Good Practices for Food Waste Reduction

Trade

Good Practices for Food Waste Reduction in Trade

INTRODUCTION

According to data from the Food and Agriculture Organization of the United Nations, FAO, (2011)[1], one third of the produced food goes to waste at some stage in the food chain worldwide. Food waste is not only a problem on the economy, but it has also severe damaging effects on the environment.

In order to find practical solutions to the issue of food waste, it is important to inspect the actors of the food chain from this point of view. Depending on the economic development of the countries, actors in the food chain are responsible for the generation of food waste to varying degrees. In developing countries, a significant amount of food waste is generated typically during cultivation, post-harvest treatment, and storage. Meanwhile in developed counties, the greatest amount is present mostly in the phases of production, processing, distribution, and consumption.

Considering the entire life cycle of a product from the food industry, the processing phase has the greatest effect on natural resources. At the same time, each phase has additional environmental effect. This means that the cost and the negative effect on the environment will increase the later we dispose of the food.[2]

According to the estimation of FUSIONS regarding 28 member states of the European Union in 2016, the most significant proportion of generated food waste 53% occurs in households. Based on their data, it can be stated that 19% of food waste is generated in the processing industry, 12% in food service and restaurants, 11% in the primary production sector, and 5% in trade (***Figure 1***).[3]

It is a fact that households are responsible for the largest proportion of food waste in developed countries. However, the presence of other sectors is not negligible; the responsibility is shared. Other actors of the food chain can have indirect effect on consumer behaviour: they can call attention to the importance of the issue with their exemplary attitude and awareness-raising campaigns.

[1] FAO (2011). Global Food Losses And Food Waste - Extent, Causes And Prevention. Rome, Italy
[2] FAO (2013). Toolkit. Reducing the Food Wastage Footprint
[3] FUSIONS (2016). Estimates of European food waste levels

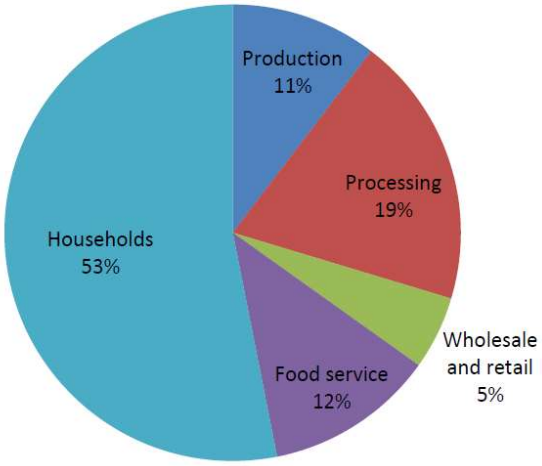

Figure 1. Sectors responsible for food waste (source:FUSIONS, 2016)

Primary data based on actual measurements was used only partially in order to prepare the estimate. In the case of the retail sector, 18 member states provided data.The focus areas of the surveys were also differentiated within this. Four countries conduct research only in retail trade, and the remaining 14 countries took waste generated in wholesale trade and/or logistic processes into account as well. Professionals found 11 sets of data among these suitable for preparing the sector estimates.

Moreover, another issue is that the estimated figures illustrate the total amount of food waste generated in the food chain, and this data set does not provide information on the result of actual wasting, called avoidable food waste.

The decrease of food loss and waste means a three-time advantage for every actor of the food chain: it alleviates the pressure on the climate, water and soil; it has positive economic effect on the producers, companies and households; and it allows that more people can be supplied with the food currently produced.

Food is the result of valuable resources' utilization, which has large ecological footprint considering energy that is invested in cultivation, harvesting, transportation, production, packaging, storage, trade and preparation. Through food waste, we also waste the invested energy.

There are several solutions to eliminate this. Prevention of waste is the most effective and easiest solution among these, since the later in the procession we are, the more invested energy and value will be thrown out and used unnecessarily. Through prevention, less resources and labour for additional treatment of the wasted food will be required. Instead, this energy can be invested in value-creating processes.

GLOBAL EFFECTS OF FOOD WASTE

The global ecological footprint of food waste is enormous. If food produced annually worldwide would be a country, it would take the third place in greenhouse gas emissions in the world, behind the United States and China. The global blue water (surface water and ground water) footprint of food waste is equivalent to the amount of water flow on the Volga River each year. The global land use of food waste was 1.4 billion hectares in 2007. This is only exceeded with the territory of Russia.Food waste is also a problem for biodiversity, as

the ever-increasing global demand for food is now satisfied with the inclusion of new lands in production (conversion) and increasing production intensity instead of reducing waste. Such development of agriculture, including conversion and intensification, poses a serious threat to biodiversity worldwide.

