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What practices can be implemented to successfully prevent food waste generation in the European Union?

Evidence from Belgian food waste prevention actions

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This thesis might have been an individual work, but it would have never been what it is today without the contribution of several actors, whom I would like to acknowledge.

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LIST OF ABBREVIATIONS

BEP	Bureau économique de la Province de Namur
CPAS	Centre Public d'Action Sociale
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FASFC	Federal Agency for the Safety of the Food Chain
FL	Food Loss
FLW	Food Loss and Waste
FSC	Food Supply Chain
FW	Food Waste
GHG	Greenhouse Gas
QCA	Qualitative Comparative Analysis
VA	Voluntary Agreement

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INTRODUCTION

Background and purpose of the research

Did you know that, if integrated into a country ranking, food waste would be third in Greenhouse Gas emission, second in land area, and first in blue water consumption? (FAO, 2013)

Up until a year and a half ago, I did not. Up until a year and a half ago, I had no idea that food waste was such an environmental, social, and economic problem; I had no idea that one third of all the food produced worldwide is lost or wasted (Gustavsson, Cederberg, Sonesson, Otterdijk, & Meybeck, 2011); I had no idea that an estimated 143 million tons of food waste was generated over a year in the European Union alone; and I had no idea that three out of those 143 million were from Belgium (Bräutigam, Jörissen, & Priefer, 2014).

A year and a half ago, I started my internship at a London-based start-up called Mimica Lab and it was an eye-opener for me on the issue of food waste. The start-up is developing Mimica Touch, "a temperature-sensitive indicator cap or label for food freshness" (Mimica Lab, n.d.). With this innovative product, Mimica aims to reduce unnecessary food waste by replacing very conservative expiry dates with a more precise technology. At the start of my internship, I was told to look at some of the materials they have on food waste to familiarize myself with the subject. Furthermore, I was later asked to write a piece for an online course on food waste and expiry dates, which made me dig deeper into the subject. By the end of my internship, I had become passionate about food waste prevention, and I decided to focus on it in my Master's thesis.

Naturally, I turned to the Sustainable Development Goals for a starting point. Food waste reduction is included in the twelfth goal that focuses on consumption and production patterns, and is more specifically addressed in Target 12.3: "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses" (United Nations, n.d.). According to the last progress report on Target 12.3, the world is not on track to meet this essential target. In fact, more governments and businesses need to set reduction targets, measure food loss and waste, and act to reduce it (Lipinski, 2020). Two main reasons can be cited as to why it is not being done.

On the one hand, governments worldwide have adopted 169 targets when they agreed on the Sustainable Development Goals, meaning that food waste reduction is only one of the many targets they need to focus on (Lipinski, 2020).

On the other hand, understanding the scale and pattern of food waste generation is required to implement prevention measures, and the data on this subject vary greatly depending on their source (Bräutigam et al., 2014). Indeed, Parfitt, Barthel, and Macnaughton (2010) already raised this issue, arguing that food waste data are old and originating from the same studies but interpretated differently, leading to low-quality information. The situation has not gotten better since, as the Food and Agriculture Organization of the United Nations reports a dire lack of consistent estimates for national food losses (FAO, 2021). The United Nations Environment Programme (2021) classified the data points from Belgium as presenting a Medium confidence level, because they only cover part of the national territory (i.e. Flanders) and they are not collected through an optimal method. This means that the food waste estimation for Belgium is currently not compatible with Target 12.3 (United Nations Environment Programme, 2021). However, this is about to change as all European Union member countries are required to monitor their food waste since 2020, and the first results are likely to appear in the course of 2022 (Lipinski, 2020).

In a nutshell, the world is not on track to meet Target 12.3, and neither is Belgium, except that this cannot be known for sure as the kingdom has no national food waste data, but the appropriate measures should have been taken to solve this problem by now, and the only thing to do on this regard is to wait for the results. However, even though necessary to accomplish the target, measuring food wastage alone will not help reach it. Only the implementation of reduction actions, of food waste prevention practices, will bring a country closer to Target 12.3. Knowing that the exchange of good practices is important to reduce food waste ("Resolution 2011/2175(INI)," 2012), the identification of such good practices would help to implement more successful practices in the future, in Belgium and elsewhere, and would therefore contribute to the progress towards Target 12.3. This will thus be the purpose of my research.

Research question

The context and purpose of this research being at present clear, the research question can be defined, which will be answered with a literature review as well as with evidence from Belgian food waste prevention actions. The question is thus the following:

What practices can be implemented to successfully prevent food waste generation in the European Union?

The term 'practice' can be defined in business English as an "action as opposed to thoughts, ideas, or plans; [or] […] the way of doing things in a particular business, industry, etc." (Cambridge Dictionary, n.d.). In this research, it can therefore either refer to a food waste prevention action or to a way of doing something when implementing or running the action.

Even though the word 'successfully' itself does not need to be defined, a precision as to what exactly it refers to is in order. In a strict sense of the word, any practice that contributes to prevent the smallest amount of food waste would be considered successful. However, all actions considered prevent food waste, or they would not exist. Such a strict use of the word therefore does not make sense. In this case, success of an action is rather defined as preventing the most food waste at its own scale, and as being perennial, sustainable.

The geographical scope of the European Union was chosen for three reasons: firstly, the empirical research is set in Belgium, and it must be representative of the scope studied; secondly, the scope must be large enough to enable a literature review, which would not be possible solely on Belgium, but narrow enough to have a consistent context throughout the scope; thirdly, the free movement of goods in the Union supports an European Union agri-food supply chain, which can be described as "a complex web of inter-related sectors that bring food to consumers" (Rossi, 2020, p. 2), rather than separate supply chains for each country.

Structure of the research

As mentioned previously, this research starts with a literature review. This first part is divided into two chapters. The first one, covering food loss and waste overall, starts by defining important concepts on which this research will be based; continues with addressing food loss and waste first at different stages of the food supply chain and then of different food groups; discusses next the environmental impact of food loss and waste; and finally tackles the causes of food loss and waste. The second chapter focuses on food loss and waste prevention actions, which are classified depending on their goal: Redistribution, Food valorization, Consumers' behavior change, Supply chain efficiency, and Food waste prevention governance (Caldeira, De Laurentiis, & Sala, 2019).

The second part is the empirical research, which is based on evidence from food waste prevention actions in Belgium, as mentioned previously. This second part is divided into three chapters. The first one consists of the methodology. The second one introduces the findings,

starting with a presentation of each action which took part in the research, and finishing with a Qualitative Comparative Analysis. The third chapter is the discussion, confronting the findings from the literature review with those from the empirical research.

To conclude, the main contributions and limits of this research will be discussed, and some suggestions for future research will be raised.

PART I – LITERATURE REVIEW

CHAPTER 1 – FOOD LOSS AND WASTE

Section 1.1 – Definitions

Food, Food Supply Chain, and Food Life Cycle

Östergren et al. (2014) define food as "any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be eaten by humans" (Östergren et al., 2014, p. 20).

Building on this definition, the Food Supply Chain (FSC) is "the connected series of activities used to produce, process, distribute and consume food" (Östergren et al., 2014, p. 20). However, Gustavsson et al. (2011) add one stage to this list, therefore distinguishing the following five stages in the FSC: agricultural production, post-harvest handling and storage, processing, distribution, and consumption. Therefore, the FSC can be defined as the connected series of activities used to produce, handle & store, process, distribute and consume food.

The Food Life Cycle comprises the same stages as the FSC, except that one last stage is added: the end of life. The two concepts, however close, provide distinct information as the FSC is used to identify the sources of Food Loss and Waste while the Food Life Cycle is used to identify the sources of environmental impacts (FAO, 2013).

Food Waste and Food Loss

Food Waste (FW) and Food Loss (FL) are two concepts closely linked which have various conflicting definitions. Moreover, the distinction between the two concepts is not always made in research.

A first school of thought, referred to by many scholars, states that FL and FW do not occur at the same stages of the food supply chain. FL takes place during cultivation, harvesting, post-harvest treatment, and processing, while FW arises during retail and final consumption (Parfitt et al., 2010; Priefer, Jörissen, & Bräutigam, 2016). This definition, although clearly separating FL and FW, remains unclear as to what exactly the two concepts refer to. The one from the Food and Agriculture Organization of the United Nations (FAO) remedies this problem:

"**Food loss** refers to a decrease in mass (dry matter) or nutritional value (quality) of food that was originally intended for human consumption. These losses are mainly caused by inefficiencies in the food supply chains, such as poor infrastructure and logistics, lack of technology, insufficient skills, knowledge and management capacity of supply chain actors,

and lack of access to markets. In addition, natural disasters play a role. **Food waste** refers to food appropriate for human consumption being discarded, whether or not after it is kept beyond its expiry date or left to spoil. Often this is because food has spoiled but it can be for other reasons such as oversupply due to markets, or individual consumer shopping/eating habits." (FAO, 2013, pp. 8-9)

On the other side, the Flemish Region has its own definitions of FL and FW, based on a completely different approach. Indeed, they consider FL as a part of FW. FL is defined as edible food that is ultimately not consumed by people, while FW encompasses inedible food products and FL (Flemish Food Supply Chain Platform for Food Loss, 2017).

Furthermore, FW can be defined as "Fractions of *food and inedible parts of food removed from the food supply chain* to be recovered or disposed" (Östergren et al., 2014, p. 23). This definition does not make a distinction between the two concepts, seemingly including what is considered as FL by other scholars in the definition of FW.

To solve the discrepancies between these definitions, the term Food Loss and Waste (FLW) (Lemaire & Limbourg, 2019), regrouping both concepts into one, will be used. However, the separate concepts of FL and FW will still be employed depending on which stage of the FSC it is referring to.

Avoidable and Unavoidable Food Loss and Waste

Avoidable and unavoidable FLW are linked to edible and inedible food, mentioned in the last two definitions.

Unavoidable FLW is the loss or waste of inedible food, such as bones and peelings, while avoidable FLW is the loss or waste of edible food, which could have thus been consumed (Stenmarck, Hanssen, Silvennoinen, Katajajuuri, & Werge, 2011).

Another disagreement between scholars appears here, seeing that many do not consider unavoidable FLW to be part of FLW, as is the case in this definition: "food losses or waste are the masses of food lost or wasted in the part of food chains leading to *edible products going to human consumption*" (Gustavsson et al., 2011).

In this thesis, unless specifically mentioned otherwise, FLW will include both avoidable and unavoidable foods, in order not to disregard any action from the analysis. However, this distinction is crucial, especially when mentioning statistics on FLW, and must therefore not be forgotten.

Food Loss and Waste Prevention

As defined in Article 3 of the Directive 2008/98/EC (2008), waste prevention refers to measures taken before a product has become waste, reducing either the quantity of waste, or its negative environmental or health impacts. According to this definition, composting cannot be considered as a FLW prevention action, but valorization of food through animal feed can.

Section 1.2 – Food Loss and Waste at different stages of the food supply chain

Due to the growing importance of the topic in the literature, many studies quantifying FLW can be found. Alas, the wide range of FLW definitions used, geographical scopes considered, supply chain stages examined, and data presentation format chosen are making the comparison and aggregation of these results practically impossible (Caldeira, De Laurentiis, Cobalea, & Sala, 2019). Moreover, as explained in the introduction, there is no good study quantifying FLW in Belgium (United Nations Environment Programme, 2021). The most recent data collection in Belgium was done by the Flemish Food Supply Chain Platform for Food Loss (2017), but the definitions of FL and FW are too different from the ones used in the present research to be able to use the data in question, which is only considered of Medium confidence anyway due to its limited geographical scope and its suboptimal methodology (United Nations Environment Programme, 2021).

Nevertheless, as the focus of this research is not on the quantification of FLW but rather on FLW prevention actions, absolute numbers are not needed, and estimations from wider datasets can be used to fill in the void of specific data in Belgium. The knowledge of which stages of the food supply chain generate the most waste is enough to determine what FLW prevention actions should focus on.

Two studies, conducted by Bräutigam et al. (2014) and Priefer et al. (2016), analyzed FLW at the different stages of the supply chain for all countries of the European Union (EU). As can be observed in *Figure 1*, they obtained similar results for Belgium: agricultural production and consumption are the two stages generating the most waste. This comparison shows that two studies, separated in time and possibly using different calculation methods, lead to the same conclusion. Considering this, one can assume that these proportions have not changed tremendously over the past years, and that those two stages are still prevailing in terms of food waste generation today.

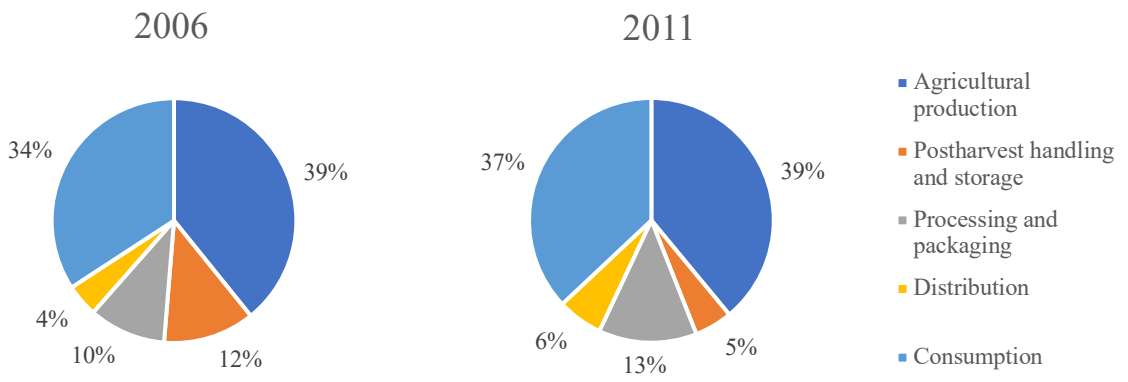

Figure 1: Contribution (in %) of each stage of the food supply chain to total FLW in Belgium in 2006 (Bräutigam et al., 2014, p. 689) and 2011 (Priefer et al., 2016, p. 157)

Bräutigam et al. (2014) also provides the aggregated results of all the countries in the European Union, which are close to those of Belgium: 33% for agricultural production and 40% for consumption.

To indicate the magnitude of the problem, this is equivalent to approximately 1.26 Mt or 119 kg/capita of food lost in agricultural production and 1.1 Mt or 104 kg/capita of food wasted at the consumption stage in Belgium in 2006 (Bräutigam et al., 2014). According to FAO (2013), these amounts reach over 500 Mt for agricultural production and about 350 Mt for consumption at world level in 2007.

Section 1.3 – Food Loss and Waste of different food groups

The range of studies quantifying FLW by food group is even more diverse than the one quantifying FLW at the different stages of the supply chain, and all that was said about the lack of FLW data from Belgium still holds. Nonetheless, as with the stages, the knowledge of which food groups generate the most waste is enough to determine what FLW prevention actions should focus on. Moreover, the lack of recent data in Belgium can be filled by older and wider data, posing the following assumptions:

1. the absolute numbers of FLW might have changed over the years but the proportions not as much;
2. the living standards are similar enough in all European countries that proportions would be comparable between Belgium and the entire continent;
3. world data reflects mostly the situation in developed countries, since most of the waste occurs there, which means that world data could be representative enough of Belgium.

Building on the findings of the previous section, FLW estimates by food group for the agricultural production and the consumption stages will be presented after a review of FLW in the entire supply chain.

Overall Food Loss and Waste

The FAO (2013) gives an overview of the FLW in the world and of the contribution of different food groups. As can be observed in *Figure 2*, the groups generating the most waste are cereals, vegetables, starchy roots, and fruits.

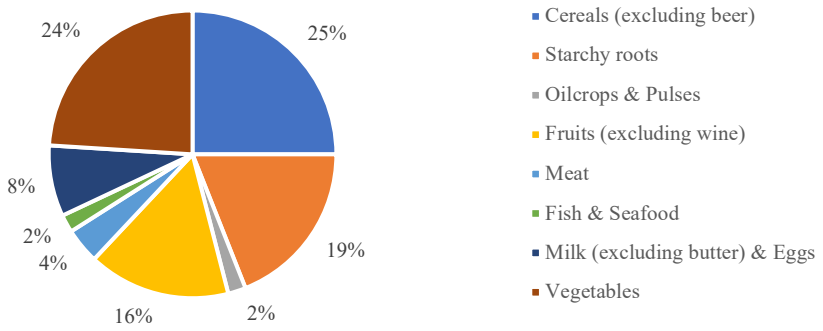

Figure 2: Contribution (in %) of each food group to total FLW in the world (FAO, 2013, p. 18)

Gustavsson et al. (2011) chose another approach in their analysis of food waste, as they provide the relative proportion of avoidable FLW generated out of the food produced, for seven groups of food, taking only edible parts of food products into account, for all regions of the world. In Europe, roots & tubers are proportionally the most wasted, with about 50% of all production that is lost or wasted, followed by fruits & vegetables, with about 45% of FLW, cereals, with about 35% of FLW, and fish & seafood, with about 30% of all production that is lost or wasted.

Although most of the same groups hold the top positions in terms of FLW in both studies, they are not especially in the same order. In addition, there are two groups that present considerably different results depending on the method used: meat and fish & seafood only represents a few percentages of the total FLW each (see *Figure 2*) but, compared to the total production in these groups, a high quantity is wasted or lost (about 20% for meat and 30% for fish & seafood) (Gustavsson et al., 2011).

Food Loss and Waste at the agricultural production stage

In agricultural production, one of the two stages where most of the FLW occurs, the fruits & vegetables and roots & tubers groups are generating the most losses (Bräutigam et al., 2014). This can be observed in *Figure 3*. These two groups were already identified in the overall

studies presented previously, which suggests that results are consistent between studies, even though different definitions, scopes, and methodologies are adopted.

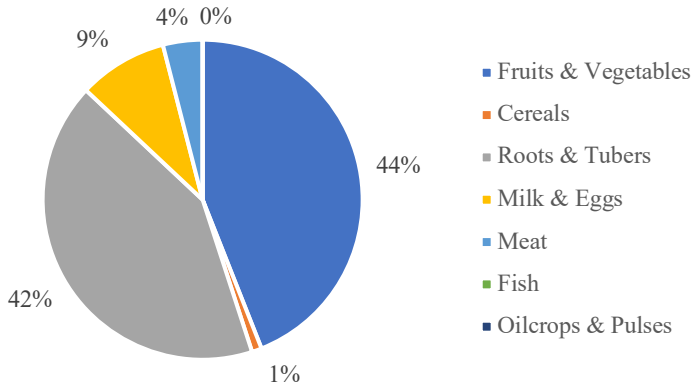

Figure 3: Contribution (in %) of each food group to total FLW in agricultural production in Belgium in 2006 (Bräutigam et al., 2014, p. 690)

Food Loss and Waste at the consumption stage

Many studies focus only on FLW at the consumer level, especially in households, as it is one of the two stages generating the most FLW and the last stage in the supply chain.

Bräutigam et al. (2014) and Priefer et al. (2016) conducted very similar studies, as they both computed the contribution of the same seven food groups to the total food waste generated in households, for all countries of the European Union. As presented in *Figure 4*, fruits & vegetables, cereals, and roots & tubers are the categories generating the most food waste in Belgium. These results are consistent with those from studies analyzing food waste in the entire supply chain, which confirms the conclusion already drawn in the previous section. In addition, it can be observed in *Figure 4* that the contribution of the cereals food group to the total FLW is even more important at the consumption stage than it was overall, which explains the significantly smaller contribution it had at the agricultural production stage (only 1%), as could be noted from *Figure 3*.

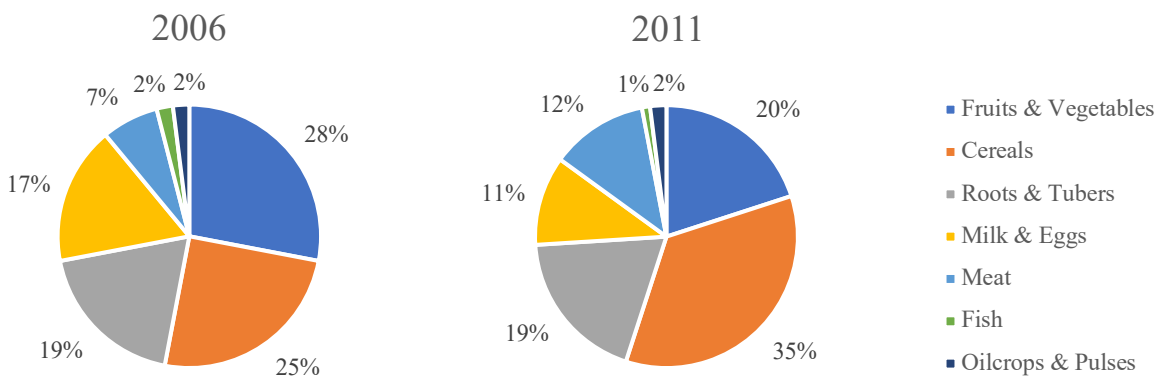

Figure 4: Contribution (in %) of each food group to total FLW in the household sector in Belgium in 2006 (Bräutigam et al., 2014, p. 690) and 2011 (Priefer et al., 2016, p. 158)

Finally, to get a better understanding of what this means in absolute terms, Chen, Chaudhary, and Mathys (2020) estimated the food waste amounts of 225 food items for 151 countries at consumption level. *Figure 5* displays these amounts, regrouped into 17 categories, for Belgium. The food groups generating the most waste are vegetables, alcoholic beverages, and cereals with respectively 86, 81, and 73 grams of food in that group wasted per person every day.

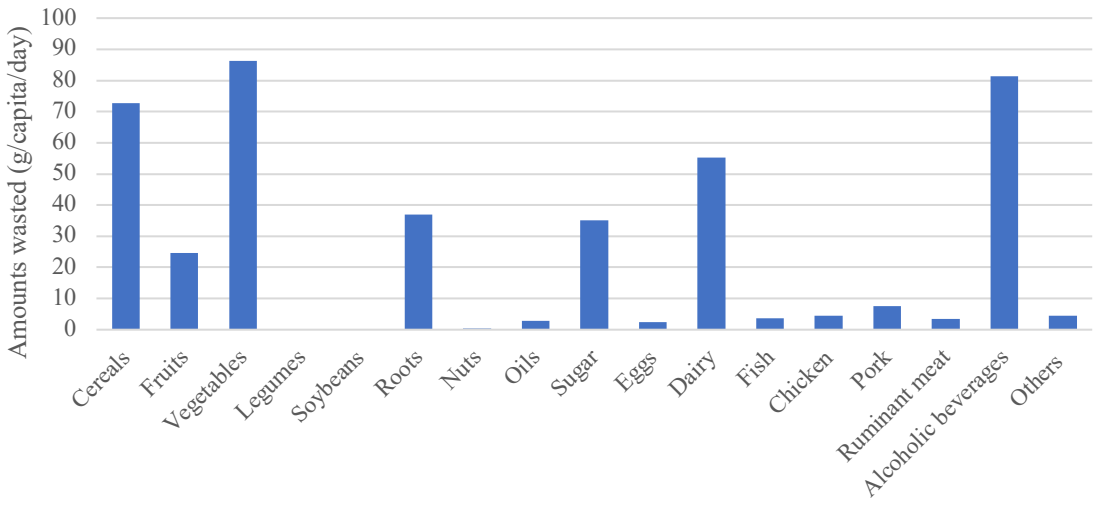

Figure 5: Food group amounts (in grams) wasted per person per day in Belgium (Chen et al., 2020, p. 10)

Section 1.4 – Environmental impact of Food Loss and Waste

With regards to environmental impacts related to FLW, Belgium is performing two to three times worse than the world average, and these results cannot solely be attributed to Belgium being a developed country since the kingdom also has a higher environmental footprint than the European average, as can be observed in *Table 1*. This emphasizes the need to reduce FLW in industrialized countries, and in Belgium specifically.

	GHG emissions (gCO2)	Freshwater use (L)	Cropland use (m2)	Nitrogen use (gN)	Phosphorus use (gP)
Belgium	303.9	131.2	0.92	6.7	1.13
Europe & Central Asia	254	106	0.76	5.5	0.92
World	124	58	0.36	2.9	0.48

Table 1: Environmental footprints embedded in daily per capita food waste (Chen et al., 2020, pp. 5, 10)

Understanding the source of these negative environmental impacts will help counter them more efficiently. According to Chen et al. (2020), ruminant meat, cereals, and dairy products are the food groups contributing the most to Greenhouse Gas (GHG) emissions, as shown in *Figure 6*. FAO (2013) concurs with the first two but not with the third, as cereals are responsible for 34% of FLW-induced carbon footprint in the world, meat for 22%, and vegetables for 21%, while milk & eggs are only responsible for 8%, according to the organization. Such a difference must come from different calculation methods, which is a powerful reminder that all these numbers are only estimations and must be handled with caution.

