get the discount prize for 10 bananas.

Some of the retail sectors requirements can lead to food waste being generated elsewhere in the food chain:

- E.g.: Specific rules on documented transport temperatures for bananas.
 - o If the temperature during the transportation has been too high, the warehouses will not receive the bananas, and these will most likely be discarded as waste from the supplier.
- E.g.: Fresh fruit sold peeled and ready to eat
 - o Peeled fruit leads to more food waste (peels) at the producer, but less food waste (in weight) if the product is wasted in the supermarket or at the households/consumers.

4.2 Finland

The most effective way of decreasing food waste is prediction, planning, co-operation with suppliers, staff education and internal control. Also sale labelling, reduced prices for food with expiring dates and food donating could work.

Donating food for human aid purposes or for animal feed is not common. One company report that 10 % of their stores give some abandoned food for charity. The hygiene requirements are very strict and the retail shops do not dare to donate food for food aid purposes. There are also very strict criteria for the animal feed. In case of providing feed the shop has to be registered like suppliers and it is also necessary to make a label on the content of the feed. Retailers need clear working methods for food donation and they need to be done in cooperation with food authorities. Such methods would motivate retailers to donate food. Finnish Grocery Trade Association is doing some work to improve practice and guidelines for donating. Also Finnish Food Safety Authority, Evira, is preparing new guidelines for retail sector regarding donation of food from the shops. Those directions will be great help in this issue and will improve donating mechanisms.

Sorting food waste requires positive attitudes among the staff and the management. If the management supports sorting then it is usually being done. If retail shops could save money by sorting food it could be a good motivator. At the moment mixed waste has a tax but sorted waste does not. Monetary cost is still small between mixed and sorted waste. Sorting of waste might be more expensive than discarding all waste as mixed waste, because of staff costs.

The control of loss is a process which contains improvement of the accounting system and prediction, better planning, education of the store staff and also better efficiency of the logistics. Internal control systems, laws and regulations are followed but other instruments are not needed or wanted.

First in first out-rules and discount pricing principles are implemented in most of the stores. There are ordering systems in the distribution centres and in the stores which helps to follow the pricing and discount products. Dry products can be transferred between the shops according to sales and transportation possibilities.

One important thing with the supply of food is to maintain a fast cycle and short shelf life of products. Attractive place and decoration in the store improves the cycle of products. Moreover the food needs to fulfil certain quality requirements. Feedback has been given to suppliers if there is something wrong with the food quality or packaging. The logistic system is developed in cooperation with suppliers and food industry.

Since December 2009, retail sector have had the possibility of keeping their stores open on Sundays and this could decrease food waste. Fresh food that is discarded from Saturday is no longer needed to throw away because Sunday is now shopping day also. Of course there are other problems concerning this arrangement, for example labour agreements. However retail sector would like to see this kind of liberation as a good method to avoid food waste and emphasized that it is possible to find some positive actions for example more liberate business politics and regulations.

4.3 Norway

In Norway, the ForMat project is the most important initiative to reduce food waste from the retail sector, as well as from other parts of the value chain of food. There are several groups established in the project or coordinated with the project to promote food waste reductions:

- The Communication group, working with development and spreading of information about food waste and food waste reduction in the whole society. A number of campaigns and initiatives will be established in 2011 to have focus on the area.
- A Food Waste Prevention group, where key persons from the food sector, the retail sector and R&D institutes will develop the strategic basis for food waste prevention in the value chain from food manufacture to the retail shop. A first report giving input to preventive strategies along value chains will be published in April, based in data and information from the retail sector in Norway
- A group with representatives from the food manufacturing sector will develop common methodologies for food waste registration in food manufacturing companies. All companies will test the methodology in 2011, both to get better data on food waste generation and not the least to identify opportunities for prevention of food waste in own companies.
- Two networks are also working with developing better basis for setting expiring dates for products, where the possible outcome will be less food waste if shelf life is optimised.

The Packaging Sector in Norway has for a long time worked with Packaging Optimisation program in close cooperation with the retail sector and food manufacturing companies (Business Organisation for Packaging Optimisation – NOK). Preventing waste through designing and selecting the right type of packaging is the highest priority in this work, closely related to using just the right amount of packaging materials, recycling of materials and improving the degree of filling of packaging. The packaging optimisation program has been in action for some years, and is probably one reason for why packaging seldom is a direct cause to generation of food waste in the retail shop.

There are also important initiatives being taken by food and retail companies in Norway, for instance by following up generation of food waste from different products continuously, to minimize food waste without compromising with customer satisfaction. With the dairy and meat industry, there has also been initiatives to change from “Not to be

sold after the expiring date”, to a “Best Before” labelling. Tracking products through the distribution chain is established to identify weakness in the chilling chain of for instance fruits and vegetables. A systematic study of all distribution chains has identified lots of opportunities for improvements that will lead to better quality preservation and reduced food waste.