Besides the ecological footprint, food waste also has a financial and social price. If more prosperous countries wasted less, lands under cultivation and other resources would be released, which could be used to grow cereals, such as wheat, essential for the production of basic foods. Consequently, global supply would increase from such raw materials, and by lowering prices, the supply of essential raw materials would become more accessible to underdeveloped regions as well. This is an increasingly important problem due to the scarcity of natural resources (such as water and land), since if the demand continues to grow at a higher rate than the supply, food prices will continue to rise in the future.

WASTE PYRAMID

A communication of the European Commission published in 2015 presents EU action plan on circular economy.4,5 In the statement's section regarding food waste, concrete commitments are made to decrease the amount of waste, which are the following:

- developing common EU methods for measuring food waste and identifying relevant indicators,
- establishing a platform with the involvement of Member States and stakeholders to support the achievement of sustainable development goals for food waste and the sharing of best practices,
- clarifying EU legislation on waste, food and forage,
- facilitating the use of by-products in forage production without jeopardizing food and forage safety,
- conducting studies on the ways in which food chain operators can improve date labelling and the consumers' knowledge on it.

In its communication, the Commission emphasizes the importance of following the waste hierarchy, with priority being given to compliance with the principle of prevention.

According to directive 2008/98/EC:

"Waste policy should also aim at reducing the use of resources and favour the practical application of the waste hierarchy." (**Figure 2**)

[4] FAO (2013). Toolkit. Reducing the Food Wastage Footprint

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52015DC0614&from=HU

Figure 2. Waste Hierarchy

Prevention

According to § 2 of Act CLXXXV of 2012 on waste (hereinafter Act CLXXXV of 2012):

is a measure taken before the substance or product has become waste, which can reduce

a) the amount of waste, through reusing products or extending the life of products, for instance,

b) the harmful effects of the waste on the environment and human health, or

c) content of hazardous substances in the materials and products

Through measures to prevent food waste, the use of necessary resources required for food production can be reduced, and the costs associated with the disposal of waste and environmental, economic and social impacts can be mitigated.

NOMENCLATURE

Waste: according to § 2 of Act CLXXXV of 2012, any substance or object which the holder discards or intends to or is required to discard.

Biowaste: according to § 2 of Act CLXXXV of 2012, biodegradable; park or garden waste; food or kitchen waste generated in households, restaurants, at caterers and establishments engaged in retailing activity, as well as similar waste generated in food processing plants.

It is important to emphasize that Act CLXXXV of 2012 does not define food waste.

Apart from the fact that food waste is not defined on the level of policy currently, the concept is understood differently in scientific publications as well. Consequently, measurements concerning the quantity and quality of food waste are not compatible with each other. The following definitions were created as a result of the project FUSIONS in order to help the

communication between each other, the unification, and the introduction of more efficient and successful solutions.

Based on the definition of FUSIONS, food waste is food removed from the food chain, so it is the total amount of food that has been thrown away. Both avoidable and unavoidable food waste belong to this category. FUSIONS does not consider food given to animals food waste, yet composted food parts belong to the category of food waste.

Avoidable food waste: raw material or meal originally intended for human consumption, which was thrown away. For example, expired yoghurt, shrunken whole fruit, thrown-out meal.

This type of food waste is in general the result of human negligence. This is the actual food waste, as its name suggests that its production could have been avoided.

Unavoidable food waste: food parts of animal or vegetable origin, which are not suitable for human consumption. For example, eggshell, bones, banana peel. Such waste inevitably arises in the food chain.

Potentially avoidable food waste: raw material or meal suitable for human consumption that was thrown away because of health reasons (such as the deterioration of chewing ability), or because of personal taste. For example, chicken skin, bread crust, apple peel.

THE REASONS BEHIND FOOD WASTE IN TRADE

Based on a study by the European Commission, the main reasons behind food waste in trade can be traced back to the following components (table 1). It can be stated based on the overview table that issues usually arise regarding the storage, packaging, handling and inventory management.[6]

Table 1: The Main Reasons behind Food Waste in Trade

The main reasons behind food waste	**Trade**	
	Wholesale trade	**Retail trade**
Awareness		
Knowledge		x
Attitude		
Preferences		
Portion size		x
Planning		
Storage	x	x
Socio-economic factors		
Labelling		x
Packaging	x	x
Handling	x	x
Inventory management	x	x
Logistics		

[6] European Commission (2010). Preparatory Study on Food Waste Across EU 27

Product quality requirements		x
Technical malfunctions		

TRANSPORTATION AND WHOLESALE TRADE

In many countries, it is a typical problem that a contractual obligation is imposed on suppliers to withdraw their remaining products from their trading partners if they have not expired. Oversupply resulting from the withdrawal system and the last-minute order cancellations can lead to the wasting of large quantities of products that are still safe and suitable for human consumption. Inaccurate forecasts of demand also have an impact on the retail sector's waste generation.