Considering only cropland use, cereals are well ahead of the other groups, the only other group with a significant percentage being the miscellaneous group which includes but is not restricted to other cereal-based products such as beer (see *Figure 6*). However, studying land occupation, a broader concept than cropland use, shows that the meat & milk group take up a far greater proportion of land than any other group, as meat & milk contributes to more than 75% of FLW land occupation in the world (FAO, 2013).

Furthermore, the cereals food group is the most polluting one with respect to freshwater use, as depicted in *Figure 6*. Sugar is second in this category, which is surprising seeing as its contribution amounts to single percentages for all the other indicators. Unfortunately, this observation cannot be confirmed by FAO (2013) as sugar is not part of the food groups considered in its study. However, FAO (2013) identified cereals as the commodity contributing the most to FLW-related blue water footprint, followed by fruits, which supports the other findings of Chen et al. (2020) on this aspect.

Finally, nitrogen and phosphorus use present very similar results, with cereals as the largest contributor and vegetables as a distant second, as can be seen in *Figure 6*.

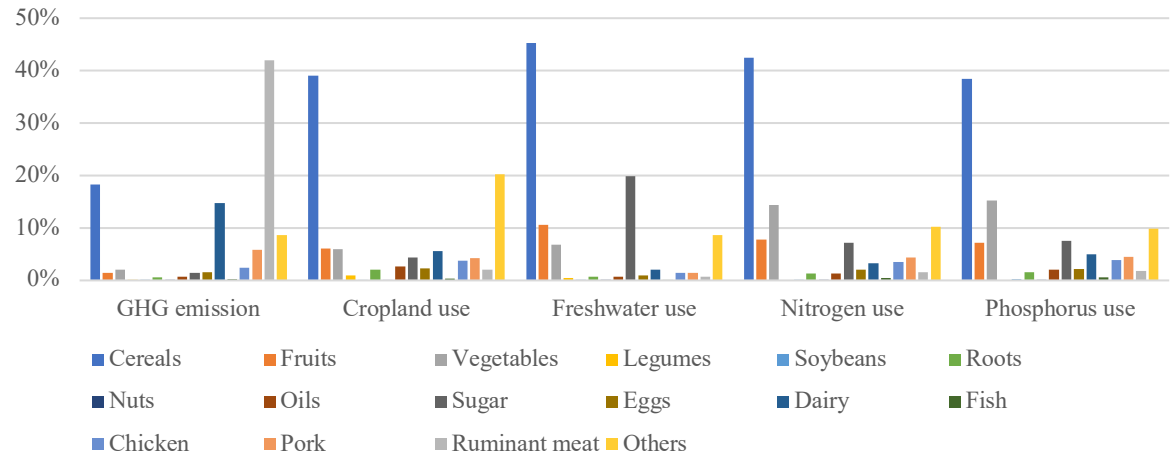

Figure 6: Contribution (in %) of different food groups to the environmental footprint embedded in FLW in the world (Chen et al., 2020, p. 10)

Regarding the stages of the FSC contributing the most to carbon footprint, consumption is first with 37% of FLW-related carbon footprint in the world originating from that stage, then agricultural production and post-harvest handling and storage are seconds, with about 17% each (FAO, 2013).

Lastly, Cooper et al. (2018) conducted a study on the impact of the food wasted at the household level in the United Kingdom. One of the outcomes was the contribution of the Food Life Cycle stages to environmental impacts arising from household food waste. Agricultural production is responsible for more than half of the negative impact for all the indicators (Freshwater consumption scarcity, Land use biodiversity impacts, Ecosystem quality, Non-renewable resource depletion, and Climate change), this contribution topping 80% in the first three indicators. Consumption holds more than a quarter of the blame in Non-renewable resource depletion and about 15% in Climate change. End of life is partly responsible for Climate change, a couple of percentages behind consumption on this indicator (Cooper et al., 2018).

Section 1.5 – Causes of Food Loss and Waste

The identification of strong FLW prevention actions requires the understanding of the underlying causes of FLW generation. A panel of fourteen articles, nearly all presenting original results, was studied to identify FLW causes for each stage of the supply chain. The number of articles mentioning each cause was counted, as presented in *Appendix 1*. Assuming that the causes most often acknowledged in each stage are the most important ones, only the causes with the highest count will be discussed.

Food Loss in agricultural production

The two main causes of FLW at this stage are overproduction and edible crops left or damaged in the field. Beretta, Stoessel, Baier, and Hellweg (2013) identified overproduction as one of the reasons for avoidable food losses, emphasizing the need to solve this issue. Richter and Bokelmann (2016) found that overproduction was a problem for the fruit & vegetable and meat & fish industries, although not for the dairy and confectionary industries. Priefer et al. (2016) specifies that overproduction may be due to supply agreements with retail chains.

According to Parfitt et al. (2010), edible crops can be left in a field, ploughed into the soil, eaten by animals, or not harvested at the right time, leading to damaged crops being wasted. Beretta et al. (2013) add that the loss can happen due to bad weather conditions, and those are unavoidable losses.

Food Loss in post-harvest handling and storage

Poor transport infrastructure and suboptimal storage are identified as the main causes of FL at this stage, followed by suboptimal inventory management. Poor transport infrastructure damages the food products, in some cases leading them to spoil prematurely (Parfitt et al., 2010).

Dora et al. (2020) identified suboptimal storage as one cause of food loss before processing. If food is not optimally stored, it can get pests, diseases, spilled, contaminated, or it can simply dry out naturally (Parfitt et al., 2010). Beretta et al. (2013) established that storage problems was a cause of unavoidable losses.

Food Loss in processing and packaging

A suboptimal method of processing, the main cause of food loss at this stage, encompasses inconsistencies of manufacturing processes, production interruptions, product changes, machines inefficiencies, and technical faults (Beretta et al., 2013; Dora et al., 2020; Priefer et al., 2016; Richter & Bokelmann, 2016).

Excess orders are another cause of waste at this stage. Due to take-back systems, cancellation of orders, or mistakes while ordering, these excess orders generate waste as the food will most likely not find another purchaser (Dora et al., 2020; Priefer et al., 2016; Stenmarck et al., 2011).

Quality control standards, by sorting out products that do not meet the high quality requirement of the industry due to their irregular size for instance, are provoking waste that could be avoided,

knowing that those products are edible and healthy all the same (Beretta et al., 2013; Parfitt et al., 2010; Priefer et al., 2016).

Food Waste in distribution

Overstocking, resulting from variability in ordering and inaccurate forecasting, has been identified as one of the main causes of FLW in distribution. According to Mena, Adenso-Diaz, and Yurt (2011), inaccurate forecasting is a problem occurring no matter what state the food is stored in (ambient, chilled, or frozen). However, Richter and Bokelmann (2016) claim that the effect is more prominent for the fruits & vegetable group than for the other groups of the studies, the meat & fish, dairy, and confectionary groups.

As important as overstocking, the failure to comply with minimum quality and food safety standards is due to issues such as mold and disease for ambient products, microbial contamination, and pesticide residues (Mena et al., 2011; Priefer et al., 2016). A stringent safety control generates more waste in the meat food group while a quality control in retail generates more waste in the fruits & vegetables group (Mena, Terry, Williams, & Ellram, 2014; Richter & Bokelmann, 2016).

Food Waste in households

The reason most often mentioned as leading to food waste in households is the lack of planning concerning food purchases, and more generally poor stock management. Parfitt et al. (2010) highlights poor pre-shop planning: consumers fail to check the stock in their cupboards, fridges, and freezers before going shopping. Similarly, consumers do not know their current food supply, nor the food items locations (Farr-Wharton, Foth, & Choi, 2014). Consumers also tend to buy larger quantities than they can consume (Wallonie environnement SPW, 2018).

The lack of skills for food preparation is another cause of consumer-generated food waste. When lacking those skills, consumers discard edible food with inedible one and do not know how to creatively use the food they have to create meals, resulting in throwing away some of that unused food (Farr-Wharton et al., 2014; Parfitt et al., 2010).

Confusion and misunderstanding of the date labelling system is as important of a cause as the lack of food preparation skills. According to Parfitt et al. (2010), almost half of the consumers do not understand what the ‘use by’ and ‘best before’ date labels mean. In addition, 30% of consumers throw fresh food away every week because it has exceeded the expiration date (Wallonie environnement SPW, 2018).

Food Waste in the hospitality and catering sectors

Heikkilä, Reinikainen, Katajajuuri, Silvennoinen, and Hartikainen (2016) identify causes of food waste generation in the catering sector, which mostly also apply to the hospitality sector, depending on the business model of the establishment. These causes are the offer of buffets at fixed prices, the amount of resources available (for instance, the possibility to display food in smaller dishes at the end of the buffet time), the oversized portions, the difficulties in assessing the demand, and the legislation – especially concerning hygiene rules. All of these causes were cited by Priefer et al. (2016) as well.

Section 1.6 – Summary

To conclude, the findings from this first chapter will be briefly summarized.

With regard to FLW generation in Belgium, the stages from the FSC contributing the most are the agricultural production and the consumption. In terms of food groups, cereals, vegetables, starchy roots, and fruits are the ones contributing the most to FLW generation in the world. These results differ slightly for the agricultural production stage in Belgium, with fruits & vegetables and roots & tubers being the largest contributors. The results for the consumption stage in Belgium are more similar to those overall for the world, with cereals, fruits & vegetables, and roots & tubers being the largest contributors. With respect to environmental impact of food wastage, cereals contribute the most overall, as they are first for every indicator except GHG emission for which they are second to ruminant meat, first by far for this indicator.

Concerning the causes of food loss in agricultural production, overproduction and having edible crops left or damaged in the field prevail. In post-harvest handling and storage, the main causes of FL are poor transport infrastructure, suboptimal storage, and suboptimal inventory management. A suboptimal method of processing, excess orders, and quality control standards are the main reasons for food losses at the processing and packaging stage. In distribution, overstocking and the failure to comply with minimum quality and food safety standards are mainly responsible for food waste. A poor stock management, the lack of skills for food preparation, and a confusion or misunderstanding of the date labelling system are the primary causes of household food waste generation. Finally, buffets at fixed prices, the amount of resources available, oversized portions, difficulties in assessing the demand, and the legislation can be cited as causes of food waste in the hospitality and catering sectors.

CHAPTER 2 – FOOD LOSS AND WASTE PREVENTION ACTIONS

FLW prevention actions are wide-ranging in terms of nature, design, implementation, and actors. Consequently, each has its own purpose, challenges, and success factors. However, to enable an analysis, comparable actions must be regrouped. To this aim, Caldeira, De Laurentiis, and Sala (2019) propose a classification in five groups, based on the goal of the action: Redistribution, Food valorization, Consumers' behavior change, Supply chain efficiency, and Food waste prevention governance. This classification will be used to structure the findings of the literature on FLW prevention actions.

Section 2.1 – Supply chain efficiency

To make the supply chain more efficient is to thrive to make sure that as little food losses occur as possible. And since "The cheapest waste is the one that does not exist." (Courtois, 2014, p. 11), preventing FLW in the supply chain is one of the best practices. Papargyropoulou, Lozano, Steinberger, Wright, and Ujang (2014) agree to that as supply chain efficiency is part of the prevention stage of the food waste hierarchy (see *Figure 7*), the most favorable option. Rezaei and Liu (2017), however, state that the linkage between actions must be considered to develop efficient FLW reduction actions. Moreover, "In industrialized countries […], solutions at the producer and industrial levels would only be marginal if consumer education and appropriate stock management at retail level is not in place" (Rezaei & Liu, 2017, p. 27).

Figure 7: The food waste hierarchy, from the most favorable (on the left) to the least favorable (on the right) (Papargyropoulou et al., 2014)

Challenges

Gokarn and Kuthambalayan (2017) identified a series of challenges to reducing waste in the FSC and classified them into strategic level, tactical & operational level, and constraints. The challenges at the strategic level are the complex market system, inefficient distribution network, inefficient procurement channels, inefficient transportation networks, lack of cooperation, lack of coordination, lack of supply chain contracts, lack of trust, lack of cold chain & storage, and lack of processing facilities. The challenges at the tactical & operational level are the lack of traceability, lack of technical expertise, lack of technical support, lack of communication, poor harvesting planning, poor packaging efficiency, poor storage facility, and poor transportation planning. Finally, the challenges due to constraints are bulkiness or size of produces,

consumerism, consumer attitude, consumer habits, demand uncertainty, inadequate food policy, lack of quality & safety measures, lack of awareness, perishability, poor regulatory framework, price uncertainty, process uncertainty, quality variation, seasonality, and supply uncertainty.

In addition to having challenges refraining the entire FSC to reduce its FLW generation, specific challenges are sometimes mentioned for some cases, such as the food services industry or the price reduction of suboptimal foods.

Martin-Rios, Demen-Meier, Gössling, and Cornuz (2018) identified constraints to the adoption of food waste reduction innovations in food services. The largest constraint is internal with a lack of space, mentioned by 30% of respondents, followed by human capital constraints, namely the lack of motivation or skills among the staff and the lack of time or staff in general, and external constraints, the most important ones being the costs, the attitude of suppliers, and the uncollaborative behavior of customers. Finally, there are also some legal constraints: sorting issues and hygiene (Martin-Rios et al., 2018).

Concerning products close to their expiry date or suboptimal in appearance, Aschemann-Witzel, Jensen, Jensen, and Kulikovskaja (2017) found four challenges faced by retailers wanting to sell them at a reduced price. First, it increases the retailer's expenses as they do not cover the costs of waste. Second, it can have a negative impact on the consumer's quality perception and store image. Third, there is a procedure to sell price-reduced food items, which must be conducted by the staff, incurring personnel costs. Last, the sales of regular items can be cannibalized by the sale of the price-reduced foods.

Good practices

As mentioned in *Chapter 1*, excess orders (in processing and packaging) and overstocking (in distribution) are main causes of FLW in the supply chain. Supply must therefore be better aligned with demand (EU Platform on Food Losses and Food Waste, 2019). To reduce overstocking at the retailer, ordering and forecasting can be improved with automated systems based on previous years' sales as well as weather forecasts (EuroCommerce, 2017; Flemish Food Supply Chain Platform for Food Loss, 2017). Likewise, digital tools exist to help food manufacturers ordering the right amount of raw material based on demand and supply forecasts, which will diminish excess orders (EU Platform on Food Losses and Food Waste, 2019).

In addition to ordering the right quantities, every link of the FSC must control its stock well to keep from creating unnecessary waste. More than half of the compagnies included in a study from Richter and Bokelmann (2016) in Germany already implemented stock control measures

to reduce food waste. Retailers can do so more efficiently with smart shelves, an innovation that indicates stock levels and informs when products are reaching their expiry date (European Commission DG ENV, 2011).

Akkerman and van Donk (2008) propose another system: a decision support tool for the food-processing industry. Also aiming to reduce food waste, this tool is more complex than solely demand forecasting. It assesses the performance of a plant regarding food losses, based on demand pattern, production batch sizes, and planning, and helps managers make decisions with these inputs.

Furthermore, farmers also have their role to play to align supply with demand. Indeed, farmers tend to overproduce to avoid shortages, which can be avoided if they communicate, cooperate, and organize themselves (Gustavsson et al., 2011). Doing so, they could step up for each other in case of shortages and they would have more power to obtain credits from financial institutions or advance payments from buyers if needed, reducing the risk of FL due to premature harvesting (Gustavsson et al., 2011).

Another way to reduce FLW in the supply chain is through packaging. Many scholars and experts mention the optimization of packaging in FLW reduction actions. The EU Platform on Food Losses and Food Waste (2019) suggests to turn to packaging solutions to extend the shelf-life of products. For instance, stronger packaging that is insect-resistant helps reducing waste of dried foods such as cereals or pastas (Licciardello, 2017). Nearly a third of compagnies survey by Richter and Bokelmann (2016) in Germany report an adjustment of packaging quality to help reduce FL and a quarter report an adjustment of packaging size. Smaller packaging sizes have the potential to reduce FW in households, especially if they are not comparatively more expensive than larger packaging sizes (Stenmarck et al., 2011). Smaller packaging sizes have been criticized for using more resources, and therefore polluting more, but Verghese et al. (2014) presented the GHG profile of an Australian household for various food groups (Meat, fish and eggs; Dairy; Beverages; and Fruit, vegetables and nuts) which showed that most of the GHG was associated with the consumed food for all groups, and that the wasted food was second for all groups except beverages for which packaging is far ahead. It was concluded that it is important to minimize waste from certain food items, leading to large GHG emissions, and that packaging is a solution. However, a similar study should be conducted in Europe and on a larger sample to confirm these findings. Wikström et al. (2018) still recommend finding the balance between packaging material use and protection of a product to reduce the overall environmental impact, and understanding how packaging affects food waste for different food

products, as packaging is responsible for a small proportion of the GHG emissions in the case of a high resource-intensive product but for a large proportion of it in the case of a low resource-intensive one.

Expiry dates cause FW at the consumption stage because of their misunderstanding by consumers as explained in *Chapter 1*, but that is not the only reason nor the only stage where there is FLW due to expiry dates. For instance, expiry dates can also cause food waste in supermarkets if products are not sold in time (Priefer et al., 2016). The EU Platform on Food Losses and Food Waste (2019) believes that reducing date labelling-induced FW should be a joint effort from all actors in the FSC and supported by public authorities: the format, presentation, and terminology of expiry dates must not only be improved to help consumer understanding but also be consistent throughout the FSC. To avoid having to disregard products that have reached the expiry date in stores and to leave enough time for consumers to enjoy the product at home before it reaches the expiry date, Colruyt takes products out of the shelves one week before they expire and sends them back to the distribution center, which will then donate them to food banks with three days to spare before they expire (Soethoudt, Van der Sluis, Waarts, & Tromp, 2013). This is a rather exceptional case as it undeniably reduces the chain's sales. Most supermarkets usually choose the option that will allow them to sell as much as possible: reduce the prices of the products coming close to their expiry date and label them for quick sales, which helps reduce FW as well (EuroCommerce, 2017). This technique is also used by some retailers to sell food items that are considered suboptimal in appearance (Aschemann-Witzel, De Hooge, Amani, Bech-Larsen, & Oostindjer, 2015). According to Aschemann-Witzel et al. (2017), some fear that reducing prices to sell food that is suboptimal or close to the expiration date will actually have the opposite effect than what is expected: save food from being wasted in stores but lead to food wastage in households. However, it has been demonstrated that, assuming that these promotions attract price-conscious consumers especially, customers consider whether they will be able to consume the product before purchasing it, which means that the product will most likely not be wasted at home (Aschemann-Witzel et al., 2017).

Education and professional training of staff has the potential to reduce FLW along the entire FSC (EU Platform on Food Losses and Food Waste, 2019). In fact, "Food chain operators should be skilled and knowledgeable in how to produce safe food" (Gustavsson et al., 2011, p. 11). Close to 60% of the compagnies questioned by Richter and Bokelmann (2016) in Germany educate their employees to reduce FLW. Training is also mentioned as example of operational

incremental food waste innovation, which has high implementation opportunities in all types of food service establishments (Martin-Rios et al., 2018).

To implement efficient food waste prevention measures, food manufacturers must know where exactly the FLW occurs. For this reason, the EU Platform on Food Losses and Food Waste (2019) recommends the use of digital tools to monitor, measure and report food waste with the aim of optimizing operations. The same applies for food services, measurement is the first step towards food reduction, followed by engaging staff, rethinking the buffet for hotels, starting small and getting creative for catering businesses, reducing overproduction for all types of food services, rethinking inventory and purchasing practices for restaurants, and repurposing excess food for all types of food services (Clowes, Hanson, & Swannell, 2019; Clowes, Mitchell, & Hanson, 2018a, 2018b).

Other food waste prevention techniques in food services include reservation requirements to better estimate guest numbers and reduction of items on the menu as having too many choices leads to inevitable waste due to the large stock needed (European Commission DG ENV, 2011). However, this last suggestion is reversed for food served in hospitals as Dias-Ferreira, Santos, and Oliveira (2015) recommend increasing menu options for patients to reduce plate waste.

Even though the recommendations in steps are applicable to many food services establishments, either restaurants, hotels, or catering businesses, there is an enormous number of recommendations that can be given to the different types of businesses in this industry, as it is a large and diverse one, but they will not be developed as it is not the only focus of this research.

Section 2.2 – Consumers' behavior change

According to the FAO's '3 Rs' strategy, which consists of reduce – re-use – recycle, informing the public about the food waste issue is part of the first R (reduce), the most important one (Courtois, 2014). Papargyropoulou et al. (2014) concur as actions to change consumers' behavior are clearly part of the prevention step of the food waste hierarchy, and therefore the preferred type of actions (see *Figure 7*).

Challenges

Consumers' behavior is influenced by the information they are provided with, studies agree (Priefer et al., 2016). However, experts warn against some constraints linked to providing information: the information needs to be repeated regularly and delivered via diverse sources as consumers tend to forget the information and do not unanimously place their trust in one

source (Aschemann-Witzel et al., 2015). The challenge lies here in continuously reaching out to consumers, both the ones who have never been informed and the ones who have been before, on many different platforms. It is therefore a never-ending effort.

Stöckli, Niklaus, and Dorn (2018) claim that, despite being popular among professionals, there is no evidence of the effectiveness of information campaigns, nor is there any indication as to which communication channels are more adequate for these. It is problematic as organizations are using resources for an action that potentially produces no results. In addition, information campaigns are generally not sufficient to change the consumers' behavior, hence they must be supplemented with prompts – "visual or auditory messages that are intended to remind people to perform a desired behavior", modeling – "demonstration of desired behavior (e.g., in a video or in vivo)", and/or commitment – "asking people to formally agree (e.g., in writing or verbally) to perform a target behavior" (Stöckli et al., 2018, p. 450).

Good practices

The EU Platform on Food Losses and Food Waste (2019) agrees that providing information to consumers performs better when combined with other areas of intervention. Stöckli et al. (2018) even specify how to best implement the additional interventions: prompts should address a clearly defined and easily performed behavior, be placed where it occurs, and be worded politely; modeling should highlight the positive consequences of the desired behavior and be conformed to social norms; and commitment should be specific, long-lasting, done publicly, as well as targeting people who are already motivated to perform the behavior. For example, a prompt can be a sign on a buffet asking people to eat all they take and to come back multiple times rather than take too much at once; modeling can be done through a video showing some household skills to teach people, or it can be the social norm of taking back leftovers from the restaurants, especially if others at the table are doing it first; and commitment can be liking the social media page of an anti-food-waste community (Stöckli et al., 2018).

Targeting the right people is mentioned by many authors. Indeed, Priefer et al. (2016) recommend adapting the awareness campaigns to various target groups rather than trying to reach all consumer groups at the same time. To do so, a greater understanding of the target groups must be gained, which should be done by academics and professionals together (EU Platform on Food Losses and Food Waste, 2019).

One of the groups on which the focus should be set is the younger generation. As explained by the European Commission DG ENV (2011), food behaviors and habits are usually defined at

an early age, making it crucial to target the youth. Gustavsson et al. (2011) agree and suggest to do so in schools. Priefer et al. (2016) go one step further and urges states to include it in the school curricula, as it has been done in France, the Netherlands, or the United Kingdom.

For any behavioral change to happen, in any group, consumers must be motivated towards it. Motivation can be enhanced with an informative campaign strengthening consumer's belief that food waste is wrong and/or displaying the financial losses embedded in FLW (Visschers, Wickli, & Siegrist, 2016). Stenmarck et al. (2011) agree that information campaigns should be done regarding FLW environmental and economic impact. The EU Platform on Food Losses and Food Waste (2019) also identified environmental and financial concerns as motivators to reduce food waste that should be communicated on. However, the platform warns against focusing on negative elements in campaigns, and rather advises to highlight positive aspects linked to the behavior. In addition, being in line with consumer demand increases the chances of success of a campaign (EuroCommerce, 2017).

As essential as the awareness campaigns that were just discussed are the educational campaigns. Educational campaigns should teach consumers about various subjects linked to food waste, such as food storage, date labelling, and leftovers (Visschers et al., 2016). Such interventions have the potential to reduce food waste (Parfitt et al., 2010). Over 60% of the companies approached by Richter and Bokelmann (2016) believed that consumers need to be educated towards food knowledge and 75% towards date labelling, as a food waste reduction measure. Aschemann-Witzel et al. (2015) identified date labelling as an important issue as well and evaluated it easy to educate about. In addition, the authors advise to teach how to assess the condition of the food by looking, smelling, and tasting. Teaching such practical methods is more of a skills training than an education campaign, which is the next step in helping consumers reduce their waste. Skills training might also teach how to control an individual's food waste generation and how to evaluate the right amount of food to be purchased (Visschers et al., 2016).

