

A REPORT  
FOR FRIENDS OF THE  
EARTH MALTA

# FOOD WASTE IN THE MALTESE RETAIL SECTOR

BY STUDENTS OF WAGENINGEN UNIVERSITY

# FOOD WASTE IN THE MALTESE RETAIL SECTOR

A REPORT ANALYSING MALTESE RETAIL-ISSUED FOOD WASTE AND SUGGESTING ALTERNATIVE PATHWAYS FOR FRIENDS OF THE EARTH MALTA

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## EXECUTIVE SUMMARY

Food waste in Malta is an important issue which receives little public attention from society at large. Malta has one of the highest per-capita waste generation rates in the EU, but recycling rates are low. Most food waste ends up in landfills which are quickly filling up, pressuring the already scarce Maltese surface area. In addition, there are environmental, economic, and social justice concerns with high levels of food waste generation and poor management. This report focuses on retail food waste as this stream is poorly understood and needs to be studied further. Much of retail food waste is currently landfilled while it is still fit for donation to food banks or re-use in a biodigester. Therefore, this research aims to analyse current food waste practices and to suggest strategies to reduce and repurpose food waste discarded by the retail sector. This report is written for Friends of the Earth Malta, a Maltese environmental non-governmental organisation (NGO). Key findings include that combating food waste faces a multitude of barriers, determined by several key factors such as political engagement and culture but also the practices of stakeholders including suppliers, foodbanks, waste collection and processing and waste quantification. Interactions between these factors and stakeholders shape barriers to successfully combating food waste.

Mitigating supermarket-issued food waste starts at where supermarkets obtain their food. Food waste reduction barriers faced by suppliers include a lack of cooperation and coordination with producers and other supply chain actors. Another issue is the existence of take-back agreements, which infer that suppliers take back unsold goods sold earlier to supermarkets in return for money, which shifts the blame for food wastage rather than mitigating it, in some cases. Milk can in some cases be repurposed as cheese, but fresh products which spoil easily quickly become food waste at times, even if they are subject to take back agreements.

The absence of strong legislation regarding retail food waste is a crucial barrier for reducing food waste in the retail sector, partially complicated by ineffective use of policy instruments. However, a new waste management plan is currently being developed which is likely to include retail food waste in its scope. Food banks also suffer from the lack of regulatory policy, as a legal obligation to donate food could increase regular food donations from supermarkets. Legislative measures negatively affecting other parties flow down to affect foodbanks as well. Waste managers are also affected by a lack of robust legislation. As a lack of standardised separation practices is not mandated in Malta. This lack of standardisation affects the functioning of waste managers as food is not separated from general waste. The unseparated waste usually ends up in landfills rather than partially in composters.

Commercial waste such as supermarket waste is collected by private waste carriers, not by local councils. However, smaller retailers tend to use the municipal waste collection system. But, these private entities also do not separate waste as they are not incentivised or obliged to do so. This lack of waste separation is cheaper for private carriers and attractive for supermarkets, who generally prefer the cheapest option.

A lack of sufficient infrastructure affects food waste generation in every link of the food chain, in particular at food banks and supermarkets. Smaller supermarkets do not have as much access to cooling facilities due to financial constraints. This leaves small retailers more vulnerable to food spoilage than

their larger competitors. Food banks are not equipped with storage facility capable of handling the volatility of supermarket donations. At the same time, an abundance of shelf space allows consumers to choose products that are not close to the expiration date over products that are due to be wasted in a few days, resulting in more food waste. .

A considerable concept flowing from structural factors would be consumer behaviour., People squeeze fruits and vegetables to check their freshness, but this results in these food products becoming bruised, ugly, and therefore unsold, eventually ending up as food waste.

Foods that end up as food waste could be treated. But. waste treatment in Malta would become more efficient if food waste streams are properly quantified and separated. Furthermore, exact data on food wasted could identify problems and aid policy makers with evaluation measures. Waste carriers and supermarkets are not obliged to monitor their waste streams so most don't keep track of this data. They are also not obliged to separate waste streams so as soon as waste streams are first monitored (when arriving at waste treatment plants) food waste is mixed with general waste. Food waste characterisation and quantification remains a knowledge gaps in Malta.

Recommendations to combat retailer food waste in Malta include a multitude of goals. These include pushing for legislation related to food donation and waste separation by retailers. These two aspects have been recognised as being central to reducing and repurposing waste in the retail sector in Malta. These goals could be attained starting with raising awareness and establishing relationships with allies in the policy sector. When awareness is high, food waste is put on can be put on the policy agenda, allowing FoEM and allies to work on a policy proposal. Simultaneously, best practices for retailers can be incentivised and food donation can be stimulated. After which pilot projects involving supermarkets donating foods to food banks can be initiated, establishing relationships with foodbanks. Foodbanks can aid with the earlier mentioned policy proposal, and cooperation between food banks and supermarkets can be fostered. All of these steps build a political support base which could result in robust legislation addressing many of the Maltese food waste issue's facets, benefitting Maltese society at large.

## REPORT STRUCTURE

The synthesis report is built up as follows: Chapter one comprises a problem statement and introduces the project. After which, the used methodology is explained. Chapter two gives an overview of the current barriers to reduce food waste in Malta. These barriers are presented by considering structural factors, such as infrastructure and policy frameworks. Additionally, retailer behaviour and consumer behaviour within the retail sector are considered. This framework will more closely be explained in Chapter 2. The barriers are followed up by chapter 3, in which suggestions to reduce food waste in Malta will be presented. Here, the overall strategy for food waste reduction by Friends of the Earth Malta (hereafter referred to as FoEM) in the retail sector will be presented. Additionally, four stakeholder groups and ways for FoEM to influence them will be discussed. Chapter 4 comprises the main conclusion of this project.

This document is the synthesis report which summarises and concludes the main findings of eight weeks of research. The more elaborate and in-depth scientific underpinning of our results published here can be found within the individual expert reports. These reports are listed as annexes alongside this synthesis report. The expert reports provide a more specific context and include the methodologies of how we substantiated our findings.

## 1. INTRODUCTION

Malta is recognised to have one of the highest waste generation per capita within the EU. With an annual waste generation of 604 kg of waste per capita, Malta exceeds the EU average by 24% (in comparison to 487 kg being the average) and shows no signs of reducing this amount (Eurostat, 2017). Recycling rates within the country are deemed as low, and most waste is found to end up in landfills (FoEM, 2020). To further complicate this situation, the current rate of landfilling in the country encounters spatial concerns when processing waste. At the same time, due to the COVID-19 crisis, the number of households in need of external help for food security in Malta has risen tenfold (FoEM, 2020).

About five per cent of the high amount of waste is generated in the Maltese retail sector (European Commission, 2010). In this project, the retail sector in Malta is defined as supermarkets, local grocery stores and the Pitkalija (middlemen market). This five per cent might appear a small share, but it represents a waste source that is more easily collected and addressed than household food waste. At a time when food banks are facing a shortage, this forms a discrepancy that must be addressed.

The purpose of this project is to analyse current food waste practices and to suggest strategies to reduce and repurpose food discarded by the retail sector in Malta. At this moment food waste' is defined in concordance with the Food and Agriculture Organisation of the United Nations (FAO) as food that is being discarded while still being fit for human consumption (EU Fusions, 2016). This research is commissioned by FoEM and executed by 23 master students at Wageningen University for eight weeks during the course 'European Workshop Environmental Science and Management'.

### 1.1. METHODOLOGY

Different data gathering methods have been used in this research project. Interviews were conducted with external stakeholders (e.g. NGOs, politicians, food waste experts and more) to find strategies combatting food waste tried and tested outside of Malta, as well as interviews with stakeholders based in Malta to determine the contemporary situation in Malta.

These interviews also provided insight into challenges and opportunities for FoEM to fight food waste. In total, 37 semi-structured interviews were conducted. The interviewees consisted of supermarket managers, NGOs, politicians, (food) waste experts, and various other stakeholders. The interviews also gave an insight into challenges and opportunities for FoEM to reduce food waste in Malta.

Two different surveys were created and used to evaluate the opinion of key stakeholders in Malta on several issues related to food waste. One survey had supermarket managers as its target group; the other survey was directed to Maltese consumers. The survey was distributed digitally via social media platforms, assisted by the University of Malta. The response rate for the consumer survey was sufficient: 259 individuals filled in the consumer survey. The supermarket manager survey was less successful than the consumer survey, with only three respondents out of a total of 150 approached su-

permarket managers. Elaborated versions of the consumer and supermarket managers as well as statistical analysis of the consumer survey and applied consumer and supermarket manager surveys are shown in Annex C.

The insights from the interviews and the surveys were supplemented with literature research from existing academical writing on the subject of food waste reduction.

Gathering data was complicated by the COVID-19 pandemic, which prohibited travel throughout Europe. This travelling ban disabled our ability to conduct in-person interviews with stakeholders in Malta and personally distribute surveys to be filled in on the spot. As a result, all surveys and interviews were conducted digitally which might have influenced our survey results, especially in respect to the online setting of the survey which prejudices our results towards consumers who are easily reached digitally. This online surveying method stands in contrast to surveying a real-life setting which reaches a more diverse set of respondents.

## 2. CURRENT BARRIERS TO FOOD WASTE REDUCTION

When identifying barriers to reduce food waste in Malta, it is necessary to consider those at a societal scale and those at the scale of specific actors. At a societal scale, structural factors are the rules and resources of social systems which influence the behaviours of actors in various ways (Shove, Pantzar & Watson, 2012). At the scale of actors, their agency or capacity to act and make decisions in a given environment must be considered. The relationship between structural factors and agency is recursive, inferring that they mutually influence each other. This chapter focuses on barriers to food waste reduction in the retail sector and identifies two main structural factors: legislative frameworks and the availability of the necessary infrastructure. In Figure 1, it is shown how these structural factors interact with retailer behaviour and in-store consumer behaviour. Both of these factors influence food waste generation in supermarkets. The structural factors also influence food waste generation outside supermarkets in multiple ways. Upstream factors are affected as supplier-retailer interactions. Downstream factors are affected as interactions between retailers and waste collectors and waste managers or between retailers and food banks.

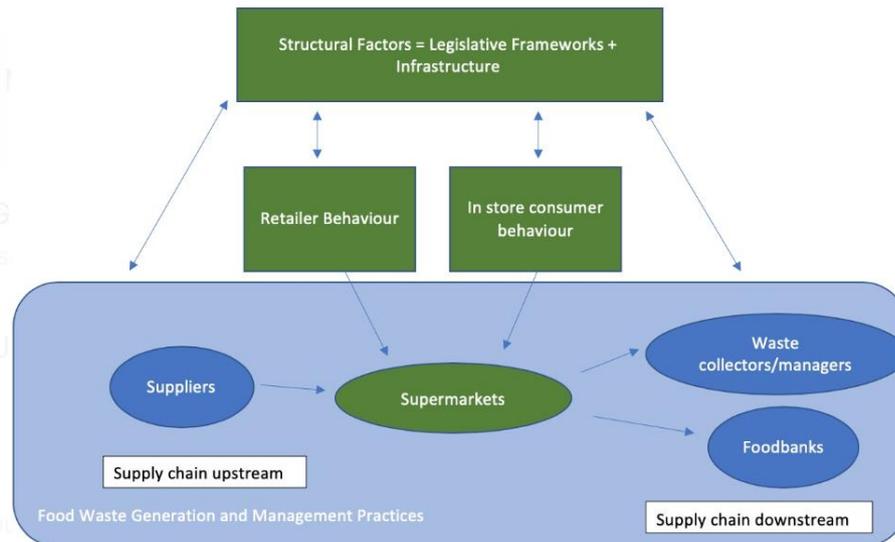


Figure 1. Structural factors in retail food waste generation

Several barriers to food waste reduction initiatives emerge from the model in Figure 1 which will be addressed in this chapter. Firstly, institutional fragmentation and inefficient governance will be discussed, followed by a lack of political engagement from consumers and retailers with the issue of food waste. After which a lack of governmental incentives for increased food waste sustainability in retail, insufficient coordination and communication in the upstream supply chain will be analysed. After the last-mentioned dissertation, insufficient retail infrastructure limiting store stocking practices and restricting in-store consumer behaviour, a lack of infrastructure and support for food banks and a lack of separation, monitoring and recycling standards will be touched upon.

## 2.1. INSTITUTIONAL FRAGMENTATION AND INEFFICIENT GOVERNANCE

Any initiative to reduce food waste in Malta will eventually be confronted with the fragmentation of its governmental institutions. Historically, the country was relatively centralised until the introduction of 68 local councils at the start of the nineties. Decentralising the governance structure usually comes hand-in-hand with the decentralisation of decision-making power. However, this did not happen in Malta (Pirota, 2001). The local and regional councils do not currently hold significant policy-making power (European Committee of the Regions, n.d.; Regional Committees, 2011), which is the prerogative of the national government, but this makes the local councils inefficient in preventing and repurposing retail food waste. Local councils are individually in charge of the waste collection of their corresponding localities with little central coordination at a national level. However, they are not responsible for retail waste collection, which is privately organised. Therefore, they cannot obligate retailers to change their waste management practices to reduce food waste. The only role local councils can play in improved waste management is through proposing community initiatives and educational projects to prevent retail food waste (EkoSkola Malta, personal communication, June 3, 2020).

Compounding the problem is a lack of political power to influence retail waste management practices on the local level, national waste management policy does not obligate retailers to adopt stringent practices regarding waste handling and separation. The current Waste Management Plan (hereafter referred to as WMP), adopted in 2014, does include food waste reduction as one of its goals. However, it primarily uses 'soft' policy instruments such as enhancing public awareness to achieve that goal, to mixed results. Projects such as the 'TRiFOCAL' campaign focused on waste prevention and recycling did receive positive engagement from the private sector and civil society (MECP, personal communication, June 16, 2020). However, the 'Don't Waste Waste' campaign turned out to be not impactful enough (Dr. Gatt, K., personal communication, June 9, 2020).

## 2.2. LACK OF POLITICAL ENGAGEMENT AND ACTIVITY

Aside from an institutional fragmentation of the Maltese government structure, there is a lack of political engagement with the issue of food waste from civil society, retailers and politicians. This lack of engagement slows down any policy change regarding food waste reduction. Following Koop et al., (2017), political engagement is defined as an enabler of effective change that includes the collective identification of shared problems so they can be acted upon. In the case of food waste reduction in Malta, we examine whether food waste is identified as a collective issue by both civil society and the retail sector and if they act accordingly to combat it.

To determine civil society's stance on food waste, this chapter draws upon data gathered in a consumer survey on food waste as an environmental issue. A particularly important finding here is that a majority of respondents are aware of general environmental issues and show a desire to improve the Maltese environment. However, the survey results also acknowledge that food waste is not a top priority amongst environmental issues in Malta. To quote a few respondents:

"[...] no one in Malta cares about the environment [...] Don't leave it up to governments/supermarkets they'll say they are working on reducing waste but won't lift a finger in reality" (Annex C2)

"People in general in Malta are wasteful and have no regard for the environment" (Annex C2)

These quotes illustrate that citizens do not seem aware of their capacity to affect the issues of food waste and environmental improvement in Malta. They also suggest little trust in political institutions to affect change, and that Maltese citizens are politically disengaged with food waste reduction.

The retail sector is also hesitant to engage with the issue of food waste politically if it negatively affects their profits, so they are hesitant to take the initiative in reducing in-store food waste. This hesitation does not compare large retail stores in other countries which have implemented food waste reduction measures (Syroegina, 2016). An indicator of the lack of political engagement is the absence of transparency in retailers' administration: administrative decisions often take place informally, such as informal take-back agreements with suppliers (Jonathan Spiteri, personal communication, June 4th, 2020). These informal decisions are typically concluded behind closed doors, without clarity as to who is involved. These backdoor agreements result in a reduction of general trust in the industry. Partially because stakeholders can never be sure if their competitors are making agreements without them, also,

another reason is that stakeholders do not know whether they are in the loop, and because of reduced trust from the general public in the retail sector as it is a closed circuit without public oversight (Baldacchino et al., 2020). Another side-effect of this closed-door informal decision making is that consumers politically engage less with the issue of retail food waste, as they feel that they cannot influence the decisions retailers and suppliers make behind closed doors.

### **Box 1. Maltese food culture**

Consumer food waste in Malta is particularly on the high side because of local food culture: the Maltese "live to eat, not eat to live" (Qrendi local council, personal communication, June 6, 2020). Restaurants serve large portions and consumers often do not take leftovers home, as they would spoil quickly in the Mediterranean climate. The focus of this Mediterranean diet is on satisfying, plentiful meals; not efficient food resource use.

Citizens also show different stances to food waste depending on their age groups. Our survey results indicate that senior citizens rate donations to food banks as less important than younger citizens do (Annex C1). Senior citizens also stock more food at home leading to increased spoilage, whereas younger citizens tend to eat out more and shop more often (Qrendi local council, personal communication, June 6, 2020).

### **2.3. LACK OF GOVERNMENTAL INCENTIVES FOR FOOD WASTE SUSTAINABILITY IN RETAIL**

Since there is no regulatory framework on food waste, retailers are neither incentivised nor deterred from changing their current practices to reduce food waste generation. Retail food waste has only been considered an issue since the late 2010s in Malta (MECP, personal communication, June 16, 2020) and therefore, retail food waste is not included in the current WMP. At the moment, Malta does not have a retail food waste legal framework to monitor food waste data or enforce reduction targets. It is imperative that 'hard' policy instruments, i.e. legally-binding obligations, are introduced at the national level to complement the awareness-raising and education that local councils have been doing with clear goals for food waste reduction at local retail levels. The use of such tools is also recommended at the national level to comply with EU food waste targets (ERA, 2018; European Commission, 2019). A mix of different policy instruments has proven to be effective in other sustainability-related issues such as water management (Mees et al., 2013).

This lax regulatory framework also results in little legal obligation or economic incentive for supermarkets to undertake the segregation of waste at their locations. Local councils are in charge of hiring a private company to collect the municipal waste of the entire locality but not the retail sector. Since retail waste is not part of the municipal waste stream, retail waste is collected by supermarkets' own private waste carriers (San Giljan local council, personal communication, June 4, 2020; WasteServ, personal communication, June 12, 2020). Therefore, the extent to which individual supermarkets separate waste is dependent on their internal policies. In terms of waste management strategies, supermarkets prefer the cheapest option, so as to minimise their waste transportation costs (Galea M., 2019). There is a very low gate fee for waste landfilling: only 20 cents per ton disposed, compared to a cost of 50

cents per ton in recycling (European Commission, 2015). There is also no extra taxation on waste disposed in landfill, therefore, the cost difference is not large enough to incentivise recycling and proper waste separation of retail waste (dr. Gatt, K., personal communication, June 9, 2020).

#### 2.4. INSUFFICIENT COORDINATION IN THE UPSTREAM SUPPLY CHAIN

Suppliers (e.g. all food chain actors between farms and retail) are key stakeholders with significant influence over food waste practices in retail due to their role in linking food producers with retailers. Overall, a lack of coordination amongst various stakeholders is one of the significant barriers to improve food waste practices. For example, farmers do not communicate what they have planted sufficiently with each other or their suppliers during crop production. This lack of communication can lead to overproduction of a specific product resulting in parts of the farmers' crops remaining unsold, withering away at a supplier or in a retail warehouse. With better communication, suppliers and retailers can plan and prepare in advance to handle large production surpluses. This lack of coordination is especially prevalent for the Pitkalija, which lacks the storage space to handle such large seasonal surpluses (Pitkalija CEO, personal communication, June 11, 2020).

Suppliers also complicate food waste reduction through the prevalence of take-back agreements (TBAs). Maltese supermarkets prefer TBAs that allow for products which arrived damaged or that have not been sold before a specific date to be taken back by the supplier (Galea, 2019). Depending on how TBAs are implemented they can reduce food waste, if the products taken back by the suppliers are re-used or repurposed, or they merely shift the burden of food waste production from supermarkets to suppliers. Eriksson, Ghosh, Mattson and Ismatov (2017) point out that TBAs do not significantly reduce food spoilage, and for this reason, TBAs have been banned in the Czech Republic. Further insight into how TBAs function in Malta regarding food waste is necessary to evaluate whether these kinds of agreements reduce or increase food waste. It might be the case that, without sufficient incentives for retailers or suppliers to repurpose the food, food taken back through a TBA ends up getting landfilled where it could have been donated instead.

#### 2.5. INSUFFICIENT RETAIL STOCKING INFRASTRUCTURE

Infrastructural availability has a bearing on the managerial aspects of supply chain management and is, therefore, of crucial importance. Supermarkets serve as a juncture in the supply chain where both food waste reduction and food waste management strategies can be undertaken. Thus, it is necessary to consider the infrastructure of the food supply chain leading to the supermarkets (upstream) as well as the infrastructure of the waste management chain leading out of the supermarkets (downstream). The upstream section of the supply chain has a significant bearing on the reduction of food waste, while the downstream section of the chain controls food waste management.

The amount of storage space is important, amongst other reasons because it dictates a store's stocking practices. Stocking practices are an important consideration regarding the role of infrastructure on managerial aspects in a supermarket (Netessine, & Rudi, 2003). Stocking of products can be centralised such that the ordering or delivery of new products is determined by higher-level management and not necessarily by local supermarket staff (Netessine, & Rudi, 2003). Therefore, centralised stocking can

sometimes lead to overstocking in supermarkets, which in turn can increase the amount of food waste that is generated (Buisman, personal communication, June 9, 2020). Aside from this, the choice of stocking practice and its efficacy depends on the infrastructural availability. Adequate shelving, cooling equipment and storage space during the transport and sale of food are essential infrastructural factors that influence food waste generation. However, this infrastructural availability largely depends on the size of supermarkets.

Small scale supermarkets have a lower quality of infrastructure at their disposal since their income is not sufficient to invest in proper cooling equipment (Attard, K., personal communication, June 13, 2020). The lack of storage facilities then increases spoilage of fresh food and shortens the shelf life of food products, thus increasing food waste. Larger supermarkets differ in their practices due to the infrastructure that is available to them. Very few large supermarkets offer discounts on products close to their expiry date since this is perceived as a loss of profit (Attard, K., personal communication, June 13, 2020). The efficacy of supermarket practices targeted at waste reduction like food rotation, sales and discounting might also be hampered by insufficient infrastructure. Aside from the distinction between large- and small-scale supermarkets, the nature of the open-air Pitkalija mandates a different set of infrastructural requirements in order to address food waste (Pitkalija CEO, personal communication, June 11, 2020). Farmers arrive with their new product on certain days, which then replace the 'older' food which has been at the market for a few days already. The lack of cooling and storage facilities results in a considerable amount of food that is still perfectly edible but at risk of going to waste.

## 2.6. IN-STORE CONSUMER BEHAVIOUR AFFECTED BY INFRASTRUCTURE

Consumer behaviour is affected by infrastructure and design within supermarkets, i.e. overall store layout, aisle design and shelf design (Elbers, 2016). These factors influence consumer preferences by controlling what products and how much will be bought ultimately (Elbers, 2016). Although no specific research on in-store consumer behaviour in Malta has been found nor have interviews with supermarket managers been successful in providing this insight. Also, it is crucial to see how retailers can influence consumer preferences and thereby reduce food waste. The infrastructure in a supermarket influences consumer interaction with food, especially fresh produce. For example, a common practice of consumers in supermarkets is to test whether a product is ripe enough to eat by squeezing it. This squeezing damages the product (Syroegina, 2016), leading to earlier spoiling and thereby more food waste. It was also found that the practices of fruit and vegetable squeezing take place in Malta to a moderate degree (Annex C1).

As mentioned above, the amount of shelving space available to retailers is a part of the infrastructure within supermarkets that is affecting in-store consumer behaviour (Elbers, 2016). It affects their food rotation practices which in turn have a bearing on the extent to which consumers can “date pick” and choose products based on the expiry date. Around 65% of survey respondents indicate that they often avoid products that are close to their expiry date (Annex C1). According to the results of other asked in-store consumer behaviours, the respondents seem to less frequently make use of the "buying food with close-to-expiry-discount stickers" as well as "buying food when it is scarce" practices compared to other asked and analysed types of behaviour. Within both practices, the most substantial proportion

of respondents is doing it "sometimes". Even though the respondents seem to less frequently make use of these two practices, it can still be concluded that the practices of "buying food when it is limited" as well as "buying food with close-to-expiry-discount stickers" can be observed in the Maltese retail sector according to the statistical analysis (Annex C1 and C2).

## 2.7. LACK OF INFRASTRUCTURE AND GOVERNMENTAL SUPPORT FOR FOOD BANKS

Food banks in Malta face several barriers impeding their functioning, such as a lack of storage space, logistical support or bureaucratic hurdles. This section will address some of these barriers, starting with a lack of regulatory policy. Some supermarkets donate left-over foods, but these arrangements are non-obligatory, informal and infrequent. Supermarkets are concerned that if their food donations are publicised, then it could affect their brand image or profitability if food banks mishandle the food (Attard, K., personal communication, June 13, 2020). These concerns for the brand image have to do with the possibility of lawsuits in case donated food causes food poisoning. Supermarkets are also concerned that if donations are publicised, then people might prefer to get donations as opposed to buying food (Attard, K., personal communication, June 13, 2020). Obligating or anonymising food donations from supermarkets through legislation would help food banks out significantly in this regard.

A lack of coordination is also a barrier. Food transportation is not coordinated on a central level; instead, supermarkets and food banks make arrangements on an individual basis that could benefit from being centrally orchestrated to reduce overlap and increase efficiency. Initiatives are quite varied: some food banks receive food donations through donation boxes placed inside supermarkets, some food banks receive food directly from the supermarkets transported with the supermarkets' own vehicles (Malta Food Bank Foundation, personal communication, June 11, 2020). Some foodbanks donate food to NGOs who distribute it further to people in need: a multitude of options to serve the individual challenges each food bank faces, but which could benefit from central coordination. Also, many foodbanks are unregistered, but they still collect food or even money for distribution. This lack of registration is a hindrance to the centralisation and formalisation of food donation systems, especially from supermarkets to foodbanks (Malta Foodbank Foundation, personal communication, June 11, 2020).

As mentioned earlier, food donations by supermarkets are often irregular, as these donations depend on what is left in supermarkets at the end of the day. These irregularities are challenging to the infrastructure of food banks; the food banks' food processing capacity (storage, logistics, volunteer) is often too restricted to handle large peak donations, but if food banks upgrade their processing capacity, this may not be fully utilised when food donations are small, which is very expensive for a charity organisation (Malta Food Bank Foundation, personal communication, June 11, 2020).

Storage capacity is an important limiting factor to food banks; a lack of storage capacity limits food banks from receiving more substantial quantities of donated food (YMCA Malta, personal communication, June 4, 2020). Storage space is precious and hard to come by in Malta, because most of the available storage space in Malta is utilised commercially which increases rents and daily operating costs for food banks (Malta Food Bank Foundation, personal communication, June 11, 2020). A lack of cooling facilities also poses a problem; food banks often cannot afford large cooling warehouses, significantly limiting the types of food donations food banks can realistically process without spoilage. Currently,

most food banks can only receive and process non-perishable foods (St. Jeanne Antide Foundation, June 5, 2020). Finally, bureaucracy is also a barrier as it might prove difficult to get planning permissions, as in the case of the Malta food bank foundation who have been patiently waiting for permission to renovate their storage space. This permission has not come in yet for multiple years (Malta Food Bank Foundation, personal communication, June 11, 2020). The infrastructural availability indirectly has a bearing on how the uncertainty of supply and demand from donated food can be managed. Limited infrastructure cannot handle peak donation; however, if the storage capacity is increased, it may not be fully utilised when the food donation is little.

Food banks lack logistical support; often they have no trucks with which to collect donations, and they lack necessary heavy equipment to handle food donation on a large scale, such as a forklift to move food from the truck into their warehouse (Malta Food Bank Foundation, personal communication, June 11, 2020).

## 2.8. LACK OF WASTE SEPARATION, MONITORING AND RECYCLING STANDARDS

Waste collection, monitoring and processing play a crucial role in waste management. Especially, monitoring and collection of mixed waste can be a significant concern. For example, some small corner shops and grocery stores may use the Council's Waste Service, which collects household waste. According to legislation, this part of the waste is food waste in the retail sector. However, it is mixed with other household waste and is difficult to monitor (Wasteserv, personal communication, June 12, 2020). A critical barrier to food waste reduction would be the lack of data collection on food waste streams and separated food waste, leading to decreased efficiency of waste treatment. As discussed in Chapter 2.3, there is no self-monitoring obligation for supermarkets nor carriers, so waste treatment organisations like WasteServ can only quantify incoming waste, which is often not split up into different waste streams (e.g. packaging and organic waste) (WasteServ, personal communication, June 12, 2020). Currently, the lack of standardised separation practices reduces the availability of digestible fractions of the waste. If WasteServ decides to receive food waste from the retail sectors, the unwanted impurities in the organic waste stream such as the packaging will impact the quality of feedstock to anaerobic digestion (WasteServ, personal communication, June 12, 2020). When the package of the food enters the biological reactor, it will also take more time to biodegrade. If the food packages start to accumulate, the reaction volume will decrease so that the efficiency of anaerobic digestion will decrease. Therefore, it is essential to standardise separation practices. If waste is not separated correctly, less available organic waste will go to the OPP. A lack of organic waste in the OPP results in not enough organic waste being treated (RRRA, personal communication, June 4, 2020; ERA, personal communication, June 8, 2020; WasteServ, personal communication, June 12, 2020).

A large part of our research was aimed at filling in the data gap concerning the quantification of food waste. However, we did not succeed in this regard. Various stakeholders proved uncooperative in providing data on waste streams from their facilities. It was reported that most supermarkets do not accurately collect waste stream data for their use (NSO, personal communication, June 9, 2020). Thus, without reporting obligations, it is not possible to accurately quantify retail food waste in Malta (Galea, 2019). Large retailers such as Lidl often contract with their own waste carriers to collect waste from

their stores who do not have to provide data on the waste, they collect either under the current WMP. However, a working group comprising the Environment and Resources Authority, the National Statistics Office, WasteServ and the Ministry for the Environment, Climate Change and Planning is currently establishing a data collection methodology, and data regarding food waste will be published in 2022.

After waste collection, approximately 80% of Maltese waste is landfilled, which means Malta currently heavily relies on landfilling (WasteServ, personal communication, June 12, 2020). The current landfill practice has severe impacts on the environment and available resources in Malta, like toxic leachate entering soil and water and leading to harm to human health (WasteServ, personal communication, June 12, 2020). To decrease high landfilling rates while increasing low recycling rates, Malta's efforts focus on shifting "from unsustainable dumpsites towards differentiated waste collection and treatment facilities" (Brincat, 2014; RRRRA, personal communication, June 4, 2020; ERA, personal communication, June 8, 2020). The Maltese government has already planned that 10% of waste will be landfilled in the next ten years. To reach only ten per cent, there will be more technical improvements like converting at least one waste treatment plant into an Organic Processing Plant (OPP) for composting, and the number of landfills will decrease.

### 3. SUGGESTIONS FOR FOOD WASTE REDUCTIONS IN MALTA

#### 3.1. ROADMAP

In this chapter an advice is made towards FoEM to reduce food waste in the retail sector. This advice is captured in a roadmap that includes actions that specifically FoEM can take. Therefore, this chapter will combine the insights gathered in chapter 2 to advise FoEM on how to advance food waste reduction in the retail sector in Malta. Overall, it was recognised that past initiatives to fight food waste have mainly targeted consumer practices surrounding municipal waste (Dr. Gatt, K., personal communication, June 9, 2020) but so far, the retail sector has not specifically been targeted. The following main barriers have been outlined that are particularly relevant to FoEM:

1. A lack of political will and awareness about food waste amongst suppliers, retailers, politicians and consumers
2. A fragmented and uncoordinated food donation system
3. A lack of communication between the stakeholder groups, such as policy makers, food banks, retailers and consumers
4. Lack of a legal framework that supports food donation and waste separation in the retail sector

As shown in Figure 2, the main goal that will be pursued in this road map is to push for legislation related to 1) food donation and 2) waste separation by retailers. These two aspects have been recognized as being central to reducing and repurposing waste in the retail sector in Malta (Annex B1 and Annex B3).

Effective policy-making in regards to the retail sector builds on various aspects, such as consumer awareness, consumer practices, the food donation infrastructure and retailer knowledge of waste management practices. Therefore, four stakeholder groups will be addressed in the following road map: Consumers, the policy sector, the retail sector, and food banks. In order to realize the main goal of the roadmap; legislative change, we will present one sub-goal per stakeholder category to FoEM that they could focus on achieving. We will also present the specific actions that FoEM should take to achieve each sub-goal. The road map will be presented by going through each stakeholder category, pointing out FoEMs main goal in relation to the stakeholder category and indicating the actions FoEM could take to reach that goal. Finally, it will be explained how these goals and actions relate to the main goal of FoEM.