Problems encountered during the transportation of the supply may also result in food waste. Damaged packaging can result in the deterioration of quality, which also poses a food safety risk. In such cases, the products must be destroyed. Packaged foods may also be wasted if the product is untouched, however, its primary or secondary packaging is damaged to some extent, as such products do not meet trader's technical and customer's aesthetic expectations, or the label or its part becomes unreadable. Therefore, in the food industry, these aspects should be taken into account as well in the design and development of packaging materials.

Because of cold chain interruptions occurring during transport, transhipment, and storage, food deterioration might start sooner. Moreover, perishable foods might carry a food safety risk as well, so special attention should be paid during logistics operations to sustain the cold chain.

RETAIL TRADE

Although it is important also in wholesale trade, retail trade needs to consider the optimization of inventory management even more. Excessive stockpiling due to the difficulties of forecasting demand affects most product groups. One of the most sensitive groups is the group of seasonal foods because of their short shelf-life and the rapid fluctuation and unpredictability of their demand.

Distribution centres provide each batchwith its own identifier (typically a barcode), which contains information about the best-before or use-by date, besides the price and product type information. However, the barcode on the unique product contains only the product type and the price. As a result, the barcode system does not follow the expiration date of products on the shelves of a retail unit. The IT system connected to the cash register usually assumes that the older products are first sold. This, however, does not reveal the reality because of the "date picking" of customers, which means that they prefer products that expire later. Of course, this behaviour is understandable, as the consumer likes to have the convenience of free choice at home, as opposed to having to consume a product only because its expiration date is approaching. However, it is often the case that older products simply stay on store shelves for this reason. Currently, they can only be tracked, sorted out, and in a lucky case utilised before expiration if decided that way by significant labour inputs.

As a consequence, it is a struggle for shops to apply the FIFO, First In First Out principle, the point of which would be to sell the product that arrived earlier into the system, thus preventing that the product which expires earlier cannot be sold because it has already reached its expiration date. In addition to FIFO, the principle of FEFO (First Expired First Out) is also widely applied in trade, whereby products with the nearest expiration date are to be sold.

Storage, handling, and packaging also affect the shelf-life of the product, and thus the extent of food waste generation. In retail trade, similarly to wholesale trade, damage to packaging also results in food waste. In retail, food waste is rather product-specific. Exposure to light – in the case of unprocessed plant-derived foods, such as potatoes – increases the amount of waste generated during storage.

Marketing strategies, such as "Buy One, Get One Free", often encourage people to unnecessarily buy many products. By granting such discounts, in some cases, retail units would like to promote the selling of such products that remained in the unit due to excessive stockpiling. However, this is often only a kind of "problem transfer" from retail to households, since there is not always enough time to consume the product within the expiration date.

The minimum requirements for product quality (such as aesthetic factors that do not affect the safety and shelf lifeof food) are in many cases contributing to the disposal of foods that are still consumable, especially if they are too strict.

Food waste may also be generated during food production in shops, such as bakeries, where poppy seed roll, popular during the Christmas period, cannot be sold because of its cracked surface, so the whole batch is often thrown out to the garbage can.

THE COST OF FOOD WASTE

Since the concept of food waste is understood differently, the studies with quantified data available have particularly different methods. For this reason, it is difficult to estimate the cost of food waste. When doing such calculations, it is important to have data from robust and comparable methods.[7]

As processing progresses, more and more resources are used, and this obviously shows in the price of the products.The trade sector is located in the second half of the food chain, so the added value of a unit of a food is high, which also reflects in the price. This means that on a yearly basis, the sector accounts for 860,000 Hungarian Forints per tonne of waste in the average of European countries, which, when total waste is taken into account, amounts to approximately 3,800 billion Hungarian Forints annually at EU level. An additional cost is the collection, transportation, and destruction of waste and also the employment of the required workforce.

[7] FUSIONS (2016). Estimates of European food waste levels.

GOOD PRACTICES

PRELIMINARY ASSESSMENT

In order to quantity the extent of the problem, retail units are advised to conduct an assessment of the food waste generated in a chosen week.