Finally an initiative to establish a Food Bank has been taken by Norgesgruppen in cooperation with the Ministry of Food and Agriculture and the Ministry of Health and Charity organisations. The plan is to establish a pilot Food Bank in Oslo, to distribute food that otherwise would have been wasted, to people who are not able to buy enough food themselves.

4.4 Sweden

On-going initiatives to reduce food waste are (apart from the ones listed above in the literature chapter):

- Selling wonky fruits and vegetables to a lower price with the arguing that it will taste the same
- Trying to influence the suppliers (or their own suppliers) to provide smaller amount of certain products
- Participating in research project regarding food waste reduction
- Trying to influence certain producers to achieve a more suitable packaging for the product (can be both in terms of size but also in terms of optimised packaging in order to get more out of it or to make it last through the transport)
- Keeping good track of the food in warehouses and have set regulations for when (how close before the best before date) products should be marked as “distribute soon” – in order to maximise the shelf life in the store.

There are positive examples and a lot of things are being done – however the feel is that there are also things that have not been done yet and that might be harder to reach – things that would possibly have effect on the sales-figures and therefore are not so wanted.

5 Examples of policy instruments (economic, regulatory, communicative), country specific

5.1 Denmark

Campaigns

Consumers: Like it is the responsibility of the retail companies to minimize the food waste they generate, some of the retail companies stated that it is the responsibility of the consumer to minimize their own food waste. The main objective for the retail companies is to sell products, so it is the responsibility of the consumer only to buy the amounts of food they need in their household. But one of the companies have formulated advices for their

customers on how to cook with leftovers, make shopping lists, and how to plan the grocery shopping.

Charity: Some of the chains are working on a model for delivering discarded food to fødevarebanken (food banks). At the moment the food bank is a solution primarily for products from warehouses and wholesales. One of the wholesales has the only known functioning cooperation with the Danish food bank.

Discount pricing

Giving discounts on products approaching the “use by” or the “best before” date is being practised in most of the chains. There are no general rules in either of the chains. It is the store manager that will decide whether to give a discount. For the wholesalers it is normal practice to lower the prices when approaching the “internal best before date” also known as the “sell by date” or the “display until date”

Products

Products sell products! But full shelves generate more food waste. Taking milk as an example, here the consumers and customers in the wholesales demand the milk to be sold at the day of production. Much of the milk left on the shelves when the stores close are wasted. Another example is bread. One of the companies conducted a sorting analysis some years ago, sorting different food categories wasted. This analysis showed that shops with an in-house bakery had a significantly higher amount of waste, whereas shops with an in-house butcher did not generate much additional waste. Bread is especially sensitive to lower sales if the shelves are not filled, so shops with in-house bakeries calculate with an overproduction of 7 % to have the maximum sales. Combined with low production costs of the bread, in-house bakeries are producing with the aim of generating food waste.

Instruments that are increasing food waste

One of the companies interviewed had previous experiences with a “best before” labelling on fruits and vegetables. This system generated a lot of food waste from greens not being sold despite of proper quality. The “best before” system on greens are now terminated and it is now the responsibility of the person in charge of the greens department in the specific store, to judge when the best before date is reached. All of the companies interviewed agreed that a re-introduction of a “best before” date on vegetables would lead to huge amounts of food waste.

Short best before dates on some products such as eggs, leads to products being wasted for no reason. There is not necessarily any scientific arguments to support the “best before” dates. The best before dates can be misleading as the shelf life of the products are determined by the handling and storage of the products.

If a rat or the like are spotted in a warehouse or a shop, all the food products, even though safely packed away in layers of packaging (card board, tin cans, plastic) are to be discarded. This is generating unnecessary additional food waste.

One company report that it is the same rules that apply for the food products they are selling as would be applied if they wanted to donate the unsold but still fine products to their employees or to charity.

Main obstacles and driving forces to reduce food waste

Better logistics would be the number one driving force to reduce food waste in the retail sector. Closer cooperation between the retail sector and their suppliers could divert food from being wasted.

Better informed consumers. Consumers have strict ideas on how an apple or a cucumber should look like, leading them to discard all products which divert a bit from the look of the "perfect apple"

The legislation banning by-products to be sold as animal feeding is also a huge obstacle for making use of food waste from retail and wholesale sector.

The companies all state that health issues are a number one priority, but some of the legislation functions as obstacles and tend to lead to more food waste, e.g. hard legislation on meat, leads to meat being wasted instead of utilized in meat dishes etc.

5.2 Finland

Campaigns

Helsinki Region Environmental Services Authority (HSY) campaigns have been targeted mainly to citizens but there is one guidebook for food retailers also. HSY has a portal "Petra" (<http://www.hsy.fi/en/>) in where retail stores can enter data about their waste. HSY monitors this data and awards well performing (remarkable reduction in the waste amounts) stores.

