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Ludovica Principato

# Food Waste at Consumer Level A Comprehensive Literature Review

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# Food Waste at Consumer Level

A Comprehensive Literature Review

 Springer

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ISSN 2191-5547 ISSN 2191-5555 (electronic)  
SpringerBriefs in Environmental Science  
ISBN 978-3-319-78886-9 ISBN 978-3-319-78887-6 (eBook)  
<https://doi.org/10.1007/978-3-319-78887-6>

Library of Congress Control Number: 2018936649

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*The more Leonia expels goods, the more it accumulates them; the scales of its past are soldered into a cuirass that cannot be removed. As the city is renewed each day, it preserves all of itself in its only definitive form: yesterday's sweepings piled up on the sweepings of the day before yesterday and of all its days and years and decades.*

Italo Calvino, *Invisible Cities*

*To my parents,  
for your unconditional love  
and for always believing in my capacities*

# Preface and Acknowledgements

Food losses and waste represent one of the biggest challenges of the future of our food and agricultural systems. One-third of global food production is wasted every year along the entire food supply chain. This also means a waste of resources, such as land, water and labour, involved in it.

In Western countries, the largest amount of food waste occurs at the consumption phase. In fact, consumers and households' waste amounts to 30–40% of the entire food waste and losses. This is due to two main reasons: the first one is that many people are not even aware of the quantity of food they waste every day and of the related environmental, social and economic impacts (also for their pocket: wasting food represents a waste of money). The second one refers to their incorrect behaviours that could be changed with policies, along with educational campaigns and interventions around food that aim at warning people not to cook, prepare or serve too much food, and use it in time (i.e. teaching them how to correctly store food, the difference between 'use by' and 'best before' dates, etc.). For these reasons, international and national institutions, along with not-for-profit and private organizations, can play a significant role in order to tackle this issue. In fact, they can not only propose and implement normative solutions and practical interventions to reduce it, but also promote social campaigns in order to raise consumer awareness about the phenomenon, along with targeted educational campaigns that build consumer knowledge on practices and habits that could significantly reduce its amount (if not eradicate).

Therefore, first, it is fundamental that the institutions, along with not-for-profit and private organizations, should invest more in promoting targeted awareness- and education-raising campaigns. Second, research can help to better understand consumers' attitudes, values and behaviours towards food in order to find underlying food waste motivations and behaviours, and therefore to raise knowledge on the phenomenon. Moreover, increased understanding of the underlying factors can help policymakers, social marketers and practitioners in finding the best and most effective solutions and initiatives against it.



This book stems from such considerations. It aims to deeply understand consumer behaviour towards food waste, while also highlighting existing and potential normative and practical solutions against this instance. Drawing from food waste literature review (Chap. 1), marketing and decision-making theories, it provides for the first time a new model that seeks to better explain why people waste food along the ‘Household food waste journey’ and away from home (Chap. 2). Along with this, it classifies the main policies implemented worldwide against the phenomenon (Chap. 3), along with a categorization of the most relevant initiatives put forward by the private sector (Chap. 4). To the best of our knowledge, this is the first work that, based on a deep literature review, seeks to address the specific phenomenon of food waste at consumption level from two points of view: the theoretical one, with the definition of two models that provide a new literature knowledge and better explain food waste behaviour within the household and away from home, and the practical one, with the classification of the most important policies and initiatives now being put forward.

This work is the result of a 6-year endeavour. I became passionate about this topic during my research fellowship at Roma Tre University in early 2011 and have not departed from it since.

This work would have not been done without the encouragement and inspiration of some great people, to whom I am sincerely thankful.

To Alessandro, my lifelong companion, all this would not have happened without you. You have been a constant support in all respects, I am grateful to you more than my words can express.

To my parents, who have always invested in my education, thank you for believing in me, supporting me and encouraging me every day. In particular, to my mom and Francesca, for being passionate and careful caregivers of my two little ones, I could not pursue this achievement without your never-ending support.

To Prof. Carlo Alberto Pratesi, from which everything started, thank you for encouraging me to pursue the academic path and for being a source of constant guidance and positive inspiration.

To Luca Secondi, my companion in this adventure on food waste, thank you. You are such a great and meticulous academic.

To Luca Ruini, thank you for being such a knowledgeable mentor, for your constant support and humanity.

To Anna Ruggerini and the Barilla Center for Food and Nutrition, thank you for giving me the possibility of collaborating within your Foundation. My big passion around sustainability in the agribusiness sector comes also from you. I am also grateful to the Milan Protocol—Food Waste team that I led: Cassandra, Alessandro, Marta and your passionate work within the team have incredibly raised my knowledge on this issue.

To Monica Maria Cuccurullo and Chiara Vizzini, thank you for your support in the identification of some initiatives and policies towards food waste.

Finally, to my little daughters, Elettra and Olimpia, thank you for giving me a power that I never thought of having and for being my best creation. I wish you to live in a better and a cleaner world.

Rome, Italy  
December 2017

Ludovica Principato

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# Chapter 1

## The Complexity of Food Waste at Consumption Level: Definitions, Data, Causes and Impacts



**Abstract** Food losses and waste represent a severe issue that is compromising our Planet’s sustainability. Every year over one-third of global food production gets lost or wasted along the food supply chain (FSC) causing several economic, environmental and social impacts. Due to the importance and magnitude of the phenomenon, the reduction of food losses and waste has been included within the Sustainable Development Goals proposed by the UN for the Agenda 2030. This introductory chapter aims at shedding light on the state of the art of food waste phenomenon, in order to highlight the literature knowledge and trends in the field and provide a starting point for future research. A comprehensive literature review over a forty-year time span (1977–2017) will shed light on the main and most updated data, definitions adopted, main causes along the FSC, and different impacts originated, with a special focus on the consumption phase.

**Keywords** Food waste · Environmental impacts · Economic impacts  
Social impacts · Food waste definitions · Food waste data · Sustainability

### 1.1 Introduction

Why do we increasingly worry about food waste? Just imagine that every year one third of all the food produced worldwide for human consumption gets lost or wasted along the food supply chain (FSC), that runs from the cultivation phase up to final consumption (Gustavsson et al. 2011). This amount represents a huge economic cost: every year we overspend about US\$1 trillion on account of food waste (FAO 2014), but it also impacts on our environment due to the exploitation of natural resources that are used to produce this food that ends up not being consumed. Moreover, food losses and waste undermine the World’s food security; that is the quantity of food wasted every year could feed the 815 million people who suffer hunger four times over (FAO 2013).

Thus, reducing these losses represent a “triple win”: it can save money for farmers, companies and people; it can alleviate hunger; it can save water, land and

can reduce the global greenhouse gases emissions and consequently climate change impacts.

Bearing this in mind, the reductions of food losses and waste have recently been included in the 17 Sustainable Development Goals (SDGs) promoted by the UN and adopted by the member states with the aims of ending poverty, protecting the planet and to ensure wealth for all. In particular, the SDG 12—Ensure sustainable consumption and production patterns—includes the food waste issue in its third target: “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” (SDG 12.3, UN, 2015).

This chapter aims at shedding light on the state of the art of food waste phenomenon, with a special focus on the consumption phase, in order to highlight the wealth of knowledge through literature and trends in the field and to provide a starting point for future research.

A comprehensive literature review over a forty-year time span (1977–2017) will shed light on the definitions adopted, the main data, the main causes along the FSC, and different impacts due to the phenomenon.

## 1.2 Definitions

Food waste and food losses occur at every stage of the FSC from the cultivation phase, passing through industrial transformation, distribution and retail up to the final consumption phase (Gustavsson et al. 2011).

One of the first definitions used for the phenomenon was made by the FAO in 1981: food waste is “wholesome edible material intended for human consumption, arising at any point in the FSC that is instead discarded, lost, degraded or consumed by pests”. Another more recent definition does not consider the underlying cause, that is food losses and waste “refers to a decrease, *at all stages of the food chain from harvest to consumption* in mass, of food that was originally intended for human consumption, regardless of the cause” (FAO High Level Panel of Experts—HLPE 2014, p. 22).

More recently, based on Parfitt et al. (2010), the FAO has proposed the distinction between food losses and food waste (Gustavsson et al. 2011). The first one occurs during the first stages of the FSC; usually referring to the decrease in the food quantity or quality, which makes it unfit for human consumption, whilst the second one is related to the latest stages of the FSC and it is generally due to retailers and consumer’s behavioural issues (Parfitt et al. 2010; Griffin et al. 2009; Gustavsson et al. 2011).

Food losses are more common in the developing countries, where it has been seen that two thirds of losses happen during the post-harvest and processing levels. This is especially due to poor agricultural practices, competences and infrastructures, along with technological and financial restrictions (Chalak et al. 2015). While food waste is typical of the industrialized countries, where food wastage occurs

primarily at the level of consumption, mostly driven by consumer's values, behaviours and attitudes (Parfitt et al. 2010; Bond et al. 2013; Principato et al. 2015).

Another FAO definition of food losses and waste is also worth noting: it links food waste only to consumer level and food losses to any stage before the consumer level, regardless of the real underlying explanatory cause, and regardless of its "behavioural" character or not, or of its "voluntary" character or not. Therefore, to this definition, food waste "refers to food appropriate for human consumption being discarded or left to spoil *at consumer level*—regardless of the cause"; while food losses "refers to a decrease, *at all stages of the food chain prior to the consumer level*, in mass, of food that was originally intended for human consumption, regardless of the cause" (HLPE 2014, p.22). Contrary to the definition made by Gustavsson et al. (2011), this one does not consider food waste as the losses that occur at retail and distribution level, but only considers the consumer's point of view, that is food purchased within any type of store or restaurant or catering service, but for any reason not consumed by individuals.

The FAO definitions are the ones most commonly used by scholars and researchers. Yet, there are other specific classifications that are worth listing:

- (1) Food waste seen as "any by-product or waste product from the production, processing, distribution and consumption of food" (Okazaki et al. 2008).
- (2) Similar to FAO (1981), but it includes also the "edible material that is intentionally fed to animals or is a by-product of food processing diverted away from the human food" (Stuart 2009).
- (3) As definitions made by FAO (1981) and (2) but it also includes "over-nutrition—the gap between the energy value of consumed food per capita and the energy value of food needed per capita" (Smil 2004) (Table 1.1).

In this book we will focus on the food waste issue as defined by the HLPE (2014), that is wasted food occurring at consumption level, which in turn is divided into household and *away from home* consumption (see Fig. 1.1).

More specifically, household food consumption could be defined as: "all the sources of food and drinks, that are consumed within the home, including retail and contributions from home-grown food and takeaways" (Parfitt et al. 2010).

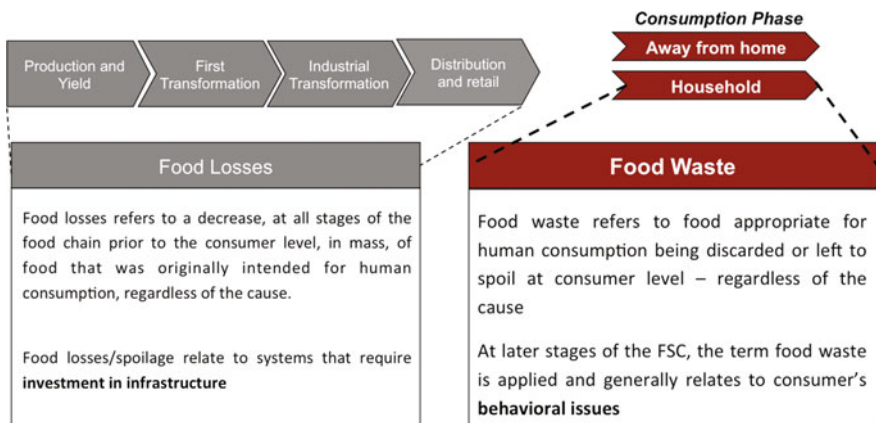
Focusing on household food waste (WRAP 2009a, Parfitt et al. 2010), there is another important distinction between:

- *edible* food waste, which is avoidable and possibly avoidable waste of food, that has been thrown away for certain reasons;
- *non-edible* food waste, which includes unavoidable food waste, deriving from food preparation, such as bones, shells and skins.

For the purpose of this work we will consider the definition of avoidable and possibly avoidable food waste, that is "food thrown away that was, at some point prior to disposal, edible (e.g. slices of bread, apples, meat) and could have been eaten if it had been better portioned, managed, stored and/or prepared. 'Avoidable' food waste also includes some otherwise acceptable food items that have not been

**Table 1.1** Food losses and waste definitions according to the main studies

Source and Year	Food Losses and Waste Definitions
FAO (1981)	Food waste is wholesome edible material intended for human consumption, arising at any point in the FSC that is instead discarded, lost, degraded or consumed by pests
Parfitt et al. (2010), Gustavsson et al. (2011)	Food losses refer to the decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption. Food losses take place at production, post-harvest and processing stages in the food supply chain Food waste can be considered as food losses occurring at the end of the food chain (retail and final consumption), which relate to retailers' and consumers' behaviour
FAO High Level Panel of Experts- HLPE (2014)	Food losses refers to a decrease, at all stages of the food chain prior to the consumer level, in mass, of food that was originally intended for human consumption, regardless of the cause Food waste refers to food appropriate for human consumption being discarded or left to spoil at consumer level—regardless of the cause
Okazaki et al. (2008)	Any by-product or waste product from the production, processing, distribution and consumption of food
Stuart (2009)	The edible material that is intentionally fed to animals or is a by-product of food processing diverted away from the human food
Smil (2004)	It includes also “over-nutrition—the gap between the energy value of consumed food per capita and the energy value of food needed per capita”



**Fig. 1.1** Food losses and waste definition along the FSC Source: own elaboration from HLPE (2014), BCFN (2012), Gustavsson et al. (2011)



eaten because of consumer preference, such as bread crusts and jacket potato skins” (Waste Resources Action Programme—WRAP, 2013b, p. 4).

The avoidable and possibly avoidable food waste, as defined by the WRAP (2009b, 2013) covers the largest amount in volume of food waste generated by household and it is mainly caused by consumer’s attitudes and behaviours (Parfitt et al. 2010; Principato et al. 2015).

Considering the *away from home* definitions we will focus on: avoidable and possibly avoidable food waste that occurs: (i) in the restaurant industry, which includes restaurant, bars and cafeterias that offer table service; along with (ii) catering services, that is food served within private or public canteens, catering and hotels; and (iii) within counter service and fast food.

In particular, food waste in the *away from home* phase occurs at two levels: preparation and service (or consumption) phase (Risku-Norja et al. 2010; Papargyropoulou et al. 2016). We should therefore consider food waste as the avoidable and possibly avoidable food discarded during the preparation/processing of the meals as well as spoilage and expiration, and also food wasted from the client’s plate (food scraps or leftovers) (Marthinsen et al. 2012; Pirani and Arafat 2015).

As we can see, until now, there has not been a harmonized food waste definition at international level and this represents an issue when striving to collect direct data on food waste and to compare them accurately between countries.

### 1.3 Data and Main Types of Food Wasted

In Europe as much as 42% of all the food produced gets lost at consumption level; this corresponds to approximately 88 million tonnes of food wasted every year, a value that could grow to 126 million tonnes by 2020 if no action is implemented (BIO Intelligence Service 2010). Two-thirds of this amount refers to avoidable and possibly avoidable food waste (WRAP 2009a). Similar results come from the United States where the 31% of food available for human consumption gets lost at retail and consumption level.<sup>1</sup>

Following the household level, in Europe the second source of food waste generated at consumption level occurs in the *away from home* sector (Brautigam et al. 2014; Monier et al. 2010). Recent data show that in Italy 54% of food gets wasted within the household, followed by a 21% of waste from the restaurant sector (Coldiretti 2017).