The EU Platform on Food Losses and Food Waste (2019) believes that influencing social norms is more important than merely informing consumers to trigger a behavior change. The Platform is therefore urging funding program managers, researchers, and academia to "Develop and use a wider range of methods to better understand consumer behavior as regards food waste and design effective solutions" (EU Platform on Food Losses and Food Waste, 2019, p. 20), and to focus those methods on influencing social norms. In fact, consumers are influenced by social norms, gotten from the media, public settings, or personal networks, which means that actions

impacting these norms have the potential to change the individuals' behavior (Aschemann-Witzel et al., 2015). Moreover, the literature on influencing social norms to reduce food waste is very scarce, as a few studies could be found on this subject, but they were set in Asia or in North America, which have different social norms than Europe and therefore cannot be used.

The case of suboptimal food products can be analyzed to illustrate these three types of intervention – informative/awareness campaigns, educational campaigns, and skills training. Indeed, these products are often discarded solely based on visual criteria, while still being tasty and safe to eat (Göbel, Langen, Blumenthal, Teitscheid, & Ritter, 2015). As retailers blame consumers for only purchasing perfect-looking products, it becomes a matter of consumers' behavior change (Aschemann-Witzel et al., 2015). Therefore, consumers must first be informed about how these products are safe to consume and the positive effects that saving these products would have, second be educated about freshness and expiration of these products, and finally be taught different recipes to help them use the products (Stangherlin, Duarte Ribeiro, & Barcellos, 2019).

Section 2.3 – Redistribution

Even though FLW in the supply chain can be tackled in many different ways, there will always be some surplus in the various stages of the supply chain, which can be saved through redistribution (Priefer et al., 2016). The basic principle of redistribution is that food banks and charity organizations retrieve food that is not saleable in stores anymore and provide meals for people in precarious situations with it (EuroCommerce, 2017). Redistribution works through the donation/acceptation chain, a separate chain from the regular FSC, with the donors being producer organizations, food industries, or retailers, and the acceptors being food banks or (charity) organizations (De Boeck, Jacxsens, Goubert, & Uyttendaele, 2017; Flemish Food Supply Chain Platform for Food Loss, 2017).

Redistribution is not considered as prevention in the strict food waste hierarchy sense, but as re-use (Papargyropoulou et al., 2014). However, it is deemed to be a prevention action in accordance with the definition of prevention given in *Chapter 1*. As can be observed in *Figure 7*, redistribution is not the most preferred option to fight food waste, but it is still high in the hierarchy.

Challenges

For the donors, one of the main difficulties is the lack of alignment with the acceptors (Flemish Food Supply Chain Platform for Food Loss, 2017). The owner of an organic supermarket

explains: “The problem with the food banks was always that the food bank did not have that many people, and they couldn’t collect daily. Because things must be collected daily. And they were always laying around for a week.” (Hermsdorf, Rombach, & Bitsch, 2017, p. 2540). The partnership with food banks or charity organizations therefore compels retailers to make extra efforts as they must sort food according to the acceptor’s requirements, which takes them additional time and refrigerated storage space (Hermsdorf et al., 2017).

Acceptors face more challenges than donors, since they do most of the work – they find the FLW, pick it up, sort it, and give it out (Foote, 2020). Many of the difficulties encountered by food banks and charity organizations are linked to their limited capacity, to their shortage of means. Indeed, not only must acceptors deal with insufficient storage capacity, especially for refrigerated items, but they also lack knowledge regarding food labelling and food hygiene requirements, which is partly due to the fact that they mainly employ volunteers, resulting in a high employee turnover, not allowing a sufficient transfer of knowledge (De Boeck et al., 2017).

The acceptors are ensuring that the right food is delivered to the right place within a specific and usually short timeframe to allow its consumption, which requires a good internal organization, another challenge for the small entities that are the acceptors (Stenmarck et al., 2011).

To provide meals for a consistent number of people in need, food banks and charity organizations need to recover a stable amount of food every week, which has proven to be difficult, partly due to the seasonality in the offer of surplus food (Flemish Food Supply Chain Platform for Food Loss, 2017; Stenmarck et al., 2011). In addition, acceptors are in competition with each other for the food waste of retailers, which often have an agreement with one acceptor to whom they give it all, making it difficult for new organizations to get sufficient amounts of food (Foote, 2020).

Finally, the legislation is a barrier to food redistribution for both donors and acceptors (European Commission DG ENV, 2011). Indeed, neither want to be held liable if some problem arises with the food donated/served (Priefer et al., 2016; Stenmarck et al., 2011). However, the issues runs even deeper as actors in the donation/acceptation chain do not actually know who is responsible for the food safety (Hermsdorf et al., 2017).

Good practices

The literature discusses redistribution challenges and potential solutions to those rather than good practices or success factors by themselves.

To solve some of the problems that donors have when working with food banks and charity organizations, Stenmarck et al. (2011) suggests for supermarkets to establish their own social kitchen as ICA Malmborgs in Sweden did. This would add to the retailer's workload, but a greater quantity of food would be saved, and the risks of contamination would fall as the chain is shortened.

The collaboration between donors and acceptors would also be improved if retailers simply added a fridge dedicated to food waste in their storage rooms, as Pauline Duclaud-Lacoste proposes (Foote, 2020). This would allow retailers to sort their food out whenever fits them, rather than on the day of the food bank's visit, as is sometimes done (Hermsdorf et al., 2017). In addition, Duclaud-Lacoste believes that supermarkets should be obliged to deal with their food waste, as has been the case in France since 2016 (Foote, 2020).

Concerning the challenge with the legislation, with the liability in the redistribution, multiple responses are introduced in the literature. On the one hand, the legislation itself could be changed to clarify it and to limit the liability of donors, as is the case in the United States with the Good Samaritan Act. However, as it is a matter of safety, the subject is controversial: some believe that the donation/acceptation chain should be dealt with the same way than the regular FSC is, as strict standards must be respected to keep the food safe, while others believe that food banks and charity organizations should have a special treatment as their activities are different than those of the food industry (Priefer et al., 2016). On the other hand, guidelines and guidance could be offered to those in the donation/acceptation chain, to help them navigate the legislation on the subject (European Commission DG ENV, 2011). By democratizing the legal framework, even the occasional volunteers will be able to know what must be done to keep the food safe.

Lastly, retailers are not the only actors of the FSC who potentially have food items to donate. According to EU Platform on Food Losses and Food Waste (2019), food redistribution should therefore be encouraged all along the supply chain, with special focus on primary producers and mass caterers. Incentives could be used by the authorities for that purpose. In addition, funds and/or other financial mechanisms should be set up to support food redistribution organizations, to help them modernize and innovate. The establishment of well-functioning

partnerships between the various actors of the FSC involved in food redistribution is a key success factor to this cause (EU Platform on Food Losses and Food Waste, 2019).

Section 2.4 – Food valorization

Caldeira, De Laurentiis, and Sala (2019) give examples of action types for each group in their classification model. For food valorization, only two examples were given, and no other emerged from the literature review. Therefore, the following two types of food valorization will be discussed: value-added processing and animal feed.

Value-added processing

Even though it is not explicitly listed in the framework of Papargyropoulou et al. (2014), value-added processing can be considered as part of the re-use stage of the food waste hierarchy (see *Figure 7*), as the waste is not prevented in the stricter sense of the word but is still used for human consumption. It is therefore at the same level as redistribution in terms of preference.

Lee and Tongarlak (2017) analyzed the practice of by-product synergy in retail stores, more precisely the use of surplus fresh produce to make prepared food items such as coleslaw, guacamole, or smoothies. This is a specific case of value-added processing as it happens directly in the stores. The authors found that the practice was most useful when the demand of the primary product (i.e. the fresh produce) is more uncertain than the demand of the secondary product (i.e., the prepared food items) and when the net tax benefit for donation is low. Indeed, by-product synergy has a negative impact on food redistribution as the stores would rather use the surplus for the new product and they are discouraged to donate the leftover surplus as the quantities are marginal (Lee & Tongarlak, 2017). Although this practice has a high potential of waste reduction, a thorough analysis is recommended before implementing it to evaluate how it will affect other actions that are already in place.

Animal feed

Animal feed is situated after redistribution and value-added processing in the food waste hierarchy (see *Figure 7*), since it is considered as a recycling method by Papargyropoulou et al. (2014). However, Courtois (2014) places animal feed in the re-use category, along with redistribution and value-added processing. As it is considered a FLW prevention practice in the wider sense of the notion but composting is not (cfr. definition in *Chapter 1*), animal feed will be regarded as part of the re-use stage, even though it should be the last option envisaged in this stage to give priority to redistribution and value-added processing.

According to the Flemish Food Supply Chain Platform for Food Loss (2017), 43% of FLW was saved from being completely discarded in Flanders in 2015 by getting turned into animal feed. This percentage varies depending on the sector, with multiple sectors (fisheries, hospitality, and catering) not reporting to give any FLW to animal feed at all while the food industry re-uses more than half (55%) of its FLW this way, and the agriculture, retail, and households stand in between with respectively 11%, 3%, and 28% repurposed into animal feed. The disparity in these numbers reveal that while some sectors are already using this practice frequently, others need to make it more common. However, not all waste can be turned into animal feed, which justifies the total absence of the practice in some sectors.

Section 2.5 – Food waste prevention governance

Unlike the groups of actions presented in the previous sections, the food waste prevention governance group cannot be associated to one step of the food waste hierarchy, as are found in this group "all those voluntary or mandatory initiatives that promote/facilitate the uptake of the prevention measures belonging to the other […] groups" (Caldeira, De Laurentiis, & Sala, 2019, p. 13). As the sub-groups (or examples) provided by Caldeira, De Laurentiis, and Sala (2019) each encompass a range of actions and are distinct from each other, they will be discussed separately in this section.

Voluntary Agreements

A Voluntary Agreement (VA) is a commitment or a pact that brings all supply chain actors together under a common cause – food waste reduction in this case (Burgos, Colin, Graf, & Mahon, 2019). Because it allows discussion between FSC stakeholders that would not happen otherwise, a VA has the potential to significantly reduce food waste through an increase of food redistribution for instance (Bos-Brouwers, Graf, Aramyan, & Oberc, 2020).

Burgos et al. (2019) as well as Osoro and Bygrave (2016) provide advice on how to set up and run a successful VA.

First of all, a special attention must be given to the context in which the VA is to be set. Indeed, there might be some helpful or unhelpful contextual factors to take into account, such as a favorable policy environment or difficult economic conditions (Osoro & Bygrave, 2016). In addition, the VA can be implemented with different aims depending on whether the country in question has food waste legislation in place or not: it can either back the realization of pre-existing targets or establish new targets to fill in for the lack of legislative ones (Burgos et al., 2019).

Secondly, to set up the agreement, two approaches can be adopted. A participatory approach fully engages the actors involved but can be a long process as a consensus must be found among all the participants. A lead organization driven approach is faster as most of the reflection is done in advance but is less engaging for the actors involved as they can usually only choose whether to join or not (Osoro & Bygrave, 2016).

Whichever approach is chosen, a VA needs a lead organization, a driving force, to take the head of the agreement and to coordinate all the actors. This entity should be a neutral and trusted third-party with a positive reputation, to build confidence among the members and have them share sensitive information. This is crucial to the success of a VA. In addition, if the entity, or the VA in general, is supported by the government, the chances of success of the agreement increase even further (Burgos et al., 2019; Osoro & Bygrave, 2016).

For a VA to be successful, it is better to start small, with the key actors to represent the entire supply chain first, so that consensuses can be found more easily (Burgos et al., 2019). Moreover, the VA will be more likely to thrive with a few engaged members than with many uninvolved members (Osoro & Bygrave, 2016). This is especially important if the participatory approach is chosen. After the initial set up, other actors, not as essential to the core strategy of the VA, can be added into the alliance to gain some specific expertise for instance (Burgos et al., 2019).

The funding scheme can also influence the success of the VA. It must be sustainable, composed both of private and public funds to achieve neutrality. Furthermore, requesting members to pay participation fees can be a good strategy as well, as it boost their engagement in the VA (Burgos et al., 2019).

Finally, “a monitoring framework is essential to check whether the alliance is on track to achieving its objective” (Osoro & Bygrave, 2016, p. 44). The measurement methodology and metrics must be clear and well-defined to be applied consistently by all actors, reporting on objectives and targets previously unanimously defined (Burgos et al., 2019).

Regulatory frameworks/policies

The regulatory frameworks or policies concerned are those aiming to simplify or promote the redistribution or reuse of surplus food and the implementation of actions to make the FSC more efficient (Caldeira, De Laurentiis, & Sala, 2019). Bos-Brouwers et al. (2020) discovered that the exchange of best practices in terms of food redistribution policies between countries is a success factor for such policies, meaning that successful policies in a country usually wind up

successful in other countries as well. Regarding household food waste prevention, well-defined regulations or policies are more effective than fiscal incentives (Chalak, Abou-Daher, Chaaben, & Abiad, 2016). Unfortunately, this conclusion applies only to household FW and cannot be generalized.

The legislation itself must be changed in some respects to help the fight against food waste. First of all, FLW must be defined properly by the European Union so that it can be used in all member countries to measure it (Vaqué, 2015). Secondly, the law on food donations should be changed, as was done in the United States with the Good Samaritan Act, to limit the liability of donors if products given in good faith happen to be harmful (Courtois, 2014; Priefer et al., 2016). Finally, the phrasing and organization of date labelling should be changed in the legislation (Aschemann-Witzel et al., 2015). The list of products not needing a minimum durability (or best before) date should be extended or the concept should be entirely abolished. Moreover, date labelling should be uniformized in the European Union as there are currently significant differences in the use of the various date labels (use by and best before) (Garske, Heyl, Ekardt, Weber, & Gradzka, 2020; Wunder et al., 2019).

Besides changing the legislation, various policies should be introduced to regulate the operations of the FSC actors and to encourage their initiatives to reduce FLW. Agricultural policies must be modified to accommodate the objective of reducing FLW in priority (Vaqué, 2015). Raw materials could be made scarcer, reducing supply for a constant demand, resulting in higher food prices, which would influence consumers towards wasting less (Aschemann-Witzel et al., 2015). Another mean to reach the same goal, a rise in food prices to induce a more careful handling of food at home, is to adapt the Value Added Tax Regulation and to use the additional revenue to support those who cannot afford the new price of foods (Priefer et al., 2016). However, these two policies aiming at the same goal are not (or only partly) considering the negative impacts of such practices: it would be socially devasting to raise food prices in this way, forcing low-income families to rely on charity organizations or social services to get food, and it would affect consumers' health since fresh produces such as fruits, vegetables, meat, and dairy are generating more waste than processed foods, but are also more nutritious (Hamilton & Richards, 2019). Raising the prices of those fresh produces would therefore drive consumers to consume cheaper, less nutritious foods.

The authorities should also encourage, or perhaps legally force, retailers to publish yearly information of their food waste generation, as it might create competition between retailers as to which one is the most sustainable (Courtois, 2014). Alternative measures to foster a more

sustainable behavior towards food wastage in supermarkets would be to prohibit retailers to waste edible food or to compel them to donate food (Vaqué, 2017; Wunder et al., 2019). Finally, policies should force retailers particularly but some other actors of the FSC as well to relax marketing standards, in order not to reject as many products (Wunder et al., 2019).

National food waste prevention programs

National food waste prevention programs are "large scale programs coordinated at national level encompassing various activities and initiatives to reduce FW through the supply chain" (Caldeira, De Laurentiis, & Sala, 2019, p. 14). Member States were required by the European Union to develop national waste prevention programs, to which the development of a national food waste prevention program can contribute (European Commission DG ENV, 2011).

The first step to create a successful national program is to analyze the current situation. Indeed, as mentioned previously, food waste must be clearly defined to allow consistent reporting, at least within the border of one country, which will help pinpoint the greater sources of food waste. Afterwards, specific objectives can be set based on the situation, and the associated indicators and targets can be established. All of this must be then taken into account to select the right measures to implement. These measures must thereupon come together in an action plan, specifying the timeline, milestones, resources needed, key actors involved, and targets. Finally, this plan must be implemented, monitored, and enforced by a regulatory body, such as a National Waste Prevention Committee. The earlier stakeholders are involved in the development and implementation of the program, the most engaged they will be on the long-term (European Commission DG ENV, 2011).

One element that must be included in the program is an information campaign. The campaign should target both consumers and actors from the supply chain, describing the environmental and economic problem of FLW to the later for example (Stenmarck et al., 2011). Concerning consumer FW, public authorities are in the best position to create a large-scale sensibilization campaign or even to educate the younger population in schools (Courtois, 2014). Recent findings in behavioral sciences and experience gained from other sectors can help set up an effective campaign against consumer food wastage (EU Platform on Food Losses and Food Waste, 2019).

Fiscal incentives

Fiscal incentives serve to guarantee that food waste prevention is economically preferable to treatment as waste (EU Platform on Food Losses and Food Waste, 2019).

Some of these incentives can target specifically one stage of the FSC while others can have an impact on all actors. An example of the latter are taxes on landfilling, which discourage consumers and professionals alike to send their (food) waste there (Courtois, 2014). Taxes on waste treatment have been proven a good instrument to send waste higher in the (food) waste hierarchy, towards recycling, reuse, recovery, and potentially prevention, depending on the configuration of the instrument (Priefer, Jörissen, & Bräutigam, 2013). Indeed, specific requirements must be met to use taxes on waste treatment in food waste prevention: food waste must be collected separately, both in households and in the industry; the tax rate must be high enough to incentivize towards FW reduction but not too high that it leads to illegal activities, or regulatory measures must be set to prevent it; and existing regulations must be reviewed to ensure that they do not have counter objectives with this new regulation (Priefer et al., 2013).

Among the incentives targeting one stage of the FSC in particular are the fiscal incentives in favor of food redistribution, aimed at retailers (Garske et al., 2020). In fact, tax deductions for food donations were identified as a strong driver towards food redistribution. An example to follow in this regard is the Netherlands which stimulate food donations with a full tax deduction (Bos-Brouwers et al., 2020).

Similar measures can also be taken by the private sector in their fight against food waste. Examples of such practices are restaurants charging consumers for leftovers or waste collection companies implementing pay-as-you-throw schemes to incite households to reduce their waste (Wunder et al., 2019).

Section 2.6 – Summary

The best actions in the fight against FLW are those higher in the food waste hierarchy: prevention actions and then re-use.

Supply chain efficiency actions are part of the prevention actions, and are therefore preferred. Good practices in supply chain efficiency include aligning supply with demand by improving ordering and forecasting, performing stock control, using a decision-support tool, getting farmers to communicate/cooperate and organize themselves, optimizing packaging, improving date labelling by making it more consistent for instance, reducing the price of suboptimal food and food close to its expiry date in the stores, educating and training the staff, and monitoring, measuring, and reporting FW. Some supply chain efficiency actions specific to the food services sector are to repurpose excess food, to require reservation, and to reduce the number of items on the menu.

Consumers' behavior change is the second and only other group of actions that is part of the prevention actions, and is therefore preferred as well. In these actions, it is advised to combine awareness campaigns with prompts, modeling, and/or commitment; to understand and adapt the communication to different target groups; to focus on the younger generation; to enhance consumers' motivation; to create educational campaigns on food storage, date labelling, and leftovers; to perform skills training; and to influence social norms.

Redistribution, even if considered as belonging to the category re-use of the food waste hierarchy, is still a prevention action as defined in *Chapter 1* and is still highly useful to reduce food wastage. Some good practices for retailers in redistribution are to establish their own social kitchen, or to add a fridge dedicated to food waste in their storage room to facilitate the cooperation with charity organizations, and to be obligated to donate or repurpose their food waste. Other good practices include the legislation limiting the responsibility of donors, guidelines and guidance being provided to the actors in the donation/acceptation chain, and the encouragement of food redistribution all along the supply chain.

Food valorization actions are considered as re-use actions as well. The first type of food valorization actions is value-added processing and a good practice in this field is the by-product synergy in retail stores, which is most useful when the demand of the primary product is more uncertain than the demand of the secondary product and when the tax benefit for donations is low. The second type of food valorization actions is animal feed, for which there is no different practices, but that is more common in some sectors than others.

Finally, food waste prevention governance actions encompass diverse actions from the other groups and therefore cannot be associated to one step of the food waste hierarchy. To implement a successful voluntary agreement, one must pay attention to the context, choose between a participatory approach and a lead organization driven approach, have an organization to lead it, start small with the key actors only, find sustainable and neutral funding, and set a monitoring framework up. Good practices in terms of regulatory framework or policies are to clearly define FLW, to limit the liability of donors, to change the phrasing and organization of date labelling, to modify agricultural policies with a focus on food losses reduction, to make retailers publish their FW generation numbers, to prohibit retailers to waste edible food or to compel them to donate it, and to relax marketing standards. For a national food waste prevention program to be implemented successfully, the current situation must be analyzed first; then objectives must be set, along with targets, indicators, and measures; and in the end an action plan must be created, implemented, monitored, and enforced. Some additional good practices for such programs are

to involve stakeholders early on, and to include informational campaigns targeting consumers and actors from the FSC in it. Lastly, good practices for fiscal incentives are taxes on landfilling to discourage all actors from wasting food, incentives in favor of food redistribution aimed at retailers, charging consumers for leftovers in restaurants, and pay-as-you-throw schemes for waste collection.

PART II – EMPIRICAL RESEARCH

CHAPTER 3 – METHODOLOGY

Section 3.1 – Sampling

The goal of this empirical research being to identify best practices among food waste prevention actions taken in Belgium, the target population is hereby defined. Clearly defining the target population is the first stage of the sampling process (Taherdoost, 2016).

The second stage is to select the sampling frame, "a list of the actual cases from which sample will be drawn" (Taherdoost, 2016, p. 20). Ideally, a list compiling every food waste prevention action implemented in Belgium should be used as the sampling frame. Unfortunately, such a list does not exist because the authorities do not index such actions. A list must therefore be created from scratch using publicly available resources, meaning that this list will never be complete. To create the sampling frame, Google Alerts were set up for the following keywords: "Food loss Belgium", "Food waste Belgium", "Gaspillage alimentaire Belgique", and "Perte alimentaire Belgique". A report of the web publications containing these keywords was received once a week for six months (from beginning of October 2020 to end of March 2021) and the results were analyzed to identify relevant initiatives. In addition, the following keywords were used in Google search: "gaspillage alimentaire Belgique" and "food waste Belgium". The first 100 search results for both keywords were analyzed to add any potential food waste prevention action to the list. Actions were then regrouped by organization, to produce a list of 63 organizations that have implemented food waste prevention actions. This final list, which can be found in *Appendix 2*, is the sampling frame.

The next stage is to choose a sampling technique. The first choice, between probability and non-probability sampling, is an easy one to make as non-probability sampling is associated with qualitative research (Taherdoost, 2016). In fact, because qualitative research "focuses on reports of experience or on data which cannot be adequately expressed numerically" and "employs a flexible, emergent but systematic research process" (Hancock, Windridge, & Ockleford, 2007, p. 6), this method will be used in this research. Therefore, a non-probability sampling technique will be chosen. The diagram in *Figure 8* will lead the decision of which exact technique is to be applied. Because the amount of data to be analyzed would be too important if it were collected from the entire population, the answer to the first question is negative (see *Figure 8*). As the cases to be analyzed are quite different from each other, no

statistical inferences will be made from the sample, leading to a negative response to the second question. For the same reason used to answer the last question, the sample does not have to be representative, thus the answer to the third question is negative as well. The answer to the next question requests a little more discussion. If "*social science exploration* is a broad-ranging, purposive, systematic, prearranged undertaking designed to maximize the discovery of generalizations leading to description and understanding of an area of social or psychological life" (Stebbins, 2001, p. 3), then this research is explorative as it aims to describe and understand what are good practices in food waste prevention. The answer to this question is therefore positive, and it reveals the sampling technique to be used: self-selection sampling.