FoEM should follow different communication approaches when addressing these stakeholders as outlined in the expert report “Solution-Oriented Analysis” (Annex B4). Due to the different power relations between the stakeholder groups, which are presented in the expert report “Policy and Stakeholder Analysis” (Annex B1), the communication approach differentiates every time. Generally, FoEM should not only communicate with each stakeholder group separately, but also encourage and facilitate inter- and intra-communication amongst stakeholders. Inter communication refers to communication between different stakeholder groups. Intra communication on the other hand refers to communication within a single stakeholder group. In the following paragraphs, the roadmap will be explained in detail.

Though, specific communication strategies that may be followed to support the actions mentioned below can be found in Annex B4.

### **Power relations between stakeholder groups**

When tackling food waste in the retail sector in Malta, taking the different stakeholders and their relations to each other into account is important in order to arrive at a valid policy proposal. Within the food waste management system, every stakeholder has its own level of influence on the problem of food waste. Consumers exercise influence through in-store behaviour. On the other hand, supermarkets can influence consumer choices, for instance by including discounts on products close to the best-before date. Supermarkets also influence the way that retail waste can be collected and processed. The separation of waste facilitates recycling or composting by waste management companies and decreases the load on landfills. Pitkalija also holds similar influence over supermarkets regarding food waste disposal. The direct influence of food banks to affect change might be limited because of their lack of economic involvement in the food chain (dr. Gatt, K., personal communication, June 9, 2020). Though, they may exert influence through educating consumers and facilitating communication between other stakeholders. Finally, the Maltese government can exercise large influence over the problem of food waste through regulation and legislation, though this is currently hampered by fragmentation and a lack of political consensus on the topic. Here, FoEM could play a vital role in lobbying for the topic of food waste to reach a status of higher importance.

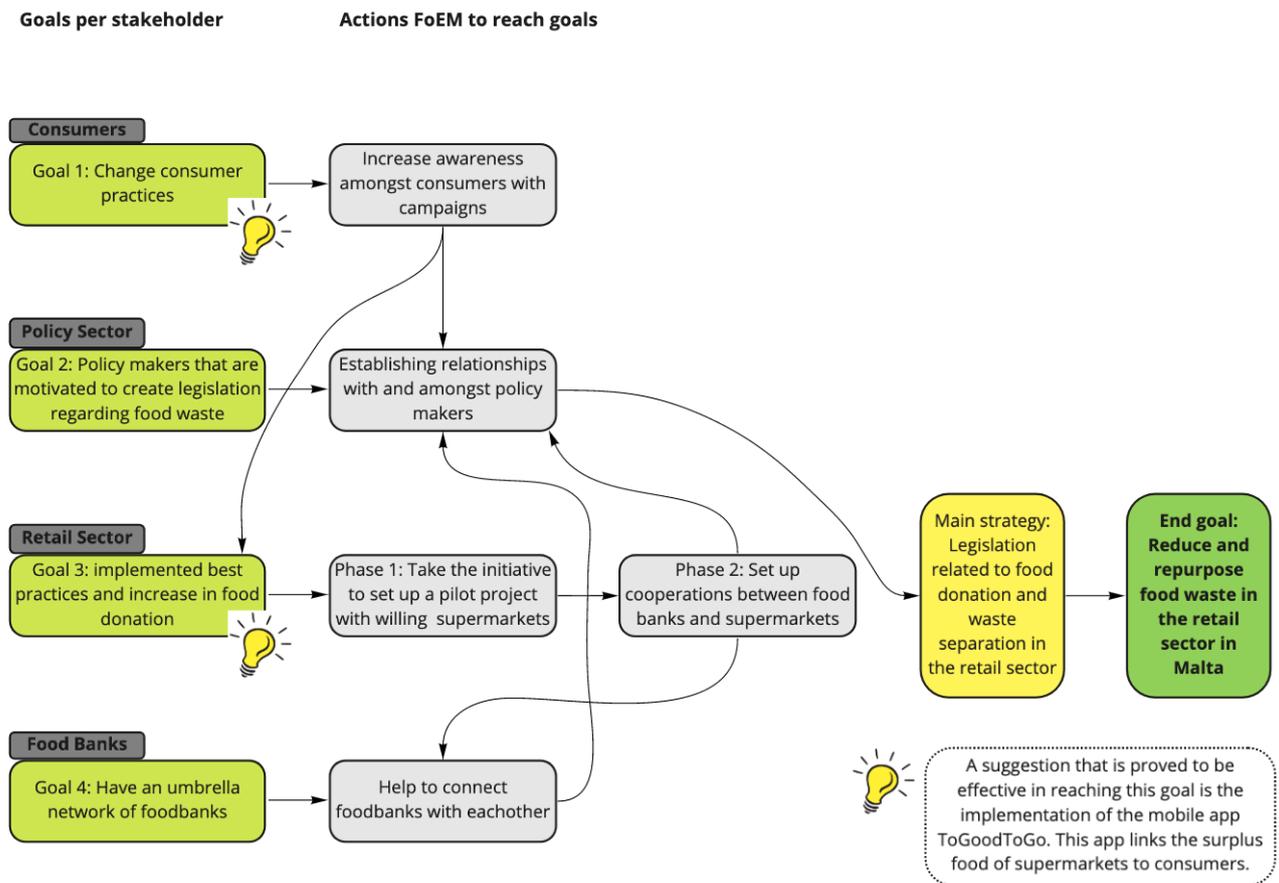


Figure 2: Roadmap for Friends of the Earth Malta

### Goal 1: Influence Consumer Practices by Increasing Awareness

As shown in the report “Policy and Stakeholder Analysis” (Annex B1), it is shown that NGOs have a relatively strong influence on consumers. This enables FoEM to not only educate consumers, but also potentially influence their in-store behaviour. One example of a consumer behaviour that has been identified as potentially creating unnecessary food waste is that consumers prefer to buy aesthetically pleasing food. FoEM could specifically raise awareness around the fact that the external appearance of food does not have an impact on the nutritional quality or taste of that food. This could be done through social media channels or in-person information stands. In order to then influence the consumer behaviour in the supermarket, FoEM could create stickers or pointers that could strategically be placed within supermarkets. Such a strategy is an example for how awareness campaigns could be translated into influencing consumer behaviour. Though, one important aspect that needs to be considered is that this strategy is highly dependent on retailers that are willing to cooperate. Therefore, inter-communication between different stakeholder groups is of vital importance to implement strategies related to changing consumer behaviour. A similar strategy could also be followed when addressing food squeezing in supermarkets.

Another barrier that has been identified in regards to consumer practices is their apprehension towards buying products that are close to the expiration date. A potential strategy that FoEM could follow in order to influence consumers to buy food that is close to the expiration date would be to actively lobby for food apps, such as “Too Good to Go” to start operating in Malta. “Too Good to Go” is an app that connects its users directly to restaurants and supermarkets, and lets them pick up unsold food for a discounted price. The app already operates in many other European countries successfully (“| Too Good To Go,” n.d.). FoEM could start a conversation with “Too Good to Go” and work on getting them to operate in Malta. This would probably require a long-term effort, though it may be worth it considering the success of the app in other countries.

Through the above-mentioned strategies, food waste may not only be reduced through influencing consumer practices. Another important aspect of educating the public is to influence the political agenda and retail practices over time. On the one hand, conscious consumers may demand policies related to retail food waste in Malta. On the other hand, consumers have the power to demand corporate social responsibility (CSR) in the retail sector. The concept of corporate social responsibility will further be explored in “Goal 3: Incentivise best Practices and Food Donations”. Regarding education, a positive message can be retrieved from the conducted survey in which a great majority indicated that they are open to learn more about food waste. Also, most respondents indicated that they think education can be a useful tool in reducing retail food waste (Annex B2).

## **Goal 2: Establish Relationships with and amongst Policy Makers**

As shown in Figure 2, the main strategy in reducing and repurposing food waste in Malta is to push for a comprehensive legislation that addresses food donation and waste separation. Therefore, policy makers are a vital stakeholder group for FoEM to form close connections with. As a first step, we recommend that FoEM should find policy makers that are interested in tackling the problem of retail food waste in Malta. When communicating with policy makers, it is vital for FoEM to clearly outline the benefits of addressing food banks and retail waste separation specifically. In addition to that, FoEM should present overlaps between the interests of different policy makers, for example between the Ministry of the Environment and the Ministry of Family. Even though both of these actors have different reasons for addressing retail food waste, FoEM could bring them together in order to foster intra-communication amongst policy makers.

Achieving a policy proposal to reduce retail food waste requires pressure from many different stakeholder groups. Therefore, FoEM should not only work with policy makers directly, but also play a role in connecting the policy makers to stakeholder groups, such as food banks, the consumers, or the retail sector. This approach ensures that the interests of all stakeholder groups are considered when formulating policy proposals. Ideally, the strategies that can be pursued in a policy proposal may be related to several stakeholder groups and strategies. Based on the expert reports (Annex B) the following approaches seem to be most promising and necessary in pursuing and pressing for when talking to policymakers:

1. Quantifying waste streams in the retail sector
2. Waste separation in the retail sector

3. A centralised donation structure that standardises and incentivises or requires retail donation to food banks
4. A central food bank organisation that oversees the operation of food banks
5. Addressing liability issues (food safety) when the retail sector donates to food banks

Pushing for legislation in above mentioned areas indirectly influences other stakeholder groups, such as the retail and the food bank sector, on which FoEM usually would not have a lot of influence over.

### **Goal 3: incentivise best practices and food donations**

Amongst all the stakeholder groups, FoEM may encounter most difficulties when trying to engage the retail sector in tackling food waste in the retail sector. An indication for that has been the low amount of willingness for cooperation by supermarket managers throughout the project regarding the survey and the interview requests. Though, other stakeholders have named some of the main barriers for food waste reduction by the retail sector to be the lack of waste separation, the lack of regular food donation and the lack of discounting products close to expiration date.

Given the current lack of a legal framework and the lack of financial incentives to change behaviour, retailers may show a lower interest in reducing food waste compared to other stakeholders. Therefore, one of the main goals of FoEM in relation to retailers should be to highlight the benefits of applying best practices, such as donating food, separating waste, or discounting products that are close to the expiration date. This may lead to FoEM being able to influence supermarket practices. An overarching concept to consider in this context is CSR. This concept appeals to the monetary benefits that retailers can gain based on a positive image they portray to consumers through addressing social or environmental issues (Annex B2).

One way of highlighting benefits of CSR would be to link up with a small number of retailers and actively help them to implement CSR practices within the context of a pilot project. For example, FoEM could bring supermarkets in contact with food banks directly. Additionally, FoEM could implement strategies discussed in section 3.3 to influence consumer behaviour, which may lead to a reduction in food waste. Another initiative that could be taken throughout the course of such a pilot project is to help the retailer implement waste separation practices and possibly even implement ways of quantifying the food waste. In addition to that, as explained in section 3.3, FoEM may also lobby the company “Too Good to Go” to start working in Malta. Thus, supermarkets can possibly be involved in the lobbying process, as it is also in their interest to sell more food. Before starting such a pilot project, strong relationships to the supermarkets have to be built. To get a better understanding of how the involved actors in the retail sector perceive the project and to get organisations on board, face-to-face contact is of high importance. (Annex B4). Such a pilot project could not only contribute to the increase of food waste reducing practices in the retail sector, it may also make retailers push for legislation that would make these sustainable practices easier to implement. Thus, a pilot project of this kind may promote inter-communication between the retail sector and other stakeholder groups. Therefore, supporting CSR in the retail sector can be a significant stepping stone towards creating meaningful and comprehensive legislation related to food donation and waste separation.

#### **Goal 4: Establish relationships with food banks**

Currently, food banks organise and distribute their donations in whatever fashion they see fit. There is no standardised legal framework that addresses the donation infrastructure, the donation procedures or liability issues. This lack of standardisation leads to unnecessary food waste generation. In relation to food banks directly, we suggest FoEM to become a leader in facilitating coordination between the food banks. Though, as described above, FoEM's main goal should be to push for legislation in relation to food banks and waste separation, which may require a long-term effort.

In the meantime however, FoEM should establish close relationships with food banks in Malta for several reasons. First, this would aid the policy making process, as FoEM would be able to address the specific needs and wants of food banks. Food banks have specific concerns that relate to the donation infrastructure and the storage of donations (see Annex B3). It is vital for FoEM to be able to connect food banks to policy makers in order to ensure effective stakeholder involvement in the policy-making process.

Furthermore, a close relationship with multiple food banks would set the stage for successful intra-communication practices and could help to create an umbrella food bank organisation (Annex B1). Such an organisation may be useful to food banks for various reasons. On the one hand, it is useful for food banks to collaborate with each other in order to exchange experiences and effective practices. On the other hand, when looking at reducing food waste, an umbrella organisation may be able to more effectively connect food banks to retailers that would like to donate food. Having a centralised organisation that handles such processes would therefore make it easier to connect food banks with retailers and therefore reduce food waste from being generated unnecessarily.

If this was done in addition to conducting the pilot project as mentioned above, this could lead to effectively connecting food banks to retailers that are willing to donate food on a regular basis.

Thus, a strong relationship to food banks could significantly contribute to a food waste reduction. Thereby, a coalition among food banks and NGOs could also increase their influence on policy-making and lay the groundwork for a centralized surplus food collection and distribution system (Annex B1).

## 4. CONCLUSIONS

The aim of the project was to analyse current food waste practices and to suggest strategies to reduce and repurpose food discarded by the retail sector in Malta. Throughout this process, when examining the retail sector, structural factors were considered, such as policy and infrastructure. Additionally, consumer and retailer practices were also studied. It was identified that the main barrier related to reducing and repurposing food waste is the lack of a robust legal framework concerning food donation and waste separation that addresses retailers specifically. The lack of such a framework influences other factors, such as the infrastructure, as well as supermarket and consumer practices. For example, retailers are not obliged to monitor and quantify their waste streams leading to a lack of waste stream data, which makes it difficult to design and evaluate an appropriate waste management policy. In addition to retailers being affected by the lack of a legal framework, peripheral stakeholders such as suppliers and food banks may also face similar difficulties, thus intensifying the problem. In order for FoEM to contribute to a comprehensive solution to this problem, we recommend the following actions. FoEM should collaborate with food banks, consumers, policy makers and the retail sector to push towards a policy framework supporting food donation and waste separation.

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## ANNEX A1 – DATA COLLECTION METHODS

The information presented in this report was first collected through background reading of EU and national food waste management peer-reviewed literature on the topics of policy, social practices, technologies and infrastructure as well like best practices of member states in Europe. Literature related to waste management in Malta was gather along with relevant grey literature such as policies and directives, legal documents, evaluation reports and news articles. This initial literature review phase provided context to collect both quantitative and qualitative data through two surveys and digital interviews. These data collection methods were useful since there is a lack of literature on Malta's food waste management and it also improved the practicality of the results.

### INTERVIEW

The interviews were semi-structured as they were guided on predefined topic lists per category of stakeholders, which allowed probing whenever beneficial while still following a structure. In each conducted interview there was a main interviewer supported by at least one notetaker. Various communication platform recordings and automatic transcription software were also used, but only to function as additions to the notes.

### SURVEY

The survey was designed for supermarket managers and consumers to collect their perspectives towards food waste in Malta. To collect more samples, a variety of social media platforms were used. Surveys were primarily distributed though email, Maltese Facebook groups, Reddit, HSBC Webinar attendants, LinkedIn and through personal connections. In the survey, open-ended questions, multiple choice questions, rating questions and Likert scale questions were used. After receiving all the responses in the set time, the data was processed by SPSS and analysed to support this research.

## ANNEX A2 – LIST OF INTERVIEWED STAKEHOLDERS

**Table A1. Overview of interviewed stakeholders in Malta. Source: own creation**

Organization	Type	Description of activity	Date
EkoSkola Malta	Environmental NGO	NGO that organises environmental education activities at schools across Malta	June 3
Dr. Jonathan Spiteri	University of Malta	Researcher of behavioural economics at UM who believes that the whole world needs to undergo a shift in the way food waste is utilized	June 4
Dr. Kevin Gatt	University of Malta	Coordinator of MSc degree in Sustainable Infrastructure, chair of Strategic Environmental Assessment Focal Point Board	June 9
Kathleen Attard	University of Malta	Visiting lecturer in the University of Malta. Author of the dissertation: 'Breaking the foodberg: a socio-ecological study of food waste production in Maltese households'	June 13
Dr. Alexandra Mifsud	University of Malta	Researcher at the Centre for Environmental Education and Research at the University of Malta, involved in food waste projects launched by Malta CSR Institute	June 5
San Giljan local council	Local council	San Giljan is a town of 13,792 inhabitants located in the Central Region of Malta	June 4
Qrendi local council	Local council	Qrendi is a village of 2,752 inhabitants located in the Southern Region of Malta	June 5
Kirkop local council	Local council	Kirkop is a village of 2,397 inhabitants located in the Southern Region of Malta	June 3
Tramuntana regional council	Regional council	Regional council of Tramuntana, also called the Northern Region of Malta. Their main role is to facilitate the communication and coordination of its 12 local councils	June 10
YMCA Malta	Social NGO	A non-profit, voluntary and ecumenical movement seeking to promote the vision to build a more just society. In Malta they collect food donations and distribute them among the people in need	June 4
RRRA (Resource, Recovery and Recycling Agency)	Government agency	The RRRA is a government agency launched by the Environment Minister tasked with working towards circular economy and increasing recycling rate as well as managing waste streams in Malta	June 4

St. Jeanne Antide Foundation	Charity		Charity that receives and redistributes food donations from supermarkets, providing families with daily cooked meals and training them to cook nutritious meals	June 5
Littles Supermarket	Small retailer		Small supermarket located in Marsaskala	June 5
ERA (Environment and Resource Authority)	Regulatory authority		Regulatory agency responsible for the natural environment in Malta. Involved in working on the new Waste Management Plan with the Ministry	June 8
NSO (National Statistics Office Malta)	Government agency		The NSO is the responsible agency for data-gathering on a number of issues, including waste generation. However, they only have data on waste in the treatment facilities	June 9
Dr. Miriam Dalli	MEP		Member of the European Parliament, member of ENVI (Committee on the Environment, Public Health and Food Safety)	June 10
OFM Valetta	Charity		Soup kitchen in Malta assisting Maltese families in need	June 11
Pitkalija	Middle-man market		The Pitkalija is a government-owned market where middle-men can sell their produce	June 11
Maltese National Youth Council	Youth Council		A voluntary and autonomous NGO, a leading actor in Maltese Civil Society and a platform for young people to express their opinions	June 11
PTMatic Environmental Services	Private waste collector		PTMatic Environmental Services is responsible for environmental testing, instrumentation and analysis; environmental consultancy; environmental contracting and remediation of contaminated soils and liquids; disposal of all forms of hazardous wastes	June 11
WasteServ	Public waste management company		WasteServ is responsible for organizing, managing and operating integrated systems for waste management including minimisation, collection, transport, sorting, reuse, utilisation, recycling, treatment and disposal of solid and hazardous waste	June 11
Malta Food Bank Foundation	Food bank		One of the food banks operating in Malta. Responsible to collect food and/or money donations from individuals and private businesses so that they can be distributed to NGOs and later on to people in need	June 11
MECP	Ministry		The Ministry for the Environment, Climate Change and Planning	June 16

**Table A2. Overview of interviewed stakeholders outside Malta. Source: own creation**

<b>Organization</b>	<b>Type</b>	<b>Country</b>	<b>Description of activity</b>	<b>Date</b>
Μπορούμε (Boroume)	NGO	Greece	Coordinate food waste donation from retail & farmers markets to charitable organisations	June 10
CORE Green	Small retailer	Malta	Conscious green micro-business promoting healthier lifestyle, connection with the earth and community	June 10
Foodcloud	NGO	Ireland	Use customized technology platform to link businesses with surplus food to local charities and community groups in need	June 12
Milan municipality	Public actor	Italy	First municipality in Milan to create own Food Policy Strategy. Many projects with multitude of stakeholders in own city	June 10
Framtiden i våre Hender	eNGO	Norway	Commissioned research to quantify % of supermarkets donating excess food in Norway (self-reported by supermarket managers), which lead to adoption of national food legislation	June 3
Matsentralen	Food bank	Norway	National food bank network in Norway	June 3
Fruta Feia	Cooperative	Portugal	Buy and redistribute "ugly" fruit directly from farmers to consumers at higher mark-ups than farmers would get for 'wasting' the fruit	June 3
Humus Pro	Project	Belgium	Small-scale collecting and composting organic waste in Brussels to grow organic vegetables and fruits	June 12
Last Minute Market	Cooperative	Italy	Link shops and producers with leftover food that would otherwise be discarded to charities. Started from project at University of Bologna	June 3
LIPOR	eNGO	Portugal	Based in Porto, their project "Dose Certa" helps businesses analyse their food waste streams to reduce food waste losses and sunk costs. They also help restaurants in creating sustainable menus	June 4
Lovin' Spoonfuls	eNGO	USA	Volunteer-driven food rescue coordination agency; collects food from wholesalers and grocery stores and delivers to charities	e-mail contact

REMA 1000	Large retailer	Denmark	Retail chain pioneering food waste reduction in Denmark focused on reducing in-store waste	e-mail contact
WRAP (Waste and Resources Program)	Voluntary industry agreement	United Kingdom	Voluntary industry agreement to help UK consumers cut down on food waste in householders. Developed a roadmap to aid businesses in creating economic and environmental value from reducing food waste	e-mail contact
Zero Desperdicio	eNGO	Portugal	Volunteer organization that monitors food waste production in all stages of the food chain; aimed at adoption of environmental behaviour	June 12
Porta Palazzo	Open air market	Italy	Porta Palazzo is the biggest open-air market in Turin, Italy. They have a project to collect the unsold food at the end of the day to then distribute or correctly dispose it	June 11
Yonodesperdicio	eNGO	Spain	A non-governmental development cooperation organization (NGDO) whose mission is to promote respect, protection and guarantee of human rights to food, health and water and sanitation	June 12
Zero Waste Europe	eNGO	Belgium	Aim to empower communities and change agents from around Europe to redesign their relationship with resources, to adopt smarter lifestyles and sustainable consumption patterns in line with "circular" resource management	e-mail contact
Marjolein Buisman	WHU - Otto Beisheim School of Management	Germany	Assistant professor in Retail Analytics	June 9

## ANNEX B – EXPERT REPORTS

This annex contains four expert reports written in the course of this research. They are stand-alone reports focusing on one specific aspect of the food waste problem in Malta, but their insights are combined in this synthesis report. Some sections of the synthesis report refer to the expert reports for clarification and theoretical justification.

- Annex B1 – Expert report Policy and Stakeholder Analysis
- Annex B2 – Expert report Food Practices
- Annex B3 – Expert report Technology and Infrastructure
- Annex B4 – Expert report Solutions

EXPERT REPORT NO. 1

# STAKEHOLDER & POLICY ANALYSIS



## WRITTEN BY

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## LIST OF ACRONYMS

ERA	Environment and Resources Authority
EU	European Union
FEBA	European Food Banks Federation
MECP	Ministry for The Environment, Climate Change and Planning
MFBF	Malta Food Bank Foundation
NGO	Non-governmental organisation
NSO	National Statistics Office
LC	Local council
RC	Regional council
RFW	Retail food waste
RFWM	Retail food waste management
RRRA	Resource, Recovery and Recycling Agency
UM	University of Malta
VAT	Value Added Tax
WFD	Waste Framework Directive
WMP	Waste Management Plan
WPP	Waste Prevention Programme

## 1. INTRODUCTION

Malta is facing serious issues with its production and processing of waste (Camilleri-Fenech et al., 2018; Think Magazine, 2019; Minelgaitė & Liobikienė, 2019). The Island's municipal waste, defined as waste generated from households or that from sectors of which the composition is similar, was the highest of all EU member states in 2017 per capita (European Commission, 2019). Food waste, defined in concordance with the Food and Agriculture Organisation of the United Nations as food that is being discarded whilst still being fit for human consumption, is considered as an important waste stream that should be reduced (EU Fusions, 2016). Malta is severely lagging behind its EU counterparts, such as France and Italy, in taking measures to divert organic waste from landfills (ERA, 2018). There is no food waste quantification or recording in place (Stenmarck et al., 2016). Although separate organic waste collection and national awareness campaigns have been set in place targeting households, barely any specific measures directly targeting the retail sector can be observed (European Commission, 2016). Supermarkets constitute a major part of the food waste generators within the retail sector, nonetheless barely any initiatives to reduce food being wasted are in place (Cicatiello et al., 2017). Alternatives to prevent food waste such as better segregation and repurposing of edible products to food banks could be applicable to the retail sector and supermarkets in order to reduce and prevent food waste (Cicatiello et al., 2016; Eriksson & Spångberg, 2017).

However, the complex interplay of actors, such as supermarkets, suppliers, waste collectors, policymakers and consumers along the food waste chain must be better understood. Waste management actors strive to fulfil their objectives whilst having a varying degree of power over the chain and possible changes (Xu, Zhou, Cao & Luo, 2016). The stakeholders required to be studied go beyond the presently operating parties within the chain, as new initiatives could require the involvement of new stakeholders (Joseph, 2005; de Moraes et al., 2020). Mapping out the stakeholders provides insight into what expertise is available, where it resides and how to resolve conflicts.

Furthermore, retail food waste management (RFWM) is strongly dictated by policies and its adjoined legislative framework (Fehr, Calçado & Romão, 2002; Vaqué, 2017; Chalak, Abou-Daher & Abiad, 2018). The policy decision-making process occurs in different negotiation arenas that vary across European, national and local levels. Analysing the current legislative frameworks and their implementations will help design potential future policies to improve RFWM.

In this report, a stakeholder analysis is used to describe the networks of actors involved in the RFWM. They are categorised as public, private, civil society. Then, taking into account the intricacy of stakeholder relationships and involvement, the report proceeds with a policy analysis in accordance with the food waste hierarchy. At last, the report concludes with an overview of the findings and suggestions for future research on this topic.

### 1.1 RESEARCH OBJECTIVES

This report is written as a supplement to the synthesis report, commissioned by Friends of the Earth Malta. The overall purpose of the project is to analyse current food waste practices and to suggest strategies to reduce and repurpose food discarded by the retail sector in Malta.

Through analysing the policies and stakeholders involved in the decision-making processes, this expert group report aims to: 1) determine the current policy context in Malta in relation to food waste; 2) identify and understand the attitudes and interconnectedness of major stakeholders from social, economic, and environmental perspectives. The general (GRQ) and specific research questions (SRQ) of this study are given below:

**GRQ 1: What is the involvement of stakeholders in the process of retail food waste management in Malta?**

- *SRQ 1.1: Which stakeholders are involved in the process of retail food waste management in Malta?*
- *SRQ 1.2: What are the objectives regarding retail food waste management in Malta among the stakeholders?*
- *SRQ 1.3: What are the power relations among the different stakeholders, and how do these relations affect retail food waste management in Malta?*

**GRQ 2: What are the policy implications and future pathways regarding retail food waste management in Malta?**

- *SRQ 2.1: What are the current legislation and policies regarding retail food waste management in Malta?*
- *SRQ 2.2: What are the implementations of the legislations and policies regarding retail food waste management in Malta?*
- *SRQ 2.3: What are the future policy pathways regarding retail food waste management in Malta?*

## 1.2 METHODOLOGY

### 1.2.2 STAKEHOLDER ANALYSIS

We first identify and classify the stakeholders into three categories according to their social roles: public stakeholders (e.g. governmental agencies), private stakeholders (e.g. supermarkets), and civil society organisations (e.g. non-governmental organisations). These categories allow for a better understanding of their relationships and responsibilities (Rosenbaum, 2006). To further understand their perspectives, we visualise the relations, power, and interest of the stakeholders via a flow chart and a matrix. *Power* is defined as the means or ability to affect both the reduction of food waste directly or to influence the related stakeholders. *Interest* means a stake or involvement in addressing food waste problems. It covers three aspects: economical, environmental and societal. This distinction reflects the three pillars of sustainability, it is illustrated by a Venn diagram that showcases the dominant interests of the stakeholders and the overlaps (Ben-Eli, 2018).

### 1.2.3 POLICY ANALYSIS

The policy context is analysed via four perspectives: intentions, implementations, implications and future pathways. *Intentions* meaning policy targets, ambitions and goals, which suggest an issue has been put on the policy agenda. *Implementation* means the translation of the desired objective into practical steps. Their actual impacts, or the lack thereof, on society will be considered as *Implications*. *Future pathways* entail upcoming developments and potential steps. The distinction among these categories helps to logically understand the ambitions (i.g. intentions), current framework (i.g. implementations), impacts (i.g. implications) and upcoming adjustments of those.

## 2. STAKEHOLDER ANALYSIS

This chapter will provide an overview of the major stakeholders involved in RFWM in Malta and their distinctive roles and attitudes. A primary concern of RFWM is the attitudes among the various actors and the responsibilities they are able to take on. Together, they constitute a network of actors that reflects the social, economical, and environmental aspects of the food waste issue. Hence, an extensive analysis of the stakeholders is necessary to identify the roles that different stakeholders group play in regard to their influence and power on the topic. Exploring their (inter)relationships and the overlaps of their interests can also offer some important insight into resolving conflicts and facilitate future collaborations. The analysis and acknowledgement of the power relations found in RFWM were especially helpful to describe an accurate roadmap to reduce retail food waste (RFW) in Chapter 3 of the synthesis report.

Using the tools of a flow chart, a stakeholder matrix and a Venn diagram, we visualise the interrelationships among the stakeholders and the overlaps of their interests. As a supplement to the policy analysis, the stakeholder analysis provides insights on the complexity of retail food waste management and its social, economical, and environmental aspects.

## 2.1 PUBLIC STAKEHOLDERS

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### 2.1.1 EUROPEAN COMMISSION

The European Commission plays an instrumental role in tackling food waste. As the executive branch of the European Union, it proposes legislation and implements decisions regarding actions against food waste (Europa EU, 2020). The European Commission also evaluates the legislative and practical barriers of food waste reduction and food donation and acts as a facilitator of knowledge sharing. In 2015, the European Commission put forward a “circular economy package” to help achieve Sustainable Development Goals (EU Circular Economy Action Plan, 2020). Aside from developing a common EU methodology to measure food waste across the Member States, it has also been operating the EU Platform on Food Losses and Food Waste; taking measures to clarify food waste legislation and improving the use of date marking (European Commission, 2020). All these actions have to be taken into account by the Ministries of the Member States. The European Commission provides the groundwork for food waste to be addressed on the national level. Since the Sustainable Development Goals aim to balance the economic, social, and environmental dimensions of sustainability, the European Commission has high interest and power in all three dimensions.

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### 2.1.2 MINISTRY FOR THE ENVIRONMENT, CLIMATE CHANGE AND PLANNING

The Ministry of the Environment, Climate Change and Planning (MECP) is the key policy-maker for reducing food loss and waste in Malta. In 2019, they have been involved in two education and awareness-raising campaigns on food waste prevention and recycling (MECP, personal communication, June 16, 2020). To help realise the EU's food waste reduction goal, the Ministry will target food as a key waste stream in the new Waste Prevention Programme (WPP). They are responsible for mainstreaming food waste-related policies and practices at all levels of the government and society. These measures include research, education, and support for voluntary initiatives such as food redistribution networks. MECP has power over many governmental stakeholders in the waste sector, such as the Resource Recovery & Recycling Agency (RRRA) and WasteServ, whom the MECP also collaborates with. The new plan on food waste suggests that MECP has a high interest in tackling organic waste in the commercial sector, from both the environmental and societal perspectives. There is no apparent economic interest for the MECP concerning food waste.

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### 2.1.3 ENVIRONMENT AND RESOURCES AUTHORITY

The Environment and Resources Authority (ERA) is in charge of protecting and managing the natural environment, mitigating its damage. They are the national regulator for the environment and the waste management on the island (ERA, 2016). Their main objective is to enforce the compliance of environmental regulations developed by MECP among the stakeholders involved. The ERA and MECP collaborated on the development of the Waste Management Plan (WMP) (2014-2020) and a new version will be completed before 2021 (ERA, personal communication, June 8, 2020).

ERA's environmental interest is high and overlaps with the one of MECP. ERA has the power to enforce regulations, but its regulatory power is limited since there is no legislative framework in place. Therefore, it has less power than the MECP but considerable power over the business entities once binding legislation is in place. Their societal interest is considered rather low because they mainly focus on environmental policy and legislation of the environment. Their economic interest is considered very low since they are the national regulator on the environment and a public organism.

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#### 2.1.4 NATIONAL STATISTICS OFFICE

The National Statistics Office (NSO) is responsible for the collection, compilation, analysis and publication of statistical information to facilitate better decision-making in Malta (NSO, n.d.). The data of NSO does not focus on food waste yet, but they will be responsible in providing data for the establishment of a legislative framework regarding organic waste (NSO, personal communication, June 9, 2020).