Representing just 5% of total food wastage, food waste at retail level could seem a little amount compared with the food waste at consumption level. However, in terms of quantity, we are talking about 4.4 million tonnes of food discarded that still consists in a huge cost in terms of economic investments and natural resources.

---

<sup>1</sup>Source: <https://www.usda.gov/oce/foodwaste/faqs.htm>.

Focusing on household food waste, many studies have tried to quantify the food items wasted the most by consumers, and the majority of them have agreed that fresh fruit and vegetables cover the highest proportion of this amount (Parfitt et al. 2010), followed by other perishable items, such as bakery and dairy products, meat and fish (WRAP 2008; Morgan 2009; Thonissen 2009).

Some figures coming from the Association for the Defence and Orientation of Consumers (ADOC 2009) and reported by Segrè and Falasconi (2011) show that in Italy 35% of fresh products (milk and dairy products, meat and seafood), 9% of bread, and 16% of fruit and vegetables are wasted within the home.

From a study conducted by the WRAP in the UK (WRAP 2009a), it emerged that: 7% of milk, 36% of bakery, and 50% of salad purchased gets wasted.

Some variations between these kinds of scientific studies that seek to analyse food waste by product type are mainly due by the differences related to consumption patterns, or different wastage rates used to measure the results, or by different type of definitions used.

## 1.4 Main Causes that Lead to Food Losses and Waste

In general, some global trends have accelerated the possibilities of food losses and waste, in particular the distance between the place of production and of final consumption, along with the shift in dietary patterns, especially in the economies in transition, where consumers are increasingly eating meat, fish and other perishable products (Centre for Non-Traditional Security Studies 2011).

Although this book focuses on food waste issues, it is important to briefly see why food gets lost in the first phases of the FSC; that is in the cultivation, production and food transformation phases. At these levels of the FSC, food gets wasted mainly due to low development of techniques, infrastructures and investments, (i.e. the ability to react to bad weather conditions, the lack of storage facilities, or poor agronomic practices). These are the reasons why in developing countries, with poor technological and infrastructure investments, and less agronomic expertise, losses of this kind are more common (FAO 2015a).

During the distribution and sale phases, food losses usually arise from distortions in the demand forecasting, leading to enormous quantities of foodstuffs not sold before the expiration date, or being damaged by natural deterioration. Additional causes at retail level can be: the limits of the technology used to preserve products (especially in the developing countries); the possible damage of food during transportation; the inadequate professional training of sales staff, not applying stock rotation procedures; the recalls of certain products from the market, as they do not meet qualitative and safety standards. Moreover, the increasing demand for food, along with the higher aesthetic standard requested by customers, contribute to raising the level of food waste in the stores (BCFN 2012). To finish, marketing strategies- such as the *buy one get one free* offers- negatively influence people's

<b>DISTRIBUTION</b>	<ul style="list-style-type: none"> <li>• Inefficient technology used for fresh products preservation (cold chain)</li> <li>• Difficult transport procedures that determine problems both to storage, and to packaging of foods</li> <li>• Poor training of sales people who do not perform the necessary "stock rotation" procedures</li> <li>• Untimely cancellation of commercial orders and contractual arrangements between suppliers and distributors (eg "take back")</li> <li>• Marketing strategies, such as 2X1 options or aesthetical standards</li> <li>• Food safety recalls</li> </ul>
<b>CONSUMPTION</b>	<ul style="list-style-type: none"> <li>• Too much food is cooked, prepared or served</li> <li>• Incorrect purchase planning (e.g. insufficient or incorrect purchases planning)</li> <li>• Lack of proper food storage</li> <li>• Incorrect understanding of the expiration dates (best before vs. best by)</li> <li>• Lack of culinary skills in order to reuse leftovers</li> <li>• Socio-economic factors (e.g. family composition, income, culture)</li> <li>• Low food waste awareness and education</li> </ul>

**Fig. 1.2** Focus on food losses and waste causes at distribution and consumption level

food-waste behaviour, that attracted by the promotions, tend to buy more than they need (Mondéjar Jiménez et al. 2016).

As we have seen, waste occurring in the final stages, in particular during household consumption, is particularly common in the developed countries (Bond et al. 2013), where the incomes of the families are higher, meanwhile the awareness and sensitivity on food waste issues is often lacking. Along with this, the main causes associated with food waste at final consumption level relate to an incorrect interpretation of expiration dates, an inadequate sales planning, the lack of proper food storage, a lack of culinary skills that allow the individuals to reuse food scraps in other recipes, and in certain countries the use of big portion sizes that end up not being consumed (BCFN 2012).

We have highlighted the food losses and waste causes during the distribution and consumption phase in Fig. 1.2.

In the next chapter we will analyse in depth the main factors and incorrect behaviours related to food waste at consumption level.

## 1.5 Main Environmental, Economic and Social Impacts Related to Food Waste

Food losses and waste generate negative environmental impacts because of the water, land, energy and other natural resources used to produce food that no-one consumes (FAO 2013). And the non-productive use of natural resources, such as land and water that results from food loss and waste has repercussions on hunger, nutrition, income generation and economic growth (FAO 2013).

Let us see some of these impacts, firstly considering the total amount of food losses and waste, then focusing on the specific impacts of food waste at consumption level.

### *Environmental Impacts*

Some studies have quantified the environmental impacts of food waste in terms of: carbon footprint, ecological footprint, and water footprint. An important study conducted by FAO in 2013, explained that if food waste could be represented as a country, it would be one of the top three greenhouse gas emitters after USA and China (FAO 2014). Other researches emphasized the water wastage coming from food waste (Lundqvist et al. 2008). Just think that food that is produced but not eaten is responsible for a loss of water equivalent to the annual flow of Russia's Volga River (FAO 2013). Moreover, food waste represents a waste of land area that is used to grow food that in the end gets wasted. Reducing it could save about 1.4 billion hectares, or close to 30% of available agricultural land, that is used annually to grow or farm food wasted (FAO 2013).

### *Economic Impacts*

As anticipated before, overall it has been estimated that the global food cost of food waste accounts approximately to 2,6 trillion \$US every year, of which the economic cost amount to 1 trillion \$US, the environmental costs could reach about 700 billion and the social costs around 900 billion (FAO 2014).

### *Social Impacts*

The social impact of food waste is linked to the concepts of food security and food access. The definition of food security, comes from the World Food Summit in 1996, which describes the phenomenon as a situation where “all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for a healthy and active life.” In particular, the impact from food wastage, in developed countries (222 million tonnes) is almost equivalent to the available food production of Sub-Saharan Africa (230 million tonnes) (Gustavsson et al. 2011). Moreover, according to FAO, the total amount of food waste generated every year, could feed more than four times the 800 and more million poor people who suffer hunger (FAO 2013).

## ***1.5.1 Focus on the Impacts at Consumption Level***

In Italy, food waste occurring in the last phase of the supply chain is estimated to cost around €12 billion per year (Min. Ambiente 2015).

Some studies have analysed the economic impact of food waste for the households. A study conducted in the UK, calculated that the cost of food waste is approximately £420 per year for an average household (WRAP 2009). While a study conducted in Italy (Segrè and Falasconi 2011), examined that the financial lost due to food waste is equivalent to €454 per year for each household. Similarly, another study, conducted in the US, estimated that American households discarded 211 kg of food per year (14% of total purchasing), costing to a family of four people, at least US\$587 annually (Jones 2004). The Dutch Ministry of Agriculture, Nature and Food Quality has estimated that Dutch consumers throw away

approximately 8–11% of food purchased equating to 43–60 kg of food waste with an average value of Euros 270–400 per person per year (Thonissen 2009).

According to a recent study conducted in the UK, food waste within the *out of home* industry accounts for more than £682 million every year including food procurement, labour and service costs, utilities, and the waste management costs (WRAP 2013a).

Regarding the environmental impacts of household food waste, according to WRAP (2009a), in UK homes, waste has reached 8.3 million tonnes of food and drink wasted each year (equivalent to 25% of the food and drinks purchased), causing a carbon impact exceeding 20 Mt of CO<sub>2</sub> equivalent emissions.

## 1.6 Conclusions and Managerial Implications

The global scenario is characterized by a big paradox: from one side there is the scourge of poverty and hunger; on the other side, 1.3 billion tonnes of food is globally wasted every year (BCFN 2012).

The magnitude and complexity of the food waste problem call the action of several interventions, both public and private, with the aim of preventing and reducing the issue.

The actors involved in the FSC, the people and companies need to modify drastically their management practices, technologies and behaviours, in order to reduce food waste. Private consumers must enhance consciousness of purchasing and consumption habits, and as we can see in the next chapter, with changes in their habits, people can play a key role in tackling this issue. Therefore, it is really essential to have a good understanding of factors that contribute to the amount of food wasted by consumers, but up to now few researches have analysed them in a comprehensive way.

In order to tackle food waste at consumption level, several public and private initiatives have been put in place in order to tackle food waste, but up to now a classification of the main initiatives and policies does not exist. These gaps became the starting point for the remainder of this book.

### **BOX 1.1—How Food Waste reduction could affect the UN Sustainable Development Goals achievement**

As written below, food losses and waste issues were included within the 12th Sustainable Development Goal (*Responsible consumption and production*). However, it is worth noting that reducing food losses and waste could not only help in the achievement of this goal, but, as highlighted below, it could be fundamental in reaching some other SDGs.

### 1. No poverty



Food waste is a waste of money: the global social cost of food losses and waste can cost up to \$940 billion per year (FAO 2014). Reducing it could save countries budget and household money, thus alleviating poverty.

### 2. Zero Hunger



With the global population rising, wastage of products including 45% of all fruit and vegetables and 20% of meat is one of the greatest challenges to achieving food security (Gustavsson et al. 2011). According to the FAO (2013), if the amount of food wasted around the world were reduced by just 25%, there would be enough food to feed all the people who are malnourished.

### 9. Industry Innovation and Infrastructure



Thanks to the sharing economy and opportunities created by digital technology, alternative distribution formats aimed at reducing food waste—also generating a positive social impact—are emerging, particularly food banks, social supermarkets (a retail formula where the retailer receives surplus food and consumer goods from partner companies for free and sells them at discounted prices to a limited section of the population living in or at risk of poverty) or app to share excess food within communities (food sharing apps). All these initiatives represent an opportunity made by institutions, private sector and citizens to promote sustainable industrialization and foster innovation (Michellini et al. 2018).

### 10. Reduce inequalities



The reduction of food losses (in particular through investments in infrastructures and storage facilities) in the developing countries could reduce inequalities within and among countries thanks to the money saved due to loss reduction (Gustavsson et al. 2011).

### 11. Sustainable cities and communities



The reduction of food waste among consumers and at retail level, together with the promotion of sorting practices (like measures to increase composting and anaerobic digestion of discarded food), together with the use of food sharing apps within communities, could foster more sustainable cities and human settlements (Michelini et al. 2018, Secondi et al. 2015).

### 12. Responsible consumption and production



The increasing awareness of people regarding food waste impacts and the consequent reduction of food waste are part of the responsible consumption pattern (Principato et al. 2015).

Along with this, practices for companies and retailers which promote the reduction of food waste (like the retail initiative “buy two, get the second free later”, or the reduction of food losses along the food supply chain), represent responsible production initiatives (Mondéjar Jiménez et al. 2016).

### 13. Climate Action



Food waste terribly impacts the environment (FAO 2013).

Food loss and waste generates about 8% of global greenhouse gas emissions (CAIT 2015). If it were a country, food loss and waste would be the third-largest greenhouse gas emitter after the United States and China (FAO 2013). It has recently been shown that reducing food waste around the world would help curb emissions of planet-warming gases, lessening some of the

impacts of climate change, such as more extreme weather and rising seas (Hiç et al. 2016).

#### 14. Life below water



Food waste is a waste of water. Food that is produced but not eaten consumes a volume of water equivalent to the annual flow of Russia's Volga River (FAO 2013).

#### 15. Life on land



Food waste represents a waste of land area that is used to grow food that in the end gets wasted. Reducing it could save about 1.4 billion hectares, or close to 30% of available agricultural land, that is yearly used to grow or to farm food now being wasted (FAO 2013).

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# Chapter 2

## Factors and Behaviours Affecting Food Waste at Consumption Level: The Household Food Waste Journey Model



**Abstract** In this chapter a comprehensive literature review over a forty-year time span (1977–2017) will shed light on the multiple, complex facets of food waste at consumption level. Drawing from behavioural and marketing theories, a new theoretical framework is proposed with the aim of better explaining food waste behaviour at household level. Along with this, a conceptual framework will define the responsible actors and the correct behaviours that significantly tackle food waste during the *away from home* phase.

**Keywords** Food waste · Consumer behaviour · Behavioural change  
Shopping list · Expiration dates · Culinary skills

### 2.1 Introduction

As we have seen in the previous chapter, food waste at consumption level can occur either within the households, or *away from home*.

In this chapter a comprehensive literature review over a forty-year time span (1977–2016) will shed light on the multiple, complex facets of food waste at consumption level. Indeed, as showed by several studies (Secondi et al. 2015; WRAP 2011; Quedsted et al. 2013), food waste happens for various reasons and could not be considered as the outcome of a single behaviour.

Drawing from behavioural and marketing theories, I will propose a new theoretical framework with the aim of better explaining food waste behaviour at household level. Starting from the study of Block et al. (2016) and on the analysis made by the Van Geffen et al. in 2016, I will identify a comprehensive framework that takes its roots on *consumer decision making* and *consumer food management processes*.

Concerning food waste *away from home*, I decided to approach it using a different perspective, that is, firstly pointing out the two responsible actors (restaurant managers/chef and the clients), and secondly analysing the behaviours that could significantly reduce it, and if the reduction is not possible, to reuse or redistribute it.

## 2.2 The Household Food Waste Journey to Explain Wasteful Behaviours

As Quested et al. (2013) acknowledged, food waste is the result of multiple, complex factors. According to the literature, we should firstly mention some demographic and socio-economic factors that drive the phenomenon (for example, youths aged 16–24 waste over twice the amount of food wasted by 65 years old individuals). These descriptive elements are surely important, but to have a better framing of the issue and to draw possible solutions, it is fundamental to understand the theoretical roots of wasteful behaviour.