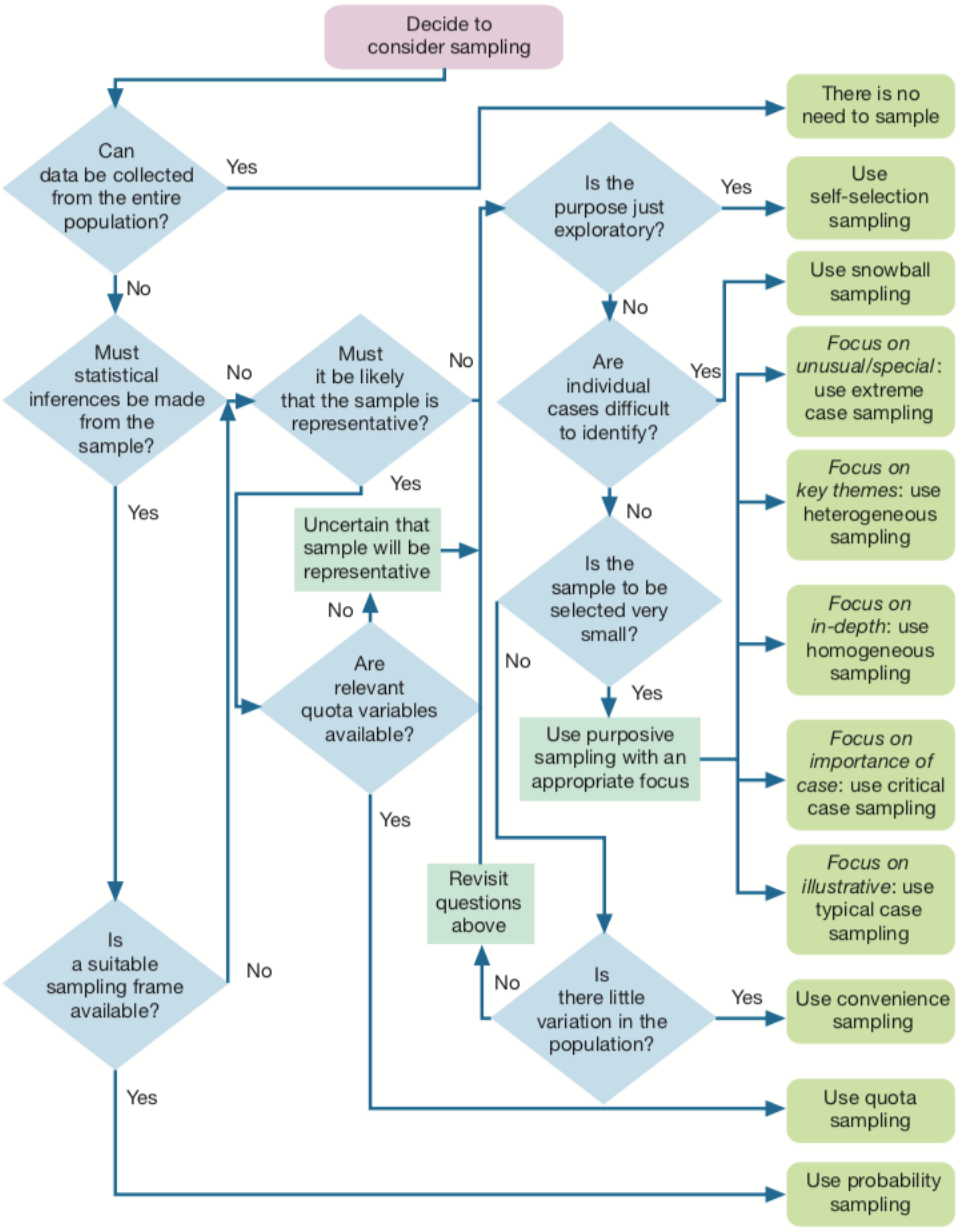

Figure 8: Selecting a non-probability sampling technique (Saunders, Lewis, & Thornhill, 2007, p. 227)

In a self-selection sampling, the research lets the population know that cases are needed and collects data from those who respond, leaving each case the choice to take part in the research (Saunders et al., 2007). This was done by contacting all organizations in the sampling frame to first inform them about the study, then to give them the means to participate, and finally to remind them about the research and to let them know when responses would no longer be accepted.

Getting back to the sampling process, the fourth stage of determining the sample size applies only to random samples. The fifth stage, collecting data, was touched upon in the self-selection sampling method explanation and will be developed in the next two sections. The sixth and final stage is to assess response rate (Taherdoost, 2016). Nearly 30% of the organizations in the sampling frame participated in the study. A tenth replied to the e-mails with a refusal to take part in the research; 5% did not participate because they believed that the questions asked did not fit their activities; and 9% either were unreachable because out of action or responded that the action had never been implemented. The rest never answered any contact attempt. *Appendix 2* displays the status of every organization.

Section 3.2 – Framework and questionnaire

The focus of this research being the successful prevention of food waste generation, the empirical research, whatever form it takes, must be able to distinguish the best practices from the others. To that aim, the Framework for the evaluation of food waste prevention actions developed by Caldeira, De Laurentiis, and Sala (2019) will be used to structure and to guide the empirical research.

The Framework was created through an iterative process, involving multiple stakeholders and using the literature to identify the right performance assessment criteria (De Laurentiis, Caldeira, & Sala, 2020). As explained at the start of the second chapter, the actions in this Framework are classified according to their goal: redistribution, food valorization, consumers' behavior change, supply chain efficiency, and food waste prevention governance. The actions are then assessed with the following criteria: quality of the action design, effectiveness, efficiency, sustainability of the action over time, transferability and scalability, and intersectoral cooperation (Caldeira, De Laurentiis, & Sala, 2019). The detail of what each criterion entails can be found in *Table 2*.

Criterion	What is assessed?
Quality of the action design	To which extent the prevention action was well planned, including: i) the definition of the action aims and objectives, ii) the design of a strategy to achieve those objectives, iii) the definition of an implementation plan, and a monitoring system.
Effectiveness	To which degree the action was successful in producing the desired result, i.e., in reaching the objectives (which should ideally have a target associated) defined initially.
Efficiency	The capacity to reach a desired result with the least time/cost/effort. Indicators were defined to assess the efficiency of actions in terms of food waste prevented, economic benefits, environmental savings, social impacts, outreach and behaviour change.
Sustainability of the action over time	The potential of the action to be sustained over time, referring to the capability of maintaining the activity over time. Other sustainability aspects (such as environmental or social sustainability) are, instead, covered by the criterion efficiency.
Transferability and scalability	To which extent transferability (possibility of being transferred or implemented in another context or place) and scalability (ability to be applied on a different scale, compared to the initial case, e.g. to be made larger) were considered during the design of the action and implemented.
Intersectoral cooperation	If the action was the result of a cooperation represented by a partnership between the private and the public sector and/or between different actors and stakeholders along the supply chain.

Table 2: Criteria defined in the Framework for the evaluation of food waste prevention actions (Caldeira, De Laurentiis, & Sala, 2019, p. 5)

Since "a reporting template was developed to collect information on food waste prevention actions for their assessment according to the framework developed" (De Laurentiis et al., 2020, p. 3), it will be used in this research. This reporting template was built as a questionnaire with a large majority of text entry questions, implying that it was not meant to be used in a quantitative research, to be analyzed through statistics, which fits the qualitative approach chosen in this research.

However, the questionnaire has not been used as it is, some adaptations have been made. The first and most obvious adaptation was in the introduction, which was completely re-written along with the instructions to fill in the survey. The second adaptation was the removal of the explanation of the costs of the prevention action, to shorten the questionnaire and to avoid confusing the respondent. The third adaptation is the addition of questions: two questions about the sustainability of the action over time and two questions about the intersectoral cooperation, because these two aspects were added to the framework at a later stage, and therefore not included in the original survey (Caldeira, De Laurentiis, & Sala, 2019). In addition, the last section of the questionnaire, 'Additional information', was entirely removed. Finally, all mentions of file uploads were deleted from the questionnaire. Furthermore, the entire questionnaire was translated to French in the hope of increasing the response rate. The final

questionnaire, which can be found in its English version in *Appendix 3*, was built on Qualtrics and its access link was sent to the organizations via e-mail.

Section 3.3 – Qualitative Comparative Analysis

One of the main issues with a qualitative approach is the researcher's tendency to go too deep into the complexity of the few cases analyzed and to end up describing the specificities of those cases without being able to generalize the results (Curchod, 2003). To avoid, or at least minimize, this problem, a Qualitative Comparative Analysis (QCA) will be performed.

A QCA "provides analytic tools for conducting holistic comparisons of cases as configurations and for elucidating their patterned similarities and differences" (Ragin, 1998, p. 107). A QCA uses Boolean algebra, the algebra of logic and sets, to facilitate the comparison of a small sample of cases, between five and fifty, with a large number of variables (Curchod, 2003; Ragin, 1998). However, because the analysis will be done without using a software, the number of variables will be small as well for this research.

One of the specificities of Boolean algebra is that cases can either be 'in' or 'out' of a set. Such sets are called 'crisp' (Ragin, 1998). It is also possible to perform QCAs with scales instead of Boolean variables. Such sets are called 'fuzzy' (Schneider & Wagemann, 2010). In this research, the analysis will be performed with a crisp set.

In the next chapter, the actions analyzed in this research will be presented one by one. The Qualitative Comparative Analysis will be performed afterwards.

CHAPTER 4 – FINDINGS

Section 4.1 – Presentation of the actions

All of the actions presented below can also be found in *Appendix 4*, in the factsheet format created by Caldeira, De Laurentiis, and Sala (2019).

Supply chain efficiency: Food Waste Trajectory

The Food Waste Trajectory, organized by FoodWIN, started in 2017 and covers all of Flanders. This action aims at reducing food waste in every Flemish canteen by 50% by 2030.

To do so, they start with a baseline food waste measurement tailored to the canteen which produces a report to identify the most pressing challenges and show potential savings. Taking it into account, the manager can then build a strategy to reduce food waste. It does not have to be perfect from the start, the manager can test different solutions. An impact measurement is done afterwards to show the progress and to indicate the amount of food, money, and CO_2 emissions saved. Finally, they also do follow-up calls and invite participants to their annual Food Waste Fest to keep them engaged.

The action has already been transferred and upscaled. In fact, their process is openly available so that as many canteens as possible are impacted, but they also provide paid support when necessary.

Supply chain efficiency: Training on food safety

The training sessions on food safety, organized by the Federal Agency for the Safety of the Food Chain (FASFC, *AFSCA* in French), started in 2008 and are taking place everywhere in Belgium.

These trainings are provided for free to charity organizations which redistribute food surpluses. This is the FASFC's contribution to food waste reduction and to help people in precarious situations. They give tens of training sessions every year, always in person. Needless to say, it has been put on hold for over a year now, due to the COVID-19 crisis.

The practice has never been transferred nor upscaled, because fighting food waste is not part of the FASFC's core business.

Another initiative taken by the FASFC to reduce food waste was to conduct a study to evaluate whether food products could be frozen up to the expiry date. They found out that it was a safe practice, given that it is done under strict conditions, and are therefore allowing charity

organizations to do so. This extends the lives of products, and consequently gives more time to the organizations to redistribute them.

Supply chain efficiency: Waste Watcher program

The Waste Watcher program, an internal initiative by IKEA, started in 2017 and is implemented in all of the IKEA stores in Belgium.

The program aims to cut food waste in stores' restaurants by half by the end of 2021. To do so, they weight the restaurant's food waste, they analyze the figures, they then create an action plan and finally they act on it. Their measures include training the staff and implementing an Artificial Intelligence system to help the stores. They have a system in place to monitor their progress.

IKEA Belgium reported preventing 400 tons of food from being wasted in four years.

The action has already been transferred and upscaled. In fact, the initiative was picked up by the global organization and rolled out to all the other countries in which the company has stores.

The respondent specifies that for such an action to be successful, it needs to receive a lot of attention from the highest management.

Consumers' behavior change: Action lunch box Zero waste

The action lunch box Zero waste, organized by the economic bureau of the Province of Namur (BEP, *Bureau économique de la Province de Namur* in French), was a pilot project that took place in Philippeville between May and August 2019.

The action was targeting restaurants with the aim of avoiding food waste by offering a practical, solid, and sustainable lunchbox to take leftovers back home, and by raising awareness on the issue of food waste with leaflets distributed to consumers and cardboards put on tables. The participating restaurants were also asked to put a promotional sticker on their front window to show their commitment.

At the end of the project, an evaluation was done with each of the participating establishments. The restaurant owners were mostly satisfied and seemed to appreciate the general awareness campaign around the boxes that some already offered.

The action was a pilot project, created with the intention to reproduce it in other communes. However, it has yet to be transferred or upscaled.

Consumers' behavior change: Foodwinners

The Foodwinners action, which started in 2020, is implemented by the City of Bruges in their own municipality.

The action, aiming to reduce food waste in households, is taking place in three phases. The first, which lasted five months in 2020, trained 50 'ambassadors' to become experts in reducing food waste. Those ambassadors recorded a 65% reduction of their household's food waste due to the action. The second phase is a five-week campaign targeting 500 households which agreed to participate, and this phase was still ongoing when the survey was answered. The third phase will be similar to the second, but on a larger scale: the goal is to reach 5,000 households. Later stages might be added afterwards.

So far, the practice has not been transferred nor upscaled. However, it is ready to be transferred and the City of Bruges is planning on creating a manual for other cities to use.

Redistribution: CollectMet

CollectMet, organized by Cultureghem, started in 2015 and is active in the Brussels region, more specifically in Anderlecht.

Aiming to reduce food waste and to help people in precarious situations, they collect unsold produces from the farmers' market once a week and redistribute them to people in need. They prevent three tons of food from being wasted every week, giving food packages to approximately 60 people every Sunday.

For over three years, they had difficulties running the project because they could not find funds to support it. They finally got funding three years ago and were consequently able to hire someone, which allowed them to professionalize and perpetuate the project. The respondent identifies funding as the key barrier to the project, but states that once you have passed that obstacle, once you have the funding you need, many things can be done to make it all go well.

The action has never been transferred nor upscaled. Nevertheless, the respondent states that they would be happy to share their experience with anyone who is interested.

Redistribution: Conso'Aimable

Conso'Aimable, run by an ASBL wearing the same name, started in July 2018 and is active in the city of Liège and its surroundings.

The action retrieves unsold fresh vegetables from the auction of Malines every week and distributes it to 200 households living under the poverty line. The project is entirely run by volunteers and does not receive any subvention.

Conso'Aimable reports having prevented, in three years, 100 tons of food from being wasted.

Transferability and scalability have not been considered yet as the action, without funding, is not even sustainable over time.

Conso'Aimable considers funding as its biggest challenge. The respondent explains that they were able to buy a van to go to the auction every week thanks to some donations, but that they are not allowed to sell the vegetables due to the agreement they have with the auction, and that they are therefore struggling to cover the operating expenses of the van such as gas and maintenance.

Redistribution: Daily donations of unsold food

The daily donations of unsold food from the Colruyt group started in 1995 and are carried on in all the chain's supermarkets in Belgium.

Aiming to reduce food waste by 70% and to help people in precarious situations, the food surplus items from all stores (Colruyt, Okay, Okay Compact, Bio-Planet, Cru), distribution centers, Colruyt Group Academies, and production sites that can still be consumed for at least two days are donated to charity organizations helping people in precarious situations, along with non-food surplus items (toys, care products, …).

Each stock movement is monitored closely, including the products taken out of the stock and their destination, allowing the Group to measure its food surplus donations. The Colruyt Group donates more than 4,500 tons of food every year, preventing it from being wasted.

The Colruyt Group also has a policy stating that if the receiving organization has to throw away some of the products received (because they are out of date for instance), they can give it back to the Group. As this happens in less than 0.1% of cases, it can be assumed that the goods arrive in time at their destination.

The practice has already been transferred and upscaled. Indeed, retailers all over the world now donate their surplus food following the Colruyt Group's method.

A success factor of the Group's action is that the preparation of goods is an integral part of their working methods, which means that no extra time is spent on this task. Therefore, donating food surpluses truly does not cost them anything.

Redistribution: Feed the culture

Feed the culture is an action/organization that started in May 2020 and that is taking place in Brussels.

The project originated from the crisis faced by the cultural sector due to the COVID-19 pandemic. The cultural, creative, and events sector had no accessible solution to get out of these difficulties, so Feed the culture was launched. With this action, they distribute unsold foods to professional workers from this specific sector exclusively. This includes students, employees, unemployed people, artists with or without status, working in performing arts (dance, theater, music, circus), books and publishing, architecture and heritage, fashion and design, audiovisual, plastic and visual arts, advertising, media, or events. The objective of the action is really the social aspect of feeding people from this specific sector rather than the reduction of food waste.

Feed the culture distributes approximately 300 food packages each week, which is equivalent to about 1.5 tons of food prevented from being wasted every week.

The action has never been transferred nor upscaled.

Feed the culture has difficulties finding enough and diversified surplus food, finding and keeping volunteers, finding a place to occupy, organizing the funding, and being structured.

Redistribution: Flavour food surplus distribution platform

The Flavour food surplus distribution platform was set up in June 2020 by the City of Bruges for its inhabitants.

The action has multiple goals: reduce food surplus, save CO_2, provide food aid, and give people jobs. In the first six months, they had gathered 34 tons of surplus food, employed three workers far from the labor market, and collaborated with fifteen organizations redistributing food surpluses or preparing meals for people in need. The food waste prevented was mostly vegetables (30%), dairy (19%), fruits (14%), and meat (10%).

The practice has not been transferred yet, but it has been upscaled. Indeed, the project started with a limited number of local organizations and was later extended to more organizations in Bruges and some in other municipalities around.

According to a survey, the receiving organizations are mostly satisfied with the program: 62% think that the amount of food received is sufficient, 80% state that the distribution is a support for them, and a large majority consider the collaboration with the workers to be very good.

Redistribution: Foodsavers

Foodsavers is an ongoing collaboration project between the social services and the department of welfare and climate of the city council of Ghent. It started in 2017.

Foodsavers redistributes food surpluses from retailers to charity organizations, fulfilling two objectives: to reduce carbon emissions and poverty. In addition, Foodsavers is a work-activation project, employing people far from the labor market and educating/supporting them, answering a third objective: social employment.

In 2020, 664.6 tons of surplus food were distributed to 103 charity organizations, resulting in a reduction of 1,711 tons of CO_2. The food donated was mostly vegetables (36%), fruits (17%), dairy (13%), and pre-prepared meals (10%). As part of the work-activation project, 23 people were employed.

The action has already been transferred and upscaled. In fact, Foodsavers Ghent is copied in many other municipalities in Flanders with the support of the organization HERWIN. In addition, the action is working with more and more charity organizations and retailers in Ghent.

As key learnings, the respondent mentions that working in a social employment system has an impact on the operations as the workers usually need more time to understand what is asked of them (because of a language barrier for instance). On a more positive note, the respondent states that, due to their large scale, retailers are more willing to collaborate, and more food can therefore be saved. Finally, they also have a more professional approach than small organizations run by volunteers, meaning that food safety is guaranteed with them.

Redistribution: Frigo pour tous

Frigo pour tous, organized by Sharefood, started in 2016 and is taking place in Brussels.

Frigo pour tous is a solidary fridge located in Saint-Gilles (Brussels). The volunteers collect surplus food from supermarkets and other shops and distribute it the next day. The objectives of the actions are therefore to reduce food waste and to fight against food and social insecurity.

In one month, they donate between 800 and 1,000 meals, preventing four tons of food from being wasted. The food distributed is mostly vegetables (32%), fruits (20%), pre-prepared meals (20%), and dairy (17%).

This action was implemented by replicating other already existing solitary fridges, but it was not transferred or upscaled further.

The main difficulty reported by the respondent was the human resources management as they have not found a way to handle it efficiently yet.

Redistribution: Happy Hours Market

Happy Hours Market was implemented in February 2019 by the organization of the same name and is present in multiple locations in Belgium.

Happy Hours Market is an ecological and social initiative whose mission is to reduce food waste while improving charity organizations' food provisions. They have developed a new distribution network to prevent retail food surpluses from being thrown away. Their logistic process is made of three steps:

1. At 5:30pm, they start their daily surplus food collection tour, visiting their partner stores.
2. Between 7:30pm and 9pm, the products are available at half the price through their App/website and can be collected at their pickup points.
3. At 9pm, the rest of the surplus food is delivered to charity organizations for free.

In two years, they have gained more than 21,000 users and saved more than 500 tons of food. On average, half of the food collected is sold to consumers at a reduced price and half is distributed to charity organizations.

The action has already been transferred and upscaled, as it started in Brussels and is now available in other places as well.

However, many actors are skeptical of this initiative, making it difficult for Happy Hours Market to expend: some municipalities refuse the initiative's request to install a pick-up point in their territory, some supermarkets do not negotiate with the initiative easily as they believe that the cooperation will be complicated, and some charity organizations are against the initiative and spreading false information about it because they think that Happy Hours Market steals food from them by selling part of the surpluses on its App while in reality Happy Hours Market delivers them more food than they would have gotten on their own because it has the means to do so.

Redistribution: Soli-Dons

Soli-Dons, an action named after its organization, officially started in June 2018 but was already active for a couple of years before that. The action is present in multiple locations across the Walloon Brabant.

Soli-Dons collects food surpluses from retailers, farmers, and processing facilities six days a week, always in the morning. They then prepare packages composed mostly of fresh products (fruits, vegetables, dairy, eggs, …) and distribute them to people in precarious situations. Because the room they have is too small to make packages out of all the food they collect, they distribute part of it to other charity organizations.

Not everyone can get a package from Soli-Dons. Their beneficiaries are all people in precarious situations sent from the public center for social action (CPAS, *Centre public d'action sociale* in French). After meeting with a social worker there, they can get one free package every week for two months to help them get back on track. If they still need help after those first two months, they must go back to the CPAS to ask for an extension. The system is different for the extensions: they can pick up 20 packages, whenever they want, but they have to pay 2€ for each. Unless exceptional circumstances, they cannot get more packages once they have used up all 20 from the extension.

In 2020, they received 126 tons of surplus food and donated 3,566 food packages, helping 304 families for two to seven months each.

The action has been upscaled already but not transferred. Indeed, Soli-Dons started in Nivelles before expending to other neighboring municipalities.

As success factors, the respondent cited the funding received from the authorities, the fact that they have employees working regular hours and that they do not only rely on volunteers, the fact that they are part of a professional reintegration program which sends people paid by the CPAS to work for them full-time for a year, and the fact they have the means to respect the cold chain (refrigerated vans, cold room). Some barriers are the time spent searching for funds every year as none of the funding received is automatically renewed, the fact that their room is too small and not adapted to redistribution activities, and the fact that they receive already expired food products from retailers or food with other problems which should not have been given to them.

Redistribution: Too Good To Go

Too Good To Go is a worldwide organization that started in 2016. It is active all over Belgium.

Too Good To Go is an App that sells surplus food from retailers, smaller shops, and food services to consumers. With a mission to inspire and empower everyone to take action against food waste, the organization targets households, businesses, schools, and public affairs, and creates awareness campaigns.

In 40 months, 4,684,788 meals were donated in Belgium, preventing 4,700 tons of food from being wasted.

The action has already been transferred and upscaled, as it is now present in fourteen countries.

One key challenge identified by the respondent is to keep consumers active once they have downloaded the App, and to keep them inspired.

Redistribution: Too Much

Too Much, with an organization of the same name, was implemented in 2019 and can be used everywhere in Belgium, and even in the world.

The website puts in contact those who prefer to donate than to waste with those who prefer to collect than to pay. It is based on the idea of enabling citizens to exchange food for free. The objective is therefore to reduce households' food waste. They decided to make it a website and not an App to facilitate its access to people in precarious situations (homeless people who do not have a smartphone for instance).

During the three first months, approximately 100 meals were exchanged every day, but the effect died down afterwards.

The action has never been transferred nor upscaled, even though it is technically ready to be used everywhere. It has been active in Paris for a while.

At some point, the action was used as a first contact between restaurants and charity organizations, that kept exchanging outside the website afterwards. Another positive point was the enthusiasm of the media at the launch, proving that people were interested. However, it is difficult to keep people using it without spending a lot in marketing, and therefore the effect slowed down because word-of-mouth is not enough to keep it active. Other difficulties are information technology management issues and creating such an App/website.

Food valorization: Les Glaneuses

Les Glaneuses is a small organization that was created in March 2020 and is present in the French-speaking part of Belgium.

Les Glaneuses is gleaning and recovering surplus food from organic stores and transforming it into long-life dry products such as broths and flavored salts. On the side, workshops about food preservation are also organized by Les Glaneuses. Each of these two activities is taking about half the time of the woman behind this project, who is working alone on it.

In one month, 120 kilograms of food waste was prevented, mostly vegetables (70%), fruits (10%), and cereal-based products (10%).