It is advised to conduct the measuring at least once a year, and to aim for a one-week-long period. Naturally, more measuring per year and longer measuring intervals can result in a more precise picture. It is important to choose a week that is representative of the full year of operation. The measuring can be conducted in the most practical way with a scale set up for this reason. If the weight of food waste generated in a week is extrapolated to the full year, we can get a clear picture of the actual amount of food wastes generated. It can also be a helpful feedback if the food waste is documented by type, so on the basis of the repeated measurements, we can statistically analyse which food types or ingredients are regularly thrown out. Experiences show that the measuring process itself and the knowledge of the annual volume of food waste generated improve the awareness of the employees.

It is worth organizing the measuring to pose no food safety risk and to mean no excessive burden on the employees, but at the same time, to provide sufficiently detailed results in order to successfully reduce waste.

The person responsible for carrying out the measurement and filling in the tables must be named and provided with all the necessary information. To design and conduct the assessment, the sample tables in the attachment can be used. Tables can be customized to fit the individual, the retail unit, they can be modified and combined.

To collect and select waste and to measure its weight and volume, appropriate tools and clothing must be provided, such as weighing scale and work safety clothing, such as rubber gloves, work gloves, coat, apron, etc. Food safety aspects must be taken into account while using and storing these (separation of waste and tools in contact with waste, dressing, personal hygiene measures).

Automated food waste tracking systems already exist. This solution is especially recommended for retail units selling large volumes. The software is easy to use, has a user-friendly interface, immediately calculates the necessary information, and displays the trends. Own documentation system can also be created using spreadsheet software.

STRATEGY DEVELOPMENT

When the preliminary assessment has been finished and evaluated, the process of developing the strategy might begin. The first step is to set such goals concerning the prevention of food waste that are realistic, but still make a real difference, and possibly means an economic advantage for the company as well.

Such goals might be to reduce the amount of food waste generated by the company by 10% within 5 years.

After formulating the goals, the real planning can take place, the result of which is the assignment of tasks to the formulated aims. It is also favourable to determine the main intermediate steps and their deadlines (milestones). It provides motivation during the long term work, and also helps to track the progress.

The process of preparatory activities to reduce the amount of food waste consists of three steps, as illustrated in Figure 3. Based on the results of the preliminary assessment, we can determine realistic goals for our unit, which is a prerequisite for developing the strategy.

Figure 3. Three steps of the process of preparatory activities

If possible, the action plan should be elaborated in a working group. Among the members of the working group, there must be people who, in their daily work, have a direct relationship with the process of generating food waste. Effective solutions can best be found on the basis of personal experience. When solving a problem, it is worth reconsidering the process of becoming abnormal and its reasons. This is accomplished by a series of answers to the question "Why?". As many questions can be asked as it is needed to find the main reason (Related chapter: Appendix I, tables for assisting the measurement of food waste).[8] Colleagues should also be aware that constructive criticism is helpful and allowed, as this is also a tool for effective development.

It is a highly important question to be motivated to achieve the goals. Motivations can range from moral factors through factors in performance measurement to direct financial benefits (for example, reinvesting part of the savings from less food waste after a closed period into personal payments). Only this is how it can be expected from the participants of the working group to form relevant ideas. For the whole organization, it is advantageous to have regular communication with team members, which can make a significant contribution to the personal commitment of the employees (Related chapter: Training of Workers). Recommendations arising must be considered by the management of the company, in terms of enforceability and economic aspects, before the final decision is made. Efficiency can, however, be achieved if the plan that has been accepted is known by all employees and is committed to implementation in some way.

It is not enough to achieve the goals and to accomplishthe planned optimization of the processes, the results must be sustained, so the changed must be controlled, measured, analysed, and in certain cases intervention is required as well. This is a circular process that consists of planning, implementation, control and intervention. The combination of the four processes is called the PDCA (plan, do, check, act) cycles (Related chapter: Appendix I, tables for assisting the measurement of food waste).

[8]Martichenko, R. (2013). Everything I know about LEAN I learned in first grade

PROCUREMENT AND INVENTORY MANAGEMENT

Mainly in the case of perishable foods, stockpiling is a problem, as goods that are not sold will deteriorate and have to be disposed of. An electronical management system or software can help to keep track of inventory levels more effectively. In this respect, the future is likely to be the smart shelves with RFID reader that can continuously scan products on the shelves that have RFID tags, so information can be forwarded to the system working in the background without interruption on whether they are still on the shelf or not. The shelf also informs the system whether the goods are on the right shelf. With the help of real-time data traffic, it can be tracked when the shelves need to be filled again, and it also sends a warning to the staff if the product's expiration date is approaching. However, in the present, the extension of the information content of barcodes and the widespread use of this bar code type would be a great step forward in the continuous monitoring of inventory levels.