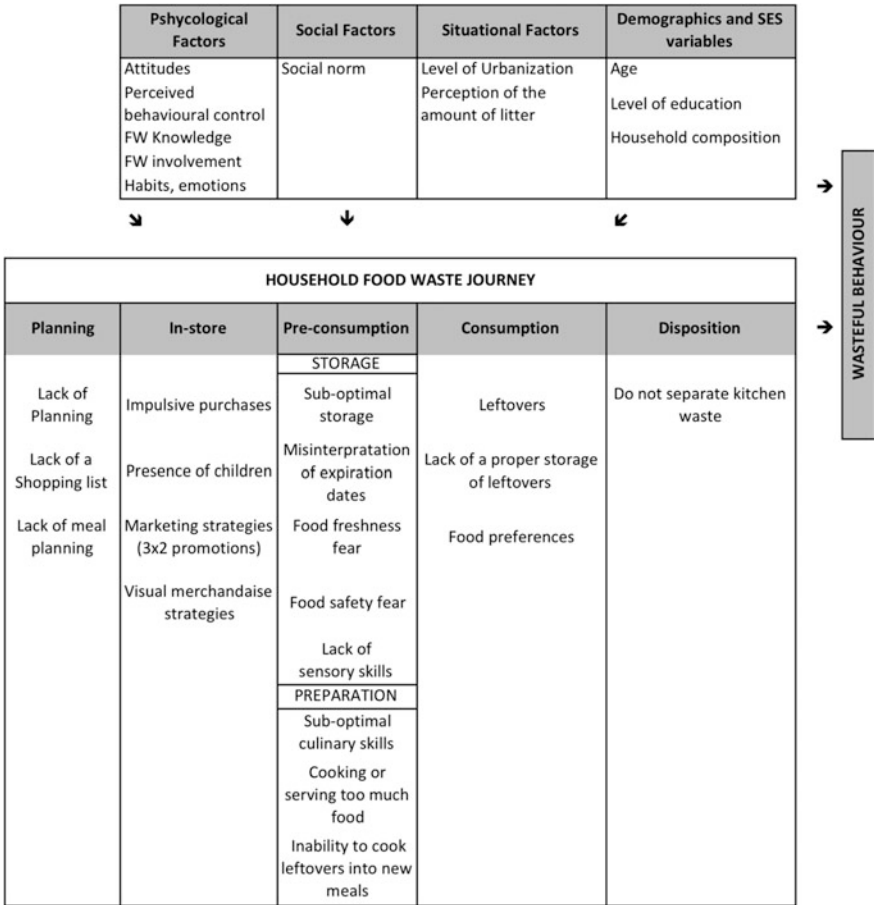
The study of food waste from a behavioural perspective is quite new and started few years ago drawing especially on the Theory of Planned Behaviour proposed by Ajzen in 1991 that adequately explain some behaviours towards food waste (Graham-Rowe et al. 2014; Stancu et al. 2016; Visschers et al. 2016, Mondejar-Jimenez et al. 2016; Block et al. 2016). According to this theory, intentions are demonstrated to be good predictors of human behaviour, and intentions are in turn influenced by three important factors: subjective norms, perceived behavioural control and attitudes. This theory has been widely used also for its adaptability for analysing different concept not included in the original model (Collins and Mullan 2011).

However, according to these studies, food waste could be seen as under the individual's volitional control and consumers are often consciously aware of why they waste food (like the intention to reduce food waste). Therefore, it is fundamental to research also on underlying factors that make individuals waste unintentionally, like habits and emotions, but not exclusively (Russell et al. 2017; Block et al. 2016).

Bearing this in mind, and according to a comprehensive literature review on the phenomenon made on a forty-year span (1977–2017), I believe it is possible to explain household wasteful behaviour drawing on marketing and behavioural theories that both explain conscious and subconscious waste. Therefore, I took into consideration the marketing *consumer decision making process* and modified it according to food waste peculiarities. Indeed, wasteful behaviour can be driven by some individual's influences like psychological, social, situational, and demographic and socio-economic factors. These factors influence both wasteful behaviours and every phase of what I called the *household food waste journey*, that is the various theoretical drivers of wasteful behaviours drawing on the *consumer food management* process: planning, provisioning, storing, preparing, consuming, disposal (Van Geffen et al. 2016 based on Boyd and McConocha 1996); and the *consumer decision process*: planning, pre-acquisition, acquisition, preparation, consumption, disposition. Every phase of the *household food waste journey* could contribute to some extent to wasteful behaviour.

In the next sections I will analyse the various theoretical drivers according to this new framework (see Table 2.1).

**Table 2.1** The household food waste journey model to understand wasteful behaviour



### 2.2.1 Psychological Factors

Among these factors we can cite some non-cognitive determinants of food waste behaviour like emotions and habits, but also food waste knowledge, and food waste involvement intended as the level of concern regarding its impacts, along with perceived behavioural control intended as the degree to which people perceive their ability, and possibility to perform a particular behaviour, in this case an example would be: “I am able to reduce my food waste”.

Some recent work acknowledged attitudes and perceived behavioural control (PBC) as predictor for consumer food waste behaviour (Visschers et al. 2016; Principato et al. 2015).

Drawing on marketing field, two important psychological factors that influence the consumer purchase decision are product knowledge and product involvement. Similarly, according to the framework presented in this book, food waste knowledge and food waste involvement, intended as the level of concern regarding food waste issues, are demonstrated to influence wasteful behaviours. Concerning the knowledge factor, Barr (2007) found that people knowledgeable about food waste issues are more likely to avoid the phenomenon. Other research has shown that the more aware youths are about food waste the more likely it is that they can reduce their wasteful behaviour (Principato et al. 2015). If we consider food waste involvement, it has been demonstrated that individuals with high environmental and civic sense waste less food (Williams et al. 2012; Parfitt et al. 2010; Barr 2007).

Since food waste behaviour is also driven by more automatic and less-conscious routines, we should definitely take into account habits (Steg and Vlek 2009; Verplanken and Holland 2002), as well as emotions (Bamberg and Möser 2007; Quested et al. 2013; Triandis 1977). A recent study conducted in the UK acknowledged habits and emotions as important determinants of intentions to reduce food waste behaviour (Russell et al. 2017).

As written before, it is important to say that these psychological factors not only influence wasteful behaviour directly, but also indirectly through their effect on some phases of the *household food waste journey*. To make an example, a greater awareness on the consequences of food waste phenomenon increases the likelihood that youths will draw a shopping list (Principato et al. 2015).

### 2.2.2 *Social Factors*

According to the food waste literature (Graham-Rowe et al. 2014; Mondejar-Jimenez et al. 2016; Visschers et al. 2016; Stancu et al. 2016), considering among social factors, social norms play an important role in influencing wasteful behaviour and the *household food waste journey*. For social norms we intend the social pressure to engage in a particular behaviour, or in other words, they represent the extent to which individuals perceive wasting food as a behaviour disapproved by people important for them (Lapinski and Rimal 2005). For instance: “my family does not like to throw away food”.

### 2.2.3 *Situational Factors*

For the purpose of this framework, I consider situational factors as external variables that influence in some way an individual’s behaviour towards food waste. In particular according to recent research (Secondi et al. 2015) that consider for the first time how contextual variables are associated with food waste, I took into account the geographical environment and the perceptions of the place where

individuals reside. The first situational factor to be considered, is the level of urbanization where individuals live, since it has been seen that people living in urban areas tend to waste more than people living in rural areas (Secondi et al. 2015). Another interesting situational factor highlighted by the same study, is the perception of the amount of litter where people reside, that is the perception of living in a clean area is associated with a virtuous behaviour of the residents. This has relevant impacts in terms of policy implications that I will discuss later in the book.

### ***2.2.4 Demographic and Socio-Economic Factors***

The last variables that influence food waste behaviour are the demographic and socio-economic (SES) ones. From a demographic perspective, most of the literature agrees that youths tend to waste more than elders (Osner 1982; Hamilton et al. 2005; Lyndhurst 2007; Eurobarometer 2014a, b). Concerning the SES variables, the more the level of education of individuals, the more the quantities of wasted food (Visschers et al. 2016; Secondi et al. 2015). Household composition also play a role: bigger household tend to waste more than smaller households (Quested et al. 2013), although it has been seen that the number of food waste per capita decreases as the members of a family grow (Parizeau et al. 2015). In any case, it has been seen that due to picky eating and food safety reasons, families with children tend to waste more than all-adult households of equal size (Quested and Luzecka 2014). Instead, regarding gender and income the debate in the literature is still open. Indeed, some studies revealed that females waste more than males (Visschers et al. 2016), however a number of researches stated that men waste more than women (Gallo 1980; Buzby and Guthrie 2002). Concerning income, the majority of the studies agree that higher-income households tend to waste more than lower-income ones (Lyndhurst 2007; Buzby and Guthrie 2002; Van Garde and Woodburn 1987; Osner 1982; Koivupuro et al. 2012; Stefan et al. 2013), but there are also others that proved the opposite (Cox and Downing 2007; Stancu et al. 2016). That is why for the moment, it is not worthy to include them in the framework.

### ***2.2.5 Household Food Waste Journey***

#### *Planning*

The first phase of the *household food waste journey* is pre-shopping planning that if lacking has been demonstrated to influence wasteful behaviours (Exodus 2006; WRAP 2007; Gustavsson et al. 2011). Indeed, a lack of planning can result in buying too much food that what is needed, therefore increasing the likelihood of

spoilage (Quested et al. 2013; Chandon and Wansink 2006). Meal-planning consists of deciding what food to eat in a determined period (e.g. a week) and could be useful in reducing wasteful behaviour (Van Geffen et al. 2016). Along with this, checking storage spaces, and drawing a shopping list have been demonstrated to be effective practice in reducing food waste (Principato et al. 2015; Stefan et al. 2013).

### *In-store*

In this phase we should put all the incorrect behaviours and influences that drive consumer to waste food at the point of purchase. In particular, it has been demonstrated that impulsive purchases, which are often spurred on by marketing strategies—like the so-called 3for2 promotions that push the consumer to buy more than what he needs—result in an increase in food waste levels (Mondejar-Jimenez et al. 2016; Exodus 2006; WRAP 2007). Or again, the presence of children demanding unnecessary items, as well as the layout and positioning of foods in stores (visual merchandising strategies) may influence wasteful behaviours (Exodus 2006).

### *Pre-consumption*

For the sake of this framework, I decided to divide this phase into two sub-phases: storing and preparation. Indeed, it has widely been acknowledged the importance of correct storing in preventing wasteful behaviours. Some people store products sub-optimally for healthy eating purposes, in fact Evans et al. (2012) demonstrated that certain parents use a bowl of fruit instead of putting it in the fridge in order to instil to children healthy eating. However, the majority of people have a lack of knowledge on how to better store food to prolong its shelf life and they are not aware of the different fridge shelves that can be effectively used in order to avoid food damage (Aschemann-Witzel et al. 2015; Graham-Rowe et al. 2014; Cox and Downing 2007). Along with this, it is necessary to understand the difference between the use by and best before dates, and it has been seen that some people misinterpret the expiration date labels (FSA 2008). The Food Standards Agency<sup>1</sup> clarified the distinction between ‘use by’ date, which refers to food safety, meaning that foods get harmful if consumed after a certain date; and ‘best before’ date relates to product quality, which will inform consumers that before a certain date the product is in the best condition for consumption, but can be consumed even after that date. Indeed, it has been shown that food close to the expiration date is erroneously perceived as less acceptable for consumption (Sen and Block 2009; Wansink and Wright 2006); similarly, food safety fear is indicated as a top reason of wasteful behaviours (Neff et al. 2015). On this research streaming, another important aspect of food storage refers to the so-called sensory skills, that is the ability of people to understand the freshness of food using their taste, smell and touch. It has been seen that elderly people, that have better sensory skills than

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<sup>1</sup>The Food Standards Agency is an independent government department of the United States of America formed in 2000 under an Act of Parliament for the purpose of protecting public health and consumer interests in relation to food products.

youths, tend to use their senses in order to understand the edibility of a food, while youths refer more on date labels or the period of time the food has been stored for (Terpstra et al. 2005). According to this study, it has been demonstrated that the sensory skills relate to less waste. Also, since Principato et al. (2015) showed that the fear of food freshness and food-borne illness increases waste, it is fundamental to educate people, and in particular youths, about the reliability of their senses in assessing the edibility of a food.

Food cooking and preparation is mostly driven by culinary skills, that has been seen as important in reducing food waste behaviours (Van Geffen et al. 2016; Principato et al. 2015; Cox and Downing 2007). Among these skills we can mention: (i) avoiding some preparation mistakes due to suboptimal culinary skills that could end up in wasting food (like food burned during preparation), (ii) cooking too much food that what is needed, together with the (iii) ability to prepare leftovers into new meals (Williams et al. 2012; Evans 2011; Exodus 2006; Lyndhurst 2007).

### *Consumption*

During this stage, food waste occurs if individuals leave food scraps on the plate, or if they do not correctly store or reuse their leftovers later (Porpino et al. 2016). Indeed, sometimes consumers forget there are leftovers in the fridge and end up throwing away them (Evans et al. 2012). Another aspect refers to food preferences that vary within the household (Block et al. 2016). For instance, families with kids struggle to make them eat some type of food like fruit and vegetables, which could result in wasteful behaviour. In order to avoid this, Evans (2011), suggests the routine of deciding a preferred dish to make sure that every day the food is be consumed as well by the picky eaters that some kids are.

### *Disposition*

This stage refers to food waste management, that is how to dispose food thrown away: giving it to animals, sorting practice (like home composting), etc. Concerning this stage, the only relevant study that links sorting practices to food waste behaviour is the one by Secondi et al. (2015) that states that individuals who separate kitchen waste tend to throw away less food than those who do not recycle or compost any part of their kitchen waste.

#### **BOX 2.1—Exogenous factors that influence food waste behaviour**

One study (Secondi et al. 2015) starts to investigate about how exogenous factors can play a role in influencing food waste behaviour. Using the representative sample of the 2013 Flash Eurobarometer survey, it proposes to model along with some variables related to food waste behaviour at individual stage, an additional level represented by the context (in terms of economic, social and cultural characteristics) in which the individuals reside. Thus, several dimensions can be considered concerning individuals' standard of living in the country (area) of residence. Cultural, governmental, technological, economic and industrial variables have been identified as being



potential characteristics, which can influence household food waste. This multi-level statistical perspective enabled the researchers to jointly consider factors at both individual and contextual level as potential variables associated with food waste.

Previous results are interesting and can foster new research paths on food waste behaviours and policies to address it. In particular, by analysing territorial variability it was possible to identify groups of countries characterized by similar behaviour patterns and therefore target them according to the need and exigency of public policy interventions.

### 2.3 Factors and Behaviours Influencing Food Waste *Away from Home*

Understanding food waste phenomenon *away from home* is a fairly new research topic. Indeed, research in the field has focused more on household behaviour since the larger amount of spoilage happens in this phase, although food waste *away from home* still represents a good 21% of the total wastage. According to a study made in the UK (WRAP 2013), food waste in restaurants happens during the preparation phase (45%), or for food deterioration (21%), or due to client's leftovers (34%).

As seen in Chap. 1, for food waste in the *away from home* phase, I will focus on: avoidable and possibly avoidable food waste that occur: (i) in the restaurant industry, which includes restaurant, bars and cafeterias that offer table service; along with (ii) catering services, that is food served within private or public canteens, catering and hotels; and (iii) within counter service and fast food.

The theoretical framework used to explain food waste at restaurant level was built based on the knowledge made by the most relevant studies on the theme that focus on the two levels where the phenomenon occurs: food preparation and consumption phases (Risku-Norja et al. 2010; Papargyropoulou et al. 2016; Betz et al. 2014; Marthinsen et al. 2012; Pirani and Arafat 2015; Heikkilä et al. 2016; Sustainable Restaurant Association 2010). Indeed, food waste at *away from home* level is composed by (i) avoidable food waste discarded during the preparation/processing of the meals as well as spoilage and expiration and I will call it *kitchen food waste* (KFW); and by (ii) leftover food from the food user and I will call it *client food waste* (CFW) (Marthinsen et al. 2012; Pirani and Arafat 2015).

KFW happens during the preparation phase for reasons related to “overproduction, peeling, cutting, expiration, spoilage, overcooking, etc.” (Papargyropoulou et al. 2016, p. 4); while CFW represents “customer plate leftover waste” that is “food wasted by customer after the food has been served to them” (Papargyropoulou et al. 2016, p. 4). Thus, as seen in the picture 2.2, it is clear that the responsibilities related to the phenomenon rests with the restaurant or catering manager or to the chef for KFW, and to the clients for CFW. Moreover, our

conceptual framework considers not only the food waste reduction behaviours, which represent the tip of the waste hierarchy (EPA 2013), but once the phenomenon happens and despite all the arrangements made, we should also consider which would be the best behaviours in order to reuse it.