The action has neither been transferred nor upscaled, as it is not even sustainable over time yet because the action's costs are too high.

Some barriers that were mentioned by the respondent are the fact that the dry products must be sold at a price too high for it to be profitable, that no funds were received from the authorities, and that the taxes are too high. Overall, it is difficult to start a project with small finances.

Food waste prevention governance: Good Food strategy

The first Good Food strategy, organized by Brussels Environment, took place between 2016 and 2020 in the capital city.

The strategy, that aims to prevent food waste at the source and to valorize food surpluses by means of redistribution, encompasses many different actions targeting households, canteens, restaurants, supermarkets, and schools. For example, the Rest-o-Pack campaign aims to encourage Brussels residents to take home the leftovers from their meal in a restaurant in order to reduce plate waste. The obligation to donate surplus food has also been added to the environmental permits for establishments larger than 1,000 square-meters.

In the five years of the project, food waste in certified canteens was reduced by 29% on average, a reduction of 25% of household food waste was reported, and supported projects collectively distributed 2,500 tons of surplus food.

The action has yet to be transferred or upscaled, but a new version, a second Good Food strategy, is currently being co-constructed with the relevant stakeholders.

Food waste prevention governance: Environmental permits and special conditions for unsold food donations

The environmental permits and special conditions for unsold food donations is an initiative from the City of Herstal which started in December 2012.

The City added to the environmental permits for supermarkets the obligation to donate their unsold food to charity organizations. Non-compliance can lead to fines between 100 euros and 1,000,000 euros, as it is considered an environmental offence.

The action has been transferred and upscaled as the Walloon Parliament has made it mandatory for establishments of more than 2,500 square-meters to donate their surplus food and other communes do the same for smaller establishments.

Section 4.2 – Qualitative Comparative Analysis

Ragin (n.d.) explains how to perform a QCA in four phases, each consisting of several steps:

1. Identification of relevant cases and causal conditions
2. Construction of the truth table and resolution of contradictions
3. Analysis of the truth table
4. Evaluation of the results

Theses phases will be used to structure this section.

Phase 1: Identification of relevant cases and causal conditions

According to De Meur and Rihoux (2002), the cases selected must be comparable, meaning that the cases must share some characteristics but differ on others. Concerning the shared characteristics, those relate to the context in which the cases evolve, implying that the environment of each of the different cases must be sufficiently similar, sufficiently homogeneous (De Meur & Rihoux, 2002).

Taking this into account, it is clear that not all cases recorded can be included in this analysis. Indeed, a redistribution action such as Soli-dons does not evolve in the same environment than a consumers' behavior change action like Foodwinners, nor than a supply chain efficiency action as the Food waste trajectory. Since the various groups of actions present different contexts, only the cases from the largest group will be chosen for the QCA, the redistribution actions. However, the food valorization action Les Glaneuses will also be added to the pool of cases as its context is similar to the redistribution actions' since they also collect surplus food from stores. Therefore, twelve actions are selected.

Nevertheless, some cases can still be removed if, during further research, it is discovered that they do not present enough common properties with the other cases studied (De Meur & Rihoux, 2002). It happened with the Daily donations of unsold food action from the Colruyt Group, as it is the only action depicting the retailer's side, which is a different context than the other actions. Consequently, the QCA will be done on a set of eleven cases.

Concerning the identification of causal conditions, one problematic aspect is the ratio between the number of cases and the number of explanatory variables. As the number of explanatory

variables increases, the number of simultaneous explanatory combinations increases exponentially, and quickly exceeds the number of cases (De Meur & Rihoux, 2002). To keep the number of explanatory combinations under the number of cases, only three variables should be selected. However, as this would restrict the findings excessively, four variables will be selected, meaning that the number of combinations will exceed by five the number of cases.

As explained by Curchod (2003), the variables in this method are qualitative, i.e. they can be reduced to a "presence-absence" dichotomy. After having searched for variables fitting this format in the survey and corroborated it with findings from the literature review, the following causal conditions were identified: monitoring, cooperation, public funding, and non-public funding.

The variable monitoring represents the answer to the question “Was there a monitoring system put in place to measure efficiency and/or efficacy of the action?” in the survey. As having specific targets is useless without a monitoring system and knowing whether a target has been reached or not is impossible without it, the variable monitoring seems to be the right starting point to evaluate the quality of the action design. In addition, it is important for an action to have a monitoring system, as it enables to identify opportunities for improvement (Caldeira, De Laurentiis, & Sala, 2019).

The variable cooperation represents the answer to the question “Was the action the result of a cooperation represented by a partnership between the private and the public sector and/or between different actors and stakeholders along the supply chain?” in the survey. This variable was chosen because it solves one of the main challenges for the donors in the redistribution, the lack of alignment with the acceptors, as well as one of the challenges for the acceptors, the competition (cfr. *Section 2.3*).

The variables public funding and non-public funding are derived from the answer to the question “Type of funding” in the survey, with on the one hand the answers “Public” and “Private-public” representing a presence of the variable public funding, and the answers “Private”, “Crowd-funding”, “None”, and “Other” representing an absence of this variable, and on the other hand the answers “Private”, “Private-public”, “Crowd-funding”, and “Other” representing a presence of the variable non-public funding, and the answers “Public” and “None” representing an absence of this variable. The choice of funding variables was done because funds are the basis for other elements sometimes mentioned by respondents in the key learnings, such as proper material and employment. As the lack of storage capacity and the employment of volunteers were identified as challenges for the acceptors in the redistribution

(cfr. *Section 2.3*), it confirms that these elements should be considered in the analysis. In addition, the separation between public and non-public funding was made as the observation of the individual cases suggests that there might be differences between actions relying on one or the other type of funding, especially in terms of implementation and business model.

Finally, one variable must be chosen to represent the result, the success of an action, making it a "best practice". Not knowing the computation method for the amount of food waste prevented, the information provided by the organizations is not comparable, especially since they all operate under different scopes. With this obvious indicator of success unusable, the transferability and/or scalability was used for the dependent variable. This variable was derived from the answers to the following questions: "What is the level of transferability of your action?" and "Was the action upscaled?". The variable was marked present if the action had been transferred, upscaled, or both. This variable was chosen because the goal of this research is to be able to replicate actions and to know why these actions in particular are doing well, the former being exactly what is represented by the variable. In addition, the associated questions were straightforward, which leaves little room for interpretation, meaning that the answers are reliable.

The QCA will therefore attempt to associate the dependent variable transferability/scalability with a combination of the explanatory variables monitoring, cooperation, public funding, and non-public funding.

Phase 2: Construction of the truth table and resolution of contradictions

Once the cases and the variables have been selected, a table listing the possible combinations of attributes as well as the cases corresponding to each configuration must be constructed (Ragin, 1998). All possible combinations must be listed, even those that did not appear in the empirical research (Ragin, n.d.).

Following these instructions, *Table 3* is obtained. Each row corresponds to one possible combination, indicating whether each of the variables monitoring (M), cooperation (C), public funding (P), and non-public funding (N) is present (1) or absent (0). The number of cases matching the combination with the variable transferability/scalability present (T) is then indicated, followed by the number of cases matching the combination with the variable transferability/scalability absent (t). The titles of the actions matching the combination are cited in the last column.

M	C	P	N	T	t	Consistency	Actions
1	1	1	1	0	0	?	/
1	1	1	0	2	0	1	Flavour food surplus distribution platform ; Foodsavers
1	1	0	1	1	0	1	Too Good To Go
1	1	0	0	0	0	?	/
1	0	1	1	0	1	0	CollectMet
1	0	1	0	0	0	?	/
1	0	0	1	1	1	0.5	Happy Hours Market ; Conso'Aimable
1	0	0	0	0	1	0	TooMuch
0	1	1	1	0	0	?	/
0	1	1	0	1	0	1	Soli-dons
0	1	0	1	0	0	?	/
0	1	0	0	0	0	?	/
0	0	1	1	0	1	0	Feed the culture
0	0	1	0	0	0	?	/
0	0	0	1	0	0	?	/
0	0	0	0	0	2	0	Frigo pour tous ; Les Glaneuses

Legend: Monitoring (M), Cooperation (C), Private funding (P), Non-private funding (N), Transferred/up-scaled (T), Not transferred/up-scaled (t)

Table 3: Truth table with consistencies before resolution of contradictions

Once the truth table is created, the consistency of the cases in each row must be calculated. The consistency displays whether the cases agree on the outcome for the row or not. For a crisp set, a measure of consistency is the proportion of cases in each row displaying the result. Perfect consistency is indicated by scores of either 1 or 0, and perfect inconsistency is indicated by a score of 0.50 (Ragin, n.d.). A question mark replaces the consistency score when it cannot be calculated due to the absence of empirical data for the row.

Contradictory rows, that is rows with a consistency score different from 0 and 1, must be identified and resolved (Ragin, n.d.). In this analysis, only one row is contradictory, and it is a perfect inconsistency. Indeed, Happy Hours Market and Conso'Aimable present the same combination of variables, but the former has been transferred/upscaled while the latter has not. However, looking back at the data for Happy Hours Market, it can be noted that cooperation was noted absent because no answer was received for that question, but it can be deducted from the other answers in the survey that cooperation should be marked as present. The truth table can therefore be revised to obtain the final truth table, *Table 4*.

M	C	P	N	T	t	Consistency	Actions	Equation*
1	1	1	1	0	0	?	/	
1	1	1	0	2	0	1	Flavour food surplus distribution platform ; Foodsavers	$MCPn = T$
1	1	0	1	2	0	1	Happy Hours Market ; Too Good To Go	$MCpN = T$
1	1	0	0	0	0	?	/	
1	0	1	1	0	1	0	CollectMet	$McPN = t$
1	0	1	0	0	0	?	/	
1	0	0	1	0	1	1	Conso'Aimable	$McpN = t$
1	0	0	0	0	1	0	TooMuch	$Mcpn = t$
0	1	1	1	0	0	?	/	
0	1	1	0	1	0	1	Soli-dons	$mCPn = T$
0	1	0	1	0	0	?	/	
0	1	0	0	0	0	?	/	
0	0	1	1	0	1	0	Feed the culture	$mcPN = t$
0	0	1	0	0	0	?	/	
0	0	0	1	0	0	?	/	
0	0	0	0	0	2	0	Frigo pour tous ; Les Glaneuses	$mcpn = t$

Legend: Monitoring (M), Cooperation (C), Private funding (P), Non-private funding (N), Transferred/up-scaled (T), Not transferred/up-scaled (t)

***Upper case letter means the variable is present, lower case letter means the variable is absent (M/m, C/c, P/p, N/n)**

Table 4: Revised truth table with consistencies and equations

Phase 3: Analysis of the truth table

The goal of the analysis is to understand what features the positive cases (T) have to consistently distinguish them from the negative cases (t), and to specify the different combinations of variables linked to the outcome based on that (Ragin, n.d.).

The Boolean equations for each combination observed can be computed, following the basic Boolean calculation rules (Curchod, 2003):

- An upper case letter means the variable is present, so is equal to 1, and a lower case letter means the variable is absent, so is equal to 0.
- The addition is equivalent to the logical operator "or". Thus, $A + B = Z$ translates into "if A equals 1 or B equals 1, then Z equals 1".
- The multiplication is equivalent to the logical operator "and". Thus, $Abc = Z$ translates into "if A equals 1 and B equals 0 and C equals 0, then Z equals 1".
- The reduction is the principle of taking a variable out of the equation to simplify it, under the condition that the variable is taken out of two expressions that produce the

same result and that only differ in the variable in question, allowing the two expressions to be synthesized into one. Thus, $Abc + AbC = Z$ is equivalent to $Ab = Z$.

- The factorization is used to highlight a necessary condition. Thus, $AB + AC + AD = Z$ is equivalent to $A(B + C + D) = Z$, and A is a necessary condition of Z. A condition is qualified as necessary if it appears in each of the combinations of conditions resulting in the outcome studied (Curchod, 2003).

The Boolean equations for each combination observed can be found in *Table 4*.

The individual equations can then be added up together to have all the possible combinations leading to one outcome: the action being transferred/upscaled (T) or not (t). The following equations are obtained:

$$MCPn + MCpN + mCPn = T \Leftrightarrow C(MPn + MpN + mPn) = T$$

$$McPN + McpN + Mcpn + mcPN + mcpn = t \Leftrightarrow c(MPN + MpN + mPN + mpn) = t$$

The presence of cooperation appears as a necessary condition for the presence of transferability/scalability.

The first equation can be simplified even further, using the reduction principle:

$$C(Pn + MpN) = T$$

According to Curchod (2003), configurations that were not observed empirically can be used to obtain more parsimonious results. Therefore, supposing that the combination $CmpN$, had it been observed, would have been associated to a result T, the previous equation can be adapted as follows:

$$C(Pn + MpN + mpN) = T \Leftrightarrow C(Pn + pN) = T$$

The reduction principle was used to obtain the equation on the right, the final equation, as no further simplification can be performed.

Phase 4: Evaluation of the results

Three conclusions can be drawn from this final Boolean equation:

1. The cooperation between different actors is essential for an action to be successful, as the presence of cooperation is a necessary condition for the presence of transferability/scalability.
2. Some type of funding, either public or non-public, is necessary for an action to be successful. A mix of both types of funding is likely not recommended, however it cannot

be confirmed that a mix of funding would not lead to a successful action as neither of the following configurations were observed: $MCPN$ and $mCPN$.

3. The monitoring does not have an impact on the transferability/scalability of an action, since the variable was completely removed from the equation.

Ragin (n.d.) advises to identify the cases that fall within each causal formula and to analyze whether the formulas group cases in a meaningful way. The first group consists of actions that are the result of a cooperation and that rely on public funding to exist but that do not use any type of non-public funding: Flavour food surplus distribution platform, Foodsavers, and Soli-dons. The second group consists of actions that are the result of a cooperation and that are funded by non-public sources but that do not receive public funding: Happy Hours Market and Too Good To Go.

Two out of the three actions in the first group are government-run and are not redistributing the surplus food themselves, but rather make the link between the retailers and the charity organizations, using the large scale they then have to facilitate the collaboration with retailers. The third action, Soli-dons, does a mix of both as the organization gives part of the collected surplus food to other organizations, and uses part of it to create food packages.

All three actions in the first group are part of a social employment system, in which people work for the organizations for a limited time and are educated and supported there, to hopefully be able to find a job once their time in the organization is over. In the case of Soli-dons, the only action that must apply for public funding every year since it was not funded by the government, this practice is particularly advantageous as these workers are paid by the CPAS.

Both of the actions in the second group are using Apps to sell surplus food, allowing them to get their own funds, even though it is not clear whether that source of money is sufficient to make Happy Hours Market profitable since they mentioned crowd-funding as their type of funding in the questionnaire. However, Happy Hours Market mentions having the means to recuperate much more surplus food than charity organizations in their success factors, which implies that the sale of part of the surplus food collected is indeed one of the roots of their success. Too Good To Go, on the other hand, does not need as much material as Happy Hours Market as the company does not collect surplus food itself, it only puts restaurants and retailers in contact with consumers. However, seeing the success of the App, the company makes enough money to cover all the operating costs. This type of business model that they both share, even though different in some aspects, seems to be a successful way of redistributing surplus food.

CHAPTER 5 – DISCUSSION

Section 5.1 – Supply chain efficiency

Supply chain efficiency actions should be among the most frequent food waste prevention actions, as they can be taken at any stage of the FSC and they are part of the most favorable option of the food waste hierarchy (Papargyropoulou et al., 2014). It is therefore surprising that only 16% of questionnaire responses could be classified as supply chain efficiency actions. However, companies probably do not communicate much about actions they implement in their supply chain, which means that there likely are many more supply chain efficiency actions than the ones analyzed in this research.

Restaurants and food services sector

Out of the three actions listed in this group, two are reducing food waste generation in the restaurants and food services sector. These two actions are the Food Waste Trajectory by FoodWIN, helping canteens reduce their waste, and the Waste Watcher program by IKEA, reducing food waste in their stores' restaurants. Both actions were transferred and/or upscaled, making them best practices in accordance with the criteria established in the previous chapter.

Both actions start with a baseline measurement of the food wasted in the canteen/restaurant, analyze the figures, create an action plan accordingly, and put it into action. Both actions also monitor the progress in each establishment. As both actions follow a highly similar process and are successful, the conclusion that this process in itself is a best practice in food waste prevention actions targeting the restaurants and food services industry can be drawn.

A series of steps to reduce food wastage in food services was also mentioned in the literature, and it has the first step in common with the process uncovered previously, but the following steps are more concrete measures such as engaging staff or reducing overproduction (Clowes et al., 2019; Clowes et al., 2018a, 2018b). Neither FoodWIN nor IKEA went into details about the measures implemented in the various establishments, but that is most likely because they are all different, designed for the needs of each place, following the insights obtained in the first measurement. Another conclusion, diverging slightly from the literature, is therefore that specific actions for the restaurants and food services industry cannot be considered as best practices because it always depends on the situation.

Retail and other distribution of food

The last action recorded in the supply chain efficiency group is the training on food safety given by the FASFC. This action, because it was never transferred nor upscaled, cannot be considered as a best practice. However, it does not mean that the action is not useful or that there is nothing to learn from it.

This initiative is active in the donation/acceptation chain rather than in the traditional FSC, as the FASFC gives training sessions to charity organizations that redistribute food waste. As the EU Platform on Food Losses and Food Waste (2019) states, training has the potential to reduce FLW along the entire supply chain. In this case, the reduction happens at the retail stage. Therefore, knowing that it is helping to reduce food waste, the only conclusion possible is that the action should be transferred and/or upscaled. The FASFC is not doing it because fighting food waste is not part of their core business, which means that it should either become part of their competencies, or it should be done by those whose core business it is to reduce food wastage. In either case, it is up to the government to decide and to make it happen.

Section 5.2 – Consumers' behavior change

Consumers' behavior change actions, just as supply chain efficiency actions, should be among the groups of actions the most represented, since it is high in the food waste hierarchy, making it one of the most favorable types of actions (Papargyropoulou et al., 2014). However, an even smaller proportion of the actions recorded belongs to this group: 10.5%. By definition, awareness/educational campaigns should be visible, communicated on. It is therefore unlikely that such actions exist and have not been listed in the empirical research, even though it is possible that one or two have been missed. One can only conclude that more awareness or educational campaigns aiming to reduce food waste must be launched in Belgium in particular, and elsewhere as well in general. Public authorities being in the best position to create such campaigns on a large scale (Courtois, 2014), federal governments should start working on it. In fact, the two actions recorded in this group are both run by governmental instances, confirming this conclusion.

Both actions are still in their first stages: one was a pilot project run in restaurants in spring/summer 2019, which has probably not been reiterated since due to the COVID-19 crisis, and the other is an action targeting households, which successfully completed its first stage in 2020 and is currently in the middle of its second stage. For this reason, neither has been transferred or upscaled yet, even though both have considered it in the implementation and are

ready for it. However, because transferability and scalability have not happened so far, the actions cannot be considered as best practices.

Restaurants and food services sector

The action put in place by the BEP targeted consumer food waste in the restaurants by offering them to take back the leftovers and by raising awareness with leaflets and cardboard signs. Stöckli et al. (2018) advise to supplement information campaigns with prompts, modeling, and/or commitment, and that is exactly what was done here. The leaflets distributed to the consumers are the information campaign, that is completed with the cardboard signs on the tables, which are prompts, and the boxes to take back leftovers, which can be considered as modeling. Some of the restaurant owners already offered boxes to take back leftovers but appreciated the awareness campaign around it. All of this leads to the conclusion that information campaigns, prompts, modeling, and commitment are not sufficient to change consumers' behavior on their own, a combination of them must be used.

Households

Little is known on what type of information is sent to households in this second action, or on which form that information has taken. It therefore cannot be used to endorse or refute the previous conclusion.

What is known, however, is that the households are asked to measure their food waste before and after the campaign, which allows to evaluate the food waste reduction and by extension the effectiveness of the campaign. The first stage saw a 65% reduction of food waste generation in the participating households, proving that such campaigns are useful and providing results. The challenge exposed by Stöckli et al. (2018), stating that there is no evidence of the effectiveness of information campaigns, is therefore no longer relevant.

Section 5.3 – Redistribution

Even though redistribution is not part of the most favorable actions according to the food waste hierarchy (Papargyropoulou et al., 2014), it is the prevention action group with the largest representation in this research, as 58% of actions fall into this category. However, Rezaei and Liu (2017) state that it is more important to take actions in the retail and consumer stage of the supply chain first since actions in earlier steps would only lead to more waste in these last steps if no actions are taken there. It is therefore justified to have many actions fighting food waste in supermarkets.

Qualitative Comparative Analysis

The QCA in *Chapter 4* drew some conclusions and identified similarities within cases of each group, which must be confronted to the literature.

The first conclusion, stating that the cooperation between different actors is essential for an action to be successful, answers the challenge identified by researchers according to which donors have difficulties aligning with acceptors (Flemish Food Supply Chain Platform for Food Loss, 2017). By cooperating from the start, various actors work together to find solutions that fit everyone, and that will facilitate every actor's participation in the initiative.

The second conclusion, claiming that a type of funding (public or non-public) is necessary for an action to be successful but that a mix of both is likely not recommended, can partly be explained by the literature. Indeed, some of the acceptors' challenges are their limited capacity and their high employee turnover due to the fact that most of them are volunteers (De Boeck et al., 2017). Both of these challenges are the result of a lack of funds to afford more material, better rooms, and paid employees. The conclusion that some type of funding is necessary is therefore supporting research in that regard. Nevertheless, very few articles and reports mention funding explicitly. The EU Platform on Food Losses and Food Waste (2019) is one of them, declaring that authorities should set up funds to support food redistribution organizations. In consequence, further research needs to be conducted to fill this gap in the literature.

The third conclusion, according to which monitoring does not have an impact on the success of an action, goes against a general recommendation for all food waste prevention actions issued by Caldeira, De Laurentiis, and Sala (2019), saying that a monitoring system enables the identification of opportunities for improvement, and is therefore an important element for an action to have. It can thus be assumed that this recommendation applies mainly for other groups of actions, such as supply chain efficiency or food waste prevention governance, for which the literature specifically recommends monitoring (EU Platform on Food Losses and Food Waste, 2019; European Commission DG ENV, 2011; Osoro & Bygrave, 2016).

As explained in *Chapter 4*, all three actions that rely on public funding but that do not use other types of funding are at least partly acting as an intermediary between retailers and charity organizations, taking advantage of the larger scale they then have to facilitate the collaboration with retailers. In addition to helping donors and acceptors align, having an intermediary might help with another challenge that charity organizations face: the irregularity in the surplus food donations (Stenmarck et al., 2011). Indeed, having an intermediary collecting food from many

retailers and distributing it to many charity organizations could help with irregularity as it is unlikely that all retailers will have particularly high or particularly low quantities to donate on the same day, unless a special event/circumstance has occurred, which means that a low donation day at one retailer could probably be compensated by a high day at another. It can then be concluded that adding an actor in the donation/acceptation chain, an intermediary between retailers and charity organizations, is a best practice in redistribution as it helps the current actors align and it tames the irregularity of donations.

Retailer's actions

Finally, one of the redistribution actions was not included in the QCA and must therefore be analyzed separately. In fact, the Daily donations of unsold food action from the Colruyt Group was removed from the analysis because its context is too different from the one of the other actions. Nonetheless, the action can be considered as a best practice because it has been transferred and upscaled, making it important to study this action in detail.

The action was the result of a cooperation, which confirms the QCA's findings that cooperation between various actors is a driver for success.

The action also has a couple of internal policies which seem to contribute to the success of the redistribution action: the food items are given to charity organizations at least two days before they can no longer be consumed, ensuring the organizations have enough time to use them, and the organizations can return to the Group any product that turns out to be spoiled or not edible anymore for any reason. As the latter reportedly happens in less than 0.1% of cases, it indicates that the Colruyt Group is doing truly well with this action. Additionally, this practice of Colruyt of taking food off the shelves earlier to make sure that enough time is left for it to be consumed, is also considered as a good practice by the literature (Soethoudt et al., 2013). However, when confronting this claim with the experience of one of the receiving organizations, Colruyt's practice does not seem as perfect anymore. Soli-Dons, which has explicitly mentioned that most of the surplus food they collect is from Colruyt supermarkets, indeed states that one of the difficulties they face is the fact that part of what they receive should not have been given to them. Yogurts multiple days past their expiry date were cited as an example. Even though Soli-Dons works with other supermarkets than Colruyt's, they would have mentioned it if they saw a difference between the food donated from one or another supermarket. To conclude, one can therefore say that the practice of taking the products off the shelves earlier to ensure their consumption after redistribution is a good practice in theory, that should be implemented by all

retailers, but that the Colruyt Group still has progress to make in this matter and cannot be entirely taken as an example.