Overordering clearly leads to waste generation. If you order the products when you truly need it, it can be guaranteed that it's fresher when it's sold. Additionally, the possibility of food waste due to last-minute cancellation of orders decreases. We should also strive not to order an excessive amount of products. This is the system of Just In Time, which is designed to optimize inventory management costs, but it can also play a big part in preventing waste.

In order to estimate the needs of customers, a sufficiently accurate forecasting model can be helpful. They usually work from data from previous years, which indicates the exact growth and decrease of demand for seasonal products.

STORAGE AND CARGO HANDLING

In each case, we check the integrity of the incoming goods, looking for signs of deteriorating as well. Check the package to see if it is damaged and whether it has been transported and stored at the correct temperature. Products that have started to deteriorate can speed up the deterioration of the still intact products if they are near to each other. The expected spread of the TTI (Time Temperature Indicator) packaging will help a great amount in this activity, as these indicators are able to continuously detect the temperature of the product, and there is a change of colour on the label when the product reaches the predetermined critical temperature even once. These labels are expected to be a great help in identifying such elements of the cold chain that play a major role in the development of deterioration processes. The labels and the manufacturer's information provided on them help the staff to store food under proper conditions and to apply the FIFO and FEFO principles. Compliance with the cold chain and other food hygiene conditions are a priority in terms of prevention of food waste.

SALES AND SERVICE

DEMAND-BASED PRODUCTION AND SUPPLY

Retail units offering buffet often produce a larger amount of foods at once. On the one hand, this can be more advantageous in terms of work organization, while on the other hand, they can better cope with impulsely appearing crowd. From the point of view of marketing, it may also be important that pre-made and aesthetically-arranged foods give the appearance of abundance. However, food that is not sold or consumed will be discarded. Where it is

possible, it is more effective to produce less amount at a time that would fit the current demandintermittently throughout the day, instead of producing large quantities at once.

Different methods are available to retail units to provide the impression of abundance regarding stockpile. In-store bakeries, buffets, restaurants can also place their products on a smaller tray.[9]

STORAGE CONDITIONS IN THE CUSTOMER SPACE

The occasional attitude of retailers is that the closer the expiration date of the product is, the more practical it seems to discard it than to keep it in the supply. These products occupy a valuable place on the shelf, while consumers are reluctant to buy them due to the near expiration date. In addition, in case of an expired product that was accidentally left there, they may also be fined during a possible food chain supervision procedure. At the same time, this approach increases the amount of waste, so it is worth developing a process to avoid this. It can evoke aversion from the buyer if we try to obtrude products with near expiration dates on them, but at the same time, they prefer special shelves designed for discounted products with near expiration date, so it can serve as an alternative to the stores. It is also a good idea to offer these products for charity prior to their expiration (considering that there is enough time to allocate them to those in need).

Compliance to the storage conditions adjusted to the needs of each product is also an important aspect. Maintaining the cold chain is also important in the sales area. Moreover, care must be taken to keep the temperature distribution within the refrigerator balanced. In the case of open refrigerators, the temperature is too low compared to the recommended value at the bottom and top, while the actual temperature is too high in the middle. Refrigerators with doors can provide a much more balanced temperature distribution that contributes to good appearance of the product and reduces the rate of deterioration. Furthermore, the energy consumption of closed refrigerators is much lower than the consumption of open ones.[10]

Consideringnot refrigerated products, it is also important to note that the temperature on the top of the shelves is often much higher. In addition to the normal physical phenomena, even the proximity of the ceiling lamp can be an influencing factor.

In the case of vegetables and fruits, circumstances that extent the shelf-life of a product may tend to accelerate the deterioration of other products. Therefore, special attention should be paid when storing different products together in this category. Certain tropical and subtropical fruits and vegetables, such as papaya, mango, tomato, cucumber and California pepper are sensitive to cold, and if they are stored cold (usually below 10 °C), they may be cold damaged, which is a non-reversible process. Consequently, characteristic visible symptoms appear, such as surface changes, small pits, permeable tissues and colour change, and the process of deterioration also accelerates.

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[9] Agri-Food & Veterinary Authority of Singapore (2016). Food Waste Minimisation Guidebook for Retail Food Establishments.

[10] Frias, J. A., Luo, Y., Kou, L. et al.,(2015). Improving spinach quality and reducing energy costs by retrofitting retail open refrigerated cases with doors. Postharvest Biology and Technology. 110:114-120.

Horticultural goods generally have a recommended storage relative humidity content of 90%, but the humidity of the surrounding air often does not reach this desired value, which results in a significant loss of moisture in the vegetables and fruits. A relatively low loss of moisture (3-6%) is also a cause of shrivelling, but economic damage must also be considered, given that the price is typically proportional to the weight.