Therefore, starting from an analysis of the literature spanning seven years (2010–2017), the main aim of this paragraph is to understand the factors and incorrect behaviours that are associated to food waste *away from home* by focusing on food waste generated in the kitchen (KFW) and those generated by clients (CFW).

### **2.3.1 Kitchen Food Waste**

Considering the managers' and chefs' perspective, according to the literature, these are the behaviours that significantly reduce food waste: careful ordering and menu planning (Sustainable Restaurant Association 2010), avoiding spoilage waste by monitoring used-by-dates and storage conditions (WRAP 2013), offering different portion sizes according to client's needs and educating the client to carefully order to avoid leftovers (WRAP 2013; Sustainable Restaurant Association 2010).

Concerning food waste reuse and redistribution, it has been seen that the best behaviours rest on the possibility of reusing edible food items for making other recipes (WRAP 2013; Sustainable Restaurant Association 2010); on the donation of kitchen surplus food; and on offering the customer the chance to take the leftovers home through the adoption of a doggie bag (WRAP 2013).

### **2.3.2 Client Food Waste**

Considering the clients' perspective, the main behaviour in order to reduce waste would be not to leave food scraps on the plate. One of the biggest factors that influences clients' leftovers is serving too big portions of food (WRAP 2013; Sustainable Restaurant Association 2010). Therefore, going back to the manager's perspective, it is fundamental to adapt portion sizes to the client's needs. Indeed, according to a study conducted in the UK which focus on CFW, 2/5 of the interviewed stated that among the potential solutions to reduce waste there should be the customization of portion sizes, various food choices and price, and that they would agree to eat smaller portions for a minor cost (WRAP 2013).

Concerning food waste reuse, from the clients' perspective, the adoption of the doggie bag made available by the restaurant manager is fundamental for them to be able to consume their leftovers at a later time (WRAP 2013; Sustainable Restaurant Association 2010). In Anglo-Saxon countries (like in the US and UK) and in the Northern European countries this practice is widely embraced at any social level, while in the Mediterranean countries the majority of the people still don't ask for it, especially for cultural reasons. To give an example, although 90% of Italians

**Table 2.2** Food waste away from home. The conceptual framework

	Responsibilities	FW Reduction Behaviours	FW Reuse or Redistribution Behaviours
<p><b>Kichen food waste</b> Food wasted during the preparation phase, due to overproduction, peeling, cutting, expiration, spoilage, overcooking, etc.</p>	<p><b>Restaurant's managers and chefs</b></p>	<p>Careful ordering and menu planning; Avoiding spoilage waste by monitoring used by dates and storage ; Offering different portion sizes. Educate the client to carefully order to avoid leftovers.</p>	<p>Reuse edible food items for making other recipes; Donation of surplus food; Offering a doggy bag to the client.</p>
<p><b>Client food waste</b> Food wasted by the client after the food has been served to them</p>	<p><b>Restaurant's clients</b></p>	<p>Avoid leftovers</p>	<p>Doggie bag adoption</p>

Author elaboration based on an idea by Principato, Pratesi, Secondi, 2017

believe that restaurants waste a large amount of food, as many as 41% are embarrassed to ask for a doggie bag (Last Minute Market, SWG 2016). Indeed, only one out of three Italians brought leftovers home from restaurants at least once (36%), and 22% believe that asking for a doggie bag represent a rude behaviour and they feel ashamed to do so (Coldiretti 2017; similar results were found by Sirieix et al. 2017) (Table 2.2)

**BOX 2.2 Food Waste at Workplace level: an exploratory study in company canteens**

To the best of our knowledge, until now, no study has focused on the main factors that influence food waste within the workplace. Also from a practical standpoint, the main initiatives against food waste in this sector are concentrated on food waste redistribution, and not on the prevention of it. Thus, the main aim of this research<sup>2</sup> was to identify food waste drivers in company canteens, and secondly elaborate some guidelines for canteens operators in order to prevent it.

“Canteens food waste” can be defined as all the wasted food that occur in the kitchen and leftovers made by canteen’s clients. In Europe food waste in this sector represents the 14%<sup>3</sup> of total.

The research methodology is structured as follows:

<sup>2</sup>Research made by Ludovica Principato and Monica Maria Cucurullo.

<sup>3</sup>European Commission (DG ENV), *Food Waste in the EU: a study by the European Commission, Workshop on Municipal Waste Prevention*, Barcelona, 24th of November 2011.

1. In-depth interviews addressed to seven canteen operators, with the aim of deepening the knowledge of this phenomenon;
2. Interviews have been analysed using a qualitative methodology (content analysis);
3. Data have been interpreted and compared.

The decision of using the in-depth interviews has been guided by the following factors: (i) it is based on a flexible and non-standardized scheme of interrogation; (ii) it can explore a new phenomenon and identify the latent critical variables; (iii) it allows subjects to establish a direct relationship without conditioning and mediation.

Interviews have been conducted inside the canteens, because people feel more comfortable in their natural place, they give genuine answers and they are not distracted by external stimuli.

During the interview it was used a semi-structured form consisting of twelve open-ended questions.

In the first phase of the analysis, “word clouds” were built on some of the key questions, in particular those related to the causes of food wasting, the initiatives taken to reduce it and the management of surplus food.

According to this analysis, the most popular causes of food waste are: the number of clients present that is not always easy to forecast, and the preparation of greater quantities of food (supply higher than the demand). Concerning the actions put in place to reduce the phenomenon, these are the most relevant: a careful estimation of costs and the preparation of portion sizes on the base of specific needs.

In the second stage of the analysis, a content analysis has been conducted, following these phases: (i) the transcriptions of the interviews have been decomposed in constitutive elements; (ii) the constitutive elements have been encoded in categories; (iii) a contingency table has been created to show the most frequent categories.

According to the analysis, 18 categories have emerged: 13 of these cover the phases before the food waste occur, such as the causes or factors that have strong influence on the phenomenon manifestation, four concern the management of surplus food and the category “generation of food waste”, which is the central theme of the analysis.

The categories identified are variables that affect the phenomenon of food waste.

Therefore, according to our results, the food waste drivers of company canteens are the following:

1. The flow of guests;
2. The inventory planning;
3. The kitchen management;
4. The consumer behaviour;

5. The level of control implemented by canteens' manager on suppliers and staff;
6. The choice of ingredients used to prepare the dishes;
7. The staff training;
8. The menu planning;
9. The size of the portion of the dishes;
10. The cooking;
11. The attention paid to the costs;
12. The attention not to waste food;
13. The level of communication between the different company areas.

The variables that have more impact on the generation of food waste are related to the management perspective, rather than to the client's behaviour itself.

Thanks to these results, it was possible to define guidelines for the prevention of food waste addressed to canteen managers.

These guidelines have been developed for all the canteens activities, therefore to reduce food waste we need to revise these "canteen routines":

1. Inventory planning:
  - make daily purchases,
  - select carefully the ingredients to use,
  - check the suppliers carefully.
2. Menu planning:
  - create different menus to meet all preferences (vegetarian menu, gluten-free menu, healthy menu, etc.),
  - create a menu based on the most "popular" dishes,
  - promoting the "second life menu", i.e. a menu made up of easily reusable ingredients in case of surpluses.
3. Production:
  - apply the "just in time" logic to the production phase, prepare the food when is requested by the customers,
  - freeze food after cooking,
  - prepare different portion sizes.
4. Management of customer flow:
  - correctly forecast the number of customers considering factors like: weather, public transport strikes, staff leave, etc.
  - develop an application that can inform guests about the day's menu and that gives customers the chance to book meals for the next day.

## 5. The service:

- use marketing nudging to change guests' behaviour towards less waste,
- self-service can minimise food waste, as it has been demonstrated that guests eat 92% of the food they serve themselves,
- defining the price according to the weight of the portions,
- use beverage distributors with the aim of reducing drink waste and waste production.

## 6. Sensitize the staff and guests regarding food waste:

- make poster campaigns,
- organize events on food waste,
- use tablecloths for food waste prevention, as they are the first things that guests see under the plates and during the queue,
- create a leftover recipes book.

## 7. Staff training:

- staff training activities on sale techniques to guide guests in the choice of dishes,
- incentives,
- highlight the work of staff.

## 8. Food waste monitoring:

- periodic monitoring of surplus food,
- leftover accounting system,
- place a monitor that controls waste production and that people make the separate collection in the right way.

## 9. The management of food surpluses:

- increase the doggie bag adoption among clients,
- food donation to charitable associations,
- food donation to canteen staff,
- animal feed.

**BOX 2.3—Kitchen food waste: an interview with the chefs**

Concerning the away from home phase, we have seen that chefs, responsible for food preparation and cooking in the kitchen, play an important role on food waste phenomenon. However, up to now, a specific study does not exist that seeks to understand how the chefs' category is moving to reduce the phenomenon in the kitchen and in the restaurant room.

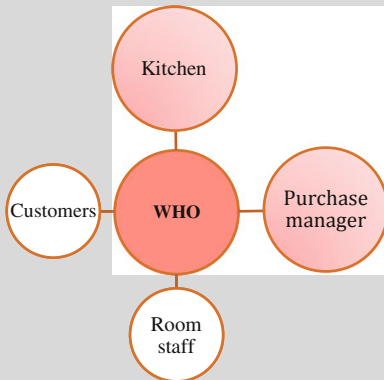
That is why in 2016 we decided to interview 11 relevant Italian chefs in order to understand their attitudes and behaviours on the phenomenon.<sup>4</sup>

The open-ended interviews consist of a set of 10 questions, the first three to define the chef's profiles, and the others more specific on food waste issue and the actions put forward by the chef in order to tackle it. Responses have been recorded and transcribed. The chefs were interviewed in their restaurants, via Skype calls, and also through face to face mode, during the Fourth Edition of Taste of Excellence, an Italian event that brought together producers, chefs, cooking schools, operators, and institutions about the most relevant innovations and trends at restaurant and catering level.

The responses were analysed through a categorization process: six macro-categories were drawn from a summary of the statements and the answers of the interviews, as follows:

1. WHO waste in restaurants;
2. What are the CAUSES leading to Food Waste;
3. What are the ACTIONS made by the Chefs and/or the restaurants' managers;
4. What are the INTERNAL PROBLEMS related to the phenomenon;
5. What are the EXTERNAL PROBLEMS related to the phenomenon;
6. How, effectively, the phenomenon is MANAGED within restaurants;

In order to group them into the six macro-categories radial cyclical charts were used.



From these statements, we can notice that all chefs, even if seeking waste avoidance, feel that the greatest amount of waste in the Italian restaurants takes place in the kitchens, followed by waste generated by the managers devoted to purchasing; therefore the most significant waste builders are the Chefs themselves, followed by the restaurant's managers and the room staff.

<sup>4</sup>Research made by Ludovica Principato and Chiara Vizzini.

Customers also contribute to the generation of waste into the restaurants, but less than the above-mentioned actors.

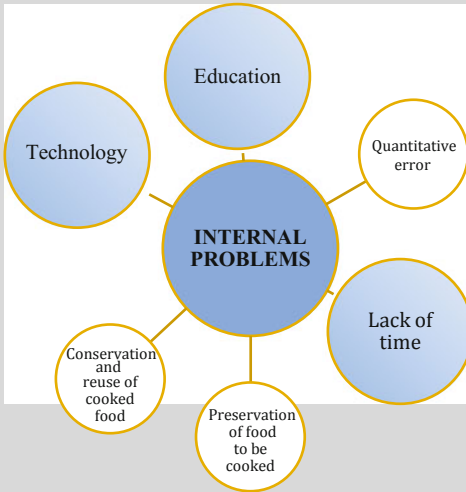


Considering the causes, time, education and professionalism are the three keywords that most frequently appear in Chef’s responses. Time could be considered as the rush that characterizes cooking activity that often causes staff mistakes in managing food, thus resulting in waste. The lack of education of most of those who work in restaurants is the cause of the lack of professionalism and consequent superficiality in daily actions that lead to a huge growth of food waste within the kitchens, if not in the entire restaurant.

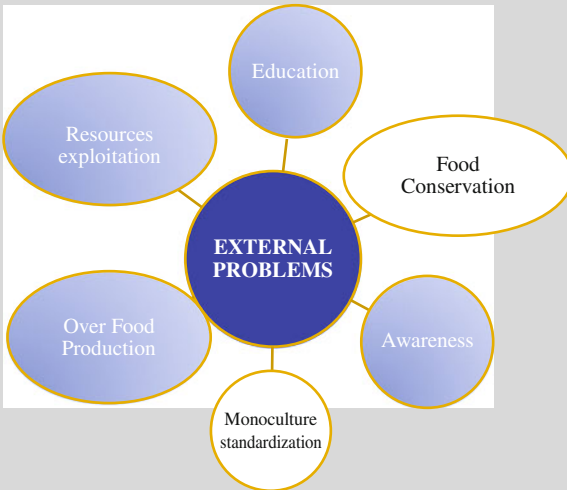


Among the main actions to adopt to limit the waste, the most obvious is the internal education in restaurants, so that almost all chefs interviewed talked about the importance of making team aware, in particular through training courses. It is therefore fundamental to educate the kitchen staff about the respect for food first, by teaching how to better handle raw materials.

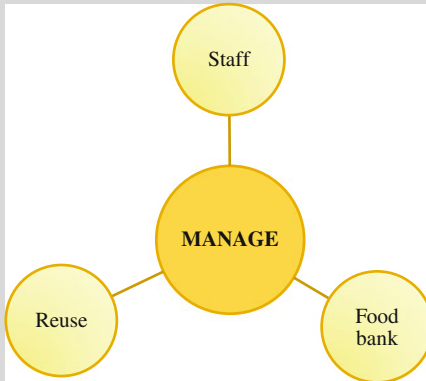




Regarding the internal problems, we should mention the lack of technology awareness, that is the inadequate knowledge of how to make the best use of the innovative technology in food conservation and preparation (refrigerators, freezers, temperature cutter, HiTech ovens, etc.) often leads to a bad preservation of cooked and non-cooked food, resulting in food spoilage and ultimately in an economic loss for the restaurant.



Also in the category of external issues related to the phenomenon, a lack of client’s education and awareness of food waste and its related issues need to be addressed.



The concrete actions that some restaurants are already implementing are represented by the use of tasty leftover recipes that allow the chef not to waste food scraps, and the redistribution of still edible cooked meals to people in need.

## 2.4 Discussion and Future Research

This chapter proposed a new theoretical framework to explain the multiple, complex food waste behaviour at household level. It is nevertheless important to say that the different influences and incorrect behaviours highlighted in the model could not be seen as exhaustive. Yet, researchers are encouraged to fill the framework with other factors and influences that impact on wasteful behaviour.

Similarly, since the *away from home* phase represents a fairly new research stream within the food waste literature, I believe that the conceptual framework proposed in this book could be expanded by new reduction and reuse behaviours useful to tackle the phenomenon.

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# Chapter 3

## Food Policies to Tackle Food Waste: A Classification



**Abstract** Food waste definitely represents a threat for the sustainability of our food systems. Recently governments are starting to be aware of it and are implementing promising food policies. Indeed, in this chapter we will seek to highlight the most relevant international policies put forward to curb the phenomenon and to classify them, according to the most effective food policy measures.