Discount pricing

Discount pricing is used in most retail chains, but it needs skills and understanding to use it as a marketing tool. Consumers might think there is something wrong with the company's products if they are often at sale. Usually discounts are 30% or 50 %. Discounting have been more used now days than before, partly because of attention and discussion that food waste issue has have in different media recently (Yle 3.1.2011). Food that has been discounted is sold very well, only one third of them are still abandoned.

Products

The consumer's possibilities to contribute are limited and the price is the clincher. Consumers want a wide selection and a guarantee of freshness. That is why traders have to order a lot of different products although a part will be thrown away. Predicting food supply and demand is challenging for the traders. This would be easier if consumers would approve that some food products are sometimes out-of-store.

The consumers also tell that they want to buy organic, ecologic and fair trade products. Anyway the decision to really purchase a product, that is more expensive, is not always or ever realized.

Main obstacles and driving forces to reduce food waste

The new initiatives are accepted if there are no extra costs or costs remain low. The new regulation handling raw meat and fish is an example that is seen unsuccessful and that is not wanted. It will only raise the need of transporting, working hours and costs. The cost is the driving force. Also knowledge and initiatives of the personnel related to environmental issues help to develop improved systems with food waste. If the costs raise the customer has to pay for it ultimately.

The consumers should not be responsible for the amount of food waste, it is the company's issue to take care of minimizing the waste in the supply chain. Exact information about waste statistics is not wanted because it will mislead consumers and public conversation. Public media etc. might emphasize amounts and it will only pinpoint one small part of the solution. The entire picture is more important.

More free and liberate business policy is desirable, open ours etc. Monitoring food waste is a continuing matter which aims to minimize the waste and maximize the profit. However the main purpose in business is to serve customers and satisfy their needs.

5.3 Norway

The interviews with key persons from the retail sector in Norway have given the following main findings:

- After the banning of deposits for organic waste, there has been much more focus on better sorting of different waste fractions in the retail sector. Sending unsorted waste to incineration is still too cheap compared with more sustainable waste treatment methods. It should therefore be considered to prevent the opportunity to deliver unsorted waste from both companies and the household sector. It should also be more incentives to establish better infrastructure for biogas production and distribution from food waste. Today this is improving with some funding from authorities, but the funding mechanisms should be improved and strengthened, in addition to regulating separation of organic waste from other waste fractions. There are today available technologies in the market for separating food from packaging of pre-packed food, making it efficient for the retail sector to send food waste to pre-treatment for biogas production without removing packaging materials manually.
- The main reason for food waste in the retail sector is that products are not sold before the expiring date. For almost all products, it is up to the food producing companies to define the right expiring date. However, for distribution of fresh eggs, there has been defined very short shelf life for eggs by the EU, which has been mandatory to implement also for Norwegian egg producers, although it has been documented that eggs are distributed safely as chilled products. The safe shelf life of eggs in Norway could have been at least 2 months, whereas the present EU regulations set the limit to 2 weeks. This is the most important reason for the generation of food waste from egg distribution in Norway, and could easily have been prevented if the Nordic countries had shelf life regulations that were in accordance with conditions in the chilled distribution. There has also been a lot of

discussions between the food industries, the retail sector and the food safety authorities regarding how to practise the regulations for using “Best before” and “Not to be used after” labelling, but this seems to have been sorted out in a way that makes it possible to apply the labelling system in a way that will prevent food waste. As the expiring date is set by the food producer, they can use their own experience about distribution chains and safe food requirements to define the right shelf life period. In two network projects financed by the Norwegian Innovation Program and coordinated with the ForMat project, companies are working together with food research scientists to develop better methods and common platforms for defining the right expiring dates.

- A significant part of the food waste from retail shops that is due to expiring dates, is a result of how the sector has been developed to meet new requirements from consumers. First of all is this seen in relation to fresh bakery products, where customers expect to find all types of fresh breads in the shops until the shops close late in the evening. Consumers are also expecting higher diversities of products in typical fresh food groups like vegetables, meat products, fish products and dairy products. This is also assumed to be an important reason for food waste generation in the retail sector, and the question has been raised if the variety of products today is too high.
- As the retail sector has a driving force towards preventing food loss and food waste in their part of the value chain, the sector do not foresee the need for new types of regulations for this area in the future. In Norway, the sector collaborate with other parts of the value chain through the ForMat project, and this work will certainly result in reduced food waste

5.4 Sweden

Campaigns

All the chains interviewed is positive to participate in a campaign “hosted by” some central organisation (could be Swedish EPA or “Svensk Dagligvaruhandel”) – like “Love food – hate waste” in Great Britain.