Section 5.4 – Food valorization

No conclusions can be drawn from the only case recorded belonging to the food valorization group. Indeed, the action cannot be considered a best practice since it has never been transferred nor upscaled, and it is not even sustainable over time at the moment.

Moreover, few analogies can be found between practice and theory as the literature does not address food valorization practices much, and value-added processing actions in particular even less.

However, as the action is also collecting food surpluses from retailers, it was included in the QCA, and therefore contributed to the findings in that regard.

Section 5.5 – Food waste prevention governance

There are four types of food waste prevention actions in this group – voluntary agreements, regulatory frameworks/policies, national food waste prevention programs, and fiscal incentives. Only two of these types are represented in this study and by only one action each. This is partly due to the fact that most of these actions are formed and lead by public authorities, so it is not only more difficult to find the right person to contact, but also to get that person to collaborate as they get many demands for many different things.

Regulatory framework/policy

The City of Herstal decided, back in 2012, to add a condition to the environmental permits granted to retailers: they now have to donate their unsold food. The action is a best practice as it was transferred and upscaled. Indeed, the Walloon Parliament reproduced the action by making it mandatory for supermarkets larger than 2,500 square-meters to donate their surplus food. In Herstal, recurrent controls are carried out in the stores to verify compliance with the condition and administrative fines are given to those who do not comply. As the literature agrees that supermarkets should be compelled to donate food (Vaqué, 2017; Wunder et al., 2019), one can conclude that all supermarkets, whatever their size and location, should be under that obligation.

National food waste prevention program

The only action in this group is the Good Food strategy and, in this case, the 'national' does not truly fit as the action was implemented for the Brussels-Capital region, but the underlying concept is the same, thus the action still qualifies as a national food waste prevention program.

The strategy cannot be considered a best practice in this field as transferability and scalability have yet to be applied. However, the action evaluated is the first Good Food strategy, which took place between 2016 and 2020, and a second strategy is under development.

One of the many initiatives that the strategy encompassed was the addition of a similar clause to the environmental permits for food stores in Brussels than was done for those in Herstal: all retailers larger than 1,000 square-meters are obliged to donate their food surplus. This is one more instance of the practice that was proven useful.

The strategy also included the Rest-o-Pack campaign, encouraging consumers to take their leftovers home from the restaurant. However, it was not mentioned whether this initiative in restaurants was complemented with an information campaign or not, which makes it difficult to evaluate if this campaign followed the good practice identified previously.

Other initiatives present in this strategy are training programs for canteens, anti-waste and cooking workshops in schools, and a challenge for households. As the literature suggests to have campaigns targeting both the consumers and the actors from the FSC (Stenmarck et al., 2011), it seems like this program is on the right track to becoming a best practice. In addition, Courtois (2014) claims that public authorities should educate the younger population in schools, which Brussels Environment is doing with the Good Food strategy.

To conclude, this strategy seems to hold all the right features to be called a best practice, but more information on the process that was followed to create this strategy would be needed to confirm it. However, it can already be confirmed that such programs, incorporating so many different initiatives, should be implemented by all authorities, whatever their level of power.

CONCLUSION

Managerial contributions

Throughout this research, an answer to the following question was provided:

What practices can be implemented to successfully prevent food waste generation in the European Union?

The answer depends on the type of food waste prevention action considered, as all types have the potential to reduce food waste generation, and actions of all types should be implemented to have a comprehensive food waste prevention strategy in a country.

In supply chain efficiency, different recommendations can be given depending on the stage of the FSC on which to act. Unfortunately, only the later stages of the FSC can be addressed due to the lack of respondents in the earlier stages. To prevent food waste in the retail and other distribution of food sector, the charity organizations redistributing the surplus food from this sector must be trained on food safety, as the FASFC is doing. In restaurants and food services, specific actions cannot be considered as best practices because the best practice to implement always depends on the situation. However, actions following this process are likely to be successful in preventing food waste in this sector: start with a baseline measurement, analyze the figures, create an action plan accordingly, put it into action, and monitor the progress.

Concerning consumers' behavior change, awareness or educational campaigns aiming to reduce food waste must be launched in every country that does not have such large-scale campaigns, and it should be done by public authorities. In addition, a recommendation specifically for actions in the restaurants and food services sector is to use a combination of information campaigns, prompts, modeling, and commitment rather than just one of these elements. This recommendation would be good to apply to actions in any stage of the FSC, but its success was only proven in this research for the restaurants and food services.

With regard to redistribution actions, a general recommendation is to cooperate with the other actors as early in the implementation process as possible. In addition, charity organizations distributing the surplus food need to have some regular funding, either public or non-public, but should probably not have a mix of both public and non-public funding. Retailers, for their part, should take products off the shelves a few days early to ensure that they still have enough time to be consumed before reaching their expiry date. Finally, it is recommended to have an intermediary between retailers and charity organizations, one actor to deal with all distributing

retailers and receiving organizations, as it helps the actors align and it tames the irregularity of donations.

Finally, in terms of food waste prevention governance, the main recommendation is for all governments to implement national food waste prevention programs, incorporating many different initiatives. In addition, all supermarkets, whatever their size or location, should be under the obligation of a regulatory policy to donate their surplus food.

Limitations

Although all the above recommendations are practices that would contribute to successfully prevent food waste generation, the list is far from exhaustive, and that is the main limitation of this research. Indeed, even just in Belgium, looking at search results in Dutch or contacting Belgian food production companies without knowing whether they have food waste prevention actions in place, would have potentially gotten other organizations to participate in the research which would have led to other recommendations. This does not mean that the above recommendations are worthless, implementing those will lead to a successful food waste prevention action, but it means that other practices leading to the same thing exist and are not mentioned in this research.

A second limitation of this research is the fact that good practices are identified, but the underlying reasons why these practices lead to a more successful outcome than others are usually not developed. It happens especially in the literature review, where many good practices are simply mentioned without explaining them further. This limitation is due to the quite large scope of this research, which means that every aspect of it cannot be thoroughly analyzed.

Future research

Consequently, future research should attempt to conduct a similar study but on a larger scale. This would help fill in the gaps left by this first research that paves the way for others to follow. A research on a larger scale would require to shorten and simplify the questionnaire to obtain more responses and to go after not only the actions that are communicated about but also those that are never mentioned, which is trickier. This would be especially useful to analyze good practices in supply chain efficiency at other stages than retail and food services, as companies might not publicize the actions they take internally.

Another research should focus on the issue of funding for redistribution actions, as the data collected in this research was not sufficient to prove whether a mix of public and non-public

funding is to be avoided or not. However, it was proven that having one type of funding or the other is important for a redistribution action to be successful, and the lack of funding was mentioned by more than one organization as a barrier to the smooth running of their action and therefore to the reduction of food wastage. This issue therefore deserves to be investigated further.

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APPENDICES

Appendix 1 – Food Loss and Waste causes per Food Supply Chain stage

Food Supply Chain stages	Food Loss and Waste causes	Number of studies
Agricultural production	Edible crops left or damaged in the field	3
	Overproduction	3
	Poor harvesting technique	2
	Sorting out of products due to specific standards	2
	Not harvested because of low demand/market prices	2
Postharvest handling and storage	Poor transport infrastructure	3
	Suboptimal storage	3
	Suboptimal inventory management	2
	Poor threshing technique	1
Processing and packaging	Suboptimal method of processing	5
	Failure to meet quality control standards	4
	Excess stock (take-back systems, cancellation of orders, wrong orders)	4
	Contamination	3
	Inappropriate/damaged packaging	2
	Product defects	2
	Surplus production of supermarket's own brands that cannot be sold elsewhere	1
	Human errors	1
	Labelling errors	1
	Suboptimal inventory management	1
Distribution	Overstocking (variability in ordering & inaccurate forecasting)	6
	Failure to comply with minimum quality/food safety standards	6
	Date labelling (out of shelf-life products & other issues)	5
	Poor handling of food products (by employees and customers)	4
	Marketing strategies (such as "buy one get one free")	4
	Quality expectations by retailer and customer	4
	Damage during transport	3
	Cold chain issues (interruption & lack of storage)	3
	Packaging defects	3
	Stock management (poor inventory records & insufficient shelf space available)	3
	Customers' expectation of full shelves (resulting in inflated orders from retailers)	3
	Beneficial prices for retailers if order a wide range of products and brand from a producer	2
	Seasonality of demand & weather change	2
	Temperature management/control	1
	Human error	1
Consumption – Households	Lack of planning concerning food purchases / Poor stock management	7
	Lack of skills for food preparation	6
	Date labelling (confusion, misunderstanding, exceeding the date)	6
	Preparation of oversized meals	5
	Impulse buying in stores	4
	Lack of knowledge concerning storage	3
	Poor experience in planning meals	3
	Plate scrapings	2
	Purchasing of (new) products that the consumer do not like	2
	Inadequate package sizes	2
	Lack of skills for recombining leftovers into new meals	2
	Lack of desire to consume leftover food	2
	High frequency of purchase	1
	Lack of ability to properly estimate the shelf life of food	1
	Irregular eating habits	1
	Unplanned events	1
	Culture of consumerism and abundance	1
	Low price level of food	1

Consumption – Hospitability & Catering	Amount of resources available for procurement (oversized dishes)	2
	Offer of buffets at fixed prices	2
	Oversized portions	2
	Difficulties in assessing the demand	2
	Legislation / Hygiene rules	2
	Poor quality of ingredients used	1
	Oversized batches	1
	Poor inventory	1
	Untrained employees	1
	Lack of communication	1

Sources: Aschemann-Witzel et al. (2015); Beretta et al. (2013); Dora et al. (2020); Farr-Wharton et al. (2014); GfK Belgium (2018); Heikkilä et al. (2016); Lebersorger and Schneider (2014); Mena et al. (2011); Mena et al. (2014); Parfitt et al. (2010); Priefer et al. (2016); Richter and Bokelmann (2016); Stenmarck et al. (2011); Wallonie environnement SPW (2018)

Appendix 2 – Sampling frame and status of each organization

	Organization	Status
1	AFSCA	Response recorded
2	Aldi	Refused to participate
3	Beerfood	No response
4	BEP	Response recorded
5	Bourse aux dons	No response
6	Brussels Beer Project	No response
7	Carrefour	Refused to participate
8	City of Bruges	Response recorded
9	City of Ghent	Response recorded
10	City of Herstal	Response recorded
11	City of Namur	No response
12	Colruyt	Response recorded
13	Compass Group	No response
14	Conso'Aimable	Response recorded
15	Copidec	No response
16	Cultureghem	Response recorded
17	Delhaize	Refused to participate
18	Disco Soupe	Out of action
19	Eatmosphere	No response
20	enVie Atelier	Survey does not fit their activities
21	Exki	No response
22	Federal Government (Finance)	No response
23	Feed the culture	Response recorded
24	Feedtruck Belgium	No response
25	Food Waste Evasion (Foodwe)	No response
26	FoodWIN	Response recorded
27	Frigo magic	No response
28	FruitCollect	No response
29	Fruitopia	Refused to participate
30	Gleaning Network Belgium	Out of action
31	Good Planet	No response
32	Government of Brussels	Response recorded
33	Government of Wallonia	Survey does not fit their activities
34	Happy Hours Market	Response recorded
35	Hello Fresh	Refused to participate
36	Hostel De Draecke	No response
37	Idelux	No response
38	Ikea Belgium	Response recorded
39	Intermarché Jurbise	Out of action (never happened)
40	Intradel	No response
41	Ipalle	Out of action
42	Just Keep It	Refused to participate
43	La Miche	No response
44	Les Gastrosophes	No response
45	Les Glaneuses	Response recorded
46	Lidl	No response
47	Life is wonderpoule	No response
48	MAD LAB	No response

	Organization	Status
49	Medex Museum	Refused to participate
50	Metabolance	Out of action
51	No Waste ASBL	Out of action
52	Permafungi	No response
53	Rikolto	No response
54	SAFE	No response
55	Shak'Eat	No response
56	Share Food	Response recorded
57	Simply You Box	No response
58	Sodexo	No response
59	Soepcafé Dampkring	No response
60	Soli-Dons	Response recorded
61	Too Good To Go	Response recorded
62	Too Much	Response recorded
63	Zero Waste Belgium	Survey does not fit their activities

Appendix 3 – Questionnaire

Reporting survey for food waste prevention actions

1. Introduction

Welcome to this reporting survey for food waste prevention actions.

My name is Prune Hardy and I am a Master 2 student in Business Engineering at the Louvain School of Management (UCLouvain). I am conducting this survey for the primary research part of my Master's Thesis on the evaluation of food waste prevention actions in Belgium. The goal of my research is to identify best practices in the field.

The questionnaire used for this survey was created by Caldeira et al. in the report "Assessment of food waste prevention actions: development of an evaluation framework to assess the performance of food waste prevention actions"[1].

Please answer this survey to the best of your abilities. I remain at your disposal for any question you may have or for any help you may need with the survey.

Prune Hardy
prune.hardy@student.uclouvain.be
+32 489 566 321

[1] Caldeira, C., De Laurentiis, V., & Sala, S. (2019). Assessment of food waste prevention actions: development of an evaluation framework to assess the performance of food waste prevention actions (EUR 29901 EN). Retrieved from Luxembourg: https://op.europa.eu/en/publication-detail/-/publication/8f771f0c-1d4c-11ea-95ab-01aa75ed71a1/language-en

Instructions to fill in the survey

The survey can be used to report information for single and multi-component food waste prevention initiatives (e.g. national food waste prevention programs), either completed or ongoing.

The survey consists of two parts: the first part (section 2) is designed to collect general information about the action (e.g. actors, objectives, etc.), while the second one (section 3) aims to collect information on the implementation and results (e.g. economic, environmental and social indicators, audience impact, etc.).

You are encouraged to provide as much information and data that you have available in regard to the indicators included in the survey in order to allow for an evidence-based assessment of the initiative. It is particularly relevant to provide information on the amount and economic value of food waste

prevented due to the implementation of the prevention action (section 3.2) as this will enable a more comprehensive assessment of the action. However, should you not hold some pieces of information, the answers can be left blank, and I will either work without it or approximate the missing data.

The information provided on the implementation and results of the action (section 3) should correspond to the duration of the action, as specified under section 2.8.

Any additional information or supporting documents that you deem relevant can be sent directly by email to prune.hardy@student.uclouvain.be.

2. General information

2.1 Title of the food waste prevention action

_____

Is this action concluded or ongoing?

- ○ Concluded
- ○ Ongoing

2.2 Type of action

If the action includes different types of actions, please select the predominant action type and provide in the box below additional information on other associated activities.

- ○ Food redistribution
- ○ Gleaning
- ○ Production of animal feed
- ○ Supply chain efficiency (e.g. manufacturing/processing optimisation, cold chain management, inventory management, storage and handling, improving canteen/food service efficiency, logistics)
- ○ Packaging (e.g. innovation to increase shelf life, facilitate use, different formats e.g. single-serve etc...)

- ○ Innovation (e.g. value-added processing; marketing)
- ○ Date marking
- ○ Awareness/educational campaigns (e.g. consumer communications, conferences, events)
- ○ Digital tools (e.g. websites, apps)
- ○ School programmes (e.g. educational materials)
- ○ Training
- ○ Awards/certification
- ○ Public procurement (e.g. improving logistics in public procurement)
- ○ Fiscal incentives
- ○ Voluntary/framework agreements
- ○ Regulatory frameworks/policies
- ○ National food waste prevention programme
- ○ Other

If you selected other, please specify

_____

_____

_____

_____

_____

If relevant, please add here additional information

_____

_____

_____

_____

_____

2.3 Objectives

Reason and objectives of the action

Please introduce here the rationale for implementing the action and the main goals pursued including, where relevant, any specific objectives and/or information related to the target audience(s) (e.g. number of households/ individuals targeted, etc.).

_____

_____

_____

_____

_____

Food waste prevention target (in %)

If applicable, please introduce the food waste reduction target defined for the action. This information should correspond to the duration of the action.

_____

Baseline

Please introduce information on the baseline against which progress towards the goal of the action was assessed (e.g. food waste levels and/or data on consumer understanding, behavior etc prior to the launch of the initiative).

_____

_____

_____

_____

_____

2.4 Short summary

Please include here a summary of the implementation of the action (e.g. policy measures, training programmes, campaigns implemented, funds allocated, etc.)

_____

_____

_____

_____

_____

2.5 Actor(s) involved in the implementation

Multiple answers possible

- ☐ National government
- ☐ Regional government
- ☐ Municipalities
- ☐ NGOs
- ☐ Trade associations
- ☐ Professional organisations
- ☐ Farmers
- ☐ Processors/manufacturers
- ☐ Wholesalers
- ☐ Retailers

- [ ] Food service
- [ ] Waste collection companies
- [ ] Restaurants/hospitality sector
- [ ] Healthcare
- [ ] Schools
- [ ] Academia/research
- [ ] Consumers
- [ ] Opinion leaders (e.g. high profile media, celebrities, chefs)
- [ ] Multi-stakeholder
- [ ] Other (e.g. please indicate under this section if the actors involved in the implementation were SMEs)

If you selected other, please specify

_____

_____

_____

_____

_____

From the list above, which actors were responsible for the implementation?

In case of multiple actors, please identify the lead and/or coordinator with overall responsibility for the initiative.

_____

_____

_____

_____

_____

2.6 Target audience

Multiple answers possible

- [ ] National government
- [ ] Regional government
- [ ] Municipalities
- [ ] NGOs
- [ ] Trade associations
- [ ] Professional organisations
- [ ] Small and medium entreprises (SMEs)
- [ ] Entrepreneurs
- [ ] Farmers
- [ ] Processors/manufacturers
- [ ] Wholesalers
- [ ] Retailers
- [ ] Food service
- [ ] Restaurants/hospitality sector

- [ ] Healthcare
- [ ] Schools
- [ ] Academia/research
- [ ] Consumers
- [ ] Multi-stakeholder
- [ ] Other (e.g. please indicate under this section if the action targeted specifically SMEs)

If you selected other, please specify

_____

_____

_____

_____

_____

If relevant, please add here additional information on the target audience

_____

_____

_____

_____

_____

2.7 Geographic coverage

- [ ] Local
- [ ] Regional

- [ ] National
- [ ] International

Please specify further (e.g. National: Belgium)

_____

2.8 Timeline

- ○ Start date _____
- ○ Duration (in months) _____

Frequency

- ○ Single action
- ○ Recurring action (e.g. repeated every summer)

If you selected recurring action, please specify the frequency

_____

2.9 Type of funding

- [ ] Private
- [ ] Public
- [ ] Private-public
- [ ] Crowd-funding
- [ ] None
- [ ] Other

2.10 Contact information

Contact person

_____

Email

_____

3. Implementation and results

3.1 Was there a monitoring system put in place to measure efficiency and/or efficacy of the action?

- ○ Yes
- ○ No

If you selected yes, please describe it

_____

_____

_____

_____

_____

3.2 Information on food waste prevented by the implemented action

You can report this amount either in kg or in number of meals donated. In case you choose the latter, proxies to determine the amount in kg will be used.

Preferably, this amount should refer to the total amount of food waste prevented due to the implemented action. This information is very important for a comprehensive assessment of your action. In case you are not able to provide this information, proxies based on measured outcomes of similar initiatives might be used.

- ○ Amount of food waste prevented (in kg) _____
- ○ Number of meals donated _____

○ Period to which the amount prevented refers to (in months) _____

Stage(s) of the supply chain where food waste was prevented

☐ Primary production

☐ Processing and manufacturing

☐ Retail and other distribution of food

☐ Restaurants and food services sector

☐ Households

Composition of the food waste prevented

If known, please include here the main composition of the food waste prevented according to the following categories.

	Amount (in %)	Additional information (e.g. cereals, bread)
Beverages		
Cereal based products		
Coffee		
Dairy		
Eggs		
Fish		
Fruit		
Meat		
Vegetable oils		
Pre-prepared meals		
Vegetables		
Mixed food		
Other		

3.3 Economic indicators

3.3.1 Costs

Total cost of the action implementation (in €)

Include here the total cost associated with the implementation of the prevention action

_____

What is the value of the avoided food waste? (in €)

If you do not have this information, it will be calculated by using proxies. This information should correspond to the duration of the action.

_____

Had food waste been generated, what would be the treatment process?

This information will help determine the costs and environmental burdens avoided by the action.

- ○ Anaerobic Digestion
- ○ Composting
- ○ Incineration
- ○ Landfill
- ○ Other
- ○ Unknown

If you selected other, please specify

_____

_____

_____

_____

_____

3.3.2 If you wish to provide additional information on the economic assessment of your initiative or in case you have used other economic indicators (e.g. financial benefits), you can include it in the space provided below (e.g. innovation - number of new products introduced on the market from food which would otherwise have been wasted, % growth for the commercial business linked to food waste prevention etc.).

_____

_____

_____

_____

_____

3.4 Environmental indicators

The environmental impacts of the prevention action should be determined using the same rationale as the total cost calculation.

3.4.1 Have you considered environmental indicators to assess the action?

- ○ Yes
- ○ No

If yes, please specify which ones and the results.

_____

_____

_____

_____

_____

3.4.2 If you wish to provide additional information on the environmental assessment of your initiative, you can include it in the space provided below.

_____

_____

_____

_____

_____

3.5 Social indicators

3.5.1 Please insert in the table the social indicators

	Value	Additional information
Poverty – number of meals donated		
Unemployment – number of jobs created		
Social inclusion – involvement of individuals and groups in the initiative either as person responsible for its implementation or as target audience with the aim to improve their situation in the society		
New skills – number of people who developed new competences while taking part in the initiative (either as person responsible for its implementation or as target audience)		

3.5.2 If you wish to provide additional information on the social assessment of your initiative or in case you have used other social indicators not included in 3.5.1, you can include it in the space provided below (e.g. indicator(s) used, value(s) obtained and how the assessment was conducted).

_____

_____

_____

_____

_____

3.6 Outreach and target audience impact

Please describe here the outreach and target audience impact by including relevant findings from quantitative and/or qualitative research wherever possible e.g. % audience reach; changes in awareness; understanding and/or behaviour; number of people mobilised by the action.

Please indicate how the impact was assessed and include findings pre- and post-intervention, should these be available.

_____

_____

_____

_____

_____

3.7 Is your action sustainable over time?

- ○ Yes
- ○ No

If yes, please use the space below to describe why and how is your action sustainable over time.

_____

_____

_____

_____

_____

3.8 What is the level of transferability of your action?

- ○ Transferability has not been considered. The action has been implemented for the geographic level selected in 2.7 and transferability was not considered in its design.
- ○ Ready for transfer, but the practice has not been transferred yet. The action has been developed for the geographic level selected in 2.7. Transferability was considered in its design and recommendations in this regard have been presented; however, the action has not been transferred yet.
- ○ The action has been transferred/replicated within the same country/region.
- ○ The action has been transferred to/replicated in another country.

If the action has been transferred, please use the space below to explain how it was done, the barriers and/or facilitators that you have identified and how you have addressed these.

_____

_____

_____

_____

_____

3.9 Was the action upscaled?

- ○ Yes
- ○ No

If yes, please use the space below to explain how the action was upscaled, the barriers and/or facilitators that you have identified and how you have addressed these.

_____

_____

_____

_____

_____

3.10 Was the action the result of a cooperation representated by a partnership between the private and the public sector and/or between different actors and stakeholders along the supply chain?

- ○ Yes
- ○ No

If yes, please use the space below to describe the various actors, how the partnership was created and conducted, and the barriers and/or facilitators that you have identified and how you have addressed these.

_____

_____

_____

_____

_____

3.11 Key learning regarding the implementation

Please introduce here positive elements, difficulties, challenges that you have encountered in the implementation of the action and what was done to overcome them.

_____

_____

_____

_____

_____

3.12 Action follow-up

If the action is concluded, please provide information on the follow-up plan, detailing how you ensure that the achievements and behavior changes are maintained.