Information on the storage parameters of different horticultural products (such as optimum storage conditions, the lowest temperature values that do not cause cold damage, co-storage possibilities, etc.) are given in the tables of Appendix III. It is also worth paying attention to ethylene (especially in the case of products stored in a more closed area) produced by the plants as a plant hormone, which helps the ripening of the crop. There are plants very sensitive and less sensitive for ethylene, and some plants produce large, and some produce smalleramount of ethylene. Different degrees of ethylene exposure are ideal for each species and varieties, depending on the stage of ripening.[11]

Chilled storage of fresh fruit and vegetables is not a food safety requirement, but it may be beneficial for further shelf-life. However, the cooling of vegetable and fruit products prepared for direct consumption is matter of food safety as the deterioration process of the half-cut, split-up, chopped products is accelerating. During cold treatment, the storage temperature that is optimal for a given product must be selected carefully. When co-storing several varieties, the most sensitive one should be the determiner regarding environmental parameters (e.g. temperature, relative humidity). There should be an air gap between the storage compartments, so that the air can flow, and the crops are in a less muggy environment. The over-packing of the vegetables and fruit area leads to accelerating deterioration processes. Sorting the bulk to search for spoiled products requires excessive workload beyond the core activities. Therefore, it is desirable to ease the crowding of these shelves.

Additionally, examining these issues, it turned out that buyers usually do not realise when the shelves are less packed, and thus their choices are somewhat limited.[12]

MOTIVATING CUSTOMERS IN THE CUSTOMER SPACE

Retail units can encourage consumers to reduce their food waste by displaying and placing different signs in the customer space. In the case of buffet service, small incentives can also be effective, such as providing a dessert or discount if they do not leave a surplus on the plate.

The use of promotional strategies can help to reduce the generation of food waste occurring because of the overripening of vegetables and fruits. Selling fresh products with different quality at differentiated prices can also help to maximise the impact of the strategy (the introduction of premium, normal and economical classification depending on the size and condition).

Preventing the “date picking” mentioned above is a delicate area, because buyers do not like it if they are denied the freedom of choice. By raising the awareness of customers and developing their consciousness, the phenomenon can be mitigated.

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[11] Debbie R., Graham F., John O. (2012). Crop Post-Harvest: Science and Technology, Volume 3: Perishables

[12] FAO (2013). Toolkit. Reducing the Food Wastage Footprint

FEEDBACK COLLECTION

Customer feedback is a great way to understand the true needs of consumers and to satisfy them at a higher level. This is also true for solutions to reduce food waste.

Awareness and Motivation of Employees

Raising the awareness of employees is of chief importance, especially if they are in direct contact with customers. Employees should be aware of the problem of food waste both on macro (regarding global economy, energy waste and environmental effects) and micro level (commercial unit, household) as well. Not only social benefits, but personal connection should also be highlighted (for example, how many kilograms an average person wastes during a year and how much this costs). Strengthen the engagement of employees to prevent food waste.

By educating and training employees, the optimal storage conditions of different products can be taught to them. For help, see the tables in the appendix.

There is a close relationship between hygiene and the decrease of food waste, and this connection should also be highlighted. The amount of waste can be reduced by teaching food safety aspects, revising them regularly, and applying them.

Employees should also be involved in the developments, because they can, through their direct contact, have relevant experience and ideas to help reduce waste.

RAISING CUSTOMER AND CONSUMER AWARENESS

Raising the awareness of consumers should also be emphasised, since surveys show that consumer behaviour is extremely responsible for food waste to a great extent. In Hungary, more and more consumers recognize the importance of sustainability goals, so if the company credibly represents these values, the loyalty of our costumers who are sensitive to this cause can be enhanced.

Communicate that the pursuit against food waste is an important task, and if the consumer buys from us, then he is a part of this responsible activity. Highlight why the aspirations of the retail unit and the consumer's own personal involvement in the processes to reduce food waste are beneficial for him.

Awareness-raising campaigns with informational pamphlets can be launched. Inform the final consumer about what the concept of use-by and best-fore dates means, what the difference is between them. A great amount of waste is generated due to inappropriate knowledge of the concepts.

Selective standards for the shape, size and appearance of vegetables and fruits are quite discriminatory: consumers should be encouraged to choose less regular products, as there is no difference between the usual-shape and the irregular products.

It is a common idea that since the generated food waste decomposes, it is not a big issue. It must be highlighted that the production and destruction of food waste that ends up in landfill without selection can produce a significant amount of greenhouse gas. The consumer must be encouraged to compost if the generated food waste is of plant origin and suitable for it, so

some of the used nutrients are returned to the soil at least. Not everyone has the opportunity to compost at home, in which case, composting sites provide a solution.