The NSO reports data bi-annually to Eurostat, the statistical office of the EU, for the food waste 'plugin', which entails a food waste data collection for reference. The office is also involved in a national working group composed of ERA, WasteServ, and MECP. Its main function is to establish methodologies for the compilation of data for the European Commission's food waste reporting and the making of new legislation. The relation between the NSO and WasteServ is regarded as positive, although WasteServ can have problems with providing required data on time (NSO, personal communication, June 9, 2020). NSO does not collect further data about food waste other than what is requested by Eurostat. The working group is focusing on delivering data for the European Commission, there is no specific focus on the retail sector yet. NSO does not directly influence policy, but only collects data to display the current situation. Hence, the entity does not hold much power over other stakeholders. The collected data is published and used by the ministries. Since the NSO is funded by the government, it does not have economic interest in RFWM (NSO, personal communication, June 9, 2020).

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#### 2.1.5 REGIONAL COUNCILS

In Malta, there are currently five regional councils (RCs) in place. Their main role is to facilitate communication and coordination among the 68 local councils (European Committee of the Regions, n.d.; Tramuntana Regional Council, personal communication, June 10, 2020). Additionally, the RCs function as a bridge between the local councils and the national government, by giving policy recommendations. However, they do not have direct power on the decision-making process (Tramuntana Regional Council, personal communication, June 10, 2020; Regional Councils Regulations, 2011).

In terms of the three pillars of sustainability, it becomes evident that the RCs majorly focus on social and environmental objectives. Regarding environmental aspects, RCs are assigned "*to protect the natural and urban environment of the locality and take all necessary measures to ensure the more efficient use of energy, good waste management and climate change initiatives*" (Regional Councils Regulations, 2011, p. 5). Next to the environmental obligations the RCs are majorly tasked to take care of societal issues such as education, social welfare and sanitation (Country profile 2017-18 Malta, 2017). As the RCs must not engage in any form of a commercial partnership, except with the clear authority given in

writing by the Ministry, their economic interest can be regarded as fairly small (Regional Councils Regulations, 2011).

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#### 2.1.6 LOCAL COUNCILS

The Maltese local governance comprises 68 local councils (LCs). The LCs' main responsibilities are the protection of the natural and urban environment of the locality and the promotion of entrepreneurship. However, the LCs' power on these objectives is very limited as they do not have any direct impact on the policymaking processes (Committee of the Regions, n.d.). The LCs can only communicate their needs and opinions to the RCs, who can bring it forth to the national government authorities. Despite their low political influence, LCs can play an important role when it comes to community initiatives regarding educational projects surrounding (food) waste management (EkoSkola Malta, personal communication, June 3, 2020). In this regard, LCs can help to facilitate such projects and campaigns and nurture collaborations.

Based on the tasks assigned to the LCs, their main interests are societal and environmental ones. The LCs' fiscal autonomy is limited as there are no tax revenues raised at local level, and LCs do not profit from shared tax incomes. Around 80% of the LC's revenue is derived from state grants (Committee of the Regions, n.d.). Therefore, the LCs do not have the monetary nor staff capacity to focus on food waste reduction measures (Qrendi Local Council, personal communication, June 5, 2020). Thus, as the LCs are funded by the government and do not directly generate revenue, their economic interest can be perceived as rather low.

Overall, the LCs do not have much power over RFWM, nevertheless, WasteServ acknowledges them as important actors when it comes to communicating waste management strategies to the local community (WasteServ, personal communication, June 11, 2020).

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#### 2.1.7 RESOURCE RECYCLING AND RECOVERY AGENCY

Resource Recycling and Recovery Agency (RRRA) focuses on Malta's transition towards a circular economy by increasing Malta's efforts to reduce their landfilling rates, which emphasises on re-use, recycling and recovery. The RRRA aims to implement measures for this transition through collaboration with the MECP. The RRRA's strategy has two main objectives regarding Food Waste Management, in collaboration with the MECP. Firstly, to prevent and reduce food waste at source through educational/media campaigns promoting how to make use of discarded food in different recipes. Secondly, to create strategies whereby the unused food from catering establishments is collected via refrigerant storage vans connected through an e-App. The collected food may be given to charities or food banks (MECP, personal communication, June 16, 2020). Once this transition has taken off, the RRRA will also be responsible for monitoring compliance of all actors engaging in the circular economy system by creating a level playing field (RRRA, n.d.).

RRRA has a strong interest in improving the environment. It also focuses on changing the mentality and social practices in regard to waste. The RRRA is funded by the government which means the entity

does not have a prevalent economic interest (RRRA, personal communication, June 4, 2020). The RRRA is a facilitating agency that collaborates with the government but has no direct influence on the policy decision-making process.

The RRRA mainly interacts with WasteServ, MECP and ERA as well as businesses and organisations engaged in the circular economy. The agency interacts with WasteServ and ERA to identify waste streams and the handling thereof and set up recycling schemes. Due to the fact that the RRRA is only operating since 2018, food waste has not been specifically addressed by the RRRA yet. So far, they prioritised non-biodegradable waste. Our interview suggested that if they have more employees at hand they see great potential in food waste (RRRA, personal communication, June 4, 2020).

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#### 2.1.8 WASTESERV

WasteServ is responsible for organising, managing and operating integrated systems for waste management (WasteServ, n.d.). Aside from maximising the extraction of good quality recyclable materials and generating renewable energy, they are also involved in public education and play an advisory role for the Ministry (WasteServ, 2019). They operate Sant' Antnin Waste Treatment Plant, Malta North Mechanical and Biological Treatment Plant, and a new organic waste processing facility called ECOHIVE Organic will be put in place in the future (MECP, personal communication, June 16, 2020).

WasteServ does not trace the source of the organic waste they receive. Their communication with smaller supermarkets goes through LCs (WasteServ, personal communication, June 11, 2020). Since food waste segregation is not mandatory for the private sector, discussions on its standardisation are ongoing. Data shows that WasteServ has a high interest in environmental and societal aspects of RFW. As a state-owned company, they have a low interest in economic aspects. WasteServ can be considered quite high in power as it is the dominant waste processor of the country.

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#### 2.1.9 PITKALIJA

Pitkalija is a state-owned middleman fruit and vegetable market. It serves as a platform for farmers to auction their fresh produce, which is then sold to the consumers. At site the food is packaged in reusable crates, however, though technically possible, the entity does not quantify the edible food that is thrown away. In 2020, Pitkalija initiated a food bank diverting surplus food away from animal feed. However, this food bank does not operate year-round as it depends on the shelf life of the product that middlemen try to sell (Pitkalija, personal communication, June 11, 2020). Other than indirectly reducing food waste through increasing sales outside the market, Pitkalija does not track the input and output of the food supply, nor does it consider food waste an urgent issue due to their ongoing privatisation (Pitkalija, personal communication, June 11, 2020). This shows that they have minimal interest in the environment, but the adaptation of a food bank hints that they have a societal interest. As a profit-oriented organisation, Pitkalija has a high economical interest. The market has power over farmers yet not other stakeholders.

## 2.2 PRIVATE STAKEHOLDERS

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### 2.2.1 SUPERMARKET MANAGERS

In the context of retail food waste, Malta's setting consists of a division between many small corner shops and a few large corporate supermarket chains. The perspective of the 'Littles Supermarket' illustrates some concern of food waste amongst corner shop managers. In an interview, it was highlighted by the corner shop owner that they had relatively little food waste as they could return most products close to or passed their best-by date via a take-back agreement (Littles Supermarket, personal communication, June 5, 2020). The staff was aware and dedicated to reuse waste streams, such as handing out packaged card boxes to local bakeries and insisting on returning customers to bring their own plastic backs.

Larger supermarkets did not respond to interview propositions and their motivations are harder to fathom. Nevertheless, from an economic vantage point, supermarkets can be placed to have a high stake in donating because most food banks depend on them. However, several supermarkets are discouraged to donate food as they have a high economic interest. This is due to transport costs and the existence of (more favourable) take-back agreements. Supermarkets are also found to calculate and weigh such opportunity costs (Dr. Kevin Gatt, personal communication, June 9, 2020). Lastly, supermarkets have moderate power, as they can make the choice to deliver food for better brand image but are obstructed by a competitive market where small margins still matter. From an environmental viewpoint, supermarkets have a moderate power, as they have a moderate role in the amount of food waste that is directly produced in their facilities.

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### 2.2.2 SUPPLIERS/FARMERS

Although data is limited, it is still worth noting that in our questionnaire, two out of the three supermarket respondents brought up suppliers and producers to have responsibility for reducing supermarket food waste. The farmers and suppliers can be said to have medium power to influence supermarket food waste due to their role in take-back agreements and in setting best-by dates. The take-back agreement's bargaining position likely lies in the supermarket's hand, and the setting of best-by dates is subjected to strict EU legislation. The farmer/supplier group can be regarded to have a moderate interest in the subject of food waste because they do have an economic stake in the take-back agreements with respective supermarkets.

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### 2.2.3 PRIVATE WASTE COLLECTORS

Private waste collection companies are in charge of the collection and the removal of waste that cannot be recycled or reused. These companies require a permit from the ERA to operate as waste collectors. Both local councils and supermarkets, independently, are required to appoint their own private collection companies. Organic waste from the supermarkets is excluded from the waste collection

stream of the locality where it operates, as supermarkets are obliged to have their own waste collectors (i.e. Greenskip Service). However, it has been found that smaller retailers often "free-ride" the municipal waste collection stream to avoid service cost. Some private waste collectors have also been involved in scandals regarding inadequate separation and disposal of organic waste (Independent Malta, 2019). As Cilia (2019) stated, this already-separated waste still ends up in landfills, which shows private waste collectors tend to have a rather high economic interest over social and especially environmental sustainability. The efforts of the citizens to separate waste at source seems to not be taken much into consideration by some companies, which suggests their higher power over civil society. However, local councils still have an influence on choosing other companies after the termination of the contract, if the service was not correctly delivered. Overall, private waste collection companies show a moderate power in food waste collection.

## 2.3 CIVIL SOCIETY

### 2.3.1 UNIVERSITY OF MALTA

As one of the few Malta-based knowledge institutions that have researched the subject of food waste in the retail sector (Galea, 2019), the University of Malta (UM) has considerable interests in promoting food waste prevention. The epistemic community at the UM are involved in national-level policies and planning, assisting the government in achieving sustainable development and a circular economy (K. Gatt, personal communication, June 9, 2020; Ministry for Sustainable Development, Environment and Climate Change, 2014). Though they mainly play a consultancy role in waste management, the cognitive power of UM makes them quintessential in generating knowledge, evaluating food waste practices, and participating in various food waste education campaigns and research projects, both on the national and EU level (A. Mifsud, personal communication, June 5, 2020; J. Spiteri, personal communication, June 4, 2020). Meanwhile, the institution is also connected to companies like WasteServ (the current chairperson is a lecturer at the UM) and involved in the development of the new WMP (K. Gatt, personal communication, June 9, 2020). This suggests that the entity has high environmental and societal interest and medium power in food waste management. Their degree of economic interest is not clear.

### 2.3.2 CONSUMERS

Consumers do not have much power individually. Environmental interest amongst consumers is conflicted. On one hand, the consumer questionnaire shows that 98% of the respondents considered more could be done to improve the Maltese environment; 85% of the respondents agreed to several proposed solutions that would be beneficial in aiding food waste reduction and recognised that they should bear some extent of responsibility. On the other hand, respondents also called for more awareness campaigns and stated that 'average' Maltese consumers do not have awareness about food waste (See Annex C2). Therefore, we place consumers in a moderate environmental interest level. Similar findings are presented by the questionnaire in a societal regard, where a proactive response rate indicates public participation. Mixed comments about Malta's current waste policy ultimately indicates a

moderate societal interest. Lastly, consumers also face a moderate economic interest in food waste as increased costs in waste policy measures can hypothetically be reflected back to consumers, either in terms of increased taxes, or increased product prices.

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### 2.3.3 FOOD BANKS

Three food banks are currently operating in Malta. Their main objective is to receive food or money donations from the retail sector and individuals to later distribute them to people at risk. Due to the lack of infrastructure and transportation, one of the food banks, the Malta Food Bank Foundation (MFBF) has been fighting for almost ten years to have the adequate space and permits from the planning authorities (MFBF, personal communication, June 11, 2020). Therefore, they have little power over other stakeholders. Another indicator of their low power is that food banks have to accept donations and distribute food even if they have low nutrition value, otherwise, they might lose the opportunity to receive future donations (MFBF, personal communication, June 11, 2020.). Moreover, they do not receive government funding. Their interest in social sustainability is considered very high without any economic incentives being found for their service.

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### 2.3.4 CHARITIES AND ENVIRONMENTAL NGOS

Food banks and charities both collect food and/or money donations and distribute them to families in need. But the difference between them is that food banks have to comply with safety standards and guidelines to report data to the European Food Banks Federation (FEBA) (MFBF, personal communication, June 11, 2020). Charities, on the contrary, do not have to follow any requirements to distribute food donations. They have the same functions as a food bank but without the obligations coming from the FEBA, which puts them in an advantageous position over food banks. In the context of RWFM, charities rely on supermarkets and consumers for food donation. Their interest mainly covers the social pillar of sustainability. Environmental NGOs do not just work with food donations and redistribution. Their main objectives are raising public awareness, engaging stakeholders, lobbying and initiating activism on food waste.

Overall, we consider that NGOs and charities have a very high interest in social and environmental sustainability, and a moderate power over civil society.

## 2.4 POWER RELATIONS BETWEEN STAKEHOLDERS AND THEIR EFFECT ON RETAIL FOOD WASTE MANAGEMENT

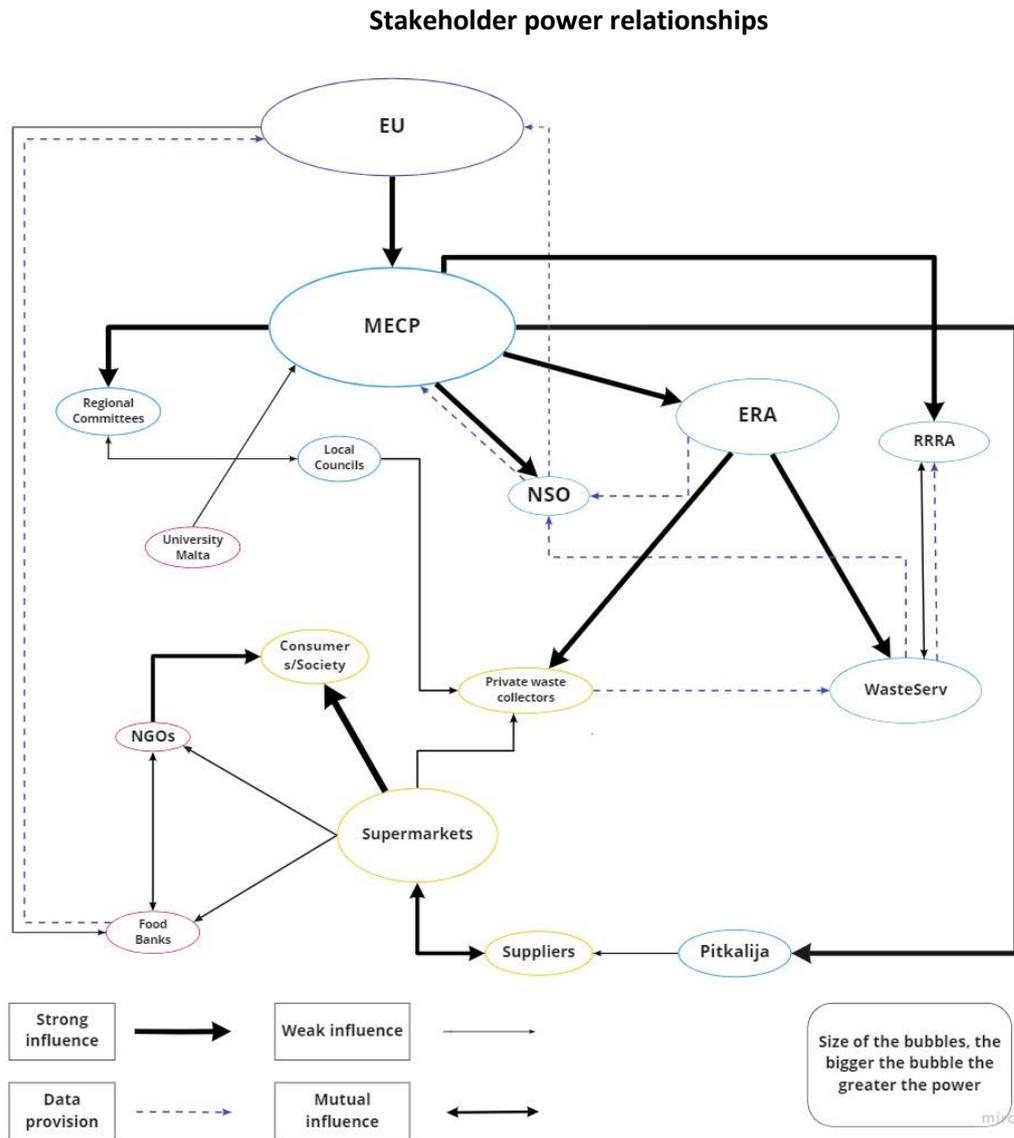


Figure 1. Stakeholder power relationship in Malta; flow chart

Figure 1 displays the different stakeholders and their (power) relations in relation to RFWM. The figure is based upon the stakeholder analysis above. From the gathered data can be suggested that the EU

and the MECP hold the greatest power over the other stakeholders. They develop (food) waste legislation, set the rules and the playing field for the remaining stakeholders. The ERA holds the responsibility to enforce such legislation on the stakeholders. Nevertheless, as there are currently no food waste legislations, the ERA has no impact on that specific field of waste management. Therefore, the relationship among the government, WasteServ, and the NSO is of importance in order to develop a methodology for collecting data about food waste, upon which the construction of a legal framework can be based. The RCs and the LCs hold the potential to address food waste management at the local level, but so far they do not have sufficient power and resources to do so. Their responsibility and power is mainly defined by the MECP. Furthermore, it becomes apparent that the supermarkets hold considerable power over consumers, suppliers and private waste collectors. Additionally, the supermarkets have influence over food banks in the sense of donations being made or not. So far, there are no binding regulations or incentives for the supermarkets to engage in food donations. NGOs and food banks play an important role when it comes to awareness raising and shifting the mentality of the civil society of Malta.

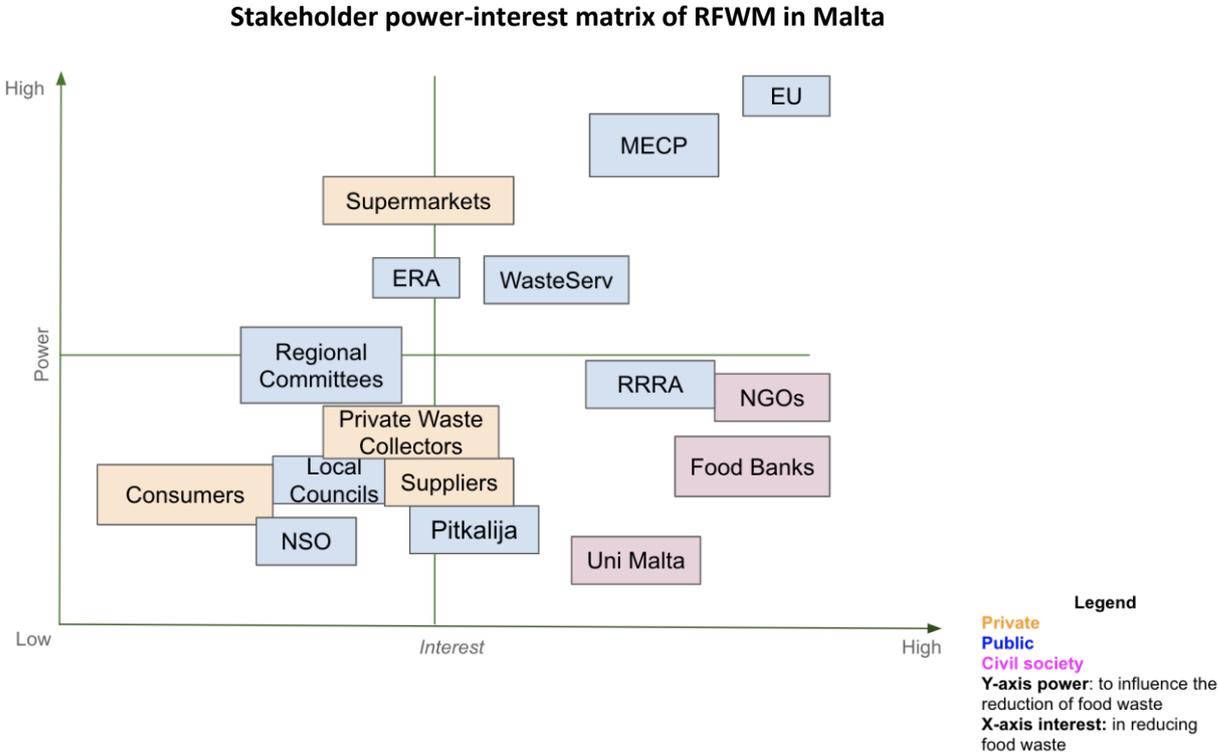


Figure 2: Stakeholder power-interest matrix of RFWM in Malta

Based on the stakeholder analysis, the stakeholder power-interest matrix displays the power of the different stakeholders in terms of their power to influence the reduction of food waste and their interest to do so. As the differing objectives and interests are fairly complex and not singly motivated interest will be further divided. Figure 3 indicates the three different layers of primary interest, namely, economic, environmental and societal interests. Exploring the different layers of interest is particularly

useful if one engages in negotiations with the different stakeholders. For example, if approaching supermarkets to collaborate in food donations, it immediately becomes apparent that their greatest interest is an economic one. Which is why a strategy based upon economic incentives would hold the highest inducement for supermarkets to engage in a collaboration addressing food waste.

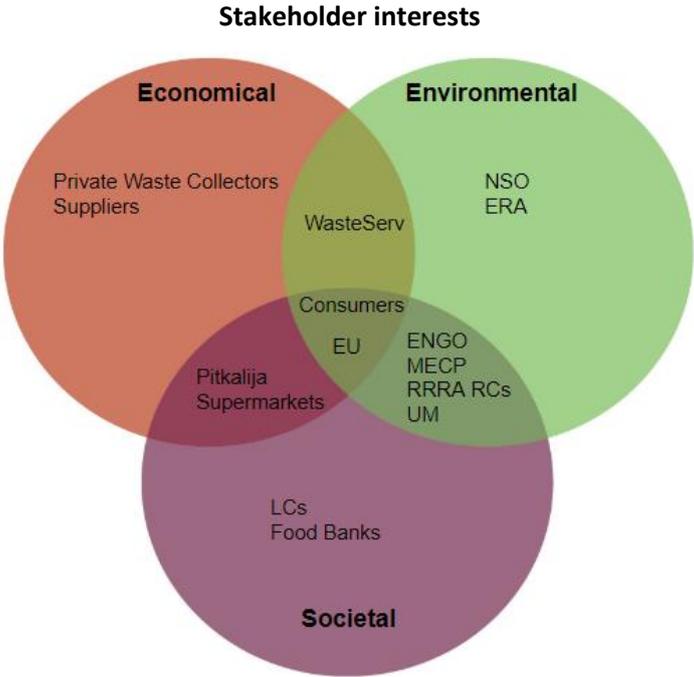


Figure 3: Stakeholder interests in Malta based on the three pillars of sustainability

### 3. POLICY ANALYSIS

Mapping out the legislations and their effect on various stakeholders helps to contextualise the current policy landscape where RFWM takes place. It is only when boundaries and rules are identified that they can be dealt with by policy interventions. Together with other aspects of the analysis in the main report, they help forge strategies that cater to different actors. The policies surrounding RFWM are analysed for their *intention*, *implementation*, and *implications*. Doing so, helps to draw comparisons between what Malta policymakers are required to do and what has been done. It also indicates the *future pathways* — the trajectory of what must be done in the near future.

#### 3.1 FOOD WASTE HIERARCHY

In the following section, we examine what policies entered into force thus far by the EU. Against this backdrop, we compare them with what has been transposed into Malta’s national plans. Our analysis

prioritises the most preferred options on the food waste hierarchy (Storup et al., 2016): prevention and donation. We then analyse the EU and Malta level policies relevant to food waste disposal due to the urgency to address landfilling organic waste in Malta (Camilleri-Fenech, 2018). A thorough comparison of the EU’s and Malta’s approach to food waste suggest a considerable amount of actions could be done for future policy development.

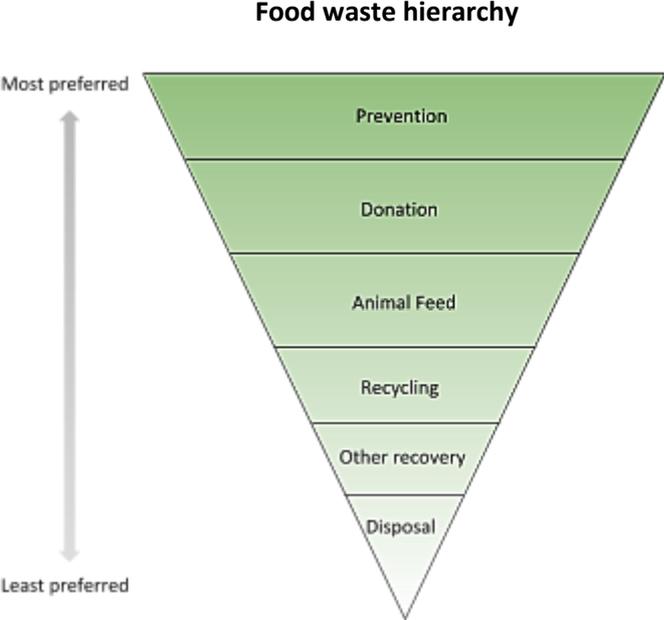


Figure 4. Food waste hierarchy. Storup et al. (2016) created figure 4 for European Court of Auditors’ special report on food waste. The figure is based on several commonly used food waste hierarchies across the globe, including Wageningen University’s Ladder of Moerman and Food Waste Pyramid for London.

**3.2 FOOD WASTE PREVENTION**

Preventing food waste was identified as one of the priority areas in the Circular Economy Action Plan in 2015 (Ecologic Institution, 2018), a year before the WMP was published. It is unsurprising to see that such prioritisation was not reflected in Malta’s national environmental policies. With no specific food waste prevention programme in place, food waste prevention measures are included in one section in the WMP (2014-2020) with few general targets.

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**INTENTION: ADDRESSING FOOD WASTE IN THE WMP**

The WMP (2014-2020) sets out objectives and actions for waste streams to reach the targets set by the prescribed directives on the EU level. In the Food Waste section, “enabling actions” regarding RFW include education on consumption habits and leftover management; strategic alliances with supermarkets to advise customers; and food waste reduction programmes that involve medium to large employers. The targets that will be pursued covers: “increase the number of committed food reducers

by 10% per annum” and “aim to lower food waste from 22% to at least 15% over a period of five (5) years”. These actions are monitored by biennial awareness surveys, and a five-year survey on domestic food waste conducted by the NSO (Ministry for Sustainable Development, Environment and Climate Change, 2014). To conclude, policy intention regarding food waste prevention focuses mostly on consumer behavioural change. The policy instruments are mainly communication-based, and the monitoring methods are based on surveys.

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#### IMPLEMENTATION: “SOFT” POLICY INSTRUMENTS AND THE INCEPTION OF FOOD WASTE QUANTIFICATION

The Waste Framework Directive (WFD) (2008) is directly transposed into national policy with Malta’s Waste Regulations of 2011 (Ministry for Sustainable Development, Environment and Climate Change, 2014). Two governmental entities are responsible for policy implementation and monitoring: the ERA and NSO. The former regulates the national environmental policy, responsible for the Environmental Protection Act 2016 Chapter 549. The ERA is allowed to use sanctions according to the severity of potential violations (Environment Protection Act, 2016). The latter collects statistics and reports to the EU designated statistics collector Eurostat. As data on organic waste streams are not directly provided by waste generators, the NSO collects them from both WasteServ and ERA.

As implied in the WMP (2014-2020), actions from public stakeholders are centred around consumer awareness. In 2016, the MECP and WasteServ initiated an educational and awareness-raising campaign “Don’t waste Waste”, supported by the ERA. In 2019, the MECP and WasteServ also launched a Tri-FOCAL project, which includes social media campaigns, a 5-day International Food Festival and small-scale pilot projects (MECP, personal communication, June 16, 2020). It is not clear whether the aforementioned monitoring process took place, as there is no food waste collection in place in Malta, and organic waste segregation for households started only in 2018. No evidence suggests strategic alliances with supermarkets were initiated by the government; food waste reduction programmes were observed only among food service and hospitality sectors (Malta Business Bureau, 2020).

Since the Delegated Decision on food waste measurement methodology entered force in November 2019 (European Commission, 2019), Member States are required to monitor and assess the implementation of their food waste prevention measures. Food waste measurement on the basis of this methodology should start from the first full calendar year after the adoption of the delegated act. 2020 marks the first reporting period for food waste data collection and reporting, our interviews indicate that a working group consisting of NSO, WasteServ, ERA, and MCEP have started to develop the national methodology for measuring and reporting specific food waste data to the EU.

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#### IMPLICATION: PIVOTAL POINTS FOR WMP REFORM

Based on the findings on policy implementation, the overall targets in the WMP (2014-2020) are unlikely to be met. ‘Soft’ policy instruments can reach a large audience, but they are costly and the results still left much to be desired (ERA, 2018; K. Gatt, personal communication, June 9, 2020). This result

echoes the literature and reports on the EU level food waste policies, which suggest that strong legislation with specific targets are often the most effective policy approaches (Priefer, Jörissen & Bräutigam, 2016; European Commission, 2019).

When it comes to food waste measurement, the current indirect data collection hinders the traceability for linking specific waste streams with supermarkets. It was reported that small-scale retailers have been using the municipal waste curb side collection that they are not entitled to (European Commission, 2016). Specific waste streams collection and quantification are two interconnected issues, both have to be in place in order to operationalise food waste prevention. On one hand, the absence of a legislative framework regarding RFWM means no waste reduction target is set on the council level (San Giljan Local Council, personal communication, June 4, 2020). On the other hand, Legislation 3.6.3 160 shifts the responsibility for waste collection from the LCs to the RCs, which has met opposition from some LCs (San Giljan Local Council, personal communication, June 4, 2020). If the RCs could fully be in charge of waste collection in their designated regions, the current municipal waste collection system could expand from household waste to the retail sector. The costs of the waste collection would also be decreased, as some costs will be unified. This system would further allow the RCs to take actions against the free-riding waste disposal of some actors within the retail sector (Tramuntana Regional Council, personal communication, June 10, 2020).

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#### FUTURE PATHWAYS: NEW WMP AND REGULATION ON COMMERCIAL ORGANIC WASTE

Food waste prevention in Malta will be strongly influenced by two factors: (i) the new food waste data collection methods, and (ii) the new WMP (2020-2030) which encompasses the Waste Prevention Programme. Both of them will need to be in line with EU-level strategies for food loss and food waste in the upcoming years, including reaching the deadline for the first reporting year on June 30th, 2022; and the legally binding targets for food waste reduction that will be proposed by the European Commission by December 31st, 2023.

Reporting on food waste shall increase in accordance with EU intentions. As mentioned earlier, the NSO will, on behalf of the national government, report food waste data to the EU. The aforementioned working group will remain for evaluation and further improvements on food waste quantification after the methods are established in the Maltese context (NSO, personal communication, June 9, 2020).

The new WMP will respond to the strategies required by the “Circular Economy Package”: Member States take measures to achieve a Union food waste reduction target of 30 % by 2025 and 50 % by 2030 compared to the 2014 baseline (Ecologic Institution, 2018). The reduction target applies to the per capita global food waste at the retail level. The new WMP will reflect upon the current progress made in Malta towards these requirements, in which food waste as a key waste stream will be targeted in the WPP. Furthermore, there will be an expanding Extended Producer Responsibility regimes and a discussion on how localities will be better involved in the sustainable management of organic waste from the commercial sector. Although information on the new WMP is limited as it is still being devel-

oped, prompted actions and measures will include: research to identify the causes of food waste, raising awareness through education of food waste prevention, and to support voluntary initiatives such as food distribution networks (MECP, personal communication, June 16, 2020).