Regarding the role of the customer and the role the retail chains should play against the customers the approaches from the chains are a little bit different. Some of them thinks that they can influence the customers and also that they have a role to play in educating the customers. Others have the opinion that only when this becomes an issue that is driven to a large extent by the customer, giving marketing benefits to work with it, only then will things happen. The chains working with “customer education” thinks that this does have a marketing effect.

Discount pricing

Discount pricing is another issue where the opinions varies over the whole scale – from that it is a good idea and commonly used to that it is not a good idea (customers that learn to only buy discount, worse planning on what to order, makes the store look cheap). All chains leave it to the manager to decide.

Products

The general idea of being a retailer is that you want to sell – therefore the retailers tend to be sensitive to what they think the customer wants. Few surveys (published) has been done – however the interviews gives at hand that the customer often states that he/she wants a broad variety of products to choose from. This gives very little initiatives for the retailer to present fewer brands for each product category. It is not known how the customers would react if some brands where taken away and the reason for it (reducing food waste for example) was presented.

Instruments that are increasing food waste

Short best before dates on eggs are mentioned by all persons interviewed. What is also mentioned is the will to donate food instead of wasting it – but there is a wish not to risk any bad publicity doing so.

Main obstacles and driving forces to reduce food waste

The main obstacles in reducing food waste looking at it from the wholesale and retail sector is the customers expected need for full shelves with a great variety and “fresh” food. No one in the sector would do anything to decrease the sales. This is a difficult task to try to change (both from the customers but also to make the shop-owners more brave in a sense that they will allow themselves to have empty shelves by the end of the day or having less varieties of each product) but it needs to start somewhere.

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APPENDIX 3 - LIST OF QUESTIONS

Status for work with data on food waste from retail/wholesale in each country

Available data on food waste and waste handling

- How is the amount of food waste being registered, and on what level of detail and since when has this been done?
- Amount of food waste (avoidable/ unavoidable)
 - Statistics – product groups⁸ and amount
 - Which period of time
 - Monetary value of food waste
 - How is data registered
 - On what level of detail
 - How is data regarding food waste used within the organisation
- Why is waste generated?
 - In which phase of the retail process is the waste generated (logistics, warehouse, actual selling process, cold storage.....etc.)
 - Reasons why waste is being generated, does it exist clear category groups? And how much waste is generated due to each reason (for example – 90 % of the waste is generated due to best-before-date wasting)
 - How is the food waste issue being handled at the moment
- Describe the present food waste handling system
 - How is the food waste normally stored in the backyard?
 - How is the food waste normally sorted and handled after it leaves the store (landfill site, bioenergy etc.)
 - Are there any goals set in minimizing the amount of food waste

Status for work with prevention of food waste in retail shops/Ideas for prevention of food waste –what can be done by the sector with relation to own shops and the whole value chain?

Examples and new ideas to reduce food waste.

- Experiences from earlier or on-going initiatives to reduce food waste. Examples from your own business
- Do you work directly with the suppliers regarding this issue – for example:
 - a. Do you participate in development work with your suppliers?
 - b. Are there aspects related to food waste covered in your relationship with

⁸ If no data are available at product groups – please specify as detailed as possible.

suppliers (for instance increased shelf life)?

c. How is responsibility for food waste distributed between the shop (or the chain) and suppliers for different foodstuff?

- Are there any discussion with suppliers etc. on change packaging systems, distributions etc.
- Measures identified but not yet implemented due to costs or any other reason?

Technical improvements to reduce food waste

- Storage
- Transportation
- Cages and shelves
- Packaging
- Display
- Freezers
- Electronic selection/delivery system in-store

Influence on other parts of the value chain.

- Measures taken within your own business that have affected others (up and down the chain)- certain demands on the sub-contractors, careful planning and timing of the orders from the food industry companies, consumer information and certain procedures to affect consumers action (freezer bags)

Which types of instruments might be relevant for preventing food waste?

Examples of potential instruments (economic, regulatory and communicative instruments) to reduce food waste in the retail and wholesale sector (already used or new ideas).

- Examples of information campaigns?
- Charity campaigns?
- Discount pricing?
- Number of products in certain categories?
- Source of origin?
- Are there any cross sector initiatives in the retail sector, or is this something which is only covered in each company?
- Are there any initiatives across the whole food value chain?
- Position towards new initiatives and policy instruments (voluntary or mandatory)
- What type of initiatives etc. do you feel would be a driving force for minimising food waste?
- Any new ideas on incentives or instruments
 - concerning companies own procedures
 - actions concerning the whole chain
- The views and role of consumers?
 - how can the retail sector or the food value chain best affect their habits?
 - the possible role of some bonus system?
- Are there any existing instruments etc. that are actually increasing food waste?
- What is the main driving forces to decrease food waste?