CHECKLIST

Using the Food Waste Prevention Checklist can help the retail unit to prevent and reduce the generation of food waste connected to its operation. Example can be found in Appendix II.

APPENDIX I.

TABLES FOR ASSISTING THE MEASUREMENT OF FOOD WASTE

The following tables are examples that can provide help for companies in measuring food waste.

Table for recording the mass of food waste for a period of one week:

Day	Date	Expired, spoiled raw materials, processing aids (kg)	Waste arising from malfunction (kg)	Damaged packaging (kg)	Total weight (kg)
1					
2					
3					
4					
5					
6					
7					
Total (kg)					

APPENDIX II.

FOOD WASTE PREVENTION CHECKLIST

Please mark the cells describing the current state clearly.

	FOOD WASTE PREVENTION CHECKLIST	Yes	No	N.A.
1.	Do the company conduct a survey of the amount of food waste generated at least once a year for a week?			
2.	Do the company conduct a survey of the composition of food waste generated at least once a year for a week?			
3.	Do the company conduct a survey of the reason of the generation of food waste at least once a year for a week?			

4.	Are there adequate tools to measure the amount of food waste produced by the retail unit?			
5.	Is an automated food waste tracking system used in the retail unit?			
6.	Do you use a paper-based food waste tracking system in the retail unit?			
7.	Do you calculate the amount of material loss food waste mean for the retail unit per year?			
8.	Do you calculate the annual environmental impact of food waste that can be linked to the operation of the retail unit?			
9.	Is the knowledge of the prevention of food waste included in the training of new workers?			
10.	Is the knowledge of the prevention of food waste included in the regularly repeated education and training of workers?			
11.	Are there good practices available in the retail unit to reduce food waste?			
12.	Does the retail unit have a procurement and logistics system that contributes to the prevention and reduction of food waste generation?			
13.	Does raw material expiry often due to excessive inventory accumulation?			
14.	Does the retail unit apply the FIFO and FEFO principle?			
15.	Does the retail unit have an inventory management system?			
16.	Do you have a sales system that can help you distribute vegetables and fruit that differ from aesthetical expectations?			
17.	Is there a possibility in the retail unit to make meals out of products that will soon expire?			
18.	Is there a possibility in the retail unit that products that will expiresoon are sold separately at reduced prices?			
19.	Do you have a practice regarding the offer of food surplus for charitable organizations?			
20.	Is it possible for the retail unit to donate food within organized framework?			
21.	Does it occur often that food waste is generated due crowded shelves?			
22.	Is the ideal condition provided for products when vegetables and fruits are stored together?			
23.	Are consumers regularly encouraged to combat food waste by communicating this?			
24.	Are consumers regularly encouraged to combat food waste with discounts?			
25.	Does the retail unit regularly receive customer feedback on food waste?			

26.	Are there information materials on sustainability and food waste available on the official website of the retail unit or on their social media page?			

Date: ……..

Checking carried out by: ……

APPENDIX III.

INFORMATION REGARDING THE STORAGE CONDITIONS OF HORTICULTURAL PRODUCTS

WHOLESALE TRADE

List of vegetables that can be stored together for 7 days of storage:

*: ethylene-sensitive

Storage temperature: 0-2 °C		**Relative humidity: 90-98%**	
Amaranth*	**Fennel***	Water chestnut	**Carrot***
Anise*	**Belgian endive***	**Alfalfa sprouts**	**Asparagus***
Artichoke	**Turnip**	**Swiss chard***	**Spinach***
Beans: lima beans, favabeans	Scorzonera	**Mint***	Mustard greens*
Bean sprouts	**Garlic**	Shallot*	**Celery stalk***
Salsify	**Mushroom**	Collard*	**Horse-radish**
Bok choy*	**Daikon ***	Watercress*	**Celery root**
Arugula*	**Cabbage***	**Parsnip**	**Romanesco broccoli***
Broccoli*	**Kohlrabi**	**Parsley***	**Green onion***
Beetroot	**Cauliflower***	**Leek***	
Chicory*	Rutabaga	**Radicchio**	**Herbs* (except basil)**
Snowpea*	**Kale***	**Rhubarb**	
Jerusalem artichoke	**Brussels sprouts***	**Radish**	**Sliced, cut vegetables**
Sweet corn	**Chinese cabbage***	**Lettuce***	

Storage temperature: 7-10 °C		**Relative humidity: 85-95%**	
Basil*	Cowpea	**Pattypan squash**	Winged bean
Beans: green, wax,snap, longbean	Taro*	**Pepper: bell, chili**	Horned melon/kiwano
Zucchini	Tomatillo	**Calabaza, summer squash***	**Cucumber***
Chayote*	**Okra***		
Prickly pear*	**Aubergine**		