It is important that RFWM is tackled with a mixture of regulatory instruments and financial incentives. Most of the stakeholders interviewed advocated for a stronger regulatory framework, which would be supported by the new food waste data that will be collected. Studies in the EU level also suggest national prevention strategies and adopting targets are the most helpful across geographical scales, and encourage food companies to set voluntary targets can also drastically reduce food waste generation (Vittuari et al., 2015; Priefer, Jörissen & Bräutigam, 2016). In general, both the upcoming data collection structure and the new WMP offer promising potential to facilitate food waste prevention in Malta.

### 3.3 FOOD DONATIONS

Malta lacked food standards before its EU accession (Mizzi, 1995). Joining the EU resulted in the implementation of the international standards on food safety and hygiene since 1995. This legislation is presently known as Regulation (EC) No 852/2004 on the hygiene of foodstuffs, or also known as the general food hygiene Law. It has been the quality benchmark of food commercialisation but also provides the competence for food donation requirements.

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#### INTENTIONS: LEGAL FRAMEWORKS AND GUIDELINES FOR FOOD DONATION

There are several legislative frameworks that either directly or indirectly influence food donation. EU food hygiene law directly affects practises that involve food meant for human consumption. The key laws that pertain to the subject of food donation are the Regulation (EC) No 852/2004 on the hygiene of foodstuffs and Regulation (EC) No 178/2002, wherein the latter provides the general principles and requirements of food law (also known as the general food law). Furthermore, Malta also establishes these responsibilities within their own national Food Safety Act of 2002 to conform their national legislation with the EU.

When it comes to food donations, the European Commission issued in 2017 the EU guidelines for food donation, also made with respect to the general food hygiene law. In this document, the European Commission established guidelines to be followed in food redistribution schemes and strongly recommends that relevant rules are developed at national level. But this is a non-binding document aimed to be used only as a reference for Member States when elaborating national guidelines and rules (European Commission, 2017).

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#### IMPLEMENTATION: LACK OF NATIONAL GUIDELINES ON FOOD DONATIONS AND FOOD BANKS INTERNAL POLICY

In Malta, it is not yet mandatory for businesses to donate the surplus of their operations because food donations have not been addressed in national guidelines or rules. Food donation is considered a voluntary practice that the retail sector has contributed to in specific occasions, especially under the

COVID-19 pandemic (MFBF, personal communication, June 11, 2020; St. Jeanne Antide Foundation, personal communication, June 5, 2020) but these arrangements are still non-obligatory, informal and infrequent. Additionally, it has been found the presence of the Value Added Tax (VAT) may hinder collaboration between retailers and food banks as it increases costs for food donation operations (EU Fusions, 2016).

The EU guidelines for food donation state that food surplus may be redistributed given that it is fit for human consumption and compliant with all food safety requirements. Food suitable for food donation may include, among others, products that have passed the 'best before' date but still can be safely consumed (European Commission, 2017). Food banks of Malta accept donations on the basis of their internal policy, since national regulations or rules are not in place. They accept products both before their 'use by' date and after their 'best before' date (MFBF, personal communication, June 11, 2020). With fresh produce, they manually check the products based on their physical appearance and modify it if necessary, so that it is suitable for human consumption (i.e. taking off the rotten leaves off a lettuce when the rest is still fine) (MFBF, personal communication, June 11, 2020). On top of that, EU food hygiene law requires the registration of those operations or activities where food is supplied, whether given away free or sold for some form of monetary or other return (European Commission, 2004). Food banks in Malta do keep a register of the partners and the food that is donated, so that these numbers can be reported back to the FEBA (MFBF, personal communication, June 11, 2020).

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#### IMPLICATION: SCARCE FOOD DONATIONS FROM SUPERMARKETS AND LACKING COORDINATION BETWEEN FOOD BANKS

The bottom line is that there are no hard or soft policy incentives to promote food donations in Malta. Food donations are not legislated as a mandatory activity for the retail sector to conduct, and market-based mechanisms are not in place either. There have been food donations of the retail sector to food banks in Malta, but these are not considered a recurrent activity throughout the year apart from Christmas (MFBF, personal communication, June 11, 2020). Moreover, the EU guidelines on food donations disincentivise food repurposing, both in terms of associated risk of damage costs and via potential brand image (European Commission, 2017). Food donated is subjected to the same food safety and hygiene standards as normally marketed food, whereas retailers are not in any way relieved or exempted from liability if they decide to donate it (European Commission, 2017). Nevertheless, the same guidelines do indicate that it is up to member states how they interpret these liabilities.

Besides the irregular food donations from the retail sector, there is a lack of coordination between the food banks of the island. There is no centralised governance structure that coordinates the operations of the food banks in Malta (MFBF, personal communication, June 11, 2020). Every food bank has a different transportation and distribution system, which makes it difficult to share knowledge and distribute the food efficiently between the people in need. Moreover, food collection and distribution are becoming increasing activities for individuals, charities and NGOs aiming to enhance food security especially after the COVID-19 pandemic (MFBF, personal communication, June 11, 2020; St. Jeanne Antide Foundation, personal communication, June 5, 2020). Food banks have to register their partners as

well as to comply with the guidelines of the FEBA in terms of monitoring data and safety standards, unlike other organisations, which makes them more unlikely to be the preferred option to donate to.

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#### FUTURE PATHWAYS: A CENTRALISED FOOD BANKING SYSTEM AND MARKET-BASED POLICY INSTRUMENTS

From a governance perspective, the concern to centralise the food banks in Malta has been expressed already to the government, but no response has been given to them yet (MFBF, personal communication, June 11, 2020). In the new WMP, the Ministry stated that they will increase their support to voluntary initiatives such as food redistribution networks (MECP, personal communication, June 16, 2020).

Next to voluntary initiatives, food donations could be implemented in the Maltese national legal framework, similarly as France did in 2016: banning grocery stores from throwing away edible food. This in turn also provides the opportunity to allow formal agreements that shift liability from the donor to the recipient to avoid a strong opposition from the retail sector, since Member States can freely interpret food donation's liability recommendations, as mentioned before (European Commission, 2017).

Besides legally binding rules, market-based policy instruments could also be useful to incentivise food donations on the island. As a recommendation, the EU guidelines state that corporate tax incentives have been proven to be the most efficient measure to encourage food donations from retailers, as it has been demonstrated in countries that implemented this initiative like France, Portugal or Spain (European Commission, 2020). Moreover, exemption of the VAT on food donations on either a national or international scale has also been proposed to help enable food donations (EU Fusions, 2016).

Next to those single economic incentives, “win-win” solutions can be emphasised as well. “Win-win” solutions can be established when addressing the retail sector, illustrating the economic losses generated by wasting food, additionally, the increased amount of waste, for which supermarkets have to pay, can be used as a compelling argument. Moreover, pointing out the opportunity to improve their brand image by donating food can be part of such a strategy.

#### 3.4 FOOD WASTE DISPOSAL

The most common food waste disposal method in Malta is landfilling, defined here as the method in which waste is being dumped at a land site. In Malta more than 80% of waste is actually being landfilled (ERA, 2018). Landfilling is considered the least desirable disposal method in the EU waste hierarchy (European Commission, 2008). Although this disposal method is fairly cheap, it has numerous negative impacts such as pollution, resource loss and extensive land-use (Cossu & Stegmann, 2019).

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#### INTENTION: ONLY 10% OF MALTESE MUNICIPAL WASTE CAN BE LANDFILLED BY 2025

The emendation of the WFD in 2015, originally issued in 2008, recognised the huge differences in the relative amount of municipal waste that was being landfilled in 2011 among countries in the EU. Some Member States were well on their way of achieving the targets whereas others, such as Malta, were

lagging behind. To counteract this, a common target for all member states of 10% of municipal waste being landfilled has been set for 2025 (European Commission, 2015). More specifically, only 35% (based on 2002 levels) of biodegradable municipal waste will be allowed to be landfilled by 2020 (Ministry for Sustainable Development, Environment and Climate Change, 2014). Whether these targets have been met is currently unknown. Emphasis on raising national waste management to higher levels of the waste hierarchy has been emphasised due to Malta's high waste production and landfill rate per capita (Spiteri, 2019).

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#### IMPLEMENTATION: MORE BIOLOGICAL TREATMENT PLANTS

The current WMP included a broad range of actions and targets directly targeting landfilling. These included reviewing the current legislative framework, raising awareness, collecting and processing (MSW) organic waste separately and disincentivising landfilling (Ministry for Sustainable Development, Environment and Climate Change, 2014). When waste is landfilled, the current gate fee in Malta is 20€ per tonne of waste (European Commission, 2015). According to the European Commission's BiPRO project, the WMP also suffers from the deficiencies of: "Information about targets/requirements is included for most issues, however not complete for biodegradable waste going to landfills. This was manifested in the fact that Malta contravened its obligations under the Landfill Directive for two target years in a row (European Commission, 2015). In general, Malta is struggling with the implementation of EU waste law, as the island has a lacking infrastructure and insufficient collection systems for recyclable or organic waste (European Commission, 2018)

As of 2016, Malta has two biological treatment facilities, both managed by WasteServ: the Sant' Antnin Waste Treatment Plant - Mechanical and Biological Treatment Plant, whereby food waste from organic waste collections is converted into renewable energy; and the Malta North Mechanical and Biological Treatment Plant, which caters to the treatment of organic waste that has been extracted from the black bag, as well as animal manure (MECP, personal communication, June 16, 2020). This enables more waste to be diverted from landfills as it is converted into energy (ERA, 2018; European Commission, 2019). There are also plans for a new organic waste processing facility at Wasteserv's new ECOHIVE complex at Magħtab, named ECOHIVE Organic (WasteServ, personal communication, June 11, 2020). In an interview it was also mentioned that one of the current facilities is being upgraded and therefore temporarily not being used. Also, in the future two more will be constructed, presumably of which one is the afore mentioned ECOHIVE Organic facility (WasteServ, personal communication, June 11, 2020).

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#### IMPLICATION: OLD TARGETS NOT MET, HOPE FOR ORGANIC WASTE CONVERTED INTO ENERGY

In 2018, it was concluded by the ERA that several landfill targets from the old WMP will not be met. Insufficient action has been undertaken by the government to achieve its ambitions. Although 'soft' policy instruments are and will be used for preventing food waste, effective economic incentives such as a landfill tax are still absent. Also, the current gate fee for landfilling is too low to disincentivise landfilling (ERA, 2018). The lack of data on retail organic waste production is an important underlying

issue, causing uncertainties around the effectiveness of potential measures in the retail sector. The capacity of WasteServ to convert organic waste to energy will increase on both the short and long term, as both (WasteServ, personal communication, June 11, 2020). This will hopefully lead to a reduction of the amount of waste being landfilled.

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#### FUTURE PATHWAYS: INTRODUCTION OF A LANDFILL GATE FEE AND A LANDFILL TAX

The goal of the new WMP is that more waste, including food waste, will be redirected away from landfilling. This is projected to happen by implementing various soft instruments focused on prevention, already discussed in chapter 3.1. Since preventing waste translates in less waste to be processed or landfilled later on, these measures are also relevant for landfilling. No information has been found on actions in the new WMP directly targeting landfilling (MECP, personal communication, June 16, 2020).

New direct actions in regard to landfilling should mostly entail negative financial incentives (European Commission, 2019; ERA, 2018). Two actions can be implemented in the future within the current political landscape: (i) increase the landfill gate fee significantly and (ii) introduce a landfill-tax (European Commission, 2019). However, these financial incentives are not welcomed by waste producers themselves, as they present a new financial burden (K. Gatt, personal communication, June 9, 2020). Furthermore, a stronger legislative framework will give the ERA more authority for regulation (ERA, 2018). The capacity of WasteServ to process organic waste will also increase in the upcoming years, allowing less to be landfilled (WasteServ, personal communication, June 11, 2020).

## CONCLUSION

The report investigates Malta's current policy context regarding RFW. Three major policy areas on the food waste hierarchy are analysed: food waste prevention, food waste donation, and food waste disposal. The interests and power relations of major actors involved are analysed to provide a clear picture of the playing field. Our findings suggest that, though food waste is increasingly recognised in the EU, the existing non-binding policies have not been integrated on a national level. Additionally, Malta's fragmented public administration and the lack of food waste related legislation are major obstacles to enforce regulations.

Based on the stakeholder analysis, the results show that the involvement from the public and private sector in RFWM has increased in the past years but remains insufficient. First, localities have no policy-making power, regardless of their interest in this issue. Major governmental entities in waste management have limited power to regulate the retail sector, and the latter shows inadequate interests in food waste research. Stakeholders who are the most involved in food prevention and donation fall into the civil society category. Mobilising activism and coalition among these stakeholders (i.e. environmental NGOs and food banks) could potentially increase their ability to affect policies and lay the groundwork for a centralised surplus food collection and distribution system. Additionally, establishing a more efficient food donation network a centralised coordination of the food bank is needed.

A few conclusions can be drawn concerning the policy context. Results show that Malta's national policies have yet to prioritise food waste similar to what has been done on the EU-level. RFW is mentioned in the WMP (2014-2020) yet no specific food waste prevention programme was put forth. A baseline for food waste reduction is not established; the quantification and monitoring process is also in an early stage. Several education campaigns have been launched by the public actors, but the impact of communication instruments on the retail sector left much to be desired. Several stakeholders implied that without strong regulations or financial incentives, few supermarkets would be compelled to address food waste. Furthermore, "win-win" solutions that take business interests into account would be a welcome addition; an association of retailers similar to the "Malta Hotels and Restaurants Association" might encourage the sharing of knowledge and best practices.

It is promising, however, that the MECP will target food as a key waste stream in the new Waste Prevention Programme, and more regulation on commercial waste will be expected in the new WMP (2021-2030). RCs are also envisaged to play a larger role soon. To pursue this stream of research, following issues need to be considered: 1) administrative decisions in Malta often take place informally; 2) supermarkets (and Pitkalija) and their waste carriers have to be pressured to provide sufficient data on their business practices and internal policies; 3) attention should also be paid to other players in the food supply chain, namely suppliers, farmers, and corner-shops. It would also be useful to look into the utilisation of a mix of policy instruments available in Malta, and economic incentives that could foster food waste actions among the retailers.

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EXPERT REPORT NO. 2

# FOOD PRACTICES



## WRITTEN BY

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## 1. INTRODUCTION

Food waste is increasingly being recognised as a major concern for societies all over the world due to its economic, social and environmental impacts (Papargyropoulou, Lozano, Steinberger, Wright & Bin Ujang, 2014). According to estimates from the FAO (2011), 1.3 billion tons of food are wasted globally per year which amounts to one third of all the food that is produced for human consumption. There are numerous definitions of food waste depending on the context and these are framed based on the point of origin and specific environmental controls (Parfitt, Barthel & Macnaughton, 2010). The FAO defines food waste as: "*The decrease in quantity or quality of food resulting from decisions and actions by retailers, food service providers and consumers*" (Food and Agriculture Organisation of the United Nations, n.d.). Whether this definition is complete is however debatable since defining food waste is complex as it occurs at different stages in the food supply chain (Parfitt, Barthel & Macnaughton, 2010).

Around 5% of food waste in Europe comes from the retail sector (Monier et al., 2010). Although Malta is one of the biggest producers of per capita municipal waste in Europe, national data on wholesale and retail food waste remains unavailable (Eurostat, 2017). Therefore, the focus of this report will be on the Maltese retail sector. Food waste originating in the retail sector includes multiple different causes, such as the individual behaviours and overall practices of consumers and retailers (Aschemann-Witzel, de Hooge, Amani, Bech-Larsen & Oostindjer, 2015). According to Reckwitz (2002), a practice can be defined as "a routinised type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge". Given the complexities of studying retail food, a study approach based on social practice theory is therefore useful. It highlights the mutual influence between societal structures like legislation and the agency of individuals. Such a holistic perspective is necessary in order to acknowledge the integration of consumers into a supply system where they are encouraged to buy too many products, often at the expense of farmers (Audet & Brisebois, 2019). Therefore, a "practices" approach could, for example, provide insight into how various factors influence the way in which consumers buy products and how supermarkets deal with food waste. According to Jackson and Holbrook (1995) shopping can be understood as a social practice which is a socially transferred, educated and habituated action containing routinised behaviour. Therefore, shopping is not an activity done by individuals in which they make their own decisions, but shopping is rather a social achievement. However, Audet and Brisebois (2019) state that individuals do need to make their own decisions, based on a variety of trade-offs which are both economic and moral. Thereby shopping is an activity that is subject to change even though it can become a habituated practice.

For the purpose of our project the focus lies on the practices that take place within supermarkets and to a lesser extent the Pitkalija, which is a middlemen market system unique to Malta. This report, combined with the other three expert reports, builds the base for the "synthesis report", which will be used by Friends of Earth Malta (FoEM). While the synthesis report integrates key findings from the overall project, this report offers FoEM insight into food practices as a whole, along with the utility of considering the food waste issue from a social practice theory perspective. It is intended to provide

useful information that FoEM can use in their efforts of raising awareness, mobilising people to take action, and lobbying the policy community to achieve information-based solutions. A key consideration in this report is to address FoEM's goals of tackling the issue of landfilling of the organic waste streams as well as the lack of food donation to charity organizations. This expert report aims to determine the effects of current food waste practices in the retail sector in Malta as well as to suggest opportunities regarding the improvement of these practices. Therefore, the following research question was answered:

***What are current food waste generation and management practices and which opportunities are there for improving these practices in the Maltese retail sector?***

In order to answer this research question, the focus will first be on identifying the current food waste practices in the retail sector in Malta. The second sub-research question looks into the influence that various stakeholders have on retail food practices in Malta. This will be followed by the determination of the structural factors that are able to influence these practices. Structural factors are the rules (e.g. policy) and resources (e.g. infrastructure) that influence the actions of stakeholders. Since structural factors and the agency of stakeholders mutually influence each other, it is necessary to look at both aspects to gain a more holistic understanding. Lastly, the reflective moments within routinized food waste generation and management practices are determined. These "reflective moments" could potentially serve as starting points for new routines. To summarize, the following sub-research questions will be discussed throughout this report:

1. *What practices with regards to food waste generation and management can be identified in the retail sector in Malta?*
2. *What influence do relevant actors have on food waste generation and management in the retail sector of Malta?*
3. *What are the structural factors and what role do they have on food waste generation and management practices in the retail sector in Malta?*
4. *What are the reflective moments within routinized food waste generation and management practices that could serve as starting points for new routines?*

## 4. METHODOLOGY

Over the course of the project; literature review, interviews and surveys were conducted to collect data to answer the above mentioned sub research questions. The information found during the literature review was classified according to the topics in the sub-research questions. Two surveys were created, one for supermarket consumers and one for supermarket managers. The consumer survey yielded 259 respondents and there were 3 responses on the supermarket manager survey. Four participants were excluded from the consumer survey since they were not living in Malta and therefore not relevant for the current study. The remaining responses were then analysed using IBM SPSS 25 (Annex 1 and 2). Within individual questions, the "other" responses were not included in the quantita-

tive analysis, however they were taken into account when qualitatively assessing the results. Moreover, 30 interviews were conducted with relevant stakeholders, 11 of which were relevant for this expert report (Annex 1).

## 5. CURRENT SITUATION AND RESULTS

### 3.1 CURRENT PRACTICES

#### 3.1.1 GENERAL FOOD WASTE PRACTICES

In the literature review, it becomes clear that there are different reasons as to why food waste is created from the perspective of the supermarket retailer. Firstly, consumers want to have products that are nearly perfect (Devin & Richards, 2018). Everything that is not up to these consumer standards are therefore less likely to sell and will become food waste. Secondly, a lack of accurate food demand forecasting can lead to a massive increase in food waste (Filimonau & Gherbin, 2017). An inaccurate forecasting of seasonal products like Easter eggs can lead to a lot of food waste since leftover products will not be bought after that season. Thirdly, despite supermarkets wanting to do good by setting goals and systems which are communicated through Corporate Social Responsibility (CSR) reports, it is often noted that supermarkets mainly promote products which offer value for money and keep consumption levels high (Tjärnemo & Södahl, 2015). Finally, insufficient storage and maintenance of produce that needs to be cooled can lead to food waste (Porat, Lichter, Terry, Harker & Buzby, 2018).

The middle-men market called the Pitkalija, is also a form of retail that is unique to Malta. At the Pitkalija, farmers arrive with their new produce on certain days, which then replace the "older" food which has been at the market for a few days already. This creates a considerable amount of food that is still perfectly edible, but at risk of going to waste (Pitkalija CEO, personal communication, June 11, 2020).

#### 3.1.2 WASTE PREVENTION MEASURES AND THEIR SUCCESS IN MALTESE SUPERMARKETS

Some Maltese supermarkets use take-back agreements for certain products, which means that products which arrived damaged or that have not been sold before a certain date have to be taken back by the supplier. It could be said that this incentivizes less food waste. However, it is necessary to ensure that such agreements do not simply enable the shifting of the food waste burden from one actor, the supermarkets, back to another actor, the suppliers. Eriksson, Ghosh, Mattson, and Ismatov (2017), point out that the wastage of food still occurs despite take-back agreements, it simply appears as though supermarkets are producing less food waste. In addition, these agreements often have a discreet nature which has led to little knowledge on their possible consequences (Eriksson et al., 2017). Cicatiello, Franco, Pancino and Blasi (2016) also noted that take-back agreements can lead to edible food being wasted, since products are returned to the supplier before they have reached their expiration date. In an interview with a small supermarket, it became apparent that this system can be observed in Malta as well. In fact, this method is preferred by most supermarkets due to financial considerations since unsold food can be sent back in return for money or new products (Galea, 2019). But

according to academic expert Attard (personal communication, June 13, 2020), retailers still try to sell as many products as possible and avoid sending the food back. Take-back agreements are used mainly for seasonal products, like Easter eggs.

In contrast with supermarket practices that generate food waste, there are also some practices that prevent food from becoming waste. Firstly, applying the method of 'First-in-First-out' (FiFo) on product stock. This means that products that are first brought into the store, are also placed as the most accessible products in the store, so that they get sold sooner. This practice is also observed with regards to fruit and vegetables, such that older produce is stacked on top of the newer products (Galea, 2019). This practice is conducted by the one supermarket that was interviewed as well as the three who responded to the questionnaire. A small supermarket even ensures that new products are kept in the storage room until the shelf is almost out of stock before replenishing it.

Secondly, discount stickers are placed on products that are close to their expiry date in order to make a sale more likely. However, it needs to be noted that Galea (2019) mentions that using discount stickers transfers the food waste burden from supermarkets to consumer households. Encouraged by the bargain of the discount sticker, customers buy more produce than they actually need, which in turn increases the chances of food spoiling before it can be consumed. However discounting is not a common practice since most Maltese retailers are unwilling to reduce their prices unless the wholesaler reduces them (Attard, personal communication, June 13, 2020). When it comes to the Pitkalija, there are currently no specific waste reduction measures in place.

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### 3.1.3 FOOD WASTE MANAGEMENT PRACTICES IN SUPERMARKETS AND PITKALIJA

Aside from efforts mentioned above, that aim to prevent or to reduce food waste generation, it is also important to consider the food waste management practices of supermarkets. Waste management efforts focus on recycling food waste and its packaging or repurposing the unsold food. Donation of unsold food to people in need is one possibility regarding repurposing. However it is not very common in Malta. The Malta Foodbank foundation says that they only receive food surplus from one small supermarket, however most of the donated food is not ideal for food banks, as it consists mostly of candy (personal communication, June 11, 2020).

When food is discarded, its packaging must be considered. If organic material is surrounded by plastic it cannot be thrown into the organic waste stream anymore. In their responses to the survey, two supermarkets claim that they separate about half of the organic food waste from its packaging. This packaging can then be recycled or reused separately. Others, like the small supermarket that was interviewed, separate some waste streams to retrieve and recycle cardboard or plastic, but overall they also produce a mixed waste stream. Food waste disposal practices also vary based on the quantity of waste produced, which in turn depends on the scale of the supermarket. Supermarkets with small amounts of waste can separate their waste streams more easily (as seen in the survey), while large supermarkets need to hire an external waste carrier (Gatt, personal communication, June 9, 2020). Due to the fact that considerable amounts of edible food is at risk of going to waste, the Pitkalija decided to collect surplus food at the end of the day and send it to food banks or use it as animal feed.

This system is voluntary for the middle-men, if they wish to dispose of their food waste in other ways they can still do so. Therefore, this is still a work in progress. Additionally, the Pitkalija has the great benefit of working with unpackaged food, so separation of waste streams is not an issue here (Pitkalija CEO, personal communication, June 11, 2020).

As explained, there are a variety of food practices in the Maltese retail sector, and it is difficult to make a generalized statement about the current state of food waste generation and management. The knowledge and the interest of shop owners or middlemen and how much effort or money they invest in becoming sustainable are thus key determinants of which practices dominate in Malta.

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#### 3.1.4 IN-STORE CONSUMER PRACTICES

The literature review uncovered that in supermarkets different practices are undertaken by consumers which could have an effect on food becoming food waste. In addition, survey responses from supermarket managers indicate that they consider the interaction with consumers to be a very important determinant in the amount of food waste that is generated in their stores. Several of the consumer practices mentioned in the literature review were used in the consumer survey in order to determine their frequency within the Maltese society.

Firstly, consumers touching or squeezing the products in supermarkets to test whether they are 'eating ripe,' is a common occurrence in Malta. However, the opinion of Maltese people regarding vegetable squeezing differs widely. Each of the five answer categories in the survey (ranging from never to always) have received an approximate 20% of the votes. According to the SPSS analysis (Annex 2), this practice is significant (sig. < 0.05), implying that squeezing vegetables is behaviour that is actually visible in supermarkets in Malta. However, this practice can cause damages to the product (Syroegina, 2016), leading to earlier spoiling and thereby more food waste.

Secondly, making a shopping list was the most prevalent consumer practice happening in supermarkets. Over half of the Maltese respondents (54%) affirmed to create a shopping list every time before going to the supermarket. If we add the respondents that create shopping lists "often", then this proportion rises to 81%. From the SPSS output we can conclude that this result is significant (Annex 2). Shopping lists have been found to reduce over-purchasing of products (Attard, 2016), which in turn affects the amount of food waste that is generated in supermarkets. Survey responses from supermarkets mention that unpredictability of in-store consumer behaviour is a major concern for them. Shopping lists can potentially play a role in reducing this unpredictability.

Thirdly, the survey asked about the practice of date picking. 65% of the respondents declare that they often choose products based on their expiry date, and more than half of these do it every time they go to the supermarket. The effect of date picking depends on how people choose the products. On the one hand, when people pick products with the closest expiry date, they help reduce the amount of "old" products in the supermarket and thereby prevent it from spoiling in the supermarket. On the other hand, when people pick products whose expiry date is the furthest away, they contribute to ageing products within the supermarket, which may lead to food waste. Within the respondent of the

survey, 42% choose products so that their expiry date is the furthest away and only 7% said they choose products with a close expiry date.

Finally, survey respondents indicated that "buying food when it is scarce" and "buying food with close-to-expiry-discount stickers", are not very frequently adopted practices for them. Food being "scarce" refers to it being understocked in supermarkets, in a bid to make consumers more likely to buy it (Gallea, 2019). In both cases the proportion who do it "often" or "always" are very low (18% and 29%, respectively) and the biggest proportion is people doing it sometimes (38% and 45%, respectively). The SPSS output supports this by providing a p value of 0.000, indicating significance. Buying food when it is scarce relates to the aforementioned predictability of the consumers and to the ability of the supermarket to match supply and demand. Lastly, offering discounted prices when food reaches its expiry date is an important tool of the supermarkets to prevent food waste, but it can only work successfully if people are willing to buy those discounted products.

### 3.2 RELEVANT ACTORS AND THEIR CURRENT ROLE

Consumer behaviour in the supermarket, and consequently its impact on food waste generation, is influenced by the Maltese culture (Attard, personal communication, June 13, 2020). The elderly demographic of the population which endured times of war, famine and hunger, tend to associate a greater variety and quantity of food with a higher social status (Attard, personal communication, June 13, 2020). Similar values have been passed down to younger generations but without the mindset to minimize food waste that is dominant in older demographics (Attard, personal communication, June 13, 2020). Thus older sections of the population tend to be aware of shelf life and utilize their cooking skills and knowledge to minimize wastage. This cannot be said for young people who have less experience cooking and might not be able to plan their entire week (Attard, personal communication, June 13, 2020). Whether they make a plan and a shopping list then influences what they will buy and whether they will make impulse buys on special offers. However, overall, there has been a positive change of mentality and behaviour towards the food waste issue during the last few years (Ekoskola, personal communication, June 3, 2020).

Since they are a key part of the retail sector, supermarkets have a significant influence over how food waste is managed. A small supermarket indicated that they do not feel any barriers from governmental legislation with regards to their current practices, but they feel confident that if they do encounter barriers they can send a letter and be heard. Supermarkets are in direct contact with the consumers, this opens up possibilities to raise awareness and influence their in-store practices to address food waste issues. Many supermarkets are still not willing to implement the food discount stickers, unless wholesalers also reduce the price (Gatt, personal communication, June 9, 2020; Attard, personal communication, June 13, 2020). Attard points out that supermarkets would be willing to implement more measures if they see a change of attitude regarding food waste in the consumers (personal communication, June 13, 2020).

Contrasting this, Pitkalija is working on implementing certain measures targeted at waste management. Although precise estimates on the quantity of food being donated are unavailable, this initiative is beneficial for food banks (Pitkalija CEO, personal communication, June 11, 2020). The CEO of Pitkalija

also mentioned that agreements to reduce food waste among all the stakeholders involved with Pitkalija are currently being formulated.

NGOs and food banks are other key actors when it comes to managing and reducing retail food waste. They need (free) food to function, so their main goal is to persuade supermarkets into donating. St Jeanne Antide Foundation states that in Malta, there are two large supermarkets with donation boxes for customers and volunteers that empty these. So far, the influence of food banks or NGOs has not been great, as they are too many small organizations. None of them, on their own, has enough power to implement change (Gatt, personal communication, June 9, 2020).

Currently, policy makers are starting to think about what barriers exist for the implementation of legislation on food waste management (Dalli, personal communication, June 10, 2020). The government embraces the consumerist society that we live in, and therefore their goal is often to incentivize consumption (Gatt, personal communication, June 9, 2020).

### 3.3 STRUCTURAL FACTORS INFLUENCING FOOD WASTE GENERATION AND MANAGEMENT

The retail food waste problem in Malta is a result of the combined effect of current food waste generation practices and food waste management practices. A 'practices' approach to studying retail food waste in Malta considers the influence of both the *agency* of individuals and the *structural factors* at a societal scale. The agency of an individual refers to their capacity to act and make decisions in a given environment. Structural factors specifically refer to the rules and resources of social systems which influence the behaviours of actors in various ways (Shove, Pantzar & Watson, 2012). In this study, two main structural factors that have a bearing on current food practices in Malta are identified; infrastructural resource availability and legislative frameworks. These constructs of agency and structural factors are recursively related and thus mutually influence each other. For example, a demand from consumers to strengthen legislation can result in new policy that then changes the practices of retailers and in turn consumers to make them more sustainable. The recursive link and its effects have been highlighted as double sided arrows in Figure 1. Green sections are the focal areas of this research while peripheral supply chain actors have been coloured blue.

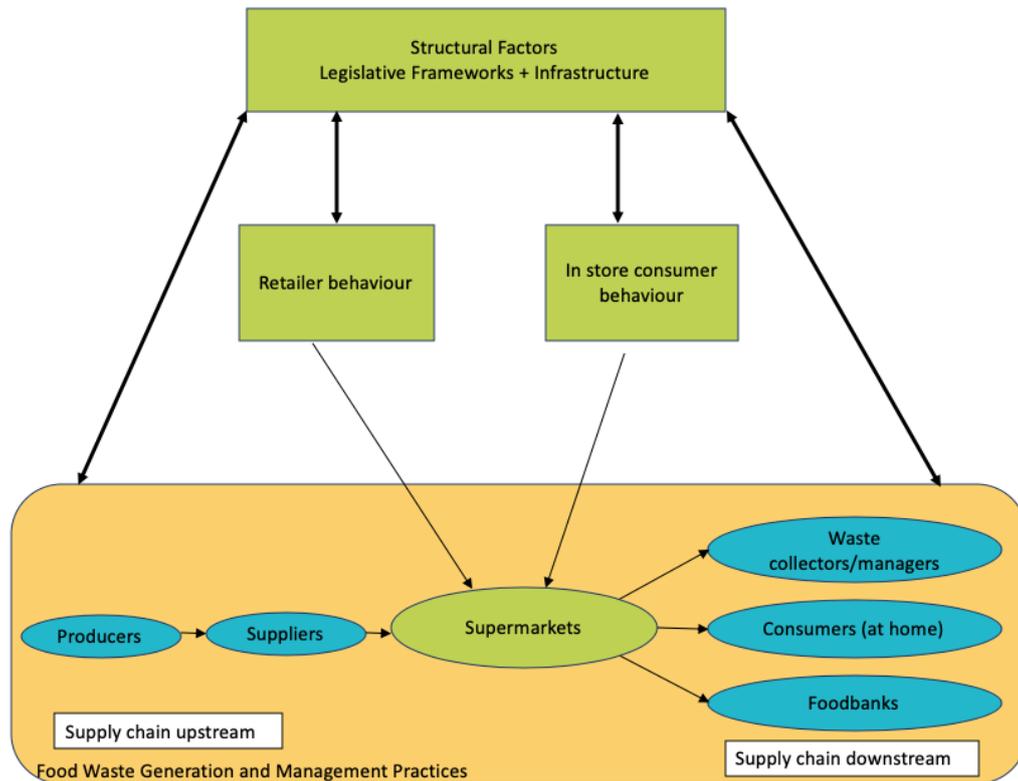


Figure 1. Relationship between structural factors and supply chain actors

### 3.3.1 INFRASTRUCTURE IN SUPERMARKETS AND PITKALIJA

Supermarkets serve as a crucial bridge between upstream supply chain actors like producers and suppliers as well as downstream actors like consumers, food banks and waste collectors (Figure 1). As a result of this intermediate position, supermarkets are uniquely positioned to engage in food waste reduction and food waste management strategies. Therefore, the in-store infrastructure has a bearing on food waste reduction via certain managerial aspects. In this project, supply chain management and marketing as a means of influencing consumer behaviour will be considered. In addition, infrastructural availability also influences food waste management strategies of supermarkets.