**Keywords** Food waste · Food waste policies · Policy measures  
Sustainable food systems

### 3.1 Policy Tools in the Food Sector to Enhance Sustainable Behaviours

In order to reduce food waste, therefore reducing its impacts and ensuring the sustainability of our resources, it is fundamental to have the commitment of Governments and Institutions that could enact food policies in order to reduce or redistribute it, along with promoting information based campaigns to make individuals more aware of the phenomenon.

According to Lorek et al. (2008) food policies aimed at preserving food system sustainability are based on three major types of measures: information-based, market-based, and regulatory. Besides these classical policy instruments, there are the so-called “nudging” tools, in which indirect suggestions can positively influence individuals to achieve a non-forced compliance (Reisch et al. 2013; Thaler and Sunstein 2008; Sunstein and Reisch 2014).

Sustainability labels, certifications and sustainable dietary guidelines represent an approach to promote sustainable consumption from an information-based point of view. Those labels raise consumer awareness about the healthiness and environmental impacts of food and enable informed decision-making (Eberle et al. 2011).

Market-based policies include subsidies for healthier food and taxation of certain type of unsustainable foods (e.g. junk food) or food components (e.g. certain fats) (Nicholls et al. 2011).

Regulatory policies include a general development of well-defined sustainability targets in the food area, such as land-usage objectives and greenhouse gas emissions (Reisch et al. 2013; EEA 2008). At consumption level we have to mention the advertising limitations for vulnerable population (especially children), and some other regulation- based policies, as the reformulation of school nutrition programs for children.

Concerning the “nudging” tools, examples include sustainable choice default environments, such as in the public canteens putting the healthiest food at consumer sight level, or presenting them in a more appealing way; and improving the availability and affordability of more sustainable meals for the low-income population (Wahlen et al. 2012; Reisch and Gwozdz 2013). These solutions are proven to be more effective than simply banning unhealthy foods from dining facilities (Downs et al. 2009; Just and Wansink, 2009; Taber et al. 2012).

Moreover, governments could and should also influence food companies and other organizations by encouraging and investing in voluntary self-commitment.

Up until now, both in Europe and United States the prevalent policy measures in the food sector are information-based and education-oriented ones that focus on raising awareness and are often accompanied by voluntary strategies (Reisch et al. 2013).

Food waste definitely represents a threat for the sustainability of our food systems. Recently, governments are starting to be aware of it and are implementing promising food policies, based on the tools we have just seen. Indeed, in this chapter we will seek to highlight the most relevant international policies put forward to curb the phenomenon and to classify them according to the food policies background.

## 3.2 Conceptual Framework

As we have just seen, according to the most relevant literature (Reisch et al. 2013; Thaler and Sunstein 2008; Sunstein and Reisch 2014; Lorek et al. 2008) the main measures adopted to enhance the sustainability of our food systems are: information-based, market-based, regulatory ones, along with the so-called “nudging” tools. That is why I decided to categorize the main food waste policies according to these measures. In addition to these, I added the so called “self-regulatory” measures, that are represented by voluntary agreements between organizations and governments in order to tackle food waste on a self-committing base.

In the introductory Sect. 3.1 defined the measures according to the literature and made some examples focusing on healthy eating and sustainable consumption in general, let us see how each of them can be declined to deal with the food waste

issue. Information-based policies are mainly represented by social campaigns promoted by the governments in order to raise citizen's awareness on the phenomenon, but they can also be addressed to different target population like companies or local communities.

Market-based instruments related to food waste specifically encompass fiscal incentives for those organizations who donate surplus food to people in need, but also the developing of monitoring programs to ensure voluntary agreements are followed (Reisch et al. 2013).

Regulatory policies include a general development of well-defined anti-food waste targets, like reducing food waste of a certain percentage by a certain year, or similarly set the rate of recycling of household food waste.

Voluntary agreements involve for instance the commitment of the food industry in signing a pact with the institutions to reduce its food waste.

To finish, among the “nudging” tools we can comprise cooking classes sponsored by the governments to instil to individuals' culinary skills in order to avoid waste and reuse them if they happen. Or also the incentive to use the doggie bag at restaurants level in order to reuse the leftover at a later time.

### 3.3 Research Methodology

In order to classify sharing models within the food industry, the first stage of our research was the selection of policies to be included in the list. The following research procedure was used:

- a search of major academic journals, EBSCO, Elsevier, Google Scholar, Scopus, Emerald databases using the following keywords: “food waste”, “food waste policies”, “food policies”, “anti-waste policies”;
- the following keywords were entered in search engines: “food waste”, “food waste policies”, “food policies”, “anti-waste policies”.

The policies were selected from the pool on the basis of two main criteria:

- extent of the relevant information;
- homogeneity throughout the sample, for example, trying to select policies that are putting forward at national level and not single community or local policies;
- policies effectively implemented and not policy drafts or proposals.

Indeed, this process led to the identification of 30 policies, which represent the sample for investigation, and which are listed in Appendix 1.

After selecting the sample, I classified them according to the policy measures previously depicted. The classification was made after a deep analysis of the selected policies. It is worth saying that some policies encompass different measures, and some are halfway between one instrument or another (like voluntary agreements and nudging). In this case we selected two measures, or we went on what for us was the most representative measure of the policy in question.



### 3.4 Results and Discussion

The years of implementation of these policies span between 1996 (with the American Good Samaritan Food Donation Act, a legislative form which encourages the donation of food to not-for-profit organizations for helping people suffering from hunger), and 2017. If we exclude the far away 1996, all the other policies refer to a earlier year, with the United Kingdom as a forerunner in the battle against food waste with the funding of Waste Resources Action Programme (WRAP) in 2005, and the Courtauld Commitment in 2005, a voluntary agreement under by Westminster, Scottish, Welsh and Northern Ireland governments in conjunction with WRAP, that target the UK grocery sector with the goal of improving resource efficiency and reducing food waste. Signatories of this agreement are the main English food distributors like Tesco and Sainsbury as well as big food companies like Unilever and Nestlé. The Courtauld Commitment has been acknowledged by the European Union as best practice to follow.

Concerning the distribution of the policies, we have to say that the majority is distributed in the regulatory measures (11), followed by the nudging tools (8), and the voluntary agreements (7). If we look inside the policies we can see that the majority of them do not consist in legal obligations. That is why we can definitely say that the most powerful rule coming from France, which as the first country in the World, in 2016, promulgated a promising law that bans big supermarkets (from 400 sq. m. upwards) from throwing away or destroying unsold food, forcing them instead to donate it to charities and food banks. Those retailers that do not respect the law can be fined up to € 75000 and incur up to two years in prison. The same law imposes on restaurants, serving between 150 and 200 meals a day, an annual maximum waste of 10 tonnes, and a more demanding recycling protocol.

It is interesting to notice that the majority of policies come from Europe, confirming that this Continent is a step forward in the fight of food waste. Indeed, different governments in Europe have fixed ‘ad hoc’ policies or programs regarding food waste. A big part of these initiatives is local and based on voluntary participation (EU Commission 2014). Overall the government agencies in Europe have created information and participation programs aiming to boost the knowledge of food waste between European citizens. In fact, the recommendations given by the European Union are not enforceable laws, but lead to voluntary national and local government programs. In particular, the ‘Waste Framework Directive’ (2008), has defined the waste hierarchy, to be taken into account from all the governments of the EU Commission: prevention; reuse; recycling, recovery, disposal. Moreover, in 2008, the EU Commission, have also established a new regulation, eliminating the aesthetic requirements for the sizes of fruits and vegetables, in order to prevent the discard of perfectly edible food. As an interesting nudging initiative, we should mention the Bruxelles Environment Agency, which in Belgium in 2009 launched anti-waste training workshops, where they offer free cooking classes with the goal of reducing food waste while cooking. Over 1000 people attended the classes, improving their culinary skill and the ability to reuse leftovers into new meals.

United States, Latin America, Australia and Asia have also carried out promising policies against the phenomenon. In the US, where food waste is very common, there are still no mandatory regulations at federal level. While some States and municipalities are actively planning some initiative to fight food waste. In particular, two federal programs targeting food waste are implemented by the USDA and EPA. Indeed, they created two programs, namely the ‘Food Waste Challenge’, and ‘Food Recovery Challenge’, with the goal to help organizations to waste less food, by giving technical assistance in managing the excess food; and the aforementioned ‘The Federal Bill Emerson Good Samaritan Food Donation Act’.

Another important project is the food waste awareness campaign, called ‘Save Food’, which works in collaboration with several regional partners, in Europe, North America, Africa, Asia, Australia and other countries, and aims to develop regional strategies adjusted to the specific need of the region, actively involved in reducing food waste. Thanks to Save Food, numerous initiatives have been developed at a worldwide level, with a strong participation in 2015, where several international conferences addressing food waste reduction were planned and executed, with the support of this network.<sup>1</sup>

### **BOX 3.1—A sketch on two interesting anti-food waste policy proposals**

It is worthy to see two interesting and brave policy proposals in order to highlight which specific problems they are targeting.

One of those is certainly the one promoted by the German Minister of Food and Agriculture in 2016 that wants to abolish the expiration date on packaging in favour of more scientific and effective alternatives.

Or again, during the huge economic downturn that affected Greece, in 2015 one of the ideas was to take unsold food from shops and restaurants, headed for the bin, and to use it to feed the growing number of Greeks going hungry as the financial crisis took hold.

### **BOX 3.2—The Food Sustainability Index**

An interesting and recent tool to assess how the single countries are dealing with food waste is the Food Sustainability Index (FSI) developed by the Economist Intelligence Unit with the BCFN Foundation. The FSI analyses the sustainability of the countries food systems taking into account three parameters: sustainable agriculture, nutritional challenges, and food losses and waste. For every pillar they also provide a specific ranking to see how the countries are performing according to the single key performance indicator. The index, now in its second edition, took into consideration 34 States, it is not done to be judgmental regarding the performances of the single countries,

<sup>1</sup>Conferences such as: ‘Food losses and waste initiatives’ in Abu Dhabi; ‘Agritech, facing challenges in postharvest losses’ in Tel Aviv; ‘Fight food waste, feed the planet’ in Milan.

but it is interesting to monitor the progress over the time and to highlight benchmarking policies and data. In particular, concerning food waste, it is interesting to notice that apart from France, that thanks to its powerful legislation jumps first in the rank, Italy upgraded its result from 9th position in 2016 to 4th position in 2017. This is due to a good law implemented in 2016 that encourages food donation and the use of the doggie bag respectively at retail and restaurant level, thanks to fiscal incentives and a bureaucratic simplification. Therefore, although the law does not have the mandatory aspect that the French one has, it is proving to be effective in the fight against waste and in particular in facilitating the redistribution of it.<sup>2</sup>

## Appendix—Main Policies Against Food Waste: The Final Classification

COUNTRY	Target population	Policy name/ Promoter	Year	Information based	Market based	Regulatory	Voluntary agreements	Nudging
EU	All	European Parliament voted to introduce farm-to-fork targets to reduce EU food waste	2017			X		
Belgium	All	Bruxelles Environment Agency began anti-waste training workshops	2009					X
Denmark	All	“Denmark without waste”	2016			X		
Finland	All	“Towards a recycling society—The national waste plan for 2016”	2016			X		
France	All	The ADEME created an information campaign in 2005 with the goal of informing citizens about food waste	2005	X				
France	Consumer	Grenelle II	2016			X		X
France	Retailers/ Food banks/ Not-for-profit	“Lutte contre le gaspillage alimentaire”	2016			X		
Germany	All	Too good for the bin	2012			X		
Greece	All	National waste prevention strategic plan	2016			X		
Ireland	All	SI 508	2009			X		
Italy	All	Law 19 August 2016, n. 166	2016		X			X

(continued)

<sup>2</sup>For more information, please check: <http://foodsustainability.eiu.com/>.

(continued)

COUNTRY	Target population	Policy name/ Promoter	Year	Information based	Market based	Regulatory	Voluntary agreements	Nudging
Malta	All	Waste Management Plan for the Maltese Islands 2014–2020	2014			X		
Norway	All	Agreement to reduce food waste	2017				X	
Netherlands	Food companies	No waste network	2013				X	
Portugal	All	Portugal creates commission to tackle food waste	2017	X				
UK	All	Courtauld commitment	2005				X	
Sweden	Distribution companies	Reducing food waste through social innovation—National strategy on food waste prevention	2016				X	
USA	All	The federal bill emerson good samaritan food donation act	1996					X
USA	All	US food waste challenge and food recovery challenge	2013				X	
USA	Food banks/ Not-for-profit consumer	U.S. 2030 food loss and waste reduction goal	2015					X
Brazil	All	Save food brazil: brazil wastes 41 tonnes of food a year	2016	X			X	
Canada	All	National food waste reduction strategy	2017		X		X	X
Australia	All	Working together to reduce food waste in Australia	2016					
China	Consumer	Clean your plate	2013	X				X
Hong kong	All	Food waste free for a better environment	2017					
Hong kong	All	Blueprint for sustainable use of resources 2013–2022	2014			X		
Israel	Food companies	Jewish state's agriculture ministry program	2017		X			
Russia	All	"Guidelines for the calculation of regulated tariffs in the treatment of municipal solid waste management	2017			X		
Singapore	Youths	Singapore's National Environment Agency (NEA)	2017					X
Latin america/ Caribbean	All	Save food	2017	X				

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# Chapter 4

## Food Waste Initiatives at Consumption Level: A Categorization



**Abstract** Several initiatives have been put forward worldwide to tackle food waste at consumer level. Yet, up until now, a comprehensive analysis and a categorization of the most relevant ones have not been proposed. In this chapter we will seek to fill this literature gap, providing a cluster analysis of the main food waste initiatives. The purposes of this analysis have been: (i) to identify the main initiatives implemented at international level against food waste at consumption level; (ii) to create homogenous groups of similar initiatives through a cluster analysis; (iii) to highlight the differences and similarities of the initiatives across the different countries. Moreover, a brief excursus on how some big food corporations are dealing with food waste and how food sharing models can be important in reducing the phenomenon has been presented.

**Keywords** Food waste · Food waste initiatives · Cluster analysis  
Food waste reuse · Food waste redistribution · Food sharing models

### 4.1 Introduction

Over the years, several organizations implemented initiatives to tackle food waste at consumer level. These initiatives concern different goals related to the phenomenon, namely some focus on food waste reduction, others on food waste redistribution and reuse, and others aim at raising consumer awareness on the food they waste. Along with this, other companies, especially in the retail sector, put their effort in selling short-date products at a discounted price. These organizations, active in managing food waste with a responsible role, are the social supermarkets, that receive food, donated from manufacturers and other retailers, and sell it at symbolic prices to a group of people in risk of poverty (Holweg and Lienbacher 2011). Concerning food waste redistribution, we should mention the huge role that food banks have been taking for some years. They represent intermediate agents that collect donated food, from manufacturers, distributors, retail stores, consumers, and

other sources; handle and store them; deliver them to charitable organizations that distribute food or prepare meals for the people in need (Gentilini 2013).

Other organizations, taking an active responsible role in managing food waste, are the social supermarkets, that receive food, donated from manufacturers and other retailers, and sell it at symbolic prices to a group of vulnerable people at risk of poverty (Holweg and Lienbacher 2011). Moreover, numerous private organizations, have taken the responsibility of redistributing surplus meals to food insecure communities. A small yet effective example developed in the Bahamas is ‘Hands for Hunger’. This organization collaborates with several businesses, in order to redistribute extra food to not-for-profit agencies, which support a variety of communities, including the victims of abuse and psychiatric patients. In Australia, ‘SecondBite’, aims to collect fresh products from grocery stores, and has been successful in connecting donor and recipient organizations together, preventing 19000 kg of unused food from going to waste every month. Meanwhile in Italy, ‘Last minute market’ is a project that aims at recovering unsold/un-marketable goods for charitable organizations.