_____

_____

_____

_____

_____

Appendix 4 – Food waste prevention actions presented in factsheets

Supply chain efficiency actions

4.1 Food Waste Trajectory

4.2 Training on food safety

4.3 Waste Watcher program

Consumers' behavior change actions

4.4 Action lunch box Zero waste

4.5 Foodwinners

Food redistribution actions

4.6 CollectMet

4.7 Conso'Aimable

4.8 Daily donations of unsold food

4.9 Feed the culture

4.10 Flavour food surplus distribution platform

4.11 Foodsavers

4.12 Frigo pour tous

4.13 Happy Hours Market

4.14 Soli-Dons

4.15 Too Good To Go

4.16 TooMuch

Food valorization

4.17 Les Glaneuses

Food waste prevention governance actions

4.18 Good Food strategy

4.19 Environmental permits and special conditions for unsold food donations

4.1 – Food Waste Trajectory

SUPPLY CHAIN EFFICIENCY	
TITLE: Food Waste Trajectory	2017 – ongoing
ORGANIZATION: FoodWIN	**LOCATION**: Flanders

SHORT DESCRIPTION

Everything starts with a baseline food waste measurement, tailored to the canteen. This measurement will show the manager how much and where food is lost in the canteen. The report identifies the most pressing challenges and shows potential savings.

Starting from the challenges uncovered by the measurement, the manager builds a strategy to cut down food waste. Involving stakeholders in this step is indispensable for successful food waste reduction. A co-created and clear action plan will give the solutions a dynamic boost in the upcoming months.

The manager can test multiple solutions, evaluate and communicate, … An impact measurement shows the fruit of the canteen's labor. It indicates how much food, money and co_2 emissions have been saved.

Stage of the FSC	**Actors**
Restaurants and food services sector	Municipalities, NGOs, food services

1. QUALITY OF THE ACTION DESIGN

The objective of the action is to reduce food waste in canteens (in the healthcare sector, schools, and companies), and the target is to have every canteen measuring their food waste by 2030 and reducing their food waste by 50%.

Every time they start working with a canteen, they conduct a baseline measurement and take it as a starting point.

They do an impact measurement by the end of the trajectory.

2. EFFECTIVENESS

No information provided.

3. EFFICIENCY

No information provided.

4. SUSTAINABILITY OF THE ACTION OVER TIME

The action is sustainable over time as it is a repeatable process, there is never an end.

5. TRANSFERABILITY AND SCALABILITY
The action has already been transferred and upscaled. Their process is openly available. Their goal is to impact as many canteens as possible. They provide paid support when necessary, but canteen owners can do it for free following their instructions. They are making their process leaner by minimizing the need for meetings, standardizing methods, and digitizing material.
6. INTERSECTORAL COOPERATION
Sometimes they work on subsidy projects.
KEY SUCCESS FACTORS AND BARRIERS
Canteens can really diminish their food waste. This has a positive result on their costs and gives the kitchen staff rewarding appreciation for their work.
ADDITIONAL COMMENTS
Action follow-up: they have follow-up calls and they invite the participants to their annual Food Waste Fest to keep them engaged.

Sources: questionnaire response, FoodWIN (n.d.)

4.2 – Training on food safety

SUPPLY CHAIN EFFICIENCY	
TITLE: Training on food safety	2008 – ongoing
ORGANIZATION: FASFC	**LOCATION**: Belgium

SHORT DESCRIPTION

They provide training on food safety, for free, to charity organizations which redistribute food surpluses. This enables more food to be redistributed, more people to benefit from it.

They give tens of training sessions every year, it depends on the year. They do it in person.

They also conducted a study to see if food products could be frozen up until the expiry date. They found out that it could be done so they are now allowing food banks and other charity organizations to do it, but under strict conditions: the date of freezing must be noted, the freezing must be done at the right temperature, in a freezer that is in order and clean, …

Stage of the FSC	**Actors**
Retail and other distribution of food	FASFC, NGOs

1. QUALITY OF THE ACTION DESIGN

The objective is to reduce food waste and to help people in precarious situations but they don't have specific targets and they don't measure anything.

Every year, they train multiple tens of charity organization, charity restaurants, CPAS, …

2. EFFECTIVENESS

The organizations trained are always very happy, it allows them to handle their operations more efficiently. However, there is no visible tendencies showing that the trainings have a positive effect (there isn't less complaints against these organizations for instance) because there is a high turnover of workers. They must therefore do them over and over again.

3. EFFICIENCY

No information provided.

4. SUSTAINABILITY OF THE ACTION OVER TIME

No information provided.

5. TRANSFERABILITY AND SCALABILITY

Transferability has not been considered because this action is not their core business.

6. INTERSECTORAL COOPERATION
No information provided.
KEY SUCCESS FACTORS AND BARRIERS
No information provided.
ADDITIONAL COMMENTS

Source: questionnaire response

4.3 – Waste Watcher program

SUPPLY CHAIN EFFICIENCY	
TITLE: Waste Watcher program	2017 – ongoing
ORGANIZATION: IKEA	**LOCATION**: Belgium
SHORT DESCRIPTION The program was introduced with training in the stores in 2017. In 2020, they implemented an AI system to help the stores, they re-trained everyone with focus on action plans.	
Stage of the FSC Restaurants and food services sector	**Actors** Retailers, restaurants/hospitality sector
1. QUALITY OF THE ACTION DESIGN They weight their production of food waste, analyze the figures, create the action plan, and act on it. Their objective is to reduce their food waste and the target is to reduce it by 50% by the end of 2021. Their measurement is the weight of food waste per ticket in their food department. The baseline was 30g of food waste per ticket in 2017 so they want to reduce that to 15g. There is a monitoring system in place, the Winnow Waste Watcher system.	
2. EFFECTIVENESS All the stores are participating in the action. No other information provided.	
3. EFFICIENCY In 4 years, the program has prevented 400t of food from being wasted. This is valued at 1.5 million euros and is preventing 1,666.80t of CO_2e from being released. The cost of the action was 250 thousand euros.	
4. SUSTAINABILITY OF THE ACTION OVER TIME The action is not sustainable over time	
5. TRANSFERABILITY AND SCALABILITY The action is transferred to other countries as it is picked up by their global organization and is rolled out afterwards to all the countries they are in. The action was upscaled as they agreed on a global contract with their supplier, created trainings and implemented workgroups to support all markets.	

6. INTERSECTORAL COOPERATION The action was not the result of a cooperation.
KEY SUCCESS FACTORS AND BARRIERS For this to be successful, the highest management must give it a lot of attention.
ADDITIONAL COMMENTS

Source: questionnaire response

4.4 – Action lunch box Zero waste

<table>
<tr><td colspan="3">CONSUMERS' BEHAVIOR CHANGE</td></tr>
<tr><td colspan="2">TITLE: Action lunch box Zero waste</td><td>May – August 2019</td></tr>
<tr><td>ORGANIZATION: BEP</td><td colspan="2">LOCATION: Philippeville</td></tr>
<tr><td colspan="3">SHORT DESCRIPTION

An action targeting restaurants with the aim of avoiding food waste by offering a practical, solid and sustainable lunchbox, was set up in Philippeville, a "Zero waste" commune. It was an awareness campaign, offering customers to take back the leftovers from their meals. The 6 participating restaurants gave leaflets to raise awareness about food waste reduction and a lunchbox to their customers, and they put a promotional sticker on their front window to show their commitment.</td></tr>
<tr><td>Stage of the FSC

Restaurants and food services sector</td><td colspan="2">Actors

Municipalities, food service, restaurants, consumers, other (Intercommuncale de gestion de déchets)</td></tr>
<tr><td colspan="3">1. QUALITY OF THE ACTION DESIGN

The aim of the action was twofold: to raise awareness about food waste reduction and to reuse the lunchboxes. The objective was to reduce food waste in restaurants while using reusable containers. No specific target was mentioned.

The number of restaurant owners interested and of lunchboxes distributed was monitored. At the end of the action, the restaurant owners were called to evaluate the action.</td></tr>
<tr><td colspan="3">2. EFFECTIVENESS

This pilot project involved 6 restaurants and it was estimated that 350 people were reached during the project. It was assessed that the project kept going autonomously after the evaluation with the restaurant owners, but no more information is known on this regard.</td></tr>
<tr><td colspan="3">3. EFFICIENCY

No information was provided on the amount of food waste avoided.

The action cost 13,000 €.</td></tr>
<tr><td colspan="3">4. SUSTAINABILITY OF THE ACTION OVER TIME

No information provided.</td></tr>
<tr><td colspan="3">5. TRANSFERABILITY AND SCALABILITY</td></tr>
</table>

This was a pilot project. The idea is to propose it again in other communes. It is therefore ready for transfer, but has not been transferred yet. And it has not been upscaled.
6. INTERSECTORAL COOPERATION No information provided.
KEY SUCCESS FACTORS AND BARRIERS They had to meet the restaurant owners to give them the material for the action and make them sign the commitment charter, but it was difficult to find a meeting time as restaurant owners have peculiar schedules and are always busy. They employed students to contact the restaurant owners, evaluate the action, and visit the restaurants. The restaurant owners were mostly satisfied. The materials were deemed useful as some already offered boxes but appreciated the more global awareness campaign around it. The explanatory leaflet was more effective than the cardboard to be put on the tables.
ADDITIONAL COMMENTS

Source: questionnaire response

4.5 – Foodwinners

CONSUMERS' BEHAVIOR CHANGE	
TITLE: Foodwinners	2020 – ongoing
ORGANIZATION: City of Bruges	**LOCATION**: Bruges

SHORT DESCRIPTION

In the context of the European 'Food Smart Cities for Development' project, the city of Bruges drew up a strategy (Bruggesmaakt) to promote sustainable food: the Food Guidelines. Food waste is included in Bruggesmaakt.

To reduce food waste in households, the City of Bruges and Foodwin first trained 50 "ambassadors" for 5 months to become experts in reducing food waste. Together with the ambassadors, they then found 500 households willing to participate in a 5-week campaign with impact measurement and tips, which is still running in June 2021. Next year, they want to reach 5000 households in Bruges.

Stage of the FSC	**Actors**
Households	Municipalities and NGOs (Foodwin)

1. QUALITY OF THE ACTION DESIGN

The City of Bruges clearly defined the action and has an action plan ready, with three stages in three years. Stages might be added later on. The objectives in terms of household reached and food waste reduction are stated before each stage begins. The households are asked to measure their food waste before and after the campaign to evaluate food waste reduction.

2. EFFECTIVENESS

The first stage was a success: the ambassadors reduced 65% of their food waste.

The second stage was successful in finding 500 households to participate, but as the campaign is still running, it is not yet known whether they will reach their 30% of food waste reduction in participating households or not.

The third stage, in 2022, aims to reach 5000 households and a 30% reduction in food waste as well.

3. EFFICIENCY

No information provided.

4. SUSTAINABILITY OF THE ACTION OVER TIME

No information provided.

5. TRANSFERABILITY AND SCALABILITY

The practice is ready for transfer but has not been transferred yet. The City of Bruges is planning on producing a manual that other cities can use.
6. INTERSECTORAL COOPERATION The action is not the result of a cooperation as the only other actor involved (Foodwin) is hired through a tender.
KEY SUCCESS FACTORS AND BARRIERS No information provided.
ADDITIONAL COMMENTS

Sources: questionnaire response, FoodWIN (2020)

4.6 – CollectMet

<table>
<tr><td colspan="3">REDISTRIBUTION</td></tr>
<tr><td colspan="2">TITLE: CollectMet</td><td>2015 – ongoing</td></tr>
<tr><td>ORGANIZATION: Cultureghem</td><td colspan="2">LOCATION: Anderlecht (the Brussels region)</td></tr>
<tr><td colspan="3">SHORT DESCRIPTION

Collect unsold produces from the farmers' market and redistribute them to people in precarious situations. They collect once a week.

For more than 3 years, they looked for funds to make it more permanent because it was just run by volunteers, which was complicated. For 3 years now, they got funding and were then able to hire someone on the project, which allowed them to professionalize and to perpetuate the project. Today the municipality supports the project.</td></tr>
<tr><td>Stage of the FSC

Retail and other distribution of food</td><td colspan="2">Actors

Municipalities, NGOs</td></tr>
<tr><td colspan="3">7. QUALITY OF THE ACTION DESIGN

The objectives of the action are to reduce food waste and to help people in precarious situations. They don't have specific targets but they monitor their operations by looking at the numbers, the food saved, its quality, the beneficiaries, …</td></tr>
<tr><td colspan="3">8. EFFECTIVENESS

They prevent 3t of food from being wasted every week, so about 2000 meals are given to people in need.

About 60 people come to pick up a food package on Sunday.</td></tr>
<tr><td colspan="3">9. EFFICIENCY

Every year, they prevent 156t of food from being wasted.

The action costs 55 thousand euros per year.</td></tr>
<tr><td colspan="3">10. SUSTAINABILITY OF THE ACTION OVER TIME

The action is only partly sustainable over time because they are not profitable but they prove to the ones who invest in them that their investment in the project is way more profitable than not to do anything at all.</td></tr>
<tr><td colspan="3">11. TRANSFERABILITY AND SCALABILITY</td></tr>
</table>

The action has never been transferred nor upscaled, but they would happily share their experience with anyone interested.
12. INTERSECTORAL COOPERATION The action was not the result of a cooperation.
KEY SUCCESS FACTORS AND BARRIERS The most difficult thing is to fund the project. Once they have that, they can put a lot of things in place for it to work well.
ADDITIONAL COMMENTS

Source: questionnaire response

4.7 – Conso'Aimable

<table>
<tr><td colspan="3">REDISTRIBUTION</td></tr>
<tr><td colspan="2">TITLE: Conso'Aimable</td><td>July 2018 – ongoing</td></tr>
<tr><td>ORGANIZATION: Conso'Aimable ASBL</td><td colspan="2">LOCATION: Liège and surroundings</td></tr>
<tr><td colspan="3">SHORT DESCRIPTION

Project started in 2018, run solely by volunteers and without subvention, aiming to fight poverty and food waste.

Distribution of fresh unsold vegetables coming from the auction of Malines to 200 households living under the poverty line every week.</td></tr>
<tr><td>Stage of the FSC

Primary production</td><td colspan="2">Actors

Farmers, ONGs (6 volunteers)</td></tr>
<tr><td colspan="3">1. QUALITY OF THE ACTION DESIGN

The objective is to help households living under the poverty line.

They monitor it by encoding the number of people at the distributions every week.</td></tr>
<tr><td colspan="3">2. EFFECTIVENESS

They help 200 households every week.</td></tr>
<tr><td colspan="3">3. EFFICIENCY

In 3 years, they have prevented approximately 100t of food from being wasted.

The costs of the action were not provided.</td></tr>
<tr><td colspan="3">4. SUSTAINABILITY OF THE ACTION OVER TIME

The action is sustainable over time if they find funding.</td></tr>
<tr><td colspan="3">5. TRANSFERABILITY AND SCALABILITY

Transferability has not been considered and the action has not been upscaled.</td></tr>
<tr><td colspan="3">6. INTERSECTORAL COOPERATION

The action was not the result of a cooperation.</td></tr>
<tr><td colspan="3">KEY SUCCESS FACTORS AND BARRIERS

Starting with our own funds. In 3 years, 8500 euros of donation allowed us to buy a van in order to go to the auction of Malines every week, thanks to an access card which allows us to take 150,000</td></tr>
</table>

kg/year. We can't sell these vegetables, so to be able to pay the expenses of the van (gasoline, maintenance, ...), we ask a participation of maximum 2 euros to the people who take our bags of vegetables (between 2.5 kg and 5 kg according to the seasons). Those who cannot give anything or less, have the right to take it like the others. Solidarity is present.
ADDITIONAL COMMENTS

Source: questionnaire response

4.8 – Daily donations of unsold food

<table>
<tr><td colspan="3">REDISTRIBUTION</td></tr>
<tr><td colspan="2">TITLE: Daily donations of unsold food</td><td>1995 – ongoing</td></tr>
<tr><td>ORGANIZATION: Colruyt Group</td><td colspan="2">LOCATION: Belgium</td></tr>
<tr><td colspan="3">SHORT DESCRIPTION

The food surplus items from all stores (Colruyt, Okay, Okay Compact, Bio-Planet, Cru), distribution centers, Colruyt Group Academies, and production sites (meat, cheese,…) that can still be consumed for at least 2 days are given to charity organizations, specifically organizations helping people in precarious situations. The non-food surplus items (toys, care products,…) are also donated with the same purpose.

Concretely, they prepare the products in boxes and/or pallets, together with a list of goods. The organizations come at specific times to collect it.</td></tr>
<tr><td colspan="2">Stage of the FSC

Retail and other distribution of food</td><td>Actors

Municipalities, NGOs, professional organizations</td></tr>
<tr><td colspan="3">1. QUALITY OF THE ACTION DESIGN

The objective of the action is to reduce food waste and to help people in precarious situations. The target is to reduce food waste by 70%.

All the products that are taken out of the stock are registered through their system, with their destination. They can therefore monitor each stock movement, including waste and donations.</td></tr>
<tr><td colspan="3">2. EFFECTIVENESS

If the receiving organization ends up needing to waste some of the products received, they can give it back to the Colruyt Group. This happens in less than 0.1% of cases, meaning that the goods arrive in time at their destination.

No information is provided on whether they reach the 70% mark or not.</td></tr>
<tr><td colspan="3">3. EFFICIENCY

The Colruyt Group prevents more than 4,500t of food from being wasted every year in Belgium, of which about 95% are fresh products (fruits, vegetables, dairy, cold cuts).

The costs are insignificant.</td></tr>
<tr><td colspan="3">4. SUSTAINABILITY OF THE ACTION OVER TIME

The action is sustainable over time as they bear very little costs for it.</td></tr>
</table>

5. TRANSFERABILITY AND SCALABILITY
The action has been transferred to other countries as retailers all over the world donate their surplus following Colruyt Group's method. The action was upscaled as well.
6. INTERSECTORAL COOPERATION
The action was the result of a cooperation with local authorities and charity organizations. They were consulted to conceive together a way of working that would be beneficial for all stakeholders.
KEY SUCCESS FACTORS AND BARRIERS
The preparation of goods is an integral part of their working methods. No extra time is spent on this task. A positive aspect is that this is a win-win situation. A negative aspect is that they must find organizations with whom it is legally possible to start cooperating. Another one is that there is no unity between the organizations.
ADDITIONAL COMMENTS
They have many different ways of treating the waste, depending on the product, to make the products that are no longer consumable valuable again (circular economy). For example, coffee grounds are used to grow mushrooms and bread is used as raw material for biscuits or *chapelure* (breadcrumbs).

Source: questionnaire response

4.9 – Feed the culture

REDISTRIBUTION	
TITLE: Feed the culture	May 2020 – ongoing
ORGANIZATION: Feed the culture	**LOCATION**: Brussels

SHORT DESCRIPTION

Since the start of the COVID-19 crisis, the cultural, creative, and events sector is going through an unprecedented crisis. This already fragile sector had no concrete, practical, regular, and free solution to get out of these difficulties. Feed the culture was born in May 2020 to address one problem: food. Their distributions are exclusively reserved for professional workers in the cultural, creative, and events sector: performing arts (dance, theater, music, circus), books and publishing, architecture and heritage, fashion and design, audiovisual, plastic and visual arts, advertising, media, events; and for all profiles: student, employee, unemployed, self-employed, artist with or without status.

Stage of the FSC	**Actors**
Retail and other distribution of food	Regional government, municipalities, NGOs

1. QUALITY OF THE ACTION DESIGN

The objective of Feed the culture, as their name indicates, is to distribute food to workers in the cultural sector. They don't have any specific target; they just collect as much food as possible and redistribute it. They don't have a monitoring system in place.

2. EFFECTIVENESS

Feed the culture distributes 300 food packages every week, each bag worth between 70 and 200 € of products.

3. EFFICIENCY

Feed the culture distributes 300 food packages every week, which amounts to about 1.5t of food waste prevented per week.

The costs of the action were not provided.

4. SUSTAINABILITY OF THE ACTION OVER TIME

The action is sustainable over time because the sector will still be facing difficulties in 2 years. They must therefore rely on themselves and the public authorities.

5. TRANSFERABILITY AND SCALABILITY

The action is ready for transfer, but has not been transferred yet. The practice hasn't been upscaled.

6. INTERSECTORAL COOPERATION
Actors of various food distribution initiatives know, meet, and call each other.
KEY SUCCESS FACTORS AND BARRIERS
They are facing the following difficulties: find enough and diversified surplus food, find (and keep) volunteers each week, find a place to occupy for the longest time possible, organize the funding and being structured.
ADDITIONAL COMMENTS

Source: questionnaire response

4.10 – Flavour food surplus distribution platform

<table>
<tr><td colspan="3">REDISTRIBUTION</td></tr>
<tr><td colspan="2">TITLE: Flavour food surplus distribution platform</td><td>June 2020 – ongoing</td></tr>
<tr><td>ORGANIZATION: City of Bruges</td><td colspan="2">LOCATION: Bruges and municipalities around</td></tr>
<tr><td colspan="3">SHORT DESCRIPTION

The distribution platform started in June 2020 and in 6 months they had gathered, sorted, and delivered 34 tons of surplus food; they employed 3 workers far from the labor market; and they collaborated with 15 organizations who redistribute food surpluses or prepare meals for people in need.</td></tr>
<tr><td>Stage of the FSC

Retail and other distribution of food</td><td colspan="2">Actors

Municipalities, NGOs, retailers</td></tr>
<tr><td colspan="3">1. QUALITY OF THE ACTION DESIGN

The main goals of the action are to reduce food surplus, to save CO_2, to provide food aid, and to give jobs to people far from the labor market. The target associated to the first goal is to prevent 70 tons of food from going to waste in a year, but no information was provided for the other objectives.

They use standard reporting formats: survey, workbook, annual progress report, etc.</td></tr>
<tr><td colspan="3">2. EFFECTIVENESS

In the first 6 months, they produced the following results:

- To reduce food surplus: 34 tons (which is almost on track to 70 tons in a year)
- To provide food aid: collaboration with 15 organizations
- To give jobs to people far from the labor market: 3 workers employed

And after a year, they had reached the 70 tons of food waste prevented.</td></tr>
<tr><td colspan="3">3. EFFICIENCY

In 12 months, 70t of food waste was prevented: 30% was vegetables, 19% dairy, 14% fruits, 10% meat, and 2% bread; the rest is unknown.

The costs of the action were not provided.</td></tr>
<tr><td colspan="3">4. SUSTAINABILITY OF THE ACTION OVER TIME

No information provided.</td></tr>
<tr><td colspan="3">5. TRANSFERABILITY AND SCALABILITY</td></tr>
</table>

The practice is ready for transfer, but has not been transferred yet. The practice has been upscaled already as they started with a limited number of local organizations in Bruges and upscaled to a larger number and to local organizations of other municipalities close to Bruges.
6. INTERSECTORAL COOPERATION Exchange and collaboration are a core activity within the framework of the Flavour Interreg project. As the whole project is to link retailers and organizations to redistribute food, it cannot be done without good partnerships with those actors.
KEY SUCCESS FACTORS AND BARRIERS They conducted a survey among the organizations receiving the food surplus: - 62% of the organizations think the amount received is sufficient - The most valued products by the organizations are vegetables, fruits, potatoes, meat, eggs - 80% of the organizations state that the distribution is a support for them to a (very) large extent - All organizations think that the internal communication is (very) good - A large majority of the organizations think that the collaboration with the workers is very good
ADDITIONAL COMMENTS

Source: questionnaire response

4.11 – Foodsavers

<table>
<tr><td colspan="3">REDISTRIBUTION</td></tr>
<tr><td colspan="2">TITLE: Foodsavers</td><td>2017 – ongoing</td></tr>
<tr><td>ORGANIZATION: City of Ghent</td><td colspan="2">LOCATION: Ghent</td></tr>
<tr><td colspan="3">SHORT DESCRIPTION

Foodsavers started in 2017 and is an ongoing collaboration project between the social services and the department of welfare and climate of the city council of Ghent. It is financed on several levels: the city, the social services, national and regional funding (for the social employment).</td></tr>
<tr><td>Stage of the FSC

Retail and other distribution of food</td><td colspan="2">Actors

Regional government, municipalities, NGOs, wholesalers, retailers</td></tr>
<tr><td colspan="3">1. QUALITY OF THE ACTION DESIGN

The action has a variety of objectives:

- Climate: reduce carbon emissions by collecting and redistributing food surplus
- Social employment: people with needs are educated and supported to work at Foodsavers, as a work-activation project towards the regular job market
- Poverty reduction: food surplus is redistributed to social and charity organizations

Except for the first year’s target of distributing 100 tons of food surplus, no information is given on targets for the other objectives or for the following years.

To monitor the quantity of products received, the order picking system of the Colruyt group is used.</td></tr>
<tr><td colspan="3">2. EFFECTIVENESS

The action has produced the following results in 2020:

- Climate: 676.31 tons of food are collected, and 664.6 tons are distributed, resulting in a reduction of 1,711 tons of CO_2
- Social employment: 23 people employed
- Poverty reduction: 103 social and charity organizations are receiving food surplus</td></tr>
<tr><td colspan="3">3. EFFICIENCY

In 12 months, 398,555 meals were donated, which is equivalent to 676.31 tons of food waste prevented: 36% was vegetables, 17% fruits, 13% dairy, 10% pre-prepared meals, 8% beverages, 6% meat, and 4% cereal-based products; the rest is unknown.</td></tr>
</table>

The costs of the action were not provided.
4. SUSTAINABILITY OF THE ACTION OVER TIME No information provided.
5. TRANSFERABILITY AND SCALABILITY The action has already been transferred to other municipalities as Foodsavers Ghent is a good practice that is copied in many different places in Flanders, with the support of HERWIN (a national organization that supports municipalities on developing social employment). The action was upscaled in Ghent as more social and charity organizations as well as more retailers are demanding.
6. INTERSECTORAL COOPERATION Intersectoral cooperation is the basis of the project.
KEY SUCCESS FACTORS AND BARRIERS Social employment: not all people employed are able to find a regular job, they stay in the system. Working in a social employment system has impact on the results as every step in the process takes more time. People need more time to understand the content of their job (because they do not speak Dutch, or because they are analphabetic, or have other difficulties). Because of the large scale, retailers are willing to collaborate. Before, the surplus distribution was amateurish, and had few perspectives. Food safety measures: because of the professional approach, food safety is guaranteed.
ADDITIONAL COMMENTS

Source: questionnaire response

4.12 – Frigo pour tous

REDISTRIBUTION	
TITLE: Frigo pour tous	2016 – ongoing
ORGANIZATION: Sharefood	**LOCATION**: Brussels
SHORT DESCRIPTION The action is simple: they collect surplus food from supermarkets and other shops, and they distribute it the next day. They have objectives in terms of awareness of citizens and politics, but they lack the time to execute them.	
Stage of the FSC Retail and other distribution of food	**Actors** Municipalities, professional organizations, wholesalers, retailers, food services, restaurants/hospitality sector
7. QUALITY OF THE ACTION DESIGN The objectives of the action are twofold: the fight against food waste (for ecological reasons) and the fight against food and social insecurity. They do not have specific targets, they do as much as they can every day. They do not have a continuous measuring system in place, but they did measure during one month the amount of food waste prevented.	
8. EFFECTIVENESS Regarding the fight against food waste, they save about 1t of food every week. Regarding food insecurity, they donate between 200 and 250 meals every week.	
9. EFFICIENCY In one month, between 800 and 1,000 meals were donated, resulting in 4t of food waste prevented: 32% was vegetables, 20% fruits, 20% pre-prepared meals, 17% dairy, 0.5% beverages, and 0.5% eggs. The cost of the action is around 1000 €.	
10. SUSTAINABILITY OF THE ACTION OVER TIME As long as food will be wasted, the action will be useful. The action is sustainable as it requires few things: human solidarity, the work of volunteers, and a bit of coordination.	

11. TRANSFERABILITY AND SCALABILITY This action was replicated from other already existing solidary fridges.
12. INTERSECTORAL COOPERATION This action was not the result of a cooperation.
KEY SUCCESS FACTORS AND BARRIERS A positive element is the goodwill of the volunteers. The main difficulty is the human resources management. They have yet to find a way to handle it efficiently.
ADDITIONAL COMMENTS

Source: questionnaire response

4.13 – Happy Hours Market

REDISTRIBUTION	
TITLE: Happy Hours Market	February 2019 – ongoing
ORGANIZATION: Happy Hours Market	**LOCATION**: Belgium

SHORT DESCRIPTION

Happy Hours Market is an ecological and social initiative whose mission is to reduce food waste while improving charities food provisions. In Brussels: food waste from large retailers is estimated to be 95.000 tons per year = 1% to 3% of their turnover. Only 13% of unsold products from large retailers is donated or valued. To that aim, they have developed a new distribution network to prevent surplus food from supermarkets from being thrown away. With their logistic process and innovative technology, they provide citizens daily access to shops' unsold products at reduced price through their App and they foster charities food collection. On the one hand, they target people willing to fight food waste for ecological reasons and on the other hand, people who want to save money on their groceries.

Their logistic process:
17h30: Daily surplus food collection from their partner stores
19h30-21h: The products are available at a reduced price through their App and website and can be collected at their pickup points in the city.
21h: At least 50% of unsold products from supermarkets are delivered to charities, free of charge.

Stage of the FSC	**Actors**
Retail and other distribution of food	Municipalities, NGOs, wholesalers, retailers, consumers

1. QUALITY OF THE ACTION DESIGN

The aim of the action is well defined, but no target was set. To achieve the objectives, they have a good logistic process and an innovative technology (the App/website).

They use several dashboards to analyze how much food they prevent from being wasted, how much they sell, and how much they distribute to organizations.

2. EFFECTIVENESS

Two years after launching the App, they have more than 21,000 users and have saved more than 500 tons of food. On average, 50% of food collected is sold to consumers at half the price and 50% is distributed to charities.

3. EFFICIENCY In 28 months, 500 tons of food waste was prevented. Their costs are covered by the money raised with a crowdfunding campaign (165,000 €).
4. SUSTAINABILITY OF THE ACTION OVER TIME As they have a source of revenue (from the sale of surplus food), it seems that the action is sustainable over time.
5. TRANSFERABILITY AND SCALABILITY The action has already been transferred and upscaled in other parts of Belgium. The business model is sustainable and should be easily replicated, but there are some barriers (see below).
6. INTERSECTORAL COOPERATION The action involves various actors, so there must be a cooperation, but it is initiated by Happy Hours Market.
KEY SUCCESS FACTORS AND BARRIERS They need the agreement from the municipality to install a pickup point in a commune in Belgium, which is sometimes rejected even though they already have the support of consumers and supermarkets. It is difficult to negotiate with some supermarkets because they think that it will be complicated to collaborate with Happy Hours Market while in reality the cooperation would facilitate their operations and make them save money. Some NGOs are against Happy Hours Market because they consider that Happy Hours steals food from them by selling part of it to consumers but in reality, Happy Hours delivers them much more food than they would have gotten on their own because Happy Hours has the means to do so. Consequently, the NGOs spread fake news about Happy Hours to the supermarkets. To overcome these difficulties, they do marketing campaigns and they raise awareness of their action.
ADDITIONAL COMMENTS

Source: questionnaire response

4.14 – Soli-Dons

REDISTRIBUTION	
TITLE: Soli-Dons	June 2018 – ongoing
ORGANIZATION: Soli-Dons	**LOCATION**: Walloon Brabant

SHORT DESCRIPTION

They recuperate unsold food from retailers, farmers, and processing facilities, and they make food packages for people in precarious situations. They pick up food from the stores 6 days out of the week. Because they have a room too small to make packages out of all the food they collect, they distribute part of what they receive to other organizations. The packages are mostly composed of fresh products (fruits, vegetables, dairy, eggs, cold cuts, …)

Their beneficiaries are all people in precarious situations sent from the CPAS. They can get one free package every week for 2 months and at the end, if they still need help, they must go back to the CPAS and ask for an extension but then they must pay 2€ per package and they are allowed to pick up 20 more packages, which differs from having one per week for a specific period.

In addition, they do "soup workshops" in the evening for which they recuperate vegetables, but this is punctual, and it has stopped with the COVID-19. This was more of an awareness action.

Stage of the FSC	**Actors**
Primary production, processing and manufacturing, retail and other distribution of food	Retailers, the Brussels-Brabant Food Bank, farmers, processors/manufacturers, CPAS, NGOs

1. QUALITY OF THE ACTION DESIGN

The objectives of Soli-Dons are to reduce food waste and to help people in precarious situations, but they don't have specific targets. They are a small team, working with volunteers, and they don't have the means to do so.

Concerning food waste, they aim to recuperate everything that their partner stores give them.

Concerning the food packages, they don't have precise objectives, they rather have constraints (because of a room that is too small): they can make 25-30 packages per day.

2. EFFECTIVENESS

They save about 120t of food from being waste in a year, and they distribute approximately 300 packages every month.

In 2020, they helped 304 different families so 723 persons, each coming for 2-7 months.

3. EFFICIENCY

In 2020, they received 126t of surplus food from their partners, and they donated 3,566 food packages.

Total cost of the action in 2020 was 46 thousand euros.

4. SUSTAINABILITY OF THE ACTION OVER TIME

As long as they can find funding, the action is sustainable over time.

5. TRANSFERABILITY AND SCALABILITY

The action has been upscaled but not really transferred yet, even though it could be done. Indeed, they started in Nivelles and have then expended to other municipalities.

6. INTERSECTORAL COOPERATION

They cooperate with many other actors (CPAS, NGOs,…) in this project.

KEY SUCCESS FACTORS AND BARRIERS

Success factors:

- The funding they receive from public authorities
- The fact that they have people employed in addition to the volunteers, meaning they they work normal hours (Monday-Friday/Saturday, 8h30-17h) which allows them to be more professional
- They also have people in professional reintegration, meaning that they have people sent and paid by the CPAS who are working for them full-time for a year
- They have the material to respect the cold chain (refrigerated vans, cold room)
- They had a logistic problem as they needed to pick up food from many different places in a short timeframe, and were able to solve it by buying a second van with funding they received

Difficulties:

- They don't have a renewed funding every year, so they must spend time to find new funding
- Their room is too small and not adapted for their activities
- Part of what they receive from retailers should not have been given to them (products already past their expiry date,…) → the retailers should help them more, should maybe even fund them

ADDITIONAL COMMENTS

Source: questionnaire response

4.15 – Too Good To Go

REDISTRIBUTION	
TITLE: Too Good To Go	2016 – ongoing
ORGANIZATION: Too Good To Go (BE)	**LOCATION**: World (Belgium)

SHORT DESCRIPTION

Too Good To Go is an application that sells surplus food from food services and retailers to final consumers.

The Movement against food waste: Too Good To Go targets four pillars (households, businesses, schools, and public affairs) and creates awareness campaigns (for example on date labelling, which will be launched in September).

The app: it is the most direct way for anyone to get involved – just download, log on, and get saving perfectly good surplus food from your local stores. It's always a surprise and an instant good deed for the planet.

Stage of the FSC	**Actors**
Processing and manufacturing, retail and other distribution of food, Restaurants and food services sector	National & regional governments, farmers, processors/manufacturers, wholesalers, retailers, food service, restaurants/hospitality sector, schools, consumers, opinion leaders

1. QUALITY OF THE ACTION DESIGN

Too Good To Go has the mission to inspire and empower everyone to take action against food waste. They have set out a new ambition – to contribute in every way they can to building the global food waste movement. Their app targets consumers and businesses (HoReCa, manufacturers, etc), but with their movement they target even more people in households, politics, schools, and enterprises.

They have a measuring tool, reporting on the amount of meals saved, on the saved ratio (amount of meals saved over supply), and on other data such as CO2 equivalent.

2. EFFECTIVENESS

On a worldwide scale, the following goals were meant to be reached by 2020:

- To save 100 million meals in Europe: at 82% in July 2021 (82.2 million meals saved)
- To inspire 50 million people to take action against food waste (measured in number of registered users on the application): at 82% in July 2021 (41.2 million people)
- To partner with 75,000 businesses: at 100% in July 2021 (102,180 partners)

- To inspire 500 schools (they work with schools and universities through events and conferences, lectures and supported research): at 100% in July 2021
- To impact the political agenda in at least 5 countries (through their own campaigns and initiatives with fellow partners): at 100% in July 2021

Over a year after the deadline, two out of the five indicators are not reached.

Unfortunately, no information was provided on the effectiveness of the Belgian operations.

3. EFFICIENCY

In 40 months, 4,684,788 meals were donated in Belgium, resulting in 4,700t of food waste prevented.

The costs of the action were not provided.

4. SUSTAINABILITY OF THE ACTION OVER TIME

Too Good To Go is a growing company, proof of its sustainable business model.

5. TRANSFERABILITY AND SCALABILITY

Too Good To Go is fully transferable and scalable, present in 14 countries in Europe and the United States.

6. INTERSECTORAL COOPERATION

Too Good To Go is an application where retailers and food services sell their surplus food to consumers. Cooperation between these actors is therefore at the root of the business model.

KEY SUCCESS FACTORS AND BARRIERS

A challenge is to keep consumers active once they have downloaded the app and to keep them inspired.

ADDITIONAL COMMENTS

Sources: questionnaire response, Too Good To Go International (n.d.-a), Too Good To Go International (n.d.-b)

4.16 – TooMuch

REDISTRIBUTION	
TITLE: TooMuch: I give you take	2019 – ongoing
ORGANIZATION: TooMuch	**LOCATION**: Belgium
SHORT DESCRIPTION The App/website TooMuch puts in contact for free those who prefer to donate than to waste with those who prefer to collect than to pay.	
Stage of the FSC Households	**Actors** Individuals, consumers
1. QUALITY OF THE ACTION DESIGN The action wasn't really designed. They had the idea of enabling citizens to exchange food and they made it happen so that it exists for those who want to use it. The objective is to reduce households food waste but no target was set nor any monitoring system. They decided to make it on a website and not in an App to make it easier to access for people in precarious situations (homeless people for example). In the beginning (first 3 months), someone monitored the number of exchanges every day.	
2. EFFECTIVENESS No information provided.	
3. EFFICIENCY During the first 3 months, there was about 100 meals were exchanged every day. It cost 10 thousand euros to set up the action (the App/website).	
4. SUSTAINABILITY OF THE ACTION OVER TIME The action is sustainable over time because once the App/website is set up, the costs are insignificant so even if there are just a few users, there is no reason to take it down.	
5. TRANSFERABILITY AND SCALABILITY The action is ready to be transferred, but has not been yet. The action is also ready to be upscaled, the website is technically working everywhere, but it isn't active in other countries (just a little bit in Paris, France).	
6. INTERSECTORAL COOPERATION	

The action was not the result of a cooperation.
KEY SUCCESS FACTORS AND BARRIERS This was used as a first contact between restaurants and organizations, that later kept exchanging outside the app. Positive points were the enthusiasm of the media at the beginning, the fact that people wanted something like that. Difficulties are IT management issues, creation of the App (making it simple to use and not costly), keeping people on the App: the media brought people at the beginning but the effect slowed down and the word-of-month is not enough to create a usage reflex.
ADDITIONAL COMMENTS Action follow-up: once in a while he makes sure that everything is alright.

Source: questionnaire response

4.17 – Les Glaneuses

FOOD VALORISATION (Value added processing)	
TITLE: Les Glaneuses	March 2020 – ongoing
ORGANIZATION: Les Glaneuses	**LOCATION**: Belgium (French Community)

SHORT DESCRIPTION

The main activity of Les Glaneuses is gleaning and transformation of surplus food from organic stores into long-life dry products, but they also do workshops about preservation which is a solution to food waste.

She is working alone, without funds or subsidies. She is producing the dried goods half-time and doing the workshops half-time. The workshops are flexible and deal with all subjects that concern preservation. She tries to work in partnerships as much as possible for the workshops.

Stage of the FSC	**Actors**
Retail and other distribution of food	Professional organizations, wholesalers

1. QUALITY OF THE ACTION DESIGN

The objectives of the action are to reduce food waste and to educate people so that they won't waste anymore. They don't have more precise targets.

They look at the number of broths and flavored salts sold, and the number of participants in the workshops. They don't have a monitoring system.

2. EFFECTIVENESS

No information provided.

3. EFFICIENCY

In one month, 120 kg of food waste was prevented: 70% was vegetables, 10% fruits, and 10% cereal-based products (bread); the rest is unknown.

The costs of the action were not provided.

4. SUSTAINABILITY OF THE ACTION OVER TIME

For now, the action is not sustainable over time. The action costs much more than it is bringing in but it is only the launch phase. An assessment will be performed in February.

5. TRANSFERABILITY AND SCALABILITY

The action is ready to be transferred, but it has not been yet. The action was not upscaled either.

6. INTERSECTORAL COOPERATION
The action was not the result of a cooperation.
KEY SUCCESS FACTORS AND BARRIERS
Positive elements are the positive feedback and the enthusiasm of the public, the fact that the action meets a demand, and that surplus food is prevented from being wasted. Negative elements are that products must be sold at a too high price for it to be profitable, that no help from the public authorities was received, the taxes are too high, and that it is difficult to start such a project with little finances.
ADDITIONAL COMMENTS

Source: questionnaire response

4.18 – Good Food Strategy

FOOD WASTE PREVENTION GOVERNANCE (National food waste prevention program)	
TITLE: (first) Good Food strategy	2016 – 2020
ORGANIZATION: Brussels Environment	**LOCATION**: the Brussels-Capital region

SHORT DESCRIPTION

During the first Good Food strategy, awareness raising activities concerning food waste in Brussels included pilot projects in collaboration with non-profit and private organizations (calls for proposals). Within the framework of zero waste actions, a challenge for households is organized, in which the fight against food waste is included. Canteens wishing to obtain the Good Food canteen label must have a system in place to measure food waste annually. The training programs offered for canteens also include sessions dedicated to the prevention of food waste. Restaurants wishing to obtain the Good Food Restaurant label may select a measuring annual food waste criteria (optional) that restaurants can complete to achieve a higher score. The Rest-o-Pack campaign aims to encourage Brussels residents to take their restaurant meal leftovers and to reduce plate waste. Since January 2016, the obligation to donate food has been introduced in the environmental permits issued by Brussels Environment, for large food stores with a total surface area equal to or greater than 1,000 m^2. Since 2016, the food donation obligation has also been introduced in 27 environmental permits issued by Brussels Environment, which obliges operators to use food donation in compliance with legal food safety standards for products they no longer wish to market but which are still consumable. In the framework of the declaration of commitment of the trade sector, Comeos, UCM/Aplsia and UNIZO have committed themselves to promote the existing tools and to inform their members about the different possibilities to donate their unsold products to the food aid sector. The Brussels region offers support to school projects concerning the environment, including in the field of food waste. In order to sensitize youth, anti-waste and cooking workshops have been offered to schools.

Stage of the FSC	**Actors**
All stages (mostly retail and other distribution of food)	Regional government, retailers, restaurants/ hospitality sector, healthcare, consumers

1. QUALITY OF THE ACTION DESIGN

The ‘Good Food strategy - Towards a sustainable food system in the Brussels-Capital region’ aims to place food at the heart of urban dynamics, addressing it in all its dimensions, economic, social and environmental. The strategy includes two main action areas to reduce food waste, as it aims to prevent food waste at source across the whole food supply chain and to valorize food surpluses by means of food redistribution. The first Good Food strategy (2016-2020) was evaluated end of 2020.

For the Brussels region, the goal set under the (first) Good Food strategy is to reduce household waste by 40% and to reduce canteen waste by 40% by 2020. The goal is to have an overall food waste reduction of 30% in Brussels.
2. EFFECTIVENESS The following results are available so far: - In canteens: food waste was reduced by 29% on average in certified canteens and 13% of public canteens state that their food waste reduction was greater than 40%. - In households: the ABP reports a reduction of 25% of household food waste between 2016 and 2019. - In retailers: in 5 years, the strategy has supported projects that collectively total 2,500t of unsold food recovered and distributed over the entire period. The obligation of food donation has been introduced in 27 environmental permits issued by Brussels Environment.
3. EFFICIENCY In 5 years, the strategy has supported projects that collectively total 2,500t of unsold food recovered and distributed over the entire period. The costs of the action were not provided.
4. SUSTAINABILITY OF THE ACTION OVER TIME The fight against food waste is included in their labelling systems (Good Food Resto, Good Food canteens).
5. TRANSFERABILITY AND SCALABILITY They say that transferability has not been considered and that the action wasn't upscaled but a new version is currently being co-constructed with relevant stakeholders. It is currently in its final evaluation phase and the new version will be adopted by relevant stakeholders in 2021 or 2022.
6. INTERSECTORAL COOPERATION The action was not the result of a cooperation.
KEY SUCCESS FACTORS AND BARRIERS It is difficult to measure food waste. It is a work in progress to comply with the European obligation to report on food waste. It is also difficult because the topic isn't very attractive.
ADDITIONAL COMMENTS

Source: questionnaire response

4.19 – Environmental permits and special conditions for unsold food donations

FOOD WASTE PREVENTION GOVERNANCE (Regulatory framework/policy)	
TITLE: Environmental permits and special conditions for unsold food donations	December 2012 – ongoing
ORGANIZATION: City of Herstal	**LOCATION**: Herstal

SHORT DESCRIPTION

On December 21st, 2012, the City of Herstal extended to all supermarkets operating on its territory, the modification of the operating conditions of all current permits by requiring operators to organize the donation of their unsold food to charities. On March 12th, 2014, the Walloon Parliament voted in plenary session a decree authorizing the Walloon Government to enact in sectoral conditions the obligation made to companies in the supermarket sector to offer their unsold food to charities. On September 15th, 2014, the first 3 official reports noting violations of the operating conditions relating to the organization of the management of unsold foodstuffs were drawn up by the reporting officers of the City of Herstal.

Stage of the FSC	**Actors**
Retail and other distribution of food	Municipalities, NGOs, retailers

1. QUALITY OF THE ACTION DESIGN

The objective of the action is clear: to impose on supermarkets to systematically offer unsold food to a charity before possibly using other channels of recovery or waste disposal.

It is done through a regulation that is permanent.

Non-compliance with operating conditions is now an environmental offence. By the decree of June 5th, 2008, the penalties relating to environmental offences (2nd category offence) are administrative fines of 100 euros to 1,000,000 euros. The municipal inspectors are competent to carry out controls, issue warnings and draw up statements of offence.

2. EFFECTIVENESS

The only objective is to make all the supermarkets comply, there is no objective that was set regarding the amount of food waste prevented.

All supermarkets are required to donate their surplus food, but there are cases of non-compliance:

March 13th, 2015: first fine of 5,000 euros issued to a supermarket by the regional sanctioning official for failure to comply with operating conditions related to unsold food. The operator loses his appeal before the 1st instance court of Namur for procedural reasons.

3. EFFICIENCY

No information provided.

4. SUSTAINABILITY OF THE ACTION OVER TIME

The action is sustainable over time. The permits are delivered for 10-20 years, depending on the establishment. Each time a permit is renewed, the operating conditions for donating unsold food has to be re-imposed.

5. TRANSFERABILITY AND SCALABILITY

The action has been transferred and upscaled as the Walloon Parliament has made it obligatory for establishments of more than 2500 m^2 to donate their surplus food and communes can still do the same for smaller establishments.

6. INTERSECTORAL COOPERATION

The action was not the result of a cooperation.

KEY SUCCESS FACTORS AND BARRIERS

The filing of an environmental permit renewal application by SA CARREFOUR in 2012 was the trigger. The existence of good practices in-house regarding the donation of unsold food facilitated the transition to the standard. The existence of European legal norms and the political will of the Local Council to generalize these good practices to all the actors present on the municipal territory made it possible to impose the norm on 12 other large surfaces in 2012. The Socialist Party made it a campaign theme, an element of its program, hence the decision of the Walloon Parliament in plenary session on March 12th, 2014 and the vote of a decree authorizing the Walloon Government to enact in sectoral conditions.

ADDITIONAL COMMENTS

Action follow-up: Recurrent controls are carried out in the supermarkets by the City's enforcement officers in order to verify the implementation of the operating conditions regarding the donation of unsold food. However, we have noticed that some supermarket chains that, a few years ago, did not practice quick sales, have adopted this practice. While this reduces unsold food and therefore donations, it also reduces food waste and is a benefit to consumers.

Source: questionnaire response

Abstract:

This thesis aims to answer the following question with evidence from Belgian food waste prevention actions: *What practices can be implemented to successfully prevent food waste generation in the European Union?*

The literature review addresses first food loss and waste generation, its extent, impact, and causes. Second, food loss and waste prevention actions are reviewed. Actions are classified according to their goal, and the best action groups are those higher in the food waste hierarchy: supply chain efficiency and consumers' behavior change actions.

A qualitative research on Belgian initiatives is carried out using the Framework for the evaluation of food waste prevention actions developed by Caldeira et al. (2019). A Qualitative Comparative Analysis is performed on a selection of cases.

As the answer to the research question depends on the group to which actions belong, it is concluded that actions of all groups should be implemented to offer a comprehensive food waste prevention strategy. A process is discovered to ensure that a supply chain efficiency action becomes successful. Awareness or educational campaigns using a combination of means are recommended to change consumers' behavior. The needs to cooperate and to have a steady source of funding (either public or non-public) are emphasized for redistribution actions. Finally, all governments are urged to set up a national food waste prevention program, incorporating many different initiatives.

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