Studies have shown that supermarket infrastructure and store design have a significant impact on in-store consumer behaviour (Elbers, 2016; Sorensen, 2009; Bezawada, Balachander, Kannan and Shankar, 2009; Sigurdsson, Larsen and Fagerstrøm, 2016). Factors such as overall store layout, aisle design and shelf design influence consumer perceptions on what products they will ultimately buy (Elbers, 2016). Research on the influence of such factors on food waste generation in Malta is lacking. In addition, the infrastructural availability is also largely dependent on the scale of supermarkets, therefore the impacts on food waste will vary from small to larger supermarkets.

Small scale supermarkets have less infrastructure at their disposal, since their income is not sufficient to invest in proper cooling equipment (Attard, personal communication, June 13, 2020). As detailed

earlier, this influences supermarket practices targeted at food waste reduction such as food rotation and discounting. However, from our survey for supermarket managers we found that supermarkets themselves do not consider poor storage conditions (in warehouse and store) as one of the main causes of food waste generation. Instead they believe that the uncertainty of in-store consumer behaviour and supply-demand logistics play a bigger role in the generation of food waste. Larger supermarkets differ in their practices due to the infrastructure that is available to them. Very few large supermarkets offer discounts on products close to their expiry date. However, they do encourage the purchasing of certain products with special offers and sales, but the motivation behind these efforts is profit and not necessarily food waste reduction (Attard, personal communication, June 13, 2020).

Stocking practices in supermarkets can also be centralized and the ordering or delivery of new products is determined by higher level management and not necessarily by local supermarket staff (Netessine, & Rudi, 2003). This can sometimes lead to overstocking in supermarkets, which in turn can increase the amount of food waste that is generated (Buisman, personal communication, June 9, 2020).

Galea (2019) points out that supermarkets in Malta are not actively taking efforts to quantify or study the composition of their waste stream, which has been confirmed by our survey. Waste management costs also vary based on the size of the supermarket. Larger supermarkets must hire or financially compensate the waste carrier due to the larger scale of their operations, while smaller supermarkets can freeride on existing local waste collection and management systems (Gatt, personal communication, June 9, 2020). The interview with the National Statistics Office (NSO) showed that data on the waste streams of supermarkets is provided to them by the Wasteserv. However, collecting this data will cost more as the waste will have to be segregated and also collected more frequently by the Wasteserv, a cost that the supermarkets then have to bear (NSO, personal communication, June 9, 2020). NSO also points out that the entire waste collection process is in need of change as it does not currently separate food waste from the remaining waste. NSO is currently making efforts to compile data from various waste treatment facilities and classify it according to European Waste Catalogue codes. This ties into legislative frameworks and how they can be utilized to enable improvements regarding the current food waste practices in Malta.

Galea (2019) elaborates on the waste management strategies preferred and most commonly used by supermarkets. Take-back agreements with suppliers are the most preferred, in the absence of these most waste ends up in the landfill. This is largely because of the transportation costs that would have to be incurred if food were to be donated to food banks (Galea, 2019). Food waste is also repurposed as animal feed (Galea, 2019; Mayor of Local Council of Qrendi, personal communication, June 5, 2020; Pitkalija CEO, personal communication, June 11, 2020). However this repurposing of the food waste is done illegally and unofficially in some cases (Mayor of Local Council of Qrendi, personal communication, June 5, 2020). In addition, the interview with Kathleen Attard revealed that some supermarkets do make food donations but prefer not to publicize it as they do not want it to affect their brand or profits.

In the open air market of the Pitkalija, the infrastructure is significantly different. During our interview with the CEO of the Pitkalija, it was stated that there are limited storage facilities for produce, thus unsold food is often destined to become waste. In addition, the lack of coordination amongst various

stakeholders across the supply chain was also cited as a barrier to food waste reduction. For example, farmers do not communicate to each other or other supply chain actors before or during the cultivation of their crops. As a result of this, there is sometimes overproduction of certain produce, leading to more amounts of edible food being thrown away in the Pitkalija. It was also stated during the interview that efforts are currently being made to collect unsold food from middle-man at the end of the day and donate it to those in need. No formalized structures are in place for this yet and it's largely up to the middlemen to decide whether they would like to participate in these efforts (Pitkalija CEO, personal communication, June 11, 2020).

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### 3.3.2 INFRASTRUCTURE IN FOOD BANKS AND OTHER FOOD DONATION AGENCIES

Interviews with various organizations involved with food donation efforts revealed that there is often insufficient storage and cooling facilities in food banks. The Malta Foodbank Foundation interview revealed that last year a company offered to donate 10,000 frozen products, but no food banks had an adequate capacity of cooling infrastructure to accept such a large donation. Compounding this issue is also a concern over the uncertainty of how much food will be supplied and what the demand for donated food will be because both streams are variable over time (YMCA, personal communication, June 4, 2020). Donations to food banks are not centralized or formalized due to concerns of supermarkets that this could affect their brand, profit, or open them up to the possibility of lawsuits if donated food spoils (Malta Foodbank Foundation, personal communication, June 11, 2020).

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### 3.3.3 LEGISLATIVE FRAMEWORKS

The earlier section pointed out the influence of infrastructure on current practices, however it is evident that current legislation also has a significant bearing on them as well. The interview with Gatt showed that the lack of regulatory mechanisms prevents better food waste practices from being adopted. For example, the low landfill gate fees means that landfilling food waste instead of donating or repurposing is the cheapest option for supermarkets when it comes to managing their waste (Gatt, personal communication, June 9, 2020). Dr. Dalli, Member of European Parliament, points out that more data on food waste is required as a baseline in order to identify and select targets for legislation that would work in Malta.

Initiatives such as 'Don't Waste Waste' did not have a sizable impact, possibly because the efforts were largely targeted at educating consumers but not any other stakeholders in the supply chain. Increasing stakeholder collaboration is especially necessary if the new waste management plan to be released later this year is targeting waste reduction as opposed to waste management as stated earlier (Galea, 2019). Academic experts like Attard and Gatt as well as the CEO of the Pitkalija who were interviewed also stated that there was a lack of coordination amongst various stakeholders in the supply chain, a prevalent issue that is not addressed by current legislation. With regards to increasing donations to food banks, the Malta Foodbank Foundation points out that many food banks are unregistered, but they still collect food or even money for distribution. This lack of registration is a hindrance to the

centralization and formalization of food donation systems- especially from supermarkets to food banks (Malta Foodbank Foundation, personal communication, June 11, 2020).

**3.4 REFLECTIVE MOMENTS**

*Reflective moments* refers to understanding the key elements of a practice i.e. *materials*, *meanings* and *competencies* in order to identify potential starting points for new routines. These elements of practice have been graphically represented along with key examples in Figure 2. Social practice theory contends that these three main elements of a practice influence its *performance* and *embeddedness*. The performance of a practice has to do with the repetition of certain actions over time and space until the practice becomes routinised (Shove, Pantzar & Watson, 2012). The embeddedness of a practice refers to its linkages to prevailing societal rules and available resources (Shove, Pantzar & Watson, 2012).

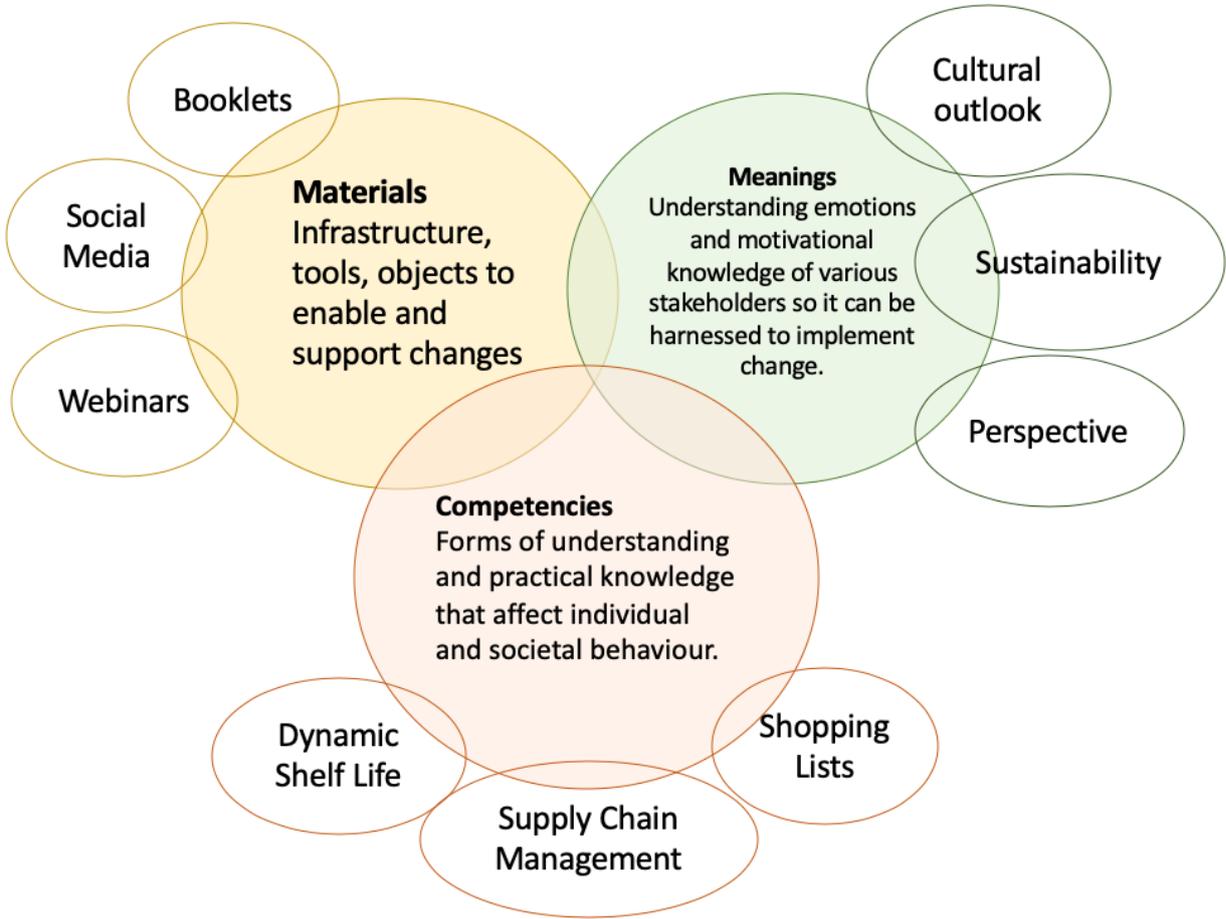


Figure 2. Elements of practice- materials, meanings and competencies along with key examples

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### 3.4.1 ELEMENTS OF PRACTICE

Materials include objects, infrastructure, tools, hardware and the body (Shove & Walker, 2007). An example of a material that can be utilized when dealing with food waste is the use of social media to encourage a change in behaviour. This can be initiated by the retailer in the form of mobile applications, promotions on social media and newsletters (Young, Russell, Robinson & Barkemeyer, 2017). According to the interview with Attard (personal communication, June 13, 2020), some supermarkets provide consumers with recipes in order to promote the sale of particular products. Easy to follow recipes that encourage the use of leftovers or produce that is quick to spoil can increase consumer willingness to buy and use such products. Furthermore, there was a week-long event organized by the waste management company Wasteserv in 2015. As part of this event, they carried out educational campaigns which are targeted at consumers by using materials like webinars, workshops, visual tools and other infrastructure. The 'Don't Waste Waste' campaign was then launched by the Ministry for the Environment, Sustainable Development and Climate Change in collaboration with Wasteserv and supported by the Environment and Resources Authority. This initiative was targeted at increasing the awareness and improving the behaviour of consumers with regards to food waste. Aside from the social media pages of the 'Don't Waste Waste' campaign, various platforms were utilized including radio and TV advertising, newspaper and magazine articles, 'Don't Waste Waste' mobile app, and the official Facebook page of the Ministry for Sustainable Development, the Environment and Climate Change. Although some believed the initiative did not have a significant impact (Attard, personal communication, June 13, 2020; Gatt, personal communication, June 9, 2020), these materials can still be of great use in future campaigns.

Meanings express the social and symbolic importance of actions (Shove, Pantzar & Watson, 2012). Aschemann-Witzel et al. (2015) mentioned that giving meaning to the food waste problem, in the form of the scarcity of raw materials created as a result of it and the consequent increase in food prices, can then constrain the food wasting behaviours of consumers. In addition, when consumers want to pay for sustainable products, chain inversion can take place such that the power over the food supply chain shifts to consumers instead of retailers (Spaargaren, Oosterveer & Loeber, 2013). Meanwhile, retailers would be more willing to join in the new, more sustainable practices from the standpoint of CSR, since the image of sustainability could increase their consumer base and consumer loyalty and therefore not negatively impact their profits. Furthermore, according to the analysis of the following survey statement: 'loyalty schemes from supermarkets influence my shopping behaviour,' younger generations (below the age of 35) seem to be more influenced by loyalty schemes than older generations (above the age of 35). Removing possible outliers did not change this conclusion. This shows the similar result as mentioned above in 3.1.3 that there is a possible correlation between age and the opinion of consumers. The implications of this finding on the meaning of practices will be discussed in the next chapter. Regarding food donations towards food banks, the same conclusion could be drawn after processing the survey results. The respondents that were within the age category of 56-65 rated donations significantly lower, while the other age groups thought donations towards food banks are of higher importance. Even after removing possible outliers, these significant results could be observed. Therefore, the age of the respondents plays a significant role in the responses that were given (Annex 2).

Lastly, the cultural background of society is influencing the mindset of Maltese consumers. After experiencing the post war period and poverty, people want big quantities and large varieties of food at a cheap price. Abundance of food became an identification of a higher social status (Attard, personal communication, June 13, 2020).

Competencies are the different varieties of comprehension and practical use of the reflective moments (Shove, Pantzar & Watson, 2012). Due to a difference in their cultural and educational backgrounds, people have different perspectives on how to apply the materials and meanings that are at their disposal. The feasibility of a practice being implemented also depends on the realities of technical, infrastructural, and political availability. The acceptability of new practices by people also plays an important role. For example, food becomes waste when it is rejected for aesthetic reasons since retailers are afraid to damage their own reputation and brand image. However, according to Aschemann-Witzel et al. (2015), many cases in the U.K. and Sweden show that consumers actually have lower aesthetic standards than retailers considered. Therefore, retailers start to loosen the superficial standards for reducing the food waste. It shows the normality is rather relative and easy to shift in these cases. Apart from that, there is a project named Fruta Feia in Portugal, which aims to change consumption patterns. About 30% of food produced by farmers is wasted due to the usual preference of the supply chain stakeholders for 'perfect' products (Fruta Feia, 2020). In this project, alternative markets are created for fruits and vegetables that are rejected for purely aesthetic reasons in order to generate value for farmers and consumers. When it comes to the topic of repurposing surplus food, one of the major factors preventing food donation from supermarkets is the logistics and transportation costs. In the case of Greece, NGO Boroume managed to set up a link between supermarkets and nearby charities and social services agencies directly. To minimize the logistic costs, they organize and ask suitable recipient agencies to collect the food on specific hours that suit the supermarket, which makes donations easier for supermarkets. This NGO is also applying education programs to train personnel and build their competencies. Beyond that, there are other ways of coping with food donation that show different competencies. Legislation can also be utilized to build competencies and initiate new practices for certain stakeholders. In France, strict legislation has been implemented to fine supermarkets that do not donate food to food banks or charities (Galea, 2019). Canada takes another approach, by legislation that protects the anonymity of donors by encouraging the removal of any branding of products being donated (Galea, 2019).

Next to the general competencies of practices that are mentioned above, there are also specific competencies of the retail sector and consumers. The knowledge and understanding of retailers regarding food waste influences their decision and behaviours in terms of managing dynamic shelf life and food rotation in the supermarkets. Some farmers have built up competencies that enable them to advertise their food and sell it as retailers through Facebook groups in Malta. "Leaving out" the step of the retailer and selling produce directly to the consumer in a big portion can help them reduce the food surplus and waste. On the other hand, this could shift the food waste burden to the consumer side which highly depends on the competencies of the consumer in terms of their knowledge on the various ways of using food and their ability to manage large quantities of food without wastage (Attard, personal communication, June 13, 2020).

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### 3.4.2 SUGGESTIONS AND STARTING POINTS FOR NEW ROUTINES

The three elements of practice discussed above, allow for the identification of reflective moments that can serve as the starting points for new routines. In this section, the starting points are mainly introduced in terms of marketing campaigns, people's willingness to change, educational campaigns, and monetary considerations. Based on the literature study and the results of survey and interview, these have been identified as the considerable factors that can propel a new routine. Each new routine consists of different combinations of existing materials, meanings, and competencies mentioned before. And the following analysis and suggestions are given based on the current cases in Malta.

First of all, marketing campaigns can persuade people to change their behaviour. For example, according to their websites and promotional pages, Greens, PaviPama, Valyou, and Park Towers all offer loyalty cards and privilege cards. In addition, seasonal discounts and festival events are offered, such as lottery prizes for big spenders in PaviPama, bonus 'cash in card points' with perishable items, and certain promotion on fish and fresh produce through social media. Apart from that, Lidl is also providing discount stickers to their consumers. These marketing strategies can be utilized to influence in-store consumer behaviour in a way that reduces food waste. Consumers tend to over-purchase because of the desire of an optimal price-quality production (Aschemann-Witzel et al., 2015). The optimal balance between the degree of consumer satisfaction and the reduction of food waste can be reached through different pricing strategies for 'suboptimal' foods. Retailers may consider ways to segment and target consumer groups and adapt packaging and sizes to the certain groups for the products that they package and label. Coupled with this, to avoid food waste in handling and storage, developing new packaging functions such as 'easy to empty' and 'information about food safety' are also considerable. Finally, the unit size and price gradient can be matched with storage life to minimize food spoilage before it is sold. According to the result of the survey mentioned in section 3.1.4, there are more people who buy food close to its expiry date due to financial reasons rather than environmental reasons. If supermarkets are aware about this reasoning, it could help them provide better offers to the consumer. In the meantime, the unit size of items is an important consideration to prevent shifting the food waste burden to consumers.

Secondly, supermarkets need to be willing to change their behaviour as a part of CSR. According to Attard (personal communication, June 13, 2020), retailers are afraid to speak up on sustainability issues, because it could potentially affect their profitability. Some retailers donate food which is close to its expiry date to charities and food banks instead of returning it back to the suppliers, but they do not publicize it, due to concerns of brand image and effects on profit, as elaborated on earlier. Retailers prefer to minimize expenditures on food waste management, which also decreases their willingness to donate food. This highlights the need for collaboration between food banks, government, and supermarkets. And through the collaboration, there would be more stakeholders influenced. For example, the initiative mentioned in section 3.2 that Pitkalija is working on could also raise the attention of middle-men and hawkers, who might be inspired to change their habits in the future. Furthermore, given Pitkalija's importance it could have the potential to actively prevent food waste through the coordination of farmers (Pitkalija CEO, personal communication, June 11, 2020). And through the collaboration, there would be more stakeholders influenced. For example, the initiative mentioned in section

3.2 that Pitkalija is working on could also raise the attention of middle-men and hawkers, who might be inspired to change their habits in the future. Furthermore, given Pitkalija's importance it could have the potential to actively prevent food waste through the coordination of farmers (Pitkalija CEO, personal communication, June 11, 2020). Additionally, retailers can also influence in-store consumer behaviour and willingness to improve their food waste practices. As mentioned earlier, some supermarkets provide recipes for promoting the sale of particular items in Malta (Attard, personal communication, June 13, 2020). Instead of profitability being the only deciding factor, supermarkets can provide easy to follow recipes that also target the reduction of food waste by promoting the sale or consumption of products that perish quickly. Such an initiative might also increase consumers' willingness to reduce food waste and their sense of sustainability. Apart from that, it might be useful to incorporate a way to make sustainability and reduction of food waste a new attractive identity. This can be achieved through posting meal pictures on social media, for example. However, in order to be effective, socio-demographic differences must be considered. As the survey result mentioned in 3.4.1, there is a possible correlation between age and the opinion of consumers. Young people may show more acceptance of changes such as loyalty schemes and food donation, especially when social media is used to promote these ideas. This makes the difference in age an important influence on whether a new practice will be adopted. So, to improve awareness and willingness on reducing food waste, there should be different measures targeting different groups of people (Attard, personal communication, June 13, 2020). Lastly, the National Youth Council of Malta pointed out that positive measures have been implemented in the tourism industry to reduce its impact on the environment. In 2002, the Malta Tourism Authority implemented voluntary standards for restaurants and hotels to become more environmentally friendly and achieve eco-certification. This included the aspect of waste management. The initiative was successful, so it was transformed into a law in 2012 (Galea, 2019). It illustrates that the willingness of change plays an important role in propelling the process of measures to success. Similar initiatives could also be taken to address the retail food waste issue by encouraging collaboration amongst various stakeholders.

Thirdly, an educational campaign can be used to extend the knowledge in the hope that an attitude change occurs. Aschemann-Witzel et al. (2015) notice the necessity of an educational campaign to let consumers know that they are responsible for the creation of food waste. They stress that it needs to be done multiple times through various approaches, since people are otherwise likely to forget, and there are differences in sources people rely on most. Consumers need to be able to understand different ways of data labelling on the products, the shelf life of the food, and the ways of using items such as cooking skill through these continuous campaigns (Aschemann-Witzel et al., 2015; Attard, personal communication, June 13, 2020). Furthermore, the educational campaign should target different stakeholders including the whole supply chain, not only consumers (Attard, personal communication, June 13, 2020). Supermarket managers could also benefit from an educative campaign, for instance on the right storage instructions regarding optimal temperatures and humidity of different types of products (Porat et al., 2018). Lastly, Dr. Dalli considered encouraging the circularity of the economy would be beneficial in addressing issues of retail food waste. The foundation of a circular economy is to build an economic system in a way that eliminates waste and instead encourages the continual use and reuse of resources. However, one of the main obstacles of the circular economy is the lack of funding and

cooperation, because this is a new concept in Malta (Dalli, personal communication, June 10, 2020). Including the concept of circular economy in educational campaigns could be beneficial in spreading and understanding of this concept among various stakeholders.

Finally, monetary considerations are an important factor in changing and altering practices. A small supermarket that was interviewed indicated that they are in need of more financial support from the government. Attard (personal communication, June 13, 2020) also mentioned that small shops are less likely to engage in reducing waste initiatives, because sales and profits of the shops tend to be their first priority. An added complexity is the Mediterranean climate in Malta, which necessitates the use of cooling equipment to slow spoilage of food. Smaller supermarkets often do not have the income significantly in such infrastructure. If there could be a strategy getting the government to financially support or incentivize smaller supermarkets to invest in cooling equipment (Attard, personal communication, June 13, 2020), this could potentially reduce food waste especially for the organic waste stream. Additionally, to measure current food waste, the accuracy of data relies on the frequency of data collection. This a cost that must be borne by supermarkets themselves, which often leads to overwhelming financial burdens for smaller supermarkets because there are additional payments for separating the waste and collecting it more frequently in order to provide the required data. Incentives from the government could motivate these supermarkets to actively engage in the process of completing the data gap regarding the topic of food waste in retail sectors. Meanwhile, the separation of the waste helps the process of transitioning to composting easier rather than being landfilled directly (NSO, personal communication, June 9, 2020).

## 6. DISCUSSION

This section comprises a reflection on the findings for each of the sub-research questions posed in this study. Following which, the limitations and strengths of the current study will be explained.

Section 3.1. was targeted at identifying the social practices regarding food waste generation and management that exist in the Maltese retail sector. Attempts were made to use surveys and interviews in order to collect data specific to the practices that dominate in Maltese supermarkets, since they form the core of the retail sector. However, in the absence of cooperation of a sufficient number of supermarkets, the practices were then identified based on a literature review, interviews with academic experts working on similar topics, the interview with one small supermarket and the three survey responses from supermarket managers. Since only three supermarket managers filled in the survey no analysis was performed on this data, but it was used qualitatively. The lack of representative data on the perspective of supermarket managers regarding food practices happening in supermarkets in Malta makes this part of the study unsuitable for generalization. The perspective of consumers could be estimated more accurately due to the higher number of responses received on the questionnaire. However, it needs to be noted that the questionnaire was distributed only online, and filled in by Maltese consumers who are likely to already be concerned with the environment. Therefore, the results of the survey are less suitable for generalization to the whole of the Maltese consumer population.

Section 3.2 dealt with the relevant actors and their role on food waste generation and management in the Maltese retail sector. Supermarkets were identified as the key actors with a secondary focus on in-store consumer behaviour. Supermarkets themselves are an important juncture in the supply chain since they establish links with and have influence over upstream and downstream supply chain actors and their practices. Producers, suppliers, food banks and waste collectors were thus considered as peripheral stakeholders on either side of the supply chain. These actors were not focussed on in the project, but provided a vital context within which to situate our findings. Further research on the role and influence of these actors would provide a more robust foundation upon which to build strategies to tackle food waste problems. As with the first sub-research question, the lack of data from supermarkets implies that generalizable conclusions on the overall situation in Malta are difficult to make.

Section 3.3 demonstrates the influence of legislation and infrastructure on food waste generation and management in the Maltese retail sector. More detailed descriptions on the structural factors themselves can be found in the expert reports of 'Policy and Stakeholders' and 'Technology and Infrastructure.' The focus of this expert report was to highlight the recursive nature of the interaction between structural factors and the relevant actors. The extent and magnitude of influence that structural factors have on the practices in the retail sector varies based on the scale and context of individual supermarkets. Therefore, it is important to highlight that the findings are representative of various possibilities, but depending on what the data is to be used for, more specific information might be required.

Section 3.4 analysed the current situation of food practices in Malta through the lens of the key elements of practice namely; materials, meanings and competencies. This theoretical approach helped to identify 'reflective moments' which serve as suggestions or starting points for new practices. These starting points thus need to be further built upon and tailored according to where and by whom they are being implemented. To create a more holistic view, efforts should be made to enhance the representation of supermarket attitudes and subsequently link them to consumer perspectives on the same issues. This is especially the case if the influence of supermarket marketing or educational campaigns on consumers is to be gauged. This information can also be correlated with the quantification of food waste, to see if there are seasonal trends in food waste that could be influenced by marketing campaigns.

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## LIMITATIONS AND STRENGTHS

Since it was not possible to travel to Malta, firsthand observations could not be made. It should be emphasized that the consequent online nature of our research impacted the quality and quantity of data that was collected. Due to time constraints it was not possible to conduct a thorough testing of the surveys before publishing it, which can affect the measurement validity. Furthermore, the responses of supermarket managers were lower than expected, for both the survey and interviews. The number of supermarket managers who filled out surveys is not high enough to reach statistical validity and therefore no quantitative analysis was possible. As for the interviews, only one supermarket was willing to talk to us, which is why no generalized statements could be concluded from this.

A strength of the current study is the triangulation; the diversity of sources used to study the current topic. By undertaking a literature review, interviews and survey, the topic was explored from different angles and perspectives of relevant stakeholders could be considered. The theoretical approach of using a social practice theory lens also keenly highlights important considerations regarding the current situation as well as future scenarios.

## 7. CONCLUSION

The study aimed to determine the *current food waste generation and management practices in the Maltese retail sector and to identify opportunities for improving these practices*. Firstly these food waste generation and management practices in the retail sector in Malta were identified. In-store consumer practices, supermarket practices and Pitkalija practices were considered as focal areas of research and were subsequently described. In-store consumer practices include date-picking, squeezing fruits and vegetables and the use of shopping lists. Supermarkets are seen to make use of take-back agreements for their nearly expiring produce, they offer discount stickers and they donate products. The Pitkalija sends surplus food to food banks or transforms it into animal feed. The identification and study of these practices is important in order to build a strong foundation for strategies to address shortcomings in the current situation.

Secondly, the *influence of relevant actors on food waste generation and management in the retail sector of Malta was considered*. From a food practices perspective the key relevant actors are; consumers, supermarkets, the Pitkalija, NGOs and food banks, and the government. It is important to note that although all of the above mentioned stakeholders have taken the initiative to address food waste issues, they have not been significantly successful thus far. Therefore, strong collaborative efforts within and across all stakeholder groups must be encouraged and facilitated to increase the chances of a successful outcome. The government plays a vital role in implementing legislation that supports the efforts of supermarkets, the Pitkalija and food banks to reduce and better manage food waste. Incentives to invest in infrastructure or financial support to do so in the case of food banks are an important role the government can fulfil. In addition, food banks would benefit from a formal and centralized donation process that also incentivizes supermarkets to donate food. Aside from directly engaging in the issues NGOs and consumers play an important role in putting food waste issues on the political agenda and lobbying for action from other stakeholders.

Thirdly, the *structural factors and their influence over food waste generation and management practices in the retail sector in Malta was studied*. Legislative frameworks and infrastructural resource availability were identified as key structural factors that aid in understanding why the current situation is the way it is. Due to the lack of legislative frameworks, the incentive to improve food practices is low, which leads to more food waste. With regards to the infrastructure the influence on the food waste generation and management becomes apparent in that if little infrastructure is available to deal with food stocks, food waste becomes more prevalent. The influence of structural factors is important to consider, since the food practices themselves are not inherently good or bad, but highly dependent on how the structural factors and relevant actors interact or mutually influence each other. Practices can

only be improved if these contextual factors are adapted or completely changed in order to support sustainability.

Finally, *the reflective moments within routinized food waste generation and management practices that could serve as starting points for new routines were determined*. This report has distinguished between efforts targeted at food waste reduction and efforts targeted at food waste management. Food waste reduction is a stronger approach since it has fewer negative environmental and economic impacts compared to weaker approaches of recycling or repurposing food waste after it has already been created. The reflective moments that can be used as starting points for new routines for either of these approaches are; marketing campaigns, people's willingness to change, educational campaigns and monetary considerations. The starting points for new routines serve as a culmination point for a practice theory perspective on the potential ways to improve food practices in Malta. They highlight the importance of identifying and studying specific practices and their elements by situating them in the context generated by the recursive relationship between actors and structural factors. The more tailored the starting points for new routines are to specific practices, the higher the likelihood of improvement. Finally, instead of targeting initiatives at specific stakeholder categories in isolation, collaboration amongst various stakeholders should be encouraged, as this could increase the chances of successful outcomes.

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## 9. ANNEXES

### ANNEX 1: RELEVANT INTERVIEWED STAKEHOLDERS

Selected stakeholders are EkoSkola Malta, a small supermarket, YMCA Malta, St Jeane Antide Foundation, Pitkalija, National Statistics Office, Malta Food Bank Foundation, Dr. Miriam Dalli from MEP, Dr. Kevin Gatt and Kathleen Attard from University of Malta, Marjolein Elize Buisman from WHU -Otto Beisheim School of Management. The interview notes of the selected stakeholders were used to answer sub research questions in the current situation and result section. Furthermore, survey results, mainly customer surveys, contributed to the answers of the sub research questions. It is aimed to reach the purpose of this research by combining both interview and survey results with literature review.