With the specific aim of reducing food waste at household consumption, ‘Save food from the fridge’ is a program launched in the Netherlands, which attempts to prevent food waste from household. The program includes several ideas for keeping food fresher for a longer time, and it also has a specific blog where consumers could upload their own innovative food storage ideas, while, in the United States, a very innovative idea has been conceived in 2004 in Portland, called ‘LeanPath—Food Waste Prevention’, which represents the first fully automated food waste tracking system. This system aims to monitor, prevent and drastically decrease food waste, mainly in the hospitality and restaurant sector. In particular, it provides the workers with an automated instrument which gives an estimated cost to the food wasted, and consequently calculates and analyses the overall food waste situation, including: type of food more often wasted in the kitchens, reasons of wasting, poor planning of food necessary for production.

Indeed, several initiatives are committed to tackling food waste at consumer level. Yet, up to now, a comprehensive analysis and a categorization of the most relevant have not been implemented. In this chapter we will seek to fill this literature gap, providing a cluster analysis of the main food waste initiatives.

## 4.2 Research Objectives<sup>1</sup>

The purpose of this analysis has been: (i) to identify the main initiatives put forward worldwide against food waste at consumption level; (ii) to create homogenous groups of similar initiatives through a cluster analysis; (iii) and finally to highlight the differences and similarities of the initiatives across the different countries.

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<sup>1</sup>The Sects. 4.2–4.4 have been written by the author and Monica Maria Cuccurullo.

For the sake of this analysis we defined as food waste initiatives at consumption level, all the initiatives implemented in the last stage of the agri-food chain, that is initiatives aimed at reducing food waste issue among individuals.

### 4.3 Research Methodology

The analysis has been divided into two parts:

1. Research and collection of food waste initiatives at consumption level;
2. Cluster analysis of the identified initiatives.

The analysis began with the collection of the anti-food waste initiatives, that have been classified according to some relevant parameters: the start year, the organization name and business profile (profit, not-for-profit), the country of presence, the area of implementation (national, international, local), the objective (food waste reuse, food waste reduction, food waste redistribution, awareness raising campaign, sale of short-date products) and the target to which the initiative is addressed (general public, consumers in need, youths). These parameters have been defined according to the literature review of the Chap. 2, in particular we decided to split the target of the initiatives into general public, that is individuals in general; consumers in need, that is low income people that need to buy food at an affordable price or have no money to buy it; and youths since we have seen in the literature that youths are a category of people that tend to waste more than individuals in general. People in need have been selected because it is interesting to see if initiatives aimed at redistributing food waste do this also for social purposes, that is, giving food to people that do not have enough money to access it. Concerning the objective, we have drawn from food waste hierarchy in order to find the most relevant goals for anti-waste initiatives. Indeed, as seen before, food waste can be reduced *tout court*, but it can also be reused, redistributed, or simply food waste can be addressed by an awareness-raising campaign that seek to make people more aware of it.

There are a total of 109 operating initiatives, which start their activity to the period from 1960 to the present: the oldest one is “Feeding America” (1960), the youngest one is “Trash Hunger, Not Food: A Guide to End Campus Food Waste” (2017).

After identifying the main initiatives, the second step of the analysis has been to perform a cluster analysis with the aim of creating groups of similar initiatives. Cluster analysis is a multivariate analysis technique used for the selection and grouping of homogeneous elements in a set of data, it is based on measures of similarity between elements.

To perform the analysis, SPSS software was used and the non-hierarchical K-means method was applied. This method is often used for exploratory analysis,



and the procedure follows a simple way to classify a given data set through a certain number of clusters fixed a priori.

In our case the number of clusters are five, that is the cluster analysis was performed using the objectives of the initiatives as the variables able to differentiate groups between them and able to group the similar initiatives.

## 4.4 Results and Discussion

From our analysis it emerged that the discriminating variable, that differentiate one initiative between the other is the initiatives objective. Indeed, here below there are highlighted the five different clusters that have emerged from our study:

### 1. **FW redistribution**

In this group are all the initiatives devoted to the redistribution of food surpluses to consumer in need. The initiatives in this cluster basically relate to food waste management, so they encompass the downstream stage of waste.

### 2. **FW reduction**

In this group are all the initiatives focused on the prevention of food waste. Prevention is the best and most efficient way to deal with food waste, as it concerns the upstream phases of waste.

### 3. **Awareness raising campaign**

In this group are all the initiatives focused on raising individuals' awareness on food waste topic, such as social advertising campaigns against food waste or events focused on sensitizing people on the subject, implemented by not-for-profit organizations and companies.

### 4. **FW reuse**

In this group are all the initiatives focused on the reuse of food surpluses with a different objective than that of redistributing it to alternative markets or people in need. For instance, by using leftovers for new business purposes.

### 5. **Sale of short-date products**

In this group are all the initiatives that focus on the sale of short-dated products at a discounted price.

From the analysis of the output of SPSS software it is possible to make the following considerations. Firstly, the ANOVA test is significant, indeed the p-value is equal to 0.000. Secondly, the number of initiatives per cluster is not homogeneous: Food Waste redistribution (Cluster 1) has 33 initiatives; Food Waste reduction (Cluster 2) has 19 initiatives, Awareness raising campaigns (Cluster 3) has 48 initiatives; Food Waste reuse (Cluster 4) has 4 initiatives; Sale of short-date products (Cluster 5) has 4 initiatives (Table 4.1).

The larger cluster is the number 3 "Awareness raising campaign" with 48 cases: most of the initiatives identified focus on awareness of the food waste phenomenon. In our opinion this could happen because it is easier for companies to perform

**Table 4.1** Initiatives per Cluster

Cluster 1: FW redistribution	Cluster 2: FW reduction	Cluster 3: Awareness raising campaigns
Banco Alimentare	Il buono che avanza	Feeding the 5000
Buon Fine	Buta Supa	Love Food, Hate Waste
Last Minute Market	City Slicker Farms	This is Rubbish
Buon Samaritano	Green Cook	Great Taste Less Waste
FareShare	Anti-Waste Workshops—Cooking Classes	Buy one, get one later
Food Cycle	The Spanish Confederation of Consumer and User Cooperatives	Réduisons nos déchets
Grow Sheffield's Abundance Project	Insignia Technologies	Plan National Nutrition Santé
ANDES	The Dickinson College Farm	Edible Schoolyard Project
City Harvest	Save Food from the Fridge	SAVE FOOD
Rock e Wrap It Up!	SolerCool Container	foodwaste tv
Feeding America	EPA's Guide to prevent food waste	Stop Wasting Food
Society of St. Andrews	Barilla Blue Box Pasta	Friends of Environment and Development Association
Mesa Brasil del SESC	Eurest restaurant and food campaign	Operation Empty Plate
Food Recovery Network	Single Bananas	Clean Your Plate Campaign
Hands for Hunger	Eetmaatje (Measure cup)	NaDEET
Annakshetra: SAVE FOOD	Fridge Sticker yes/no	Food Wise
SecondBite	Io non spreco: adotta un nonno a pranzo	Eviter la gaspillage alimentaire
Lutter contre le Gaspillage Alimentaire	Io non spreco: snack-saver bag	Appetite for Action
The Pig Idea	"Restaurant fines"	Calling Time on Waste
DC Central Kitchen		Zero Waste
Un poco de tu compra es mucho		Voedselverspilling
Auchan Spa		Slow Food Youth Network
Bennet		Every Crumb Counts
City Harvest London		European Week for Waste Reduction
Close Bakery		Sprecare non vale!
Daily Menus for Homeless		Culinary Misfits
Every Meals Matters		EU-FUSIONS

(continued)

**Table 4.1** (continued)

Cluster 1: FW redistribution	Cluster 2: FW reduction	Cluster 3: Awareness raising campaigns
OLIO		The Postharvest Education Foundation
QUI Foundation Onlus		Springboard Kitchens
SitiCibo		Stop Food Waste Campaign
Lebensmittel sind kostbar		Zero Waste Initiative
Team Austria		Think Eat Save
We Love Food		DiscoSoup
		DIVE!
		Do you have an amusement park in your fridge?
		Dutch Nutrition Centre: Information for consumer on food waste
		Generation awake
		International Food Waste Coalition
		Love Green
		Menu Dose Certa
		Restos Glücklich
		School waste heroes
		Still Tasty
		Taste the Waste
		Trash Hunger, Not Food: A Guide to End Campus Food Waste
		Waste
		Next Door Help
		Inglorious fruits and vegetables
Cluster 4: FW reuse	Cluster 5: Sale of short-date products	
IoMiAmo	Quel che c'è	
Paris Restaurants Turn Food Scraps Into Biogas	Approved Food	
EcoScraps	Essential Waitrose a little less than perfect apples	
Fish and shellfish by-products as food/feed/ other	Happy Hour in bakery	

awareness raising campaigns that have demonstrated to be effective, than reduction campaigns which are also effective in different ways, but probably are also more difficult to implement.

Clusters with fewer initiatives are Cluster no. 4 “FW reuse” and Cluster no. 5 “Sale of short-date products”, both with four cases. At global level the initiatives concentrated in these two objectives are very few, also because they encompass a very narrow issue related to food waste.

Finally, from the cluster analysis it is possible to highlight the initiatives’ country of origin per type of cluster. This is very useful in defining how different countries deal with food waste and which are the main approaches that they are implementing to tackle the phenomenon (Table 4.2).

According to our analysis, the main approaches highlighted between countries are as follows:

- Italy is more oriented towards food waste redistribution (8 initiatives), and towards food waste reduction (5 initiatives). Indeed, it seems that in this country the main initiatives are concentrated on the management of leftovers, and not on the prevention of it.
- United Kingdom and United States of America are oriented towards both food waste redistribution and awareness raising campaigns objectives.
- Germany, France, Europe, China, and Ireland are more oriented towards awareness raising campaigns. Indeed, it seems that these countries are more committed in increasing people’s knowledge and awareness towards food waste and its related impacts.
- Belgium is more oriented towards food waste redistribution.
- The Netherlands are more oriented towards food waste reduction objective.

Another interesting aspect has been to see which country has more weight for each cluster. In Cluster 1 “Food Waste redistribution” and Cluster 2 “Food Waste reduction” the country with more weight is Italy with 8 and 5 initiatives, respectively. In Cluster 3 “Awareness raising campaign” United Kingdom is the country with more initiatives (8 initiatives). Regarding Cluster 4 “Food waste reuse”, there is no country with more weight than the others; indeed, the countries that implement food waste reuse initiatives are equally distributed between Italy, France, United States of America and Europe. To finish, in Cluster 5 “Sale of short-date products” the country with more initiatives implemented is the United Kingdom.

## 4.5 Case Studies Analysis

In this paragraph one of the more interesting initiatives for each cluster will be listed and explained. The five initiatives chosen are: “Feeding America” for the “Food waste redistribution” cluster, “Insignia Technologies” for the “Food waste reduction” cluster, “Love Food, Hate Waste” for the “Awareness raising campaign” cluster, “IoMiAmo” for the “Food waste reuse” cluster and, lastly “Approved Food” for the “Sale of short-date products” cluster. Below an identikit will be provided with a detailed explanation of these five initiatives.

**Table 4.2** Initiatives’ Country of origin per type of cluster

Cluster 1: Country	Freq.	Cluster 2: Country	Freq.	Cluster 3: Country	Freq.	Cluster 4: Country	Freq.	Cluster 5: Country	Freq.
Italy	8	Italy	5	UK	8	Italy	1	Italy	1
UK	5	USA	3	France	3	France	1	UK	2
France	1	EU	1	USA	6	USA	1	Germany	1
USA	6	Belgium	1	Germany	6	EU	1		
Brazil	1	Spanish	1	Denmark	1				
Bahamas	1	Scotland	1	Egypt	1				
India	1	Netherlands	3	China	2				
Belgium	2	Ireland	1	Nambia	1				
Australia	1	Sweden	1	Australia	1				
Spanish	1	Denmark	1	Belgium	1				
Germany	2	UK	1	Ireland	3				
Czech Republic	1			Hungary	1				
Global	1			Netherlands	2				
Austria	2			Brazil	1				
				EU	6				
				Italy	2				
				Canada	1				
				Sweden	1				
				Portugal	1				

**FW redistribution: *Feeding America***

**Location:** USA

**Start Year:** 1960

**Organization Type:** Feeding America network is the nation’s largest domestic hunger-relief organization.

**Strategy:** it distributes 1.3 million tonnes of food and food produced products to over 46 million Americans with low income (14 million children and 3 million seniors); it comes from 200 food banks scattered all over the country.

**Partners:** individuals, foundations and corporates.

**Recovered food surpluses:** in 2016, 4 billion meals redistributed.

Feeding America is a not-for-profit organization based in the United States, it encompasses the largest national food banks network. It avails itself of a robust

infrastructure and a high degree of coordination. The phases of the process are the following: (1) the organizations secure donations from food and grocery manufacturers, retailers, shippers, packers and growers and from government agencies; (2) the network receives and stores donated food; (3) food banks distribute food and grocery items to people in need; (4) Feeding America network supports programs which improve food security among people and educate the public about food waste and hunger problems.

The main partners of the network are individuals that donate food, along with foundations and organizations supporting the initiative from the financial point of view and through the implementation of awareness raising campaigns.

**FW reduction: Insignia Technologies**

**Location:** Scotland

**Start Year:** 2012

**Lead Organization:** Insignia Technologies

**Organization Type:** Insignia Technologies develops smart pigments and ink-based sensing technologies for the food packaging industries.

**Strategy:** Insignia Technologies is taking an innovative approach to prevent food waste, focusing particularly on an interesting and specific topic: best by dates in the food packaging industry. Their team is currently creating distinct colour-changing labels that indicate when a food product passes its best by date, ensuring that food is consumed rather than disposed of due to preliminary spoilage.

**Partners:** several food companies.

Insignia Technologies is a Scottish food packaging company that has been developing smart pigments and ink-based sensing technologies for the food packaging industries since 2012 with the aim of enhancing food safety while reducing food waste throughout the supply chain, from field to final consumption.

It is taking an innovative approach to preventing food waste, focusing in particular on best by dates in the food packaging industry. Its team is currently creating distinct colour changing labels that indicate when a food product passes its best by date, ensuring that food is consumed rather than disposed of due to preliminary spoilage. It helps to minimize food wastage and ensures consumers know when food fits for consumption.

The benefits of these initiatives are as follows: it reduces food waste in home or restaurants by showing how long ago the package has been opened; it indicates food freshness; it can be customized in basis of the kind of food.

The main partners of Insignia Technologies are packaging companies.

### Awareness raising campaign: Love Food, Hate Waste

**Location:** UK

**Start Year:** 2007

**Lead Organization:** WRAP

**Organization Type:** WRAP is a registered charity, which works with businesses, individuals and communities to deliver practical solutions to improve resource efficiency and avoid waste.

**Strategy:** it offers suggestions and useful advice, practical recipes on reusing meal leftovers. It searches new technologies that would replace the often misinterpreted “use by” label.

**Partners:** community organizations, chefs, UK Government, UK businesses, trade bodies, local authorities and individuals.