Storage temperature: 13-18 °C		**Relative humidity: 85-95%**	
Potato	**Onion/redonion**	Bitter melon	**Tomato (ripe, semi-ripeand maturegreen)**
Sweet potato*	**Yam***	**Cassava**	**Squash, winter***
Ginger			

List of fruits that can be stored together for 7 days of storage:

*: ethylene-sensitive

#: produces a significant amount of ethylene

Storage temperature: 0-2 °C		**Relative humidity: 85-95%**	
Acerola cherry	**Date**	**Kiwifruit*#**	**Apricot#**

Blueberry	**Persimmon***	**Coconut**	**Cantaloup#**
Apple#	**Gooseberry**	**Pear**	**Strawberry**
Prunes*	**Blackberry**	**Lychee**	**Loganberry**
Avocado (ripe)#	**Fig**	**Longan**	**Plum (ripe)***
Quince*	**Pomegranate**	**Raspberry**	**Grape**
Elderberry	**Dewberry**	**Nectarine**	**Freshly sliced fruits#**
Cherry	**Loquat**	**Peach**	
Star apple/Caimito	Cashew fruit	**Currant**	

Storage temperature: 7-10 °C		**Relative humidity: 85-95%**	
Pineapple	Prickly pear fruit	**Lime***	**Pomelo**
Avocado (unripe)#	**Grapefruit***	**Mandarin**	**Tamarillo**
Babaco	Guava#	**Mango (ripe)#**	Tamarind
Lemon*	Calamondin	**Passion fruit**	Tangelo
Starfruit /Carambola	Canary melon#	Feijoa	Tangerine
Durian (ripe)#	Custard apple#	**Orange**	Sweet cucumber
Granadilla	Kumquat	**Olive**	**Cranberry**

Storage temperature: 13-18 °C		**Relative humidity: 85-95%**	
Banana#	Jackfruit#	Mamey sapote#	Canistel#
Plantain#	Breadfruit#	**Papaya#**	Jabuticaba
Watermelon	Mangosteen#	**Rambutan**	
Graviola/Soursop#	Honeydewmelon#	Sapodilla#	

RETAIL TRADE

Horticultural products, for which it is advantageous to misting during chilled storage

Artichoke	Turnip	Watercress	Lettuce
Bean: snap	Cabbage	Aubergine	Carrot
Peas	Cauliflower	Peppers	Asparagus*
Broccoli	Kale	Parsnip	Spinach
Beetroot	Brussels sprouts	Parsley	Squash, summer
Sweet corn	Swiss chard	Leek	Mustard greens
Sprouts	Shallot	Rhubarb	Celery stalk
Endive	Collard	Radish	Green onion

** Asparagus must be placed vertically with cut ends on a moisture-absorbing pad.*

Horticultural products that are prone to cold damage at low temperature, but not below freezing temperature

Product name	**Lowest safe temperature (°C)**	**Product name**	**Lowest safe temperature (°C)**
Pineapple	7-10	Malanga/Taro	10

Cranberry	2	Mango	10-13
Apple	2-3	Mangosteen	4-8
Avocado	4,5-13	Passion fruit	10
Bean: lima bean	1-4,5	Honeydew Melon	7-10
Bean: snapbean	7	Orange	3
Banana	11,5-13	Okra	7
Bengal quince	3	Olive, fresh	7
Potato	3	Aubergine	7
Lemon	11-13	Papaya	7
Chayote	5-10	Pepper, sweet	7
Sweet potato	13	Tomato, ripe	7-10
Pomegranate	4,5	Tomato, maturegreen	13
Grapefruit	10	Rambutan	10
Watermelon	4,5	Cantaloupe	2-5
Guava	4,5	Asparagus	0-2
Ginger	7	Pumpkin	10
Breadfruit	7-12	Tamarillo	3-4
Lychee	3	Cucumber	7
Lime	7-9		

Other useful information, vegetable features:

Carrot: next to ethylene-producing vegetables, bitter taste might be experienced.

Paprika: slightly ethylene-producing, but it is not recommended to co-store with ethylene producers, and it is recommended to create air gaps on the storage cartons. Symptoms of cold damage occurring below 7 °C: blear surface indentations, brownish discolouration of surface and core, and non-normal taste and fragrance.

Tomato: in the state of mature green, the presence of ethylene has a ripening starter effect.

Co-storing:in that case, it must be taken into account that products that have soil on them should not come into contact with other food that is normally not in contact with the ground.

Edited by
Working Group for Retail of the *Wasteless* programme

Published by
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Photos
Fotolia

The Wasteless program is co-funded by European Union's LIFE Program.