### ANNEX 2: SURVEY ANALYSIS

Table 1: SPSS T-Test regarding question 5

<b>Question 5:</b> <b>To what extent do you agree with the following statements?</b>	<b>N</b>	<b>β</b> <b>(Sig.)</b>	<b>M ± SE</b>
<i>Donations to food banks are important</i>	251	< 0.00	4.76 ± 0.04
<i>It is the supermarkets sector's responsibility to donate food to social causes (e.g. food banks)</i>	251	< 0.00	4.31 ± 0.06
<i>Consumers contribute to supermarket food waste production</i>	242	< 0.00	4.12 ± 0.07
<i>I care about helping the supermarket to reduce its food waste</i>	245	< 0.00	4.43 ± 0.06
<i>I regularly buy products that are close to their best before dates for environmental reasons</i>	247	0.05	3.17 ± 0.09
<i>If it saves me money, I will buy products that are close to their best before dates</i>	247	0.04	3.19 ± 0.09

<i>I feel I have little power to reduce my own food waste contribution in supermarkets as a consumer</i>	251	< 0.00	4.17 ± 0.07
<i>I would like to be informed more on how I can reduce food waste</i>	241	< 0.00	4.35 ± 0.07
<i>Advertisement about food waste reduction could influence my shopping behaviour</i>	240	< 0.00	4.17 ± 0.07
<i>Loyalty schemes from the supermarkets (e.g. collecting points in order to get rewards) influence my shopping behaviour</i>	247	< 0.00	3.48 ± 0.10
<i>The supermarkets have responsibility to reduce food waste</i>	233	< 0.00	4.70 ± 0.05

Table 2: SPSS One-Way ANOVA F-test including question 5 in correlation with age

<b>Question 5: ANOVA Table (in relation with age)</b>	<b>N</b>	<b>F</b>	<b>β (Sig.)</b>
<i>Donations to food banks are important</i>	251	2.587	0.010
<i>It is the supermarkets sector's responsibility to donate food to social causes (e.g. food banks)</i>	251	1.397	0.198
<i>Consumers contribute to supermarket food waste production</i>	242	0.966	0.456
<i>I care about helping the supermarket to reduce its food waste</i>	245	0.343	0.949
<i>I regularly buy products that are close to their best before dates for environmental reasons</i>	247	0.989	0.445
<i>If it saves me money, I will buy products that are close to their best before dates</i>	247	0.706	0.686
<i>I feel I have little power to reduce my own food waste contribution in supermarkets as a consumer</i>	251	1.398	0.198
<i>I would like to be informed more on how I can reduce food waste</i>	241	1.155	0.328
<i>Advertisement about food waste reduction could influence my shopping behaviour</i>	240	1.018	0.423
<i>Loyalty schemes from the supermarkets (e.g. collecting points in order to get rewards) influence my shopping behaviour</i>	247	2.239	0.025
<i>The supermarkets have responsibility to reduce food waste</i>	233	1.119	0.352

Table 3: SPSS T-Test regarding question 6

<b>Question 6: Which of the following activities do you do when you are in the supermarket?</b>	<b>N</b>	<b>β (Sig.)</b>	<b>M ± SE</b>
<i>Buying food with close-to-expiry discount stickers</i>	248	< 0.00	2.81 ± 0.08
<i>Creating a shopping list before going to the supermarket</i>	249	< 0.00	2.01 ± 0.08

<i>Buying food whenever it is limited (just before it sells out)</i>	243	< 0.00	2.06 ± 0.06
<i>Date picking: choosing your fresh food based on the “best before” date</i>	255	< 0.00	3.28 ± 0.06
<i>Squeezing fruits or vegetables: to see the condition of the fruits or vegetables</i>	248	< 0.00	1.68 ± 0.06

Table 4: SPSS One-Way ANOVA F-test including question 6 in correlation with age

<b>Question 6: Which of the following activities do you do when you are in the super-market?</b>	<b>N</b>	<b>F</b>	<b>β (Sig.)</b>
<i>Buying food with close-to-expiry discount stickers</i>	248	2.088	0.038
<i>Creating a shopping list before going to the supermarket</i>	249	1.043	0.404
<i>Buying food whenever it is limited (just before it sells out)</i>	243	0.904	0.514
<i>Date picking: choosing your fresh food based on the “best before” date</i>	255	3.955	0.000
<i>Squeezing fruits or vegetables: to see the condition of the fruits or vegetables</i>	248	1.036	0.409

Table 5: SPSS T-Test regarding question 9

<b>Question 9: To what extent would you agree that the following proposed solutions would decrease food waste in supermarkets?</b>	<b>N</b>	<b>β (Sig.)</b>	<b>M ± SE</b>
<i>More regulation for supermarkets to donate food waste to food banks</i>	253	< 0.00	4.64 ± 0.05
<i>A subsidy for supermarkets that donate food to food banks</i>	250	< 0.00	4.24 ± 0.07
<i>A tax for supermarkets that do not donate food waste to food banks</i>	246	< 0.00	4.12 ± 0.07
<i>A campaign to increase awareness among consumers about food waste of supermarkets</i>	251	< 0.00	4.59 ± 0.05
<i>A training program for supermarket employees to better handle waste-separation</i>	250	< 0.00	4.64 ± 0.05
<i>Oblige supermarkets to sell products that are close to their “best before” date for a lower price</i>	247	< 0.00	4.47 ± 0.06
<i>A mobile app that promotes discounted food when they are close to their “best before” date</i>	245	< 0.00	4.26 ± 0.07
<i>Giving supermarkets more freedom to come up with their own initiatives to reduce food waste</i>	239	< 0.00	4.42 ± 0.06

Table 6: SPSS One-Way ANOVA F-test including question 9 in correlation with age

<b>Question 9: To what extent would you agree that the following proposed solutions would decrease food waste in supermarkets?</b>	<b>N</b>	<b>F</b>	<b>β (Sig.)</b>
<i>More regulation for supermarkets to donate food waste to food banks</i>	253	2.932	0.004

<i>A subsidy for supermarkets that donate food to food banks</i>	250	1.170	0.318
<i>A tax for supermarkets that do not donate food waste to food banks</i>	246	2.093	0.037
<i>A campaign to increase awareness among consumers about food waste of supermarkets</i>	251	2.154	0.032
<i>A training program for supermarket employees to better handle waste-separation</i>	250	1.896	0.071
<i>Oblige supermarkets to sell products that are close to their “best before” date for a lower price</i>	247	0.896	0.520
<i>A mobile app that promotes discounted food when they are close to their “best before” date</i>	245	2.530	0.016
<i>Giving supermarkets more freedom to come up with their own initiatives to reduce food waste</i>	239	1.627	0.129

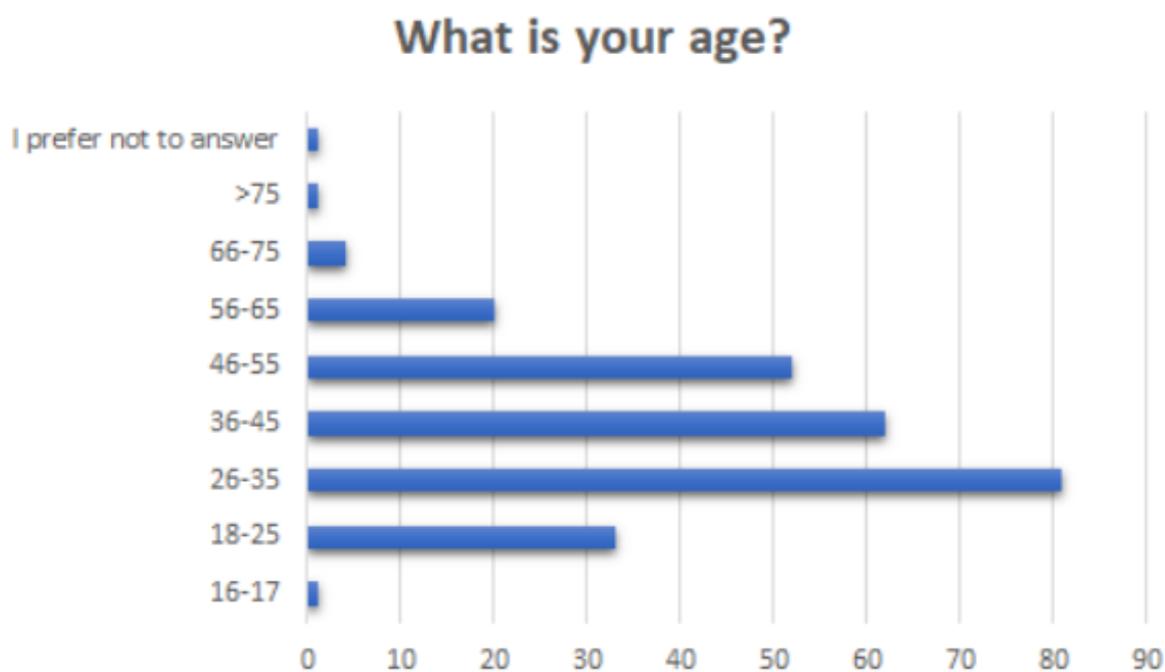


Figure 3. Question 12 of the consumer survey

EXPERT REPORT NO. 3

# TECHNOLOGY & INFRASTRUCTURE



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## WRITTEN BY

Anna Sophie Braun, Jiamin Wang, Jiarui Yang, Shaun Pramod Idiculla & Yiduo Xie



## 1 Introduction

The objective of this project is to analyse current food waste practices, and to suggest strategies to reduce and repurpose food discarded by the retail sector in Malta.

Infrastructure and technology are the cornerstones of reducing and repurposing food waste. Infrastructure encompasses the equipment and facilities needed for the supply chain management and waste management to operate. Infrastructure mainly refers to fixed installations like the waste treatment plant, but it may also be extended to the fleet of distribution and collection. Technology is the practical application of knowledge. Compared to infrastructure, technology is more abstract. For example, cold chain management is a technology to reduce food waste while animal feed is a technology to repurpose food waste.

According to the waste hierarchy, the prevention of food waste from occurring throughout the supply chain and retail sector has the highest priority. Secondly, food close to its end of shelf life may be donated to people in hunger via the food banks or other NGOs. Once food waste has been generated, it should be properly managed. To reduce landfilling while recycling and recovering as much resource as possible from food waste, it is vital to analyze waste collection, separation, quantification, and end-of-pipe treatment (Papargyropoulou et al., 2014). Each aspect mentioned above will be further divided into two parts. The first part focuses on the current situation and practices in Malta while the second part focuses on potential strategies that may be applied in Malta. Following this concept, this report raised the following two research questions.

1. What are the current food waste streams and what are the infrastructural and technological practices for food waste management?
2. What are the potential infrastructural and technological strategies of repurposing and reducing food waste?

In order to answer the above-mentioned research questions, a literature study and about 33 interviews were conducted. In addition to that, a survey of supermarket managers was created and distributed amongst supermarket managers. As presented in Figure 1, the report will move through the entire supply chain, discussing suppliers, the retail sector, the food banks, and the end of pipe treatment. First, the current situation will be explored in regard to waste management and food waste prevention in the retail sector, as well as within the supply chain. Additionally, it explores the current food bank infrastructure and analyzes its efficiency in preventing food waste. The first section is finalized by looking at the current waste collection, processing, and quantification methods that are currently being used. In the second part of the report, technological and infrastructural suggestions to improve the above-mentioned areas are being made.

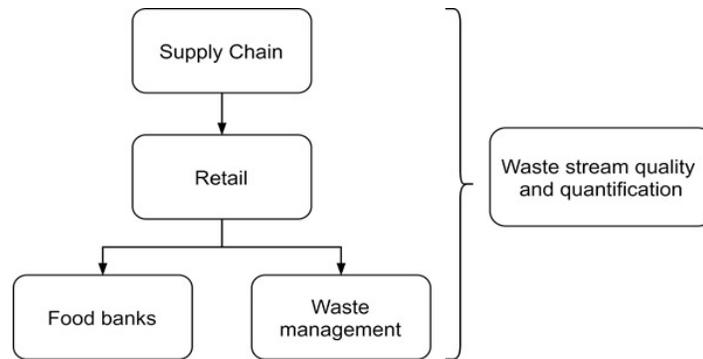


Figure 1: Report structure Infrastructure and Technology

## 2 Current situation

### 3.2. Food waste creation through retail practices

Based on one interview and four survey responses, it was found that the retail sectors have applied some good practices in reducing and repurposing food waste. All five supermarkets put products close to their end of shelf life at the front while four out of five supermarkets offered discounts to products which close to their expiry/best before date. A supermarket claimed that they offer bio-degradable bags for fruit products (Littles Supermarket, Personal Communication, June 5, 2020), which might help waste separation.

However, there are some issues that lead to unnecessary food waste in the retail sector. The CEO of Pitkalija believed that Pitkalija's food waste was largely the result of a lack of communication and coordination. Farmers do not cultivate based on consumer demands. If the total supply of a certain product exceeded the total demand, some of the products would inevitably become food waste. He also pointed out that the storage facility is another issue. Most farmers were not able to own a storage facility like a refrigerator while Pitkalija only had a limited amount of storage facilities (Pitkalija, Personal Communication, June 11, 2020). Small supermarkets have similar issues. It was also reported that there was a lack of cooling facilities for small shops. Something that could be useful to increase the sale of products of suboptimal quality is a grading system. The grading system can, for example, divide the food products into the optimal products and the suboptimal products, which can be sold at different prices. Though, such a system is currently not applied in supermarkets in Malta (K. Attard, the University of Malta, Personal Communication, June 13, 2020).

### 3.3. Current food bank practices and their infrastructural challenges

Food banks are considered to be an emergency service (Bull & Harries, 2013) that can help to provide short term food security for people. They first emerged in the US in the 60s and have spread to Europe in the 80s (González-Torre et al., 2017, p. 823). They have become an essential emergency service for people in the US as well as in Europe, though there is no standardized way of operating food banks in Malta yet (Malta Food Bank Foundation, personal communication, June 11, 2020). The main flow of food and food waste throughout the donation system can be seen in Figure 2. There, one may observe that supermarkets donate food sporadically, which is why the majority of the still edible food ends up in the end of pipe treatment.

In the following sections, the operation procedures, as well as the different methods of donation for food banks in Malta will be explored in more detail.

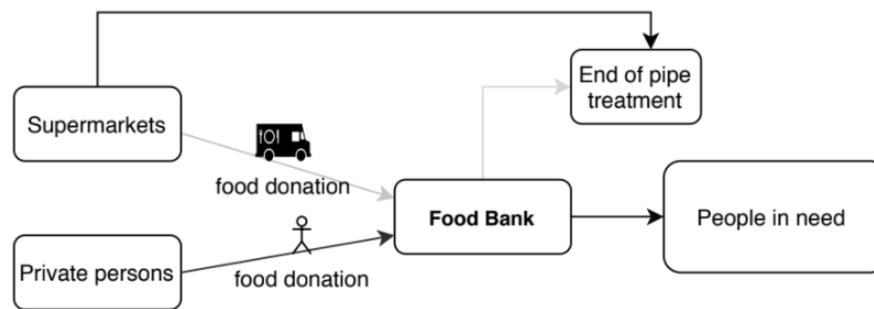


Figure 2: Food Donation Flow in Malta

### 2.2.1 Logistic challenges related to food donation

In Malta, there are many different kinds of food banks set up, thus the variability between food banks themselves, the food donors, and the donation infrastructure varies greatly. Many different organisations can act as food banks. Especially due to the outbreak of COVID-19, there has been a rise in the number of food banks that popped up. These could be traditional food banks, NGOs, churches, and community centers (Malta Food Bank Foundation, personal communication, June 11, 2020). There is no central food bank organization overlooking the operation of all food banks. This leads to a great amount of fragmentation throughout the entire system (Malta Food Bank Foundation, personal communication, June 11, 2020). Food banks are scattered across the entire island, there is no registry of how many food banks there are, and this makes it extremely difficult to evaluate the state of the system. Overall, it may be stated that the fragmentation of the donation infrastructure leads to two great challenges: the uncoordinated transport infrastructure to the food banks (YMCA representative, personal communication, June 4, 2020), and the irregularity of food donations (Malta Food Bank Foundation, personal communication, June 11, 2020).

There are stark differences between the donors and the way they donate the food. For example, some food banks receive their food from large supermarkets that transport the food in supermarket trucks to the food bank directly. This is convenient for the food bank because no logistics on their side has to be considered (Malta Food Bank Foundation representative, personal communication, June 11, 2020). Other donation modes include donation boxes in supermarkets (St. Jeanne Antide Foundation, personal communication, June 5, 2020), and unsold food from the Pitkalija middlemen market (Pitkalija, personal communication, June 11, 2020). Due to these differences in food donation sources, food banks rely heavily on the transport of donations to the food banks by the donors themselves or by unpaid volunteers offering their own transportation vehicles. This poses a significant challenge, as food banks become dependent on the benevolence of the donors. Dr. Kevin Gatt, a professor at the University of Malta warns, points out that these logistic costs for the retail sector could lead to supermarkets being less likely to donate food in the first place (K. Gatt, personal communication, June 9, 2020), leading to edible food ending up as food waste.

Another aspect to consider is the frequency at which food banks receive food donations. This frequency is highly irregular since there is no agreement between the food banks and food donors set up (Malta Food Bank Foundation representative, personal communication, June 11, 2020). For example, as two representatives from the National Youth Council explained, due to COVID-19 the donations have been increasing significantly (National Youth Council representative, personal communication, June 11, 2020). Another season at which food banks receive increasing amounts of food is the Christmas season (San Giljan Local council representative, personal communication, June 4, 2020). This infrequency leads to reliability issues, directly affecting the people in need. From the perspective of food waste, the irregularity in food donations may also imply peak times in which edible food is thrown away. Though, this is difficult to judge due to the lack of data on this type of food waste.

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### 2.2.2 Food handling procedures: logistic and procedural barriers

Once food enters the food bank, the handling of the food is vital in order to ensure proper storage and food safety. Overall, there is no standardized food handling procedure, and food banks also lack appropriate equipment to transport heavier items into storage. In order to ensure the food safety of the products, the Malta Food Bank Foundation inspects the delivered goods to ensure that the packaging is intact, and the food generally looks good (Malta Food Bank Foundation representative, personal communication, June 11, 2020). In addition to that, the best-before or use-by dates are checked (YMCA representative, personal communication, June 4, 2020). Though, once again there is no standardized inspection procedure that is required of food banks. Once the food is inspected, it has to be moved into storage, which is usually done manually, as explained by a representative of the Malta Food Bank Foundation. Even though they do receive large amounts of donations on pallets, they lack the equipment to move them into the warehouse with machinery. This food bank in particular has expressed the lack of basic infrastructures, such as a forklift and a scale. Food banks are dependent on monetary donations in order to afford such equipment, but they do not receive any government funding for such investments (Malta Food Bank Foundation Representative, personal communication, June 11, 2020). In order to ensure both, proper food safety and handling procedure, and proper equipment, policy that addresses this problem is vital. Liability issues in terms of food safety have been named as one of the essential hindrances for supermarkets donating food, which is why food that is still edible may simply end up as food waste. Therefore, these concerns should be addressed in a political context (Malta Food Bank Foundation Representative, personal communication, June 11, 2020).

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### 2.2.3 Lack of storage and cooling capacity

Another essential aspect of food banks is the storage of food donations. The main requirements in terms of storage are to use a big room protected from the sun with cool conditions (YMCA representative, personal communication, June 4, 2020). Storage space is precious in Malta and it is difficult to find space that is not occupied by the commercial sector (Malta Food Bank Foundation representative, personal communication, June 11, 2020). Two difficulties that food banks face, are the lack of storage capacity (YMCA representative, personal communication, June 4, 2020), and the lack of cooling facilities (St. Jeanne Antide Foundation representative, June 5, 2020). The lack of storage capacity makes it difficult for certain food

banks to admit larger amounts of donations, which is why some of them prefer to receive monetary donations instead of food donations (YMCA representative, personal communication, June 4, 2020). With this money, food may be bought in periodical intervals not overwhelming the storage capacity of the food bank. Though, this also limits amount of donations that a supermarket could make, potentially leading to unnecessary food waste.

Another obstacle that certain food banks may face is that the storage capacity is limited by the characteristics of the space. For example, as one food bank explained, it was not possible to effectively use the entire capacity of the storage space due to a blocked doorway. Even though the food bank has patiently been waiting for the required permits to renovate the storage space, those permits still have not come in after multiple years (Malta Food Bank Foundation representative, personal communication, June 11, 2020). The latter issue, related to cooling facilities, significantly limits the types of foods the food bank can store and give away. Some food banks are only able to give away non-perishable foods. This leads to a poorer nutritional quality of the food that can be given away (St. Jeanne Antide Foundation representative, June 5, 2020). A topic that also relates to the storage of food is the stocking system. Most food banks sort their food based on the best before and the use-by dates. Though, this is all done manually and requires regular inventory, mostly by unpaid volunteer workers (Malta Food Bank Foundation, personal communication, June 11, 2020). This leads to a high reliance on volunteers, which may also threaten the reliability of the food bank operation.

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#### 2.2.4 Donation distribution variability

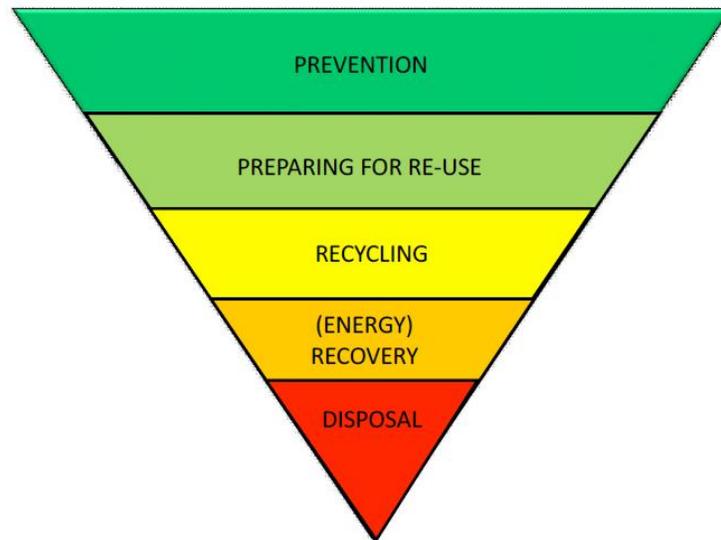
The last step in the food bank system is the distribution of donated food to the people in need. Here, different organizations pursue different approaches. Some food banks donate the food to NGOs, which then distribute it further to the people in need. The reasoning behind this is to save the anonymity and dignity of the people in need (Malta Food Bank Foundation representative, personal communication, June 11, 2020). Though this approach may also pose challenges in terms of infrastructure. On the one hand, this could be a difficult approach in terms of transport infrastructure. Here, the food banks or the NGOs would need to be able to deliver the food to the NGOs. On the other hand, especially when it comes to perishable goods, this might pose a challenge in terms of maintaining the cooling chain during transport. Additionally, NGOs need enough storage and cooling space to store the food items until they are given away.

Another approach that is more often being followed is to offer the foods for donation at the food bank. People come to the food bank and pick up the items directly at the food bank (YMCA representative, personal communication, June 4, 2020). This approach is significantly much simpler in terms of infrastructure, but there may be a trade-off, as people in need have to endure the stigma of asking for help.

### 3.4. Landfilling as the major waste management strategy

Waste management generally encompasses the measures and activities demanded to manage waste from its beginning to final disposal (Midor and Jaderko, 2017). The current situations in Malta of separation,

collection, end-of-pipe treatment and quantification regarding food waste from the retail sector will be introduced in this chapter, and it covers recycling, recovery and disposal of the EU waste hierarchy (Figure 3).



*Figure 3: Waste management hierarchy by European Commission*

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### 2.3.1 Retail waste collection and the lack of waste separation

The current practice for domestic waste is controlled by regulations that were placed in 2018. This mandated that waste from households had to be separated according to their nature in waste management. The “Sort It Out” campaign had a result where residents had to segregate their waste into three major streams. A black bag that had mixed waste, a grey bag with recyclable materials, and a white bag with only organic waste (Diacono, 2020). It is important to note that the white bag in which organic waste is collected is also biodegradable. These bags are then collected by a carrier who is hired by the local council on a three-year contract. This is a simple and clear method for collection for the domestic aspect of waste production. This allows for the quantification of the amount of waste that is produced from each local council area.

On the other hand, supermarkets like Lidl contract with their own waste carriers from different commercial entities for waste collection and the local councils are not responsible for that (Local council, personal communication, June 4, 2020). There is neither legal obligation nor economic incentives to separate waste in commercial sectors (J. Spiteri, the University of Malta, personal communication, June 4, 2020) and some of them are currently dumping waste in a mixed black bag without any form of separation in some localities (Local council, personal communication, June 4, 2020). Worse, some people illegally collect organic waste to use it as feed for livestock. This reduces the amount that is collected at the waste management sites, which can be a reason for animal diseases due to inferior or spoilt feed (Local council, personal communication, June 5, 2020).

Some small corner shops and grocery stores may use the service of the local council which collects household waste. This part of the waste is de jure food waste in the retail sector. De facto, it is mixed with other

household waste and difficult to monitor (WasteServ, personal communication, June 12, 2020) and therefore the numbers that are measured at the waste management site may be different from the actual generation. This means that some of the retail food waste is being counted as a part of the domestic waste source. Therefore, if this is fixed, then it can be expected that the amount of domestic waste collected will reduce.

Additionally, the food disposal system of Pitkalija is disorganised. Every farmer and middleman has his own manner of disposing of their food waste (Pitkalija, personal communication, June 11, 2020) so it is currently difficult to monitor their separation practices because of the lack of organization and uniformity. In a nutshell, the waste generated in the retail sectors is currently not fully separated and the main reason is the lack of standardization.

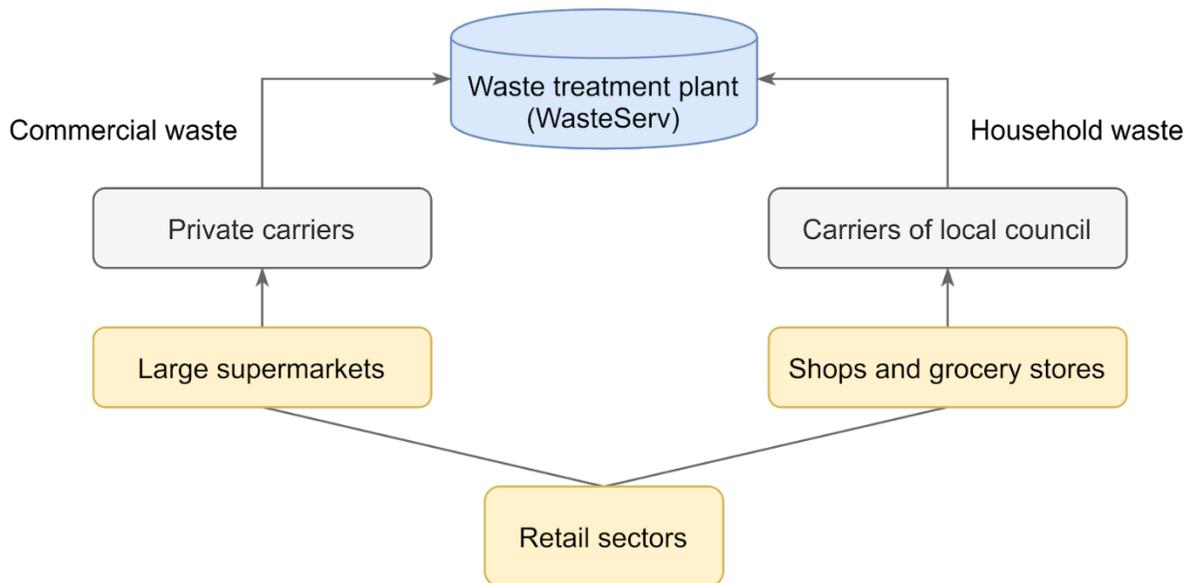


Figure 4: Current waste collection scheme for retail sectors in Malta (excl. Pitkalija)

In conclusion, the present waste collection scheme (Figure 4) lacks standardization. To alleviate this issue, there are now discussions on the new waste management plan to improve separation (WasteServ, personal communication, June 12, 2020). However, it is hard to achieve this. Firstly, the private carrier hinders standardization since most companies are small and economically fragile while logistical and financial problems may obstruct local councils from taking charge of the waste management system of the retail sector. For instance, it may generate an extra cost for food waste transportation and therefore incur additional overhead (Local council, personal communication, June 5, 2020). Also, according to the survey, some of the smaller supermarkets may not produce sufficient volumes of food waste to make collection economically feasible for contractors and have no adequate infrastructures for the food waste separation.

### 2.3.2 Landfilling as the main end-of-pipe waste treatment

Currently, about 80% of Maltese waste is landfilled, which means Malta relies heavily on landfilling (WasteServ, personal communication, June 12, 2020). Although the land consumption for landfilling is not

much, the current landfill practice has a severe impact on the environment and available resources in Malta like toxic leachate entering soil and water and leading to harm to human health (WasteServ, personal communication, June 12, 2020). To decrease the high landfilling rates and increase the low recycling rates, Malta's efforts are made to shift "from unsustainable dumpsites towards differentiated waste collection and treatment facilities" (Brincat, 2014; RRRRA, personal communication, June 4, 2020; ERA, personal communication, June 8, 2020).

For end-pipe treatment in Malta, the government through WasteServ Malta Limited (WSM) has developed some basic infrastructures to deal with this problem. Sant' Antnin waste treatment facility is one of the most important waste management infrastructures. A Mechanical Biological Treatment/Anaerobic Digestion (MBT/AD) plant has been invested in the South of Malta, and it also consists of Combined Heat and Power Plant (CHPP) and Regenerative Thermal Oxidiser (RTO) (Brincat, 2014). This combined waste treatment plant cannot only convert organic waste into biogas, but also produce heat and electricity, which has better waste utilization than landfilling. Currently, the Resource Recovery & Recycling Agency (RRRA) mentions that the plant can function properly at a threshold of 35 thousand tons of organic waste, and the current level of waste is 27 thousand tons (RRRA, personal communication, June 4, 2020; WasteServ, personal communication, June 12, 2020).

Maltese government has already planned that 10% of waste will be landfilled in the next ten years. Now in Malta, due to the contaminants in the organic waste stream, the product from the plant cannot be used for composting or other agricultural purposes. When the package of the food enters the biological reactor, it will also take more time to biodegrade. If the food packages start to accumulate, the reaction volume will decrease so that the efficiency of anaerobic digestion will decrease (RRRA, personal communication, June 4, 2020; ERA, personal communication, June 8, 2020; WasteServ, personal communication, June 12, 2020). To improve this situation and reach the goal, at least one plant will be converted into an Organic Processing Plant (OPP) for composting. For pre-treatment, there will be a mechanical sorting system to remove contaminants from the mixed stream. Then, this improved plant will have a pure organic waste stream rather than a mixed stream entering the facility. Eventually, the new product from separated waste via OPP will end up as good composting. On the other hand, if the waste is not separated correctly, less available organic waste will go to the OPP so that not enough organic waste is treated (RRRA, personal communication, June 4, 2020; ERA, personal communication, June 8, 2020; WasteServ, personal communication, June 12, 2020).

Furthermore, RRRRA notices that the domestic market for composting is saturated. There is no need for many composting products. And, it is not suitable for Malta to have several small biogas plants because Malta is just a small island (RRRA, personal communication, June 4, 2020).

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### 2.3.3 Lack of waste quantification

In general, most measurements of waste that reaches WasteServ's facilities are made in terms of mass, which is tons. However, there are measurements made in terms of carbon footprint equivalent when any material is sent to the landfill. Apart from that, there is no measurement in terms of monetary value for organics as they do not have a market for the products after waste management. For recyclable material,

there are monetary values attached as they are then sold as resources to producers outside the country (WasteServ, personal communication, June 12, 2020).

By October 31<sup>st</sup>, 2018 approximately 25,000 tons of organic waste had been collected and about 21,500 by the same time in 2019. However, the source of the waste is unmentioned (Cilia, 2019). This is the closest we can reach in terms of quantifying the amount of waste generated in Malta. The specific quantities for supermarkets do not exist as they are only measured at the weighbridge that is at the start of the waste treatment process.

On average it is seen that Maltese nationals produce 200 kg waste per year while tourists produce 700 kgs waste per year. Average waste generation is quite high, and treatment is a key aspect on an island which is relatively small (WasteServ, personal communication, June 12, 2020). In most cases, a booming economy relates to higher waste production. However, due to the COVID-19 pandemic, the economy has slowed and in parallel, the amount of waste produced is also reduced. It can be expected that this will return to normal once the Pandemic situation has passed (WasteServ, personal communication, June 12, 2020). This means that the general expectation is that the amount of waste that is generated from supermarkets is also affected by changes in tourism and quantification can help to identify any trends if any.

Currently, the NSO, ERA, and WasteServ are working on the classification of organic waste. WasteServ is only able to provide the household fraction but is unable to do so in other sectors as the waste is not quantified at the source. There are some statistics on the amount of commercial and industrial waste, but this is not sub-classified into producers like restaurants, hotels, and supermarkets. This information is still unavailable.

The ministry is now working on a new waste management plan for commercial and industrial waste quantification and collection. A key point to note is that the carriers are a private entity and it would depend on them to quantify the waste as they will know the sources and WasteServ can only collect data based on the carrier and not the origin of the waste.

### 3 Suggestions

Based on the current situation in Malta and literature research, this chapter will provide some suggestions on how to reduce and repurpose food waste through infrastructural or technological approaches.

#### 3.1 Reducing food waste by food suppliers and the retail sector

In chapter 2.1, some problems in the retail sector and supply chain have been mentioned. Even though some of these issues may be addressed through technological or infrastructural solutions, some may only be addressed through policy support. Pitkalija and small shops do not have sufficient cooling facilities. This is not due to a lack of available refrigeration technology, but because they cannot afford the cooling facilities economically. One possible solution is to give farmers and small shop owners some subsidies to buy refrigeration equipment, though, as mentioned above, this has to be discussed in a political context. Similarly, overproduction is a problem of human behavior, which originates at the suppliers. One possible solution could be to establish an institution at the national level, which gives farmers some planting suggestions. That way, production could be tailored towards the actual demand.

The following paragraphs will focus on technical and infrastructural solutions that may be applied in Malta. The first suggestion is to promote apps such as “Too Good To Go” in Maltese supermarkets to sell surplus food at lower prices to customers. Such apps would incentivise consumers to buy food that is close to the expiration date by discounting the cost of such food. This may lead to a reduction of food waste by supermarkets. This suggestion is quite feasible because this app has been used in various countries in Southern Europe including Italy, France, Spain, and Portugal, which has a similar cultural background as Malta. Furthermore, apps like “Too Good To Go” have received positive feedback from Framtiden i våre Hender, the largest environmental NGO in Norway. It was claimed that supermarkets loved this kind of smart solution (Framtiden i våre Hender, Personal Communication, June 3, 2020).

A second suggestion could be to utilize suboptimal food products and sell these products at a more affordable price (ReFED, 2018). As discussed in chapter 2.1, the suboptimal food products are fruit or vegetable which are ugly or weird in appearance but still fresh and tasty. There may be some potential barriers to utilizing suboptimal food products. For example, the shelf space at the retailer is limited; the logistics may be a barrier; the retailers may be concerned about the negative impact of suboptimal food products to their brands; the introduction of suboptimal food products may intensify competition and increase the total supply, thereby affecting the sale of optimal products (de Hooge et al., 2018). Though, through educational efforts and an appropriate supermarket layout, this strategy could lead to a reduction in food waste, not only on the retail level, but also at the level of the suppliers.

The third suggestion could be to use the spoilage prevention packaging which can extend the shelf life of food products. There are two types of packaging. A modified atmosphere packaging is a static technique. One demonstration of this technique is, instead of ambient air, filling nitrogen gas into the internal atmosphere of the packaging unit. An active and intelligent package is a dynamic technique, which can absorb or release certain compounds from or into the internal atmosphere of the packaging unit. One demonstration of this technique is to absorb ethylene, a ripening agent emitted by fruits and vegetables (Porat et al., 2018). Though, there may be a potential economic barrier. The cost of the spoilage prevention packaging is covered by either the supplier or the retailer. However, it is unclear whether consumers are willing to pay more for food products with a longer shelf life (ReFED, 2018).

The fourth suggestion is a combination of advanced logistics and cold chain management, and dynamic pricing and dynamic shelf life (DSL). Dynamic pricing is a strategy that adjusts the price constantly according to the remaining shelf life of the product. Similarly, DSL is a strategy that adjusts the expiration date of the product based on the monitored data which will be elaborated below. Keeping fresh food at their optimal storage temperature and maintaining the cold chain from harvest through the sale is the ultimate goal. However, optimal conditions may not be fulfilled in reality. Therefore, proper monitoring of storage and transportation conditions becomes an essential component of advanced logistics. The monitored data can be further combined with large sets of initial variables and the results of sampling when arriving at the retail logistics center. By gathering these data, the retailers can formulate a distribution plan and estimate the expected expiry date of fresh food. According to the expected expiry date, dynamic pricing and DSL may be applied (Porat et al., 2018) There are some barriers to this suggestion. First, DSL is only in the research phase without any commercial application. Second, sensors in food packaging are currently illegal (M. Buisman, WHU – Otto Beisheim School of Management, Personal Communication, June 9, 2020)

### 3.2 Strategies to improve the food donation system in Malta

As suggested above, some of the major issues in the food bank system are related to the donation-, the handling-, the storage- and the distribution infrastructure. Since every food bank operates differently, a strategy to address some of the infrastructural issues is to develop a more centralized food donation system. This may be achieved in many different ways, of which some of them will be outlined in the following section.

One way to potentially bridge the gap between food donors, in this case the retail sector, and food banks could be an intermediate organization. As explained by a representative of Framtiden, transparency, and collaboration between supermarkets and food banks is needed. An example of such an organization is BOR-OUME, in Greece. They act as an intermediate organization diverging surplus food from markets to food banks. This is done through a database of charities and markets, which connects the closest ones to one another. Therefore, this organization can support a relatively low-cost and logistically efficient donation system (BOROUME, personal communication, June 4, 2020).

Even though food-handling and food-storage could be supported by technological innovation, food banks currently handle food donations manually. As mentioned above, food safety is mostly determined through visually examining the donations. Though, to ensure proper storage conditions, dynamic shelf life may be useful (Gharehyakheh et al., 2019). This concept is further elaborated above. The main reason to use such a system would be to ensure food safety as well as prevent food waste in the food bank itself. Another major storage concern is related to storage capacity. Food banks with limited storage space and suboptimal stocking systems may not be able to accept all food donations that are offered to them, leading to food being wasted. A technological approach to make stocking more efficient could be a stocking application, similar to the ones used in supermarkets. Such an application could not only give information about the current stock but also correctly estimate the amount of donations that could still be accepted. This could reduce manual inventory labor significantly as well as potentially reduce food waste from retailers (Malta Food Bank Foundation representative, personal communication, June 11, 2020).

In terms of improving storage facilities and standardizing the entire donation infrastructure, a guiding and binding legal framework would have to be developed in order to centralize food banks in general. As long as there are liability issues in regard to food safety and standardized procedures for food banks, donors and beneficiaries, infrastructural and technological solutions cannot solve the above-mentioned problems.

### 3.3 From landfilling to recycling and repurposing

#### 3.3.1 Waste separation for improved recycling and recovery

##### Suggestions on food waste separation practices

Feedback from the interviewee of WasteServ (personal communication, June 11, 2020) indicates that organic food waste from the retail sector has a good quality for biological treatment. However, many organics recycling systems do not tolerate any contamination and failure will discourage businesses from continuing with the system (Bremner et al., 2013). Thus, the suggestions will be presented on prevention or removal of contamination of the digestible components.

- The separation from other streams

The food waste should be directly collected from retail sectors by contractors and therefore the quality can be monitored by collection crew. So, the best way is to put the supermarket into the existing municipal waste collection system and give the carriers the obligation of supervision. This will force retail sectors to classify their waste correctly. This approach has been successful in Sweden, the truck drivers examine the quality of the food waste by checking the skips when emptying them. the improper waste sorting is reported and the relevant person in charge will be informed. The pollution of food waste is well controlled, and the content of non-food components is reduced to 1.2% (Al Seadi et al., 2013). To achieve this method, various private carriers should work together to develop a mutual food waste collection scheme and obtain the support of policies. The risks of penalty from the local council or the incentives can promote the retail sectors to separate their food waste from other streams (ReFED, 2018). At the same time, the corresponding infrastructure (e.g. trucks, bins and sacks) should also be improved, especially for small local shops and Pitkalija. Another important thing is that multi-compartment vehicles should be chosen for transportation in order to avoid contamination by impurities (e.g. paper, plastic and glass). This concept has already been an initiative part of the Sort It Out campaign and should be put into practice (Roadshow, 2020).

- The removal of packaging contamination

As mentioned before, the increasing contamination of packaging hinders the repurpose of food waste in Malta. Thus, de-packaging equipment should be applied to produce high-quality organic waste free from impurities and therefore mitigate this issue. It is an essential preconditioning step of proper food waste management, which can alter the waste hierarchy by preventing food waste from ending up in a landfill (Lewis et al., 2017). WasteServ is considering the installation of the de-packaging equipment to take good advantage of the food waste from retail sectors (WasteServ, personal communication, June 11, 2020). A cost-benefit analysis report from MacDonald et al. (2019) shows that it is profitable to adopt the equipment within a composting system and it can also facilitate other uses of the organic food waste.

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### 3.3.2 Moving away from landfilling as an end-of-pipe treatment

As mentioned above, there is a plan for Malta that 10% waste will be landfilled in the next 10 years, the mechanical biological treatment plant will have some improvements and the construction of incineration will be considered. It is sensible that Malta has already known the running out of space for landfilling and started to optimize the treatment process. The result brought by this change is worth looking forward to.

In recent years, some research might be helpful to the current situation in Malta and can also be supporting evidence for the plan. In 2013, Pirotta et al. claimed that the municipal solid waste incineration implementation had a decisive benefit for Malta because of savings in land use (Pirotta et al., 2013). The construction of the incinerator had already been planned. Some examples from other countries are also worth learning from. In the United States and Canada, Levis et al. (2010) argued that there were some implementation issues about the aerobic composting and two anaerobic treatment of source-separated organic wastes to be addressed, “project economics and feedstock purity” (Levis et al., 2010), which could be attention for the facilities in Malta, especially the importance of waste collection and separation. In Thailand, Ali et al.

(2012) illustrated that for green markets, it was environmentally and financially advantageous to convert organic waste into biogas. Also, the ratio between benefit and cost was three times higher after conversion (Ali et al., 2012). The construction of biogas plants might be a good idea, but its size and number should be carefully considered if there are too many waste treatment plants. In the United States, the Water Resources Recovery Facility (WRRF) with AD had already been used. WRRF with AD required transporting waste by truck or through pipes to the WRRF so that the waste could be treated with AD (ReFED, 2018). For the situation in Malta, transporting waste by truck will be more suitable for its small size.

In addition to those traditional treatment processes, there is an innovative technology worth considering. Insect-based bioconversion of food waste provided a special perspective on the sustainable development of food waste (Fowles & Nansen, 2020). In 2020, Fowles and Nansen stated that “it enables food and feed production in densely populated areas (urban settings) and therefore goes against the common notion that urban development and food production are antagonistic” (Fowles & Nansen, 2020, p. 339). The most common commercial insect species are mealworms and black soldier fly which are used for bioconversion. During several years of development, this kind of treatment has been established, profitable, and moving into the world (Fowles & Nansen, 2020). The feasibility of this technology can be considered after the plan has been conducted.

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### 3.3.3 Implementation of waste quantification

The major focus with regards to quantification is to be able to distinguish the sources and the associated amounts. As it stands, this is clear for domestic waste streams. However, a similar approach is needed for the commercial sector as the waste produced is currently mixed and only measured at the treatment site.

The expansive policy will be required to ensure that commercial entities are forced to quantify how much waste they produce and segregate it. However, this needs to be completed with financial support for smaller organisations. The NSO feels that more data collection means a higher cost and this needs to be offset for the plan to work.

There is a new waste management plan expected as the current one runs till 2020. WasteServ has indicated that there are plans meant for data collection and waste separation for commercial entities. It would be key that the plan employs separation at the source and quantification as well. This can be done in the simple form of weighing the waste at each collection point or from each point source and keeping a record of the information. This would be tough to implement and needs to be worked out well to allow small scale companies to be a part of the system without a financial setback as a part of trying to comply with new regulations.

Moreover, stricter rules are needed to ensure that there is no diversion of organic waste to feedstock as the quality may be bad and this also affects the data produced. Similar measures will be needed for small entities that use local council collection for their use. In conclusion, there are major steps that need to be a part of the new waste management plant to allow for the quantification of these waste streams.

The major hurdle that has been observed is that of a lack of data with regards to the amount of waste produced from supermarkets. Moreover, supermarkets were uncooperative in sharing information which further made understanding the system difficult. These aspects need to be urgently addressed in order to tackle the issue of food waste in the Maltese retail sector. Once the actual practices are understood, it provides scope for improvement. The major segments that need clarity in terms of hard data are that of waste production, supply chain, and retail practices. Furthermore, these need to be collected over a period of time to understand trends and paint the whole picture. The upcoming waste management plan will need to include the necessary changes to tackle these deficiencies. This means that the required duration to see a change for the better will take a relatively large period of time and it is crucial to constantly push and collect as much data as possible. This will help streamline the process and also include any potential outliers or odd cases which is important in a complex system. With respect to the general research question (What are the current food waste streams and what are the infrastructural and technological practices for food waste management?), we were able to see that quantification is lacking. With Food banks, infrastructure and cohesion can be improved. Waste management and treatment units need better separation and purer waste streams to help generate useful products from the final organic waste that is produced.

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EXPERT REPORT NO. 4

# SOLUTIONS ORIENTED



## WRITTEN BY

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## 1. INTRODUCTION

Malta is one of the largest producers of municipal waste in Europe (Eurostat, 2017), with retail food waste being a significant component of it (Monier et al., 2010). With food waste and its impacts becoming increasingly relevant, the need for robust solutions to tackle this issue is becoming more pressing. To address retail food waste in Malta, the political landscape, social practices and technology and infrastructure are critical areas to intervene in this food system. Notably, there is a range of solutions available, often focusing on attitudes and behaviour of individuals, such as awareness-raising campaigns (Närvänen et al., 2020). Increasingly, food waste interventions comprise both behavioural economics (Wansink, 2018) and technological innovations (Hebrok & Boks, 2017), which are used to complement knowledge intervention. Furthermore, other policy-level solutions regarding changing legislation, setting legal obligations as in France and Italy (Vaqué, 2017), norms and standards related to labelling, product standards and food donation are also prevalent (Gruber et al., 2016). However, many of these solutions are still emerging and are context dependent.

A solution-oriented analysis was conducted to investigate food waste reduction strategies that can potentially be implemented in Malta. The focus of the solution-oriented analysis is on the retail sector, as it maintains a critical position in the supply chain (Evans, 2011). This analysis is performed in support of the overall purpose of the project found in the synthesis report: *"To analyse current food waste practices and suggest strategies to reduce and repurpose food discarded by the retail sector"*. This solution-oriented analysis assesses food waste reduction strategies implemented across the food supply chain as well as solutions implemented by non-supply chain actors, both in Malta and in foreign countries. Since food waste is a wicked problem there is simply not one solution to solve it (Weber and Khademian 2008). As such, it requires various actors to be engaged at distinct levels and with different activities (Evans, 2011). Moreover, private, public and third sector organisations, namely, NGOs need to be involved in activities and solutions regarding food waste reduction (Närvänen et al., 2020).

Prior studies have identified and addressed the complexity of food waste by adopting the following approaches: a food systems approach (Galli et al., 2019); a food waste regime approach (Gille, 2012); or a service ecosystem perspective (Baron et al., 2018). These prior studies have highlighted that in accomplishing system change, institutional structures need to be disrupted. There is a need for integrated solutions, stand-alone solutions regarding technology for instance, will not suffice. Chosen solutions need to be synthesisable between each other and within the system. Additionally, it is recognised that food waste is a system-wide challenge across various levels as well as between levels, requiring sustained and coordinated efforts primarily focused on waste prevention. However, through the transition to more robust food waste strategies, it is important to highlight approaches for Environmental Non-Governmental Organisations ((e)NGOs) working with governmental bodies and businesses to thrive in the upcoming challenges (Närvänen et al., 2020).

### 1.1 RESEARCH OBJECTIVE

The objective of the solution-oriented analysis is to develop a roadmap of suggested strategies to be developed and implemented in Malta by the retail sector possibly with the aid or facilitation by Friends of

the Earth Malta (FoEM). Therefore, this report delves into 1) lessons learnt from food waste initiatives inside and outside the Maltese context; 2) the previous expert reports (Policy & Stakeholder, Food practices and Infrastructure and Technology) applicability in Malta (Expert reports no. 1-3); and 3) potential roles that (e)NGOs can take on to manage food waste. These aspects are vital in determining the roadmap and finally, communication methods which can be used by FoEM to support their actions are highlighted. This report is written in support of the synthesis report.

## 1.2 RESEARCH QUESTIONS

The main research question of this research is:  
*Which strategies can FoEM implement to reduce and repurpose food waste in the retail sector?*

This research question will be answered with help of the following specific research questions:

1. *Which lessons can be learnt concerning food waste reduction strategies in Malta?*
2. *Which lessons can be learnt concerning food waste reduction strategies outside Malta?*
3. *Combined with insights from the other expert groups, to which extent are these mapped strategies applicable in Malta?*
4. *What is the role of FoEM in the abovementioned strategy?*
5. *Which communication methods should FoEM use while executing the earlier designated strategy?*

## 1.3 METHODS

To answer the research questions, a combination of surveys, interviews and a literature review was used. Surveys were used to gauge the acceptability of proposed solutions; interviews were conducted to gather potential strategies related to the research questions, and the literature review served to support each stage of research performed. For the surveys, three responses were received for the supermarket manager survey and the consumer survey received 259 responses. The survey responses of the consumer survey were used qualitatively to support relevant findings. For the interviews, in total, 37 interviews were conducted by Team Malta. Of those 37 interviews, 15 were initiated and carried out by this expert group. The complete list of interviewed parties and their respective initiatives can be found in Annex I. The parties were interviewed to get a broad range of strategies which would partially or wholly apply to the Maltese context. Also, the results of the interactive session from the preliminary results session were used to support the findings in Chapter 5. Overall, the interviews comprise this research's primary data source, which is supported by literature review and to a lesser extent, the survey outcomes.

## 1.4 REPORT ROADMAP

The main outcomes of this research can be found in Chapter 2-Food waste reduction strategies in Malta, Chapter 3- Lessons learnt from food waste reduction in other countries, and Chapter 4 –Strategies and their applicability. These outcomes have been compiled into the final product, which is a roadmap for food waste reduction and repurposing strategies in Malta, see Chapter 5- Food waste reduction roadmap

Malta and the role of FoEM. Lastly, Chapter 6- Communication methods for FoEM, supports the key action steps in the roadmap. The conclusions for this expert group can be found in Chapter 7.

## 2. FOOD WASTE REDUCTION STRATEGIES IN MALTA

In this chapter, the findings are formed from literature review, grey literature study and interviews. The relevant food waste reduction strategies that have been implemented in Malta were mapped. These strategies were split into strategies aimed at raising consumer awareness initiated by non-supply chain actors (Figure 1) and strategies initiated by actors within the supply-chain (Figure 2). Resulting from the identified Maltese strategies mentioned in this section, the main findings and lessons learned were drawn up. The strategies and lessons are further elaborated upon in the next two sections.

### 2.1 CONSUMER AWARENESS RAISING INITIATIVES BY NON-SUPPLY CHAIN ACTORS

Many of the actors involved in raising consumer awareness are governmental actors, businesses, or Maltese NGOs. The strategies initiated by these actors can be found in Figure 1. In the Maltese Waste Management Plan (WMP), food waste reduction is mainly targeted at a household level. The plan states that "reducing food waste essentially requires raising people's attention to their consumption patterns as well as changing their behavioural patterns" (Ministry for sustainable development the environment and climate change, 2014, p. 187). Around 22% of purchased food ends up in the households' bins combined with the solid waste stream. The root of this issue includes incorrect purchasing patterns, incorrect storage, confusion between 'best by' and 'use by' labelling and overestimating one's food portions. The WMP supplies an action plan mentioning strategies that could be implemented to reduce consumer food waste, including awareness-raising (Ministry for sustainable development the environment and climate change, 2014). The Ministry for the Environment, Climate Change and Planning (MECP) is working on the upcoming WMP for the Maltese Islands 2021-2030, including a Waste Prevention Programme (WPP). According to A. Mifsud from MECP (personal communication, June 16, 2020), this WPP will also focus on food waste in the commercial sector.

From interviews with Maltese NGOs and other stakeholders, it could also be concluded that there is little focus towards reducing and repurposing surplus food in the retail sector. Just like the WMP, their focus is mainly at the consumer level. Ekoskola, for example, created educational packages that schools can implement focusing at educating children about food waste. This way, Ekoskola tries to reach out to the community through children. Even though the project has ended, schools continue to teach the contents of the project, showing a "change in mentality" (C. Caruana, personal communication, June 3, 2020). Ekoskola believes their project has proven to be effective, as they claim that there have been changes in behaviour on a household level. Also, in the consumer survey, Ekoskola was mentioned multiple times as successful strategy. Another consumer awareness raising initiative is the Stop Waste Campaign, launched by the General Workers Union early 2020. This campaign took place through social media due to COVID-19. The main focus was on plastic wastes, but part of the campaign included tips on how to reduce food waste (J. Spiteri, personal communication, June 4, 2020).

The Maltese government has also been involved in educational and awareness-raising campaigns about household's food waste reduction. These are TRIFOVAL, focusing on food waste prevention and recycling,

and the “Don't Waste Waste” Campaign, which involved 30 supermarkets promoting SMART shopping (a concept taken-up in the waste management plan to encourage customers to reduce impulsive buying) (A. Mifsud, personal communication, June 16, 2020).

Nevertheless, despite these efforts to educate consumers, K. Attard from Malta University, and mayor of Qrendi D. Schembri argue that (the little) educational campaigns so far do not seem to be effective (personal communication, June 13, and June 5, 2020). Besides, D. Schembri, A. Mifsud, and J. Spiteri and K. Gatt from Malta University claim that there is little awareness and lacking discipline and social and environmental responsibility towards reducing food waste amongst the Maltese (personal communication, June 5, June 16, June 4, June 9, 2020). It is no wonder P. Spiteri from San Giljan local council states that "One of the key issues about food waste is education, I think we are still missing a lot" (personal communication, June 4, 2020). It could very well be argued that more consumer awareness on the impacts of food waste is an essential basis for change in attitude and practices to waste less. Increased consumer awareness could create an incentive for supermarkets to change their wasting behaviour (Moore, 2001). Supermarkets could, for example, use food waste reduction as a promotion strategy to attract more and new customers. This possibility is substantiated by K. Attard (personal communication, June 13, 2020), who stated that "Shifting the attitudes of consumers is important, which will be good to retail sector as well." For this, K. Attard argues that educational campaigns are needed on regular basis, to stress the importance (K. Attard, personal communication, June 13, 2020). The consumer survey respondents also highlighted the need for educational programs, when asked the question about food waste in Malta: "Do you have any suggestions for solutions?"

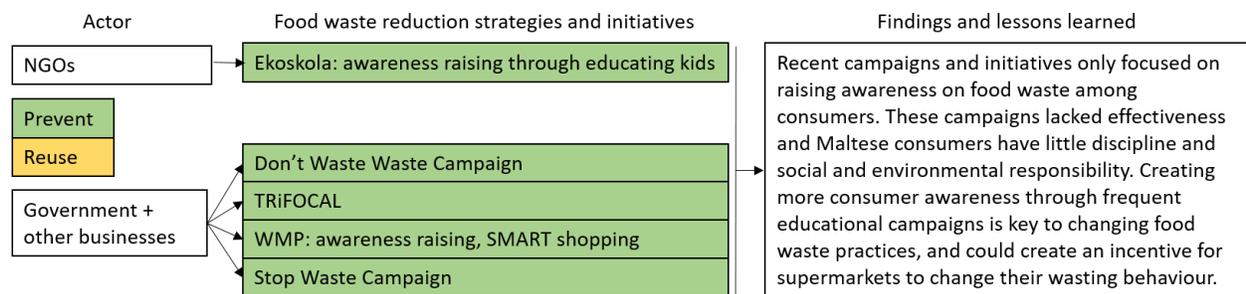


Figure 1 Food waste reduction strategies aimed at raising consumer awareness that have been implemented in Malta by non-supply chain actors, including the lessons learned.

## 2.2 INITIATIVES BY SUPPLY CHAIN ACTORS

Multiple actors within the supply chain are involved or have been involved in strategies to reduce or reuse food waste. However, to our knowledge, little projects have been set-up in Malta that target food waste management specifically in supermarkets or at the Pitkalija, except for measures taken by supermarkets and Pitkalija themselves. The strategies initiated by supply chain actors, as mapped in Figure 2, will be elaborated on in the paragraphs below.

Only few supermarkets in Malta have implemented strategies to reduce food waste. Lidl, Smart, GS and Littles use discount stickers to nudge people to buy products closer to their expiry date (A. Brincat, personal communication, June 12, 2020; K. Zimmit, personal communication, June 5, 2020). From the Facebook pages of larger supermarkets like Pavi-Pama, Greens, Park Towers and Valyou it appeared they have regular sales, offers and seasonal lotteries on items, especially fresh products. Discounting products close to expiration is a relatively simple strategy to prevent food waste at supermarket level. Therefore, it would be good if more Maltese supermarkets start implementing this strategy. Another strategy that some supermarkets, like Littles, implement includes take back agreements, where retailers return unsold goods to the supplier for money or new goods (K. Zimmit, personal communication, June 5, 2020). Dependent on how the supplier disposes of the waste, this approach can be seen as food waste reduction. As long as supermarkets receive money or fresh goods for returning their food, this economic benefit is, of course, beneficial over a donation. Consequently, take back agreements form a barrier to the desired approach to redistribute surplus food to foodbanks and charities. This is also illustrated by K. Zimmit from Littles, who said that “Sometimes I do have products suitable for the foodbank. However, those are only 1 or 2 boxes with products that can be sent back to the supplier, which gives me some money back. If food is not taken back to the supplier, I will certainly consider it [donation]” (K. Zimmit, personal communication, June 5, 2020). Only a handful of supermarkets donate surplus food to foodbanks or NGOs, such as YMCA or St Jeanne Antide Foundation, who then redistribute it to those in need. Supermarkets donate without any publication or formalization of agreements as they are afraid that it will affect their sales or profits (K. Attard, personal communication, June 13, 2020). Besides, lacking infrastructure for redistribution and fragmentation of foodbanks form a grand barrier for supermarkets to donate their food (I. Schembri, personal communication, June 11, 2020; Gabriele, personal communication, June 4, 2020). In order to enable more supermarkets to donate their surplus food on larger scale and regular basis, these issues should be dealt with.

Apart from strategies initiated by supermarkets themselves, only one other initiative was found that (partially) targets supermarket waste. This initiative was launched by Green Skip Services, a waste management company, supported by the Malta Community Chest Fund, to distribute food donation boxes to supermarkets around the country. Supermarkets and also its customers are encouraged to donate items in the boxes, after which they are distributed by partner NGOs to those in need (Ganado, 2018; Malta Independent, 2018). These partner NGOs include Foodbank Foundation, St Jeanne Antide Foundation, Ursuline Homes, Caritas, SOS Malta, and the Millennium Chapel. The initiative from Green Skip Services is part of a National Food Drive, aimed at consolidating and supporting food-collection projects already carried out by various NGOs. Starting in 2018, 16 collection boxes were distributed over several supermarkets. The director of Green Skip Services aimed at eventually placing a box in every supermarket and shop in Malta and Gozo (Ganado, 2018). Whether this goal has been reached by now is unclear. Besides, the impact of this project to reduce supermarket food waste is doubtful, since mainly the customers are encouraged to donate food in the, relatively small, food collection boxes (Ganado, 2018; Malta Independent, 2018).

Aside from supermarkets, focus is also on food waste reduction at the Pitkalija. From an interview with Pitkalija CEO M. Vella Bonnici (personal communication, June 11, 2020) it appeared that they have recently started taking action to reduce the amount of edible food being thrown away. They initiated a foodbank to collect food which is not sold and distribute this to other foodbanks. Though, this foodbank is only operating when a variety of products with long life span are surplus, most often due to overproduction by farmers. Besides, they are working on reform by writing up an agreement between stakeholders to design the best operating scenario. These initiatives sound promising, but it is still a work in progress, and more work still needs to be done to eliminate wastage of surplus food.

Wasteserv, at the end of the supply chain, organized a national campaign in 2015 about food waste using booklets, seminars, workshops, visual tools, and a Facebook competition (K. Attard, personal communication, June 13, 2020). This campaign was also mainly focussed at raising awareness and educating consumers on how to reduce food waste. Earlier statements made about lacking effectiveness of campaigns also apply to Wasteserv's campaign and raising awareness through more frequent campaigning could create an incentive for supermarkets to change their wasting behaviour.

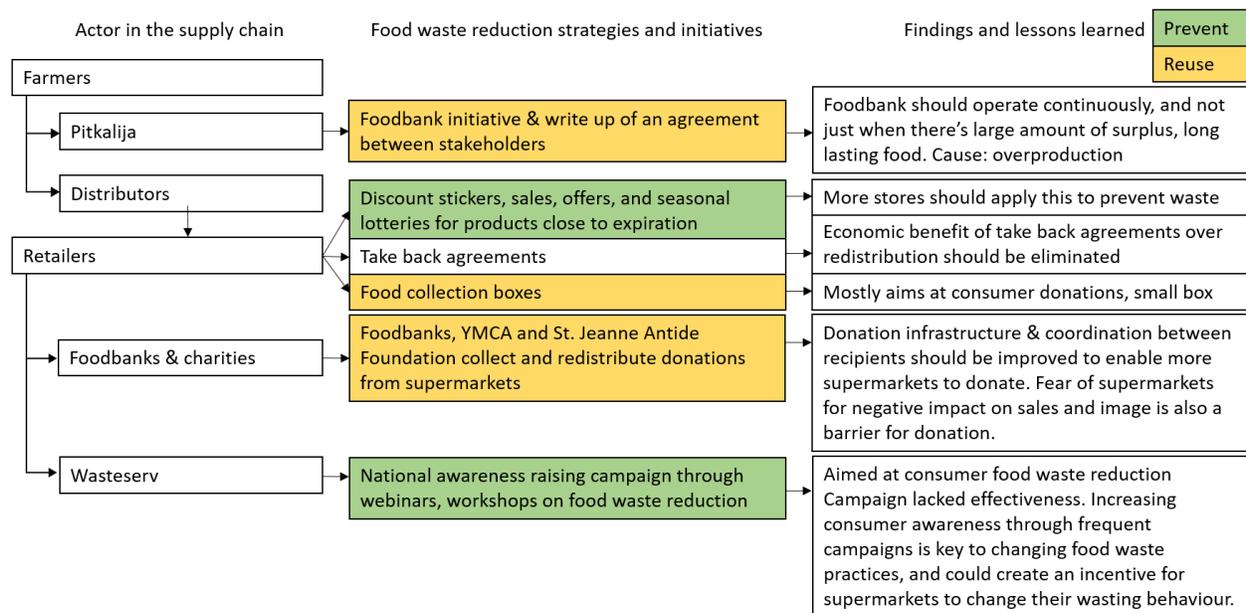


Figure 2 Food waste reduction strategies that have been implemented in Malta by supply chain actors, including lessons learned.

### 3. LESSONS LEARNED FROM FOOD WASTE REDUCTION STRATEGIES IN OTHER COUNTRIES

This chapter examines initiatives being undertaken outside the Maltese borders. The elaboration on these initiatives is based on the conducted interviews. An overview of the food waste reduction strategies outside Malta, the type of organisations interviewed, the country and the key interviewee details can be found in Annex I. From analysing the interviews, some valuable lessons could be retrieved. This choice of lessons does not pretend to be complete or indispensable. However, it helps to identify potential pitfalls when implementing food waste reduction strategies and gives an overview of do's and don'ts, from which FoEM can learn when designing and implementing strategies in Malta.

### 3.1. HIGHLIGHT (FINANCIAL) BENEFITS TO GET THE RETAIL SECTOR ON BOARD

The retail sector is primarily profit-driven, as initiatives that do not render a specific monetary benefit are hard to implement. Based on the conducted survey, an outstanding 80% of the respondents think that supermarkets should have a high responsibility in reducing retail food waste. 75% Of the people strongly agreed with the statement that more regulation for supermarkets is effective to decrease food being wasted. Extinction Rebellion Malta states that supermarkets are not that willing to cooperate in initiatives focused on reducing food-waste (personal communication, May 28, 2020). Also, D. Chorafa (personal communication, June 6, 2020), indicates that getting supermarkets and farm-markets on board can be a challenging task. The organisation Lipor conducted a project that prevented part of food in restaurants being wasted by introducing meal boxes in which people could take leftovers to their homes (S. Freitas, personal communication, June 4, 2020). This finding is supported by P. Capodistrias (personal communication, June 3, 2020), working at the Norwegian organisation Matsentralen. P. Capodistrias stated that "supermarkets do not need you", so you always have to think about what you can offer to them in return when you want them to cooperate. Also, in the interview conducted with L. Palumbo (personal communication June 5, 2020), working at the organisation Lovin Spoonfuls, it became clear that federal tax deduction and cost reduction in waste hauling motivate retailers to cooperate in their program. Thereby Palumbo state that besides related monetary reasons, the morale of the employees contribute to the motivation to cooperate. A successful example of getting the retail sector involved in a food-waste reduction initiative comes from Fruta Feia. Fruta Feia prevents ugly fruits from being wasted by picking it up from farms and directly distributing it to the supermarkets. Due to this direct link, transportation costs are lowered with the result that the price in the supermarkets can be lower than the average price for fruits. This competitive advantage in pricing makes the practice attractive for supermarkets. (M. Canelhas, personal communication, June 3, 2020).

To get organisations in the retail sector on board regarding initiatives about food waste reduction, there are various communication methods that can be useful. Mrs L. Palumbo from Lovin Spoonfuls indicates that face to face meetings with store managers or corporate contacts is the best way to get most parties on board (personal communication, June 5, 2020). Keeping communication lines short is also stressed by Powers (2001). S. Freitas adds to this that often, younger people are more willing to cooperate in projects regarding sustainability and so food-waste reduction than the older generation (personal communication, June 4, 2020).

There is another way of getting organisations on board that should be highlighted. Here, positive aspects of the initiative (in this case, a food donation-app) are communicated towards the targeted organisation. These advantages can be, for example, a reduction of waste disposal costs, brand promotion, CO2 footprint reduction, increased staff engagement and strengthening relationships with the community due to connections between supermarkets and charities (FoodCloud, n.d.). Young (2012) also mentions these advantages, together with increased environmental awareness of companies and access to knowledge, as drivers of forging relationships between NGO and supermarket.

Besides the retail sector, financial benefits can also influence the shopping behaviour of consumers in supermarkets. The results of the conducted survey showed that 80% of the people agreed that a lower price for products close to expiring is an incentive to buy these products.

### 3.2. DISCUSS RESPONSIBILITIES REGARDING CONSUMPTION AFTER EXPIRATION DATE

This lesson is mainly retrieved from the organisation Lipor, the project undertaken involved restaurant food waste. It turned out restaurants were hesitating to cooperate in the project because they were afraid of food poisoning for people that brought the food home. S. Freitas indicates that it is crucial to discuss responsibilities regarding the food that is consumed after it left the (in this case) restaurant on forehand (personal communication, June 4, 2020). L. Dias working for Zero Desperdicio also noticed that restaurants are cautious about providing food surplus because of safety reasons (personal communication, June 12, 2020).

For these reasons, FoodCloud has implemented an industry standard to ensure that food is collected and delivered in a safe condition. This standard infers that businesses may only supply food that is within its use-by date. Besides, the food should be treated per the food safety legislation. Concerning supermarkets, when a charity comes to collect the food that the supermarket put up for donation, the charity has the right to refuse the food if they think it is not suitable for consumption. As soon as the charity collects the food, food safety becomes their responsibility, and they should ensure that the food is treated in line with the food safety legislation. Besides, a charity can only register for FoodCloud if it has its food safety management system, including food safety training (FoodCloud, n.d.).

### 3.3. FACE TO FACE CONTACT WITH INVOLVED PARTIES ON A REGULAR BASE

Lipor stresses that staying in contact is essential to tackle problems in an early stage and to get a better understanding of how the involved actors perceive the project (S. Freitas, personal communication, June 4, 2020). Earlier, L. Palumbo indicates that face-to-face contact helps to get organisations on board. She also states that Lovin Spoonfuls has all of the vendors on a set schedule, so usually just when we are on-site to make pickups. In regular times, however, (before COVID-19) Lovin Spoonfuls also does quarterly visits to each store separate from a pickup to reinforce the relationship and offer training. Thereby, e-mail contact also happens quarterly (personal communication, June 5, 2020).

### 3.4. SUFFICIENT DISTRIBUTION OF RESOURCES MATTERS

In practices where food is donated from the retail sector to social causes like foodbanks, the right transport is highly important. In Mediterranean countries, vehicles with refrigerators are essential in transportation (D. Chorafa, personal communication, June 6, 2020). The practicability of implementing a good transport strategy, as well as the concrete design of the strategy can differ a lot per country. In Mediterranean countries cooled transport is more critical than in Northern, colder climates. Thereby, distances between donor and receiver of potential food-waste in, for example, Norway can be significant. This difference makes transport of food close to expiring an even more significant challenge (P. Capodistrias, personal communication, June 3, 2020).

### 3.5. RELIABLE FOOD FLOWS

To get potential organisations involved, one has to ensure a stable business. The pick-up, as well as the delivery, has to be constant so that organisations can count on you. Fruta Feia, for example, buys exact amounts of goods from farmers on regular intervals for set prices, so there is no haggling. This systematic agreement made the farmers desire to cooperate. Trust is of high importance, and trust can be strengthened by a stable business (M. Canelhas, personal communication, June 3, 2020). In the retail sector, especially on small scale with few supermarkets involved, creating a stable flow is a challenging task. The reason can be found in the continuously changing amount of offered food waste. S. Migliore & G. Baroni add that to transform the work of a facilitating NGO into a successful service; cooperation with other NGOs or social communities is essential. This cooperation pushes the success into a larger scale (personal communication, June 11, 2020). Also, L. Palumbo from Lovin Spoonfuls experienced that "the concern of supermarkets about liability can be a reason for them to reject cooperation" (personal communication, June 5, 2020).

### 3.6. EDUCATIONAL PROGRAMS CAN BE HELPFUL TO RAISE PUBLIC AWARENESS

Educational programs are standard components in services provided by NGOs because public awareness is the main reason NGOs can exist. In Europe, the food waste problem is raising public concerns starting from 2011 when socioeconomic conditions, especially in Greece, Italy, and Portugal, turned negative, which formed a golden period for food waste NGOs to implement their strategies (Goldmann, 2014). The significance of educational programs could be witnessed in the interview with Boroume and Lipor. They offer independent educational programs to both their stakeholders and the public. They had workshops to illustrate how consumers, school kids, and residents could contribute to food waste reduction actions. Such seminars inspire NGOs to produce brilliant tips on a more sustainable living style, for example, by reducing food waste by using plastic bags to prolong the situation of vegetables. The need for more educational programs in Malta was further emphasized by Enzo Favoino from his experience in Malta and regarding European waste management (Zero Waste, personal communication, June 11, 2020). From the consumer survey, question 5 indicates that a lot of Maltese residents want to be better informed about food waste. Moreover, question 9 of the consumer survey indicates that a majority think that training supermarket employees helps to decrease food waste being wasted.

## 4. STRATEGIES AND THEIR APPLICABILITY

Following consultation with food waste reduction stakeholders outside Malta, these strategies must now be combined and extrapolated into the Maltese context. This chapter groups together the lessons learned from foreign experts and stakeholders into a set of different strategies which could be implemented in Malta and estimates the feasibility of these strategies. For every suggestion or strategy, the main limiting factors towards successful implementation are given, as well as the main advantages of implementing the strategy in Malta to combat food waste. The main limiting factors are the primary perceived obstacles or elements of uncertainty for FoEM to implement the said strategy in Malta, based on the outcomes of local stakeholder interviews in Malta and insights from other expert reports. The major advantages indicate the impacts that a specific strategy could have, including side-effects, to assist FoEM in creating a detailed food waste reduction strategy.

Finally, a feasibility estimate is given for every suggestion or strategy. This feasibility estimate is based on a loose set of criteria determined through the process of our research. The estimate comprises multiple strata, including whether a suggestion or strategy has been particularly successful in other countries and whether the suggested suggestion or strategy is easily adapted to the local Maltese context based on insights gathered from interviews with local stakeholders in Malta. The estimate is also based on specific opportunities in Maltese society and FoEM's perceived ability to overcome specific barriers and deliver the suggestion or strategy as an NGO. However, it is crucial to realise that feasibility estimate is formulated by a team of master students that are not familiar with the Maltese culture and its intricacies. The feasibility estimate should be treated accordingly. An overview of all strategies can be found in Tables 2 and 3 in Annex II.

## 5. FOOD WASTE REDUCTION ROADMAP FOR MALTA AND THE ROLE OF FOEM

### 5.1 ROLE OF (E)NGOS IN FOOD WASTE REDUCTION

The primary role (e)NGOs concerning food waste reduction is educating consumers, changing behaviour, and engaging businesses to promote sustainable consumption (Young, 2012). (e)NGOs especially play a pivotal role as partners with relevant stakeholders, such as policy actors, consumers, and businesses, in promoting sustainable production and consumption (SDG 12) (UN, 2015). This section will highlight the role(s) that (e)NGOs can take in reducing food waste across the supply chain. These insights are based on the various interviews conducted, qualitative findings from the supermarket manager survey, literature, and the interactive session of preliminary results presentation.

Firstly, from the analysed interviews a few suggested roles were highlighted. For example, according to G. Baroni from the Porta Palazzo project, (e)NGOs should take on a collaborative approach (personal communication, June 11, 2020). In the interview with Ekoskola, it was suggested that data collection and campaigns are essential, for instance, regarding the consumption of ugly vegetables (personal communication, June 3, 2020). Furthermore, they highlighted that two-way communication with other parties is crucial to engage in awareness-raising. (e)NGOs should be involved in this direct way of communicating. P. Capodistrias from Matsentralen stated that an eNGO provides valuable insight on the retail sector. To get supermarkets on board, cooperation is vital. An umbrella network should be created to collaborate with different chains, and research should be conducted on what opportunities you can offer them (P. Capodistrias, personal communication, June 3, 2020). Furthermore, businesses stand to gain a lot from forging relationships with (e)NGOs, such as (1) credibility of sustainable initiatives; (2) increased environmental awareness of companies; (3) access to knowledge and innovation; and (4) accessibility to their networks (Young, 2012). According to the three surveyed supermarket managers, most agreed to having a subsidy for supermarkets to donate food to food banks and better data collection on supermarket waste as practical solutions to be implemented in Malta. Furthermore, the supermarket managers highlighted that giving supermarkets space to produce their own initiatives and a mobile app with discounted items for the consumer, were practical solutions to be implemented in Malta. These solutions require FoEM to firstly to perform research on the approach of subsidies in consultation with governmental bodies. Furthermore, the remaining three suggestions can serve as part of a pilot project with retailers and other relevant parties.

Further to the roles of (e)NGOs aforementioned, the outcomes of the interactive session of the preliminary results presentation can be considered. The attending stakeholders answered the following question: "What role should (e)NGOs play regarding reducing food waste?" University professor Dr. J. Spiteri suggested that they act as a conduit between waste creator and end-user, but that support is needed in terms of infrastructure (as described in Chapter 2). One representative, D. Schembri from Qrendi Local council mentioned local campaigns. Moreover, P. Capodistrias from Matsentralen advised campaigns for a wide public and taking a political role to establish projects (personal communication, June 3, 2020). The suggestions made by these stakeholders can be implemented in Malta. For instance, for FoEM to act as a conduit between waste creator and end-user they could do this by providing a mobile app, mediating the donations or by supporting other NGOs to facilitate this. Pilot projects with the retail sector would be especially important to establish but are dependent on the political landscape, cultural context, and on the mindsets of supermarket managers. In the supermarket manager survey, consumers were rated as having the highest responsibility regarding reducing food waste in supermarkets. After that came the national government and then supermarkets. Of the three supermarket manager responses, two mentioned that their role in reducing food waste is dependent on suppliers and producers and most agree that its dependent on other parties. While the number of respondents is small, this already gives some indication that the current strategy may not be suitable for retrieving this kind of information or engaging with supermarket managers. However, even being in Malta similar issues with getting supermarkets involved may have come about (Galea, 2019) Educational campaigns overlap with all three of the suggestions and are useful to support the other two suggestions. To start with, educational campaigns can be implemented and then projects with supermarkets can be established. Finally, research can be done by FoEM on the best course of action regarding Dr. J. Spiteri's suggestion, after which one or more of the options can be implemented.

One strategy that would prove pivotal is to formalise and incentivise collaboration with external partners and urging supermarkets to take responsibility. According to a study done in the Netherlands by Närvänen et al. (2020), the interviewed supermarket managers expressed the importance of collaborating with external partners such as restaurants and food banks to reduce food waste and that such collaboration is at the manager's discretion. One way to increase collaboration is to formalise and incentivise the collaboration of the top management of supermarkets to donate to specific recipients such as food banks (Närvänen et al., 2020). (e)NGOs can help foster collaboration between supermarkets by the establishment of pilot projects to implement food waste reduction and repurposing strategies. This idea is further supported by P. Capodistrias from Matsentralen (personal communication, June 3, 2020).

The study by Närvänen et al. (2020) showed that supermarkets hesitate to take a leading role in CSR for food waste but have considerable influence in the supply chain on producers and consumers. Thus, governments and (e)NGOs should urge supermarkets to take a more proactive approach. For instance, governments can ensure supermarkets are transparent about their food waste statistics and in doing so, can create an environment where supermarkets compete to have the least amount of waste. (e)NGOs, on the other hand, can voice the concerns of the general public, the government and channel their efforts in

targeting supermarkets (Närvänen et al., 2020). This is a possibility for (e)NGOs, like FoEM, that are already key players in environmental politics at all levels from local to global and are vital entities for the promotion of environmental sustainability (Young, 2012).

## 5.2 FOOD WASTE REDUCTION ROADMAP

The developed roadmap draws from the lessons learnt in Chapter 2 and 3 concerning various food waste reduction strategies within Malta and other countries. It also considers the applicability of the strategies resulting from Chapter 4. The roadmap, depicted in Figure 3, consists of three interlinked phases, all embedded in phase 0: monitoring food waste streams. Phase 0 which should be done throughout all phases to reduce and repurpose food waste. Each phase has its own main target, operationalised into action points. For each action point, the role of FoEM is described and other actors involved are indicated based on section 5.1. It is important to note is that the phases and action points are not strictly separated but overlap. This is due to the complexity of the problem. Consequently, there is not just one right solution, but a complex interplay between actions that need to be taken. Additionally, many actors need to be involved, and communication and collaborations between them should be established during the problem-solving process. Based on the findings from Chapter 2, 3, and 4, it is argued that in order to reduce and repurpose retail food waste in Malta, eventually legislation related to food waste reduction and food donation should be developed. Though, since public awareness and political will to reduce food waste are currently lacking, and there is no functioning donation infrastructure, these and other related issues should first be addressed by going through phase 1 and 2. The phases will be further described in the paragraphs below.

**Phase 0:** On the pathway to designing a food waste law, the first step is to develop a means to collect data on food waste streams from the retail sector to identify food waste hotspots. Data collection was highlighted by Ekoskola and by the supermarket manager survey as an important solution to implement in Malta, as mentioned in section 5.1. This phase is interwoven throughout the entire process, as continuous monitoring of food waste data is needed to re-adjust strategies accordingly. Furthermore, in the preliminary findings session it was highlighted that research institutes like Environment and Resource Authority (ERA) need to be involved from the onset. ERA can analyse the data provided by the retail sector on whether it reaches desired targets. Currently waste collection from supermarkets is not standardised, and policy is needed to encourage this collection practice (Wasteserv, personal Communication, June 11, 2020). Afterwards, policies aimed at obliging retailers to provide data on their food waste streams are needed to ensure transparency and to efficiently target strategies and optimise the food waste reduction plan.

**Phase 1:** This entails food waste reduction, the first step in the waste hierarchy. Before establishing large-scale donation of surplus food, it is important that food waste in the retail sector is reduced. Monitoring retail food waste forms an essential baseline to be able to measure whether specific food waste reduction strategies are effective or not. To reduce retail food waste, the following actions points were designed:

- a. **Raise public awareness:** As was explained in Chapter 2, raising public awareness on food waste is key to changing behaviour and creates an incentive for supermarkets to change their food waste

practices. In other words, raising public awareness forms an essential basis for food waste reduction in the supermarket. FoEM, in collaboration with other (e)NGOs like Ekoskola, should be actively involved in frequent campaigning and setting up educational programmes for both children and adults to teach about the importance of the issue. Raising awareness also creates public pressure, which could contribute to action point b: place food waste on the political agenda as seen with Yonodesperdicio (T. de Febrer, personal communication, June 12, 2020).

- b. **Food waste on political agenda:** In Malta, the political will for reducing food waste is low as it is a low-priority item on the political agenda. However, as for public awareness, political awareness and action are important to create incentives for supermarkets to change their wasting behaviour. Therefore, food waste should be placed on the political agenda. Pressure from the public as well as other NGOs can push for relevant food waste strategies to be on the agenda.

c/d/e. **Reduction strategies at supermarket level:** Three main actions can be undertaken by supermarkets to reduce their food waste, which are refraining from take back agreements, implementing best before dates, and discounting products close to expiration. FoEM's role is to convince supermarkets to apply these strategies by highlighting the (financial) benefits for the supermarket (first lesson learned in Chapter 3). At the start of this phase, the issue of food waste is probably just starting to gain public and political attention, so they will not create influential incentives for supermarkets yet. Though, governmental support is probably required to make supermarkets refrain from take back agreements, which are currently economically beneficial over donation.

Interested supermarkets could participate in more targeted pilot projects with specific food waste reduction strategies. An example of such a project that could be applicable in Malta involves supermarket(s) more adequately matching their supply and demand by using excel models and performing testing. These excel models can simulate preferred reduction strategies and give specific advice on how to optimise the current inventory system. In the supermarket, testing on replenishment levels of various products can be done along with determining substitutes between products (B. Buisman, Personal communication, June 9, 2020). Supermarkets can do these tests themselves or in collaboration with the University of Malta along with FoEM.

## Roadmap to reduce and repurpose food waste in the retail sector in Malta

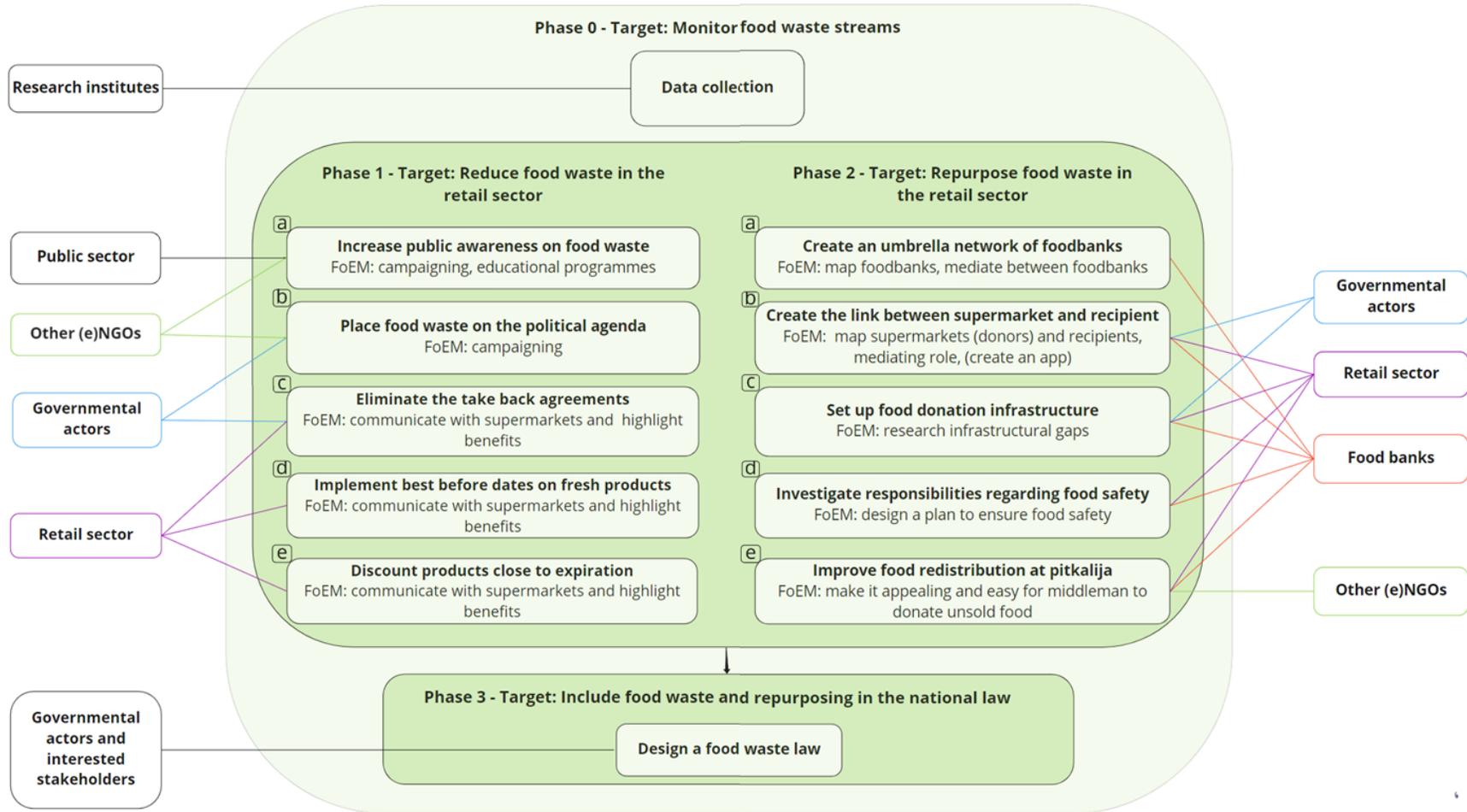


Figure 3 Roadmap showing the phases and action points to reduce and repurpose food waste in the Maltese retail sector.

**Phase 2:** This comprises of a series of action points that are required to repurpose surplus food from the retail sector. After having implemented the main reduction strategies, there will always be food that remains unsold but is still perfectly edible. Phase 2 is not only dependent on phase 1 but also interconnected to it since reduction and repurposing of food waste are intertwined processes. To some degree, elements of phase 2 need phase 1 to be established prior to its initiation. Though, the phases and steps are not strictly separated and do not necessarily need to happen in succession.

- a. **Umbrella Network:** As seen in Chapter 2, the need for coordination and communication between the, now fragmented, foodbanks and charities is important (I. Schembri, personal communication, June 11, 2020). Also P. Capodistrias from Matsentralen highlighted the need for an overarching network of foodbanks, as seen in section 5.1 and preliminary results discussion (personal communication, June 3, 2020). FoEM, in collaboration with foodbanks and charities, should map the recipients to improve coordination and create a network that could serve as a base to establish donation infrastructure and gain influence to negotiate with policymakers.
- b. **Linking donor and recipient:** This strategy was highlighted by the Last Minute Market and Boroume as a way for a company to mediate the transfer of surplus food. Firstly, it is important that FoEM maps the potential donors and recipients. Then, connections between donors (supermarkets and other retail actors) and recipients (foodbanks) should be established. FoEM can decide on the role they would like to take on, such as facilitating the donation process by writing up personalised donation and collection guidelines (Boroume) or creating an app in which supermarkets can upload their surplus food, like FoodCloud did. Important to note is that FoEM will not collect and redistribute the surplus food herself, but merely acts as mediator to make donation and collection as easy as possible for supermarkets and foodbanks or charities.
- c. **Food donation infrastructure:** Based on the lessons that were drawn from analysing the current donation practices in Malta, lacking infrastructure stood out as an issue that should be tackled to enable large-scale donation. This step is partly dependent on the outcome of action points a and b, because here agreements are made on how donation and collection or distribution will take place. Besides retail actors and foodbanks, governmental actors should be involved in enabling proper infrastructure by providing financial aid to finance refrigerated vans for example.
- d. **Responsibilities regarding food safety:** An important barrier for supermarkets to donate their surplus food is the potential problems that they could face regarding food safety. Donating food close to expiration is risky, and therefore it is important that stakeholders are aware of the risks and make agreements regarding responsibility (also see Chapter 3). FoodCloud found a nice solution to the responsibility issues by implementing an industry standard food safety system and only accepting foodbanks or charities as recipients when they have a food safety plan. FoEM could apply a similar strategy in collaboration with foodbanks and retail sector and should highlight the food safety guidelines when linking donor and recipient. Another, less direct, option could be based on policy, such as in the UK, where a law allows certain foods to be used in meals 24 hours after expiration (M. Buisman, personal communication, June 9, 2020).
- e. **Food redistribution at Pitkalija:** This strategy draws from the current situation at the Pitkalija (Chapter 2) and inspiration from the Porta Palazzo project by NGO Eco della citta. Pitkalija recently started their foodbank initiative to reduce their food waste, but this is still in its infancy. The Porta

Palazzo project could be exemplary to how the Pitkalija could implement low-level redistribution of surplus food by collecting the unsold food and redistributing it at a market stand. Eco della citta is open to collaboration and sharing knowledge with the Pitkalija.

**Phase 3:** After establishing a data collection strategy and going through phase 1 and 2, major steps will have been taken and results should be visible. By this time, a proper donor-recipient network and infrastructure should have been established and the issue of food waste should have gained more public awareness and is, hopefully, placed on the political agenda. A robust basis has been created from which increased political will and involvement of stakeholders should lead to development of policy proposal(s). Legislation related to food waste reduction and donation will create incentives towards the retail sector to make sure everything is done to reduce food waste, and all edible surplus food is donated safely. This legislative framework will eventually aid FoEM in combatting food waste.

## 6. COMMUNICATION METHODS FOR FOEM

Communication methods infer which communication tools are to be utilised when desiring to convey a specific goal to a specific audience (Dörnyei, 1995). FoEM is to play a pivotal role as a facilitating mediator among stakeholders to address food waste. In this section, the paper identifies communication methods that could potentially be utilised when taking on such a role. Firstly, FoEM should consider their target audience, as the general public, businesses, and governmental actors all desire to be approached in different ways. These actors must be approached accordingly, and FoEM should aim to achieve different results when communicating to these stakeholders.

The general public is of far more importance than it initially might seem. McLaughlin and Smith argued in 2002 that awareness is critical for any project and more so for projects which must be financed with public funds (McLaughlin and Smith, 2002). Public perception is critical regarding the way other stakeholders view FoEM. If the public becomes more aware of Maltese retailer food waste, both businesses and the government could agree to work with FoEM. Public awareness is created through heavy usage of social media and posters. Social media is a cheap feasible way to reach a broad audience rapidly, while posters tend to be perceived as more memorable when designed expertly (Yin et al., 2015; King et al., 2005).

Cooperation with the business sector is of the utmost importance when desiring to mitigate retailer issued food waste. Supermarkets hold a critical power position in the supply chain and can influence actors they are connected with. Some suppliers such as CORE Green, an importer and small-scale retailer, are very willing to work towards supermarkets wasting fewer foods (N. Debono, personal communication, June 6, 2020). As apparently, many supermarkets dragoon their suppliers into agreeing to take-back agreements. Supermarkets do not pay for unsold products, which results in financial losses for suppliers (N. Debono, personal communication, June 6, 2020). However, if food waste becomes a noticeable item on the public agenda, supermarkets will seek a way to profit of this, and implement cooperate social responsibility policies which reduce food waste, to benefit their public name culminating in more revenue (Moore, 2001). As previously highlighted in chapter, 3 when approaching businesses, direct communication lines are seen as most effective (Powers, 2001). FoEM can be pivotal in engaging with stakeholders to highlight specific gains for businesses, as seen in Chapter 3 and section 5.1. This is not as critical when public awareness is

high. If awareness is high, businesses might even actively approach organisations such as FoEM to improve their public image as a part of their corporate social responsibility clauses which in return increases their revenue (Moore, 2001). If FoEM were to raise enough awareness the corporate world might cooperate willingly, if it is clear what businesses stand to gain by cooperating.

Governmental actors are very much occupied with what is on their constituents' agenda. Their power is based upon these constituents voting them in office, and therefore, matters relevant to the general public are crucial to at least some degree for governmental actors (Forreze and Levine, 1990). Therefore, it is critical that FoEM raises awareness amongst the Maltese to create a support base by governmental actors. Governmental actors are best contacted through the proper channels (Bullain and Toftisova 2004). When approaching governmental actors, it is critical to clearly and concisely argue why a specific project benefits the actor's overarching objective. The ministry of family is very much in favour of increasing food security, while the ministry of the environment is more interested in preventing landfill waste. Each of these governmental actors has their designated duties to perform and will consider those to be of more importance than their colleagues' objectives. Another critical factor is that governmental actors prefer everything to be measurable as they have to justify their operational costs towards both the House of Commons and their constituents (T. Grech, S. Baja, M. Borg, personal communication, June 5, 2020; N. Debono, personal communication, June 6, 2020).

When considering the abovementioned aims derived from the compared applicable initiatives in specific research questions one and two, the suggested initiatives could be supported by the following communication methods, which are provided in Table 4, Annex III. Examples include brief examples of the communication methods, while brushed or targeted infers whether the communication method has specific audiences in mind or not. FoEM should invest resources towards digitised communication, while still devoting resources towards traditional channels such as face to face contact and community engagement. In Table 4, brushed approaches refer to communication methods aimed at all audiences and targeted refers to communication methods aimed at specific target groups (Bird, 2004; WRAP n.d).

## 7. CONCLUSION

Multiple lessons can be found in this report regarding food waste reduction strategies. These lessons are valuable to consider when implementing solutions in the retail sector in Malta. The solutions that are emphasized in this report are targeted primarily at supermarkets and to a lesser extent the Pitkalija.

Firstly, it is critical to monitor food waste stream, to identify food waste hotspots and analyse effectiveness of implemented strategies. Secondly, campaigns and educational programmes focusing on food waste reduction should be held on regular basis to increase public awareness which incentivises supermarkets to adapt their wasting practices. These actions could be initiated by FoEM in collaboration with other (e)NGOs. Additionally, societal pressure resulting from awareness raising could push for food waste to be placed on the political agenda, as political will to reduce food waste is currently limited. When done right, societal, and political awareness raising, combined with actions at supermarket level could lead to significant retail food waste reduction.

With regards to repurposing surplus food, lacking donation infrastructure and fragmentation of foodbanks and charities form the main barriers for setting up a large-scale functioning donation network. It is therefore advised to FoEM to map all food donors and recipients and establish connections between them, by taking a mediating and facilitating role. FoEM could draw up personalised donation and collection guidelines or create an app to make donation easy and attractive. Responsibilities regarding food safety should also be addressed in this process. Financial support from the government will be needed to improve donation transportation infrastructure.

Throughout the process of increasing reduction and repurposing retail food waste, many stakeholders will be involved, including societal actors, other NGOs, businesses, and governmental actors. FoEM plays a pivotal role as facilitating mediator and should adjust their communicational strategy according to their target audience. Based on the general lessons drawn from foreign initiatives, it can be concluded that FoEM should keep the lines of communication short. Additionally, highlighting what FoEM can offer the other party, i.e. what the benefits would be of participating, is essential to achieve successful communication and cooperation.

Going through these steps, which were outlined in the roadmap, culminates in the development of a legislative framework that regulates the reduction and repurposing of food waste. Development of food waste policies creates strong incentives on the retail sector to reduce and repurpose their food waste and will aid FoEM in combatting food waste.

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## ANNEX I – DESCRIPTION OF INTERVIEWED STAKEHOLDERS

The Table below shows the actors that were interviewed to gain insight in a broad range of food waste reduction strategies which would partially or fully apply to a Maltese context. Snowball-sampling was used by asking the interviewees for other contacts and data sources. Aside from that, other interviews linked to the research questions were also investigated. These interviews were drawn from the broader list of interviewees in Annex A2. The interview notes were assessed according to the research questions to support the findings in Chapter 2 and Chapter 3.

**Table 1 Interviewed organisations and their food waste reduction strategy description.**

Organisation	Type of organisation, country	Practices	Interviewee
<b>Boroume</b>	Non-profit, Greece	Mission to reduce food waste and fight malnutrition in Greece by coordinating food waste donations. Their "Saving & offering food" program saves over 24.400 portions of food waste from various parties including large retail chains and farmers' markets from going to waste. Today more than 95% (>200) of AB stores all over Greece are saving and offering food that otherwise would have been thrown away.	Dia Chorafa
<b>CORE Green</b>	Retailer, business to business retailer, food importer, Malta	CORE Green is a conscious green micro-business based in Malta, working to promote a healthier lifestyle, connection with the earth and overall community. It strives to leave a positive impact on whatever it is in contact with and commits to work for a healthy and sustainable future. It only agrees to work with companies that pledge to work ethically and houses an organics and fair-trade product line called EcoFood and a plant-based body products line called EcoClean.	Natalie Debono
<b>Municipality of Milan</b>	Municipality, Italy	In 2015, the city of Milan hosted its own World Exposition. As part of this exposition they launched the Urban Food Policy Pact, involving 200 cities worldwide, and launched their own Food Policy Strategy. Fighting food waste is one of the five overall priorities of this new food policy strategy, alongside food security and improving the sustainability of local food systems. The primary 'power' of the municipality is to organize "communities of practice": a group of more than thirty stakeholders who share policy ideas, policy answers and innovative solutions regarding food waste. Furthermore, the municipality boosts and facilitates cooperation between supermarkets and food banks specifically.	Chiara Pirovano