“Love Food, Hate Waste” is an English awareness-raising campaign organized by WRAP and born in 2007. The dedicated website of the initiative<sup>2</sup> offers suggestions and useful advices (for example, on how to prepare the right portions or correctly preserve food in the fridge); offers practical recipes on reusing meal leftovers, with the aim of reducing domestic food waste and raising awareness about the food waste issue; provides communication materials to local authorities in order to make people more aware about the food they waste; looks for new technologies that would replace the often misinterpreted “use by” label.



**Fig. 4.1** Some visuals of the awareness raising campaign Love Food Hate Waste

<sup>2</sup>Source: [www.lovefoodhatewaste.com](http://www.lovefoodhatewaste.com).

“Love Food, Hate Waste” has been one of the first and most relevant campaigns promoted against food waste, it encourages people not to waste food, emphasizing its related economic and environmental impacts (as an example of one of the campaign visuals, see Fig. 4.1).

**FW reuse: Ecoscraps**

**Location:** USA

**Start Year:** 2010

**Lead Organization:** Ecoscraps

**Organization Type:** Ecoscraps is a profit company that reuses food waste into organic and sustainable lawn and garden products.

**Strategy:** Ecoscraps recycles food waste from all parts of the food waste cycle, composts it and sells the natural and organic products for gardening. Since 2010, Ecoscraps has diverted over 225 million lbs of food waste from landfills.

**Impacts:** in 2017 it will collect 75 million lbs of food waste from retailers across America.

Ecoscraps reuse food waste into products for gardening and sell it to the public. This initiative is very interesting because it shows how food waste can be turned into a profitable business when correctly reused.

**Sale of short-date products: Approved Food**

**Location:** UK

**Start Year:** 2009

**Lead Organization:** Approved Food & Drink Company

**Organization Type:** online discount food retailer that sells food products close to the recommended expiration date at discounted prices.

**Strategy:** online sale at discounted price of food and drinks with the aim of increasing awareness among consumers who can afford to buy products at “normal” prices and who are aware that the useful life of foods is often longer than the expiration date printed on the label.

**Partners:** other companies (i.e. Naturally Free, Pamper Warehouse, Great British Sweets, Truly Pets, International Gourmet)

**Saved money:** Shoppers save more than 70% of their weekly grocery shopping.



Approved Food is the UK's largest online discount supplier of short-dated food and residual stock. The aim of this initiative is to increase awareness among consumers who can afford to buy food at "normal" prices and who are aware that the useful shelf life of foods is often longer than the expiration date printed on the label. Approved Food wants to educate people about the difference between sell-by-dates, use-by dates and best-before-dates. The main partners of the initiatives are companies like Pamper Warehouse and International Gourmet. Thanks to this online shop, shoppers can save more than 70% of their weekly grocery shopping.

#### **BOX 4.1—How are big food companies dealing with food waste?**

Another interesting aspect regarding food waste initiatives relates on how big food companies are dealing with it. Food waste represents a cost for companies, but many of them are still not aware about it. Concerning this, it is worth mentioning the initiative Champions 12.3 where executives from governments, businesses, international organizations, research institutions, farmer groups, and civil society are dedicated to inspiring ambition, mobilizing action, and accelerating progress toward achieving SDG target 12.3-halving per capita food waste at retail and consumer level by 2030. The main report issued by this initiative indeed highlighted the importance on investing in food waste reduction for the company budget: for every \$1 (or other relevant currency) invested in food loss and waste reduction, the median company site realized a \$14 return. Company sites with the highest returns tended to be restaurants. Hotels, food service companies, and food retailers tended to have ratios between 5:1 and 10:1.

In this book we will not directly focus on food companies, but certainly there are already many interesting processes and actions that they are putting in place in order to tackle the phenomenon along their food supply chain. In this section we will just mention two of them, but surely there are others that it would be worth quoting. The first initiative has been implemented by Barilla Company that through a life cycle assessment, analysed the food losses and waste along the entire food supply chain related to the pasta production. The reference standard used for this analysis is the global Food Loss and Waste Accounting and Reporting Standard (FLW Standard<sup>3</sup>), which is a global standard that provides requirements and guidance for quantifying and reporting on the weight of food and/or associated inedible parts removed from the food supply chain—commonly referred to as FLW. This standard

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<sup>3</sup>The Food Loss and Waste Protocol (FLW Protocol 2013) is a multi-stakeholder partnership, launched in 2013, which has developed the global Food Loss and Waste Accounting and Reporting Standard (or FLW Standard) for measuring food and/or associated inedible parts removed from the food supply chain. The main goal of the initiative is to implement an internationally accepted FLW accounting and reporting standard and tools, and to spread information about the food waste issue around the world, in order to make countries motivated to become more responsible and waste less.

enables countries, cities, companies and other entities to develop inventories of how much FLW are generated and where it goes. Concerning the Barilla Blue Box Pasta, they considered the semolina and pasta that it is produced in Italy and analysed its losses and waste along the entire life cycle, from field to table. The study began in March 2016 and ended in December 2016. In conclusion, it has been found that pasta production could represent an example of a true circular economy, where almost nothing is lost. Food losses in the field are very limited (less than 2% due to grain losses), while the straw obtained during the harvest—weighting the same as wheat—is usually used as animal feed and for litter. Loss generated during the grinding of the grain and the pasta production amounted to around 2%. However, the study carried out showed that the greatest waste is concentrated in the consumption phase. In fact, the product wasted by the household and the hospitality sector amounted to between 10 and 40%, especially in school catering with an average value of 25%. Along with this project, Barilla recently partnered with Carrefour with a multi-country project that nudges people at the point of sale. In-store materials and anti-waste recipes created by the Barilla's chefs with the call to action “don't waste, create” will motivate people to use their creativity like a top chef in order to make healthy and delicious dishes with pasta and leftover vegetables in order to avoid waste.

The second example looks at the food industry giant Unilever, which in 2015 during the Consumer Goods Forum has been one of the promoter of the resolution on food waste, in which food businesses commit to halving food waste by 2025 in retail and production operations, as well as supporting food waste reduction at consumption level and throughout their supply chain.

#### **BOX 4.2—Food sharing models to tackle food waste**

Food sharing models are mainly organizations, based on a peer-to-peer business model, whereby people use platforms to rent, sell, lend or share food with others, without the involvement of shops, banks or agencies (Nesta 2014). Recently Corbo and Fraticelli (2015) has conducted a first explorative study on technology practices for reducing food waste by enhancing unexplored connections between donors and beneficiaries of food commodities.

The real potential of the sharing economy is the ability of online platforms to match demand and supply in a faster way, sometimes even with lower costs. The platforms provide information about which assets, resources or skills are available and which are needed, almost instantly to the consumers.

Currently, there are more than 13.5 billion processes, data, and people connected to the web (Tillman 2013). The online and mobile phone community holds the potential in influencing citizens to make swift changes via websites and technological applications on a global-scale.

In particular, web platforms and the mobile app, represent a new and innovative way to develop and increase food sharing. These technological instruments have been developed basically as a tool for supporting food banks, social supermarkets and private consumers, in order to collect and distribute food. The goals of this private organizations could be different: to help poor people suffering from hunger; to prevent and avoid food waste for the good of the environment; to make new friends through sharing meals.

Food sharing models are organisations that can be classified as follows:

- Peer-to-Peer business model (P2P), in which private consumers use platforms and mobile app, in order to rent, sell, lend or share things with other consumers, without the involvement of shops, banks or agencies (Nesta 2014). Very innovative apps are ‘Left Over Swap’,<sup>4</sup> ‘Share Your Meal’,<sup>5</sup> ‘Olio’,<sup>6</sup> and ‘Food Sharing’,<sup>7</sup> which enable private consumers, who are throwing away a meal perfectly edible, to share a picture of the dish and to allow them to make the meal available for the neighbours.
- Business-to-Consumers (B2C), when agencies or retailers collect food and donate it directly to people in need. In particular on the market there are several web platforms and/or mobile app, like ‘Approved Food’,<sup>8</sup> ‘Pare Up’,<sup>9</sup> ‘Opti Miam’,<sup>10</sup> which aims to put retailers, that are selling at lower prices product in short dated or residual stock of food, in contact with consumers.
- Consumers-to-Business (C2B), where private people share food in excess with not-for-profit organizations, which will ultimately distribute this food to people in need. A successful initiative is ‘Bring Food’,<sup>11</sup> which helps private consumers to share through the mobile app, the food in excess, making the local no profit agencies aware and able to collect this food and use it for charitable goals.
- Business-to-Business (B2B), where retailers share the surplus food with other retailers or not-for-profit organizations. For example, ‘Spoil Alert’,<sup>12</sup> a web platform, where businesses with healthy, surplus food, connect to not-for-profit organizations that can quickly collect the food, at a discounted price, and share it with people in need.

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<sup>4</sup>Source: <http://leftoverswap.com/>.

<sup>5</sup>Source: <https://www.shareyourmeal.net/>.

<sup>6</sup>Source: <http://olioex.com/>.

<sup>7</sup>Source: <https://foodsharing.de/>.

<sup>8</sup>Source: [http://www.approvedfood.co.uk/page?name=about\\_us](http://www.approvedfood.co.uk/page?name=about_us).

<sup>9</sup>Source: <http://www.pareup.com/app#pareup>.

<sup>10</sup>Source: <http://www.optimiam.com/index.html>.

<sup>11</sup>Source: <http://www.bringfood.org/>.

<sup>12</sup>Source: <http://foodspoileralert.com/>.

A very recent study (Michelini et al. 2018), relying on a cluster analysis made on a sample of 52 food sharing cases, proposed three categories of models that are emerging with the aim of tackling food waste. The “sharing for money” model that is primarily a B2C model that aims at reducing waste while generating revenues; the “sharing for the community” instead represents a P2P model where individuals share excess of food; to finish the “sharing for charity” model collect surplus food and give it to not-for-profit organization that redistribute it to people in need, encompassing at the same time food waste reuse and poverty alleviation.

## Initiatives Sitography

Initiative Name	Source
<i>Banco Alimentare</i>	<a href="http://www.bancoalimentare.it/it">http://www.bancoalimentare.it/it</a>
<i>Buon Fine</i>	<a href="http://www.e-coop.it">www.e-coop.it</a>
<i>Last Minute Market</i>	<a href="https://sites.google.com/lastminutemarket.it/2017/home?authuser=1">https://sites.google.com/lastminutemarket.it/2017/home?authuser=1</a>
<i>Buon Samaritano</i>	<a href="http://www.bancoalimentare.it/it/Siticibo-In-dieci-anni-recuperate-oltre-2-milioni-di-porzioni-di-piatti-pronti">http://www.bancoalimentare.it/it/Siticibo-In-dieci-anni-recuperate-oltre-2-milioni-di-porzioni-di-piatti-pronti</a>
<i>Quel che c'è</i>	<a href="http://www.quelchece.it">http://www.quelchece.it</a>
<i>Il buono che avanza</i>	<a href="http://www.ilbuonocheavanza.it">http://www.ilbuonocheavanza.it</a>
<i>Buta Supa</i>	<a href="http://butastupa.eu">http://butastupa.eu</a>
<i>IoMiAmo</i>	<a href="https://www.greenme.it/consumare/cosmesi/2149-iomiamo-i-nuovi-cosmetici-ecologici-di-slow-food-sono-qbibo-per-il-corpoq">https://www.greenme.it/consumare/cosmesi/2149-iomiamo-i-nuovi-cosmetici-ecologici-di-slow-food-sono-qbibo-per-il-corpoq</a>
<i>FareShare</i>	<a href="http://www.fareshare.org.uk">www.fareshare.org.uk</a>
<i>Food Cycle</i>	<a href="https://www.foodcycle.org.uk">https://www.foodcycle.org.uk</a>
<i>Feeding the 5000</i>	<a href="https://feedbackglobal.org">https://feedbackglobal.org</a>
<i>Love Food, Hate Waste</i>	<a href="https://www.lovefoodhatewaste.com">https://www.lovefoodhatewaste.com</a>
<i>This is Rubbish</i>	<a href="https://www.thisisrubbish.org.uk">https://www.thisisrubbish.org.uk</a>
<i>Grow Sheffield's Abundance Project</i>	<a href="http://growsheffield.com/abundance-2/">http://growsheffield.com/abundance-2/</a>
<i>Approved Food</i>	<a href="http://www.approvedfood.co.uk">http://www.approvedfood.co.uk</a>
<i>Great Taste Less Waste</i>	<a href="https://your.morrisons.com/Home-New/Corporate/Media-centre/Corporate-news/Morrisons-launch-Great-Taste-Less-Waste-campaign-to-save-families-up-to-600-per-year-/">https://your.morrisons.com/Home-New/Corporate/Media-centre/Corporate-news/Morrisons-launch-Great-Taste-Less-Waste-campaign-to-save-families-up-to-600-per-year-/</a>
<i>Buy One, get one later</i>	<a href="https://www.tescopl.com/little-helps-plan/">https://www.tescopl.com/little-helps-plan/</a>
<i>Réduisons nos déchets</i>	<a href="http://www.ademe.fr/en/about-ademe">http://www.ademe.fr/en/about-ademe</a>
<i>ANDES</i>	<a href="https://andes-france.com">https://andes-france.com</a>

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Initiative Name	Source
<i>Plan National Nutrition Santé</i>	<a href="http://www.mangerbouger.fr">http://www.mangerbouger.fr</a>
<i>City Harvest</i>	<a href="https://www.cityharvest.org">https://www.cityharvest.org</a>
<i>Rock e Wrap It Up!</i>	<a href="https://www.rockandwrapitup.org">https://www.rockandwrapitup.org</a>
<i>Feeding America</i>	<a href="http://www.feedingamerica.org">http://www.feedingamerica.org</a>
<i>Society of St. Andrews</i>	<a href="http://endhunger.org">http://endhunger.org</a>
<i>City Slicker Farms</i>	<a href="http://www.cityslickerfarms.org">http://www.cityslickerfarms.org</a>
<i>Edible Schoolyard Project</i>	<a href="http://edibleschoolyard.org">http://edibleschoolyard.org</a>
<i>Mesa Brasil del SESC</i>	<a href="http://www.sesc.com.br/mesabrasil/">http://www.sesc.com.br/mesabrasil/</a>
<i>SAVE FOOD</i>	<a href="https://www.save-food.org">https://www.save-food.org</a>
<i>foodwaste tv</i>	<a href="https://www.youtube.com/user/foodwastetv/featured">https://www.youtube.com/user/foodwastetv/featured</a>
<i>Stop Wasting Food</i>	<a href="http://stopwastingfoodmovement.org">http://stopwastingfoodmovement.org</a>
<i>Friends of Environment and Development Association</i>	<a href="http://www.fedaeg.com/index.html">http://www.fedaeg.com/index.html</a>
<i>Operation Empty Plate</i>	<a href="http://www.bbc.com/news/world-asia-china-21711928">http://www.bbc.com/news/world-asia-china-21711928</a>
<i>Clean Your Plate Campaign</i>	<a href="https://www.pri.org/stories/2013-07-22/no-waste-lunch-chinas-clean-your-plate-campaign">https://www.pri.org/stories/2013-07-22/no-waste-lunch-chinas-clean-your-plate-campaign</a>
<i>Food Recovery Network</i>	<a href="https://www.foodrecoverynetwork.org">https://www.foodrecoverynetwork.org</a>
<i>NaDEET</i>	<a href="http://www.nadeet.org/about-us">http://www.nadeet.org/about-us</a>
<i>Hands for Hunger</i>	<a href="http://www.handsforhunger.org/learn/our-story/">http://www.handsforhunger.org/learn/our-story/</a>
<i>Annakshetra: SAVE FOOD</i>	<a href="http://annakshetra.org/pages/about_us">http://annakshetra.org/pages/about_us</a>
<i>SecondBite</i>	<a href="https://www.secondbite.org">https://www.secondbite.org</a>
<i>Food Wise</i>	<a href="http://www.foodwise.com.au">http://www.foodwise.com.au</a>
<i>Paris Restaurants Turn Food Scraps Into Biogas</i>	<a href="http://www.businessinsider.com/paris-restaurants-turn-food-scraps-into-biogas-2014-2?IR=T">http://www.businessinsider.com/paris-restaurants-turn-food-scraps-into-biogas-2014-2?IR=T</a>
<i>EcoScraps</i>	<a href="https://www.ecoscraps.com">https://www.ecoscraps.com</a>
<i>Eviter la gaspillage alimentaire</i>	<a href="https://www.pratique.fr/gaspillage-alimentaire-comment-eviter.html">https://www.pratique.fr/gaspillage-alimentaire-comment-eviter.html</a>
<i>Lutter contre le Gaspillage Alimentaire</i>	<a href="http://agriculture.gouv.fr/des-etats-generaux-de-l'alimentation-pour-lavenir-de-l'agriculture-et-de-l'alimentation">http://agriculture.gouv.fr/des-etats-generaux-de-l'alimentation-pour-lavenir-de-l'agriculture-et-de-l'alimentation</a>
<i>Green Cook</i>	<a href="http://www.green-cook.org/-The-project-.html">http://www.green-cook.org/-The-project-.html</a>
<i>Appetite for Action</i>	<a href="https://www.globalactionplan.org.uk">https://www.globalactionplan.org.uk</a>
<i>Calling Time on Waste</i>	<a href="http://www.epa.ie/pubs/reports/waste/wpp/callingtimeonwaste.html#.U4JY5fldW8U">http://www.epa.ie/pubs/reports/waste/wpp/callingtimeonwaste.html#.U4JY5fldW8U</a>
<i>Zero Waste</i>	<a href="http://www.humusz.hu/english/zero-waste-program">http://www.humusz.hu/english/zero-waste-program</a>
<i>The Pig Idea</i>	<a href="http://thepigidea.org/what-we-are-doing.html">http://thepigidea.org/what-we-are-doing.html</a>
<i>Voedselverspilling</i>	<a href="http://www.voedselverspilling.com/StartPage.aspx">http://www.voedselverspilling.com/StartPage.aspx</a>

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Initiative Name	Source
<i>Slow Food Youth Network</i>	<a href="http://www.slowfoodyouthnetwork.org/where-are-we/youth-food-movement-brasil/">http://www.slowfoodyouthnetwork.org/where-are-we/youth-food-movement-brasil/</a>
<i>Essential Waitrose a little less than perfect apples</i>	<a href="https://www.waitrose.com/ecom/products/essential-waitrose-a-little-less-than-perfect-apples/065112-32992-32993">https://www.waitrose.com/ecom/products/essential-waitrose-a-little-less-than-perfect-apples/065112-32992-32993</a>
<i>Every Crumb Counts</i>	<a href="http://everycrumbcounts.eu">http://everycrumbcounts.eu</a>
<i>Anti-Waste Workshops—Cooking Classes</i>	<a href="http://www.arc-cat.net/ca/publicacions/pdf/ccr/setmanaprevencio09/ponencies/13%20Pwp%20Joelle%20Van%20Bamb.pdf">http://www.arc-cat.net/ca/publicacions/pdf/ccr/setmanaprevencio09/ponencies/13%20Pwp%20Joelle%20Van%20Bamb.pdf</a>
<i>European Week for Waste Reduction</i>	<a href="http://www.ewwr.eu/en">http://www.ewwr.eu/en</a>
<i>The Spanish Confederation of Consumer and User Cooperatives</i>	<a href="https://www.hispacoop.com/home/index.php">https://www.hispacoop.com/home/index.php</a>
<i>Insignia Technologies</i>	<a href="https://www.insigniatechnologies.com">https://www.insigniatechnologies.com</a>
<i>Sprecare non vale!</i>	<a href="http://www.scuolachannel.it/projects/home/sprecarenonvale/progetto">http://www.scuolachannel.it/projects/home/sprecarenonvale/progetto</a>
<i>Happy Hour in bakery</i>	<a href="https://www.hofpfisterei.de">https://www.hofpfisterei.de</a>
<i>Fish and shellfish by-products as food/feed/other</i>	<a href="https://www.foodnavigator.com/Article/2014/09/15/Wasted-potential-FAO-review-highlights-food-and-feed-uses-for-fish-and-shellfish-by-products?utm_source=copyright&amp;utm_medium=OnSite&amp;utm_campaign=copyright">https://www.foodnavigator.com/Article/2014/09/15/Wasted-potential-FAO-review-highlights-food-and-feed-uses-for-fish-and-shellfish-by-products?utm_source=copyright&amp;utm_medium=OnSite&amp;utm_campaign=copyright</a>
<i>Culinary Misfits</i>	<a href="http://www.culinarymisfits.de/en/misfits/">http://www.culinarymisfits.de/en/misfits/</a>
<i>DC Central Kitchen</i>	<a href="https://dcentralkitchen.org">https://dcentralkitchen.org</a>
<i>The Dickinson College Farm</i>	<a href="http://www2.dickinson.edu/storg/sisa/campus.html">http://www2.dickinson.edu/storg/sisa/campus.html</a>
<i>EU-FUSIONS</i>	<a href="https://www.eu-fusions.org">https://www.eu-fusions.org</a>
<i>Save Food from the Fridge</i>	<a href="http://www.savefoodfromthefridge.com">http://www.savefoodfromthefridge.com</a>
<i>The Postharvest Education Foundation</i>	<a href="http://www.postharvest.org/home0.aspx">http://www.postharvest.org/home0.aspx</a>
<i>Springboard Kitchens</i>	<a href="https://newpittsburghcourieronline.com/2014/01/24/springboard-kitchens-a-springboard-for-the-community/">https://newpittsburghcourieronline.com/2014/01/24/springboard-kitchens-a-springboard-for-the-community/</a>
<i>SolerCool Container</i>	<a href="https://green.blogs.nytimes.com/2013/01/28/a-solar-powered-shed-for-indias-perishable-food/?_php=true&amp;_type=blogs&amp;_r=0">https://green.blogs.nytimes.com/2013/01/28/a-solar-powered-shed-for-indias-perishable-food/?_php=true&amp;_type=blogs&amp;_r=0</a>
<i>EPS's Guide to Prevent food waste</i>	<a href="http://www.foodwaste.ie/web-images/Food-Waste-Prevention-Guide.pdf">http://www.foodwaste.ie/web-images/Food-Waste-Prevention-Guide.pdf</a>
<i>Stop Food Waste Campaign</i>	<a href="http://stopfoodwaste.ie">http://stopfoodwaste.ie</a>
<i>Zero Waste Initiative</i>	<a href="https://zerowastecanada.ca">https://zerowastecanada.ca</a>
<i>Think Eat Save</i>	<a href="http://www.thinkeatsave.org">http://www.thinkeatsave.org</a>
<i>Barilla Blue Box Pasta</i>	
<i>Eurest respaurant and food campaign</i>	<a href="http://www.eurestfood.no/en/whatwedo/our-offer">http://www.eurestfood.no/en/whatwedo/our-offer</a>

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Initiative Name	Source
<i>Single Bananas</i>	<a href="http://www.supplychainge.org/fileadmin/reporters/eu_files/Rosita_Zilli_Sustainable_Food_Chains_What_Does_it_Take_A_Consumer_Co-operative_s_Standpoint.pdf">http://www.supplychainge.org/fileadmin/reporters/eu_files/Rosita_Zilli_Sustainable_Food_Chains_What_Does_it_Take_A_Consumer_Co-operative_s_Standpoint.pdf</a>
<i>DiscoSoup</i>	<a href="https://www.slowfood.com">https://www.slowfood.com</a>
<i>DIVE!</i>	<a href="http://www.divethefilm.com/default.aspx">http://www.divethefilm.com/default.aspx</a>
<i>Do you have an amusement park in your fridge?</i>	<a href="https://ec.europa.eu/food/safety/food_waste/good_practices/awareness_information_education_en">https://ec.europa.eu/food/safety/food_waste/good_practices/awareness_information_education_en</a>
<i>Dutch Nutrition Centre: Information for consumer on food waste</i>	<a href="http://www.voedingscentrum.nl/minderverspillen">http://www.voedingscentrum.nl/minderverspillen</a>
<i>Eetmaatje (Measure cup)</i>	<a href="http://www.voedingscentrum.nl/eetmaatje">http://www.voedingscentrum.nl/eetmaatje</a>
<i>Un poco de tu compra es mucho</i>	<a href="http://www.eroski.es/responsabilidad-social/">http://www.eroski.es/responsabilidad-social/</a>
<i>Fridge Sticker yes/no</i>	<a href="http://www.voedingscentrum.nl/koelkaststicker">http://www.voedingscentrum.nl/koelkaststicker</a>
<i>Generation awake</i>	<a href="http://www.generationawake.eu">http://www.generationawake.eu</a>
<i>International Food Waste Coalition</i>	<a href="http://internationalfoodwastecoalition.org">http://internationalfoodwastecoalition.org</a>
<i>Io non spreco: adotta un nonno a pranzo</i>	<a href="http://www.milanoristorazione.it">http://www.milanoristorazione.it</a>
<i>Io non spreco: snack-saver bag</i>	<a href="http://www.milanoristorazione.it">http://www.milanoristorazione.it</a>
<i>Love Green</i>	<a href="http://www.love-green.de">http://www.love-green.de</a>
<i>Menu Dose Certa</i>	<a href="http://ec.europa.eu/environment/waste/prevention/pdf/MenuDoseCerta_Factsheet.pdf">http://ec.europa.eu/environment/waste/prevention/pdf/MenuDoseCerta_Factsheet.pdf</a>
<i>“Restaurant fines”</i>	<a href="http://ec.europa.eu/environment/waste/prevention/pdf/MenuDoseCerta_Factsheet.pdf">http://ec.europa.eu/environment/waste/prevention/pdf/MenuDoseCerta_Factsheet.pdf</a>
<i>Restos Glücklich</i>	<a href="https://ec.europa.eu/food/safety/food_waste/good_practices/awareness_information_education_en">https://ec.europa.eu/food/safety/food_waste/good_practices/awareness_information_education_en</a>
<i>School waste heroes</i>	<a href="http://www.schoolfoodtrust.org.uk">http://www.schoolfoodtrust.org.uk</a>
<i>Still Tasty</i>	<a href="http://www.stilltasty.com">http://www.stilltasty.com</a>
<i>Taste the Waste</i>	<a href="http://tastethewaste.com">http://tastethewaste.com</a>
	<a href="http://campusfoodwaste.org">http://campusfoodwaste.org</a>
<i>Waste</i>	<a href="https://ec.europa.eu/food/safety/food_waste/good_practices/awareness_information_education_en">https://ec.europa.eu/food/safety/food_waste/good_practices/awareness_information_education_en</a>
<i>Auchan Spa</i>	<a href="http://www.auchan.it">http://www.auchan.it</a>
<i>Bennet</i>	<a href="http://www.bennet.com">http://www.bennet.com</a>
<i>City Harvest London</i>	<a href="http://www.cityharvest.org.uk">http://www.cityharvest.org.uk</a>
<i>Close Bakery</i>	<a href="https://ec.europa.eu/food/safety/food_waste/good_practices/food_redistribution_en">https://ec.europa.eu/food/safety/food_waste/good_practices/food_redistribution_en</a>
<i>Daily Menus for Homeless</i>	<a href="https://www.brno.cz/brno-aktualne/co-se-deje-v-brne/a/neprodana-menicka-dostavaji-bezdomovci/">https://www.brno.cz/brno-aktualne/co-se-deje-v-brne/a/neprodana-menicka-dostavaji-bezdomovci/</a>
<i>Every Meals Matters</i>	<a href="http://www.fooddrinkeurope.eu">http://www.fooddrinkeurope.eu</a>
<i>Next Door Help</i>	<a href="http://nextdoorhelp.it">http://nextdoorhelp.it</a>
<i>OLIO</i>	<a href="https://olioex.com">https://olioex.com</a>
<i>QUI Foundation Onlus</i>	<a href="http://www.quifoundation.it">http://www.quifoundation.it</a>

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Initiative Name	Source
<i>SitiCibo</i>	<a href="http://www.bancoalimentare.it/it/siticibo2012">http://www.bancoalimentare.it/it/siticibo2012</a>
<i>Lebensmittel sind kostbar</i>	
<i>Team Austria</i>	<a href="http://oe3.orf.at/teamoesterreich/stories/511376/">http://oe3.orf.at/teamoesterreich/stories/511376/</a>
<i>We Love Food</i>	<a href="http://www.love-green.de/blog/tag/edeka/">http://www.love-green.de/blog/tag/edeka/</a>
<i>Inglorious fruits and vegetables</i>	<a href="http://itm.marcelww.com/inglorious/">http://itm.marcelww.com/inglorious/</a>

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# General Conclusions

This book aims to analyse the food waste phenomenon in depth at consumer level. Drawing from behavioural and marketing theories, a new theoretical framework called the *Household Food Waste Journey Model* is proposed with the aim of better explaining food waste behaviour particularly at household level. Along with this, a conceptual framework helped in defining the actors responsible and the correct behaviours that significantly tackle food waste during the *away from home* phase. In addition to these two frameworks that will add knowledge to the literature in the field, two analyses have been proposed in order to highlight the main policies and initiatives that policy makers and practitioners are implementing in order to tackle the phenomenon. All these aspects concerning the food waste issue have not been researched before.

Thus, what have we learned?

Firstly, from a theoretical perspective, there are two main aspects for study. On the one hand we learned that food waste represents a mainstream problem and therefore a growing field of research. Among the areas that need to be further studied by academics are: the search for a harmonized food waste definition in order to collect direct data (i.e. the actual weight of food waste, which is not subject to underestimation problems due to self-estimated measures) on food waste and to compare them accurately for all countries; and the commitment of institutions to finance official sample surveys in order to enable researchers to analyse and compare sub-national levels (such as municipalities), since the local environment is such a crucial dimension for policy makers and practitioners when planning interventions.

On the other hand we also learn that behavioural and marketing theories could help to better explain the complex multi-facet food-waste behaviour. Indeed, we have seen that wasteful behaviour can be driven by influences such as psychological, social, situational, and demographic and socio-economic factors. These factors influence both wasteful behaviour and every phase of what I called the *household food waste journey*, that is the various theoretical drivers of wasteful behaviours drawing on the *consumer food management* process: planning,

provisioning, storing, preparing, consuming, disposal, and the *consumer decision process*: planning, pre-acquisition, acquisition, preparation, consumption, disposition.

Therefore, based on the literature findings, we have seen that every phase of the *household food waste journey* could contribute to some extent to wasteful behaviour among individuals.

Secondly, since we know that individuals alone cannot make the difference, we provided an advanced analysis and highlighted the main policies and initiatives to tackle the phenomenon of food waste, that could represent an interesting starting point for governments, institutions and food companies in order to take action against it, thus ensuring a sustainable development of our Planet and to meet the 12th UN Sustainable Development Goal in which food waste has been included.

This work adds to an important and rapidly growing literature base, making it fertile ground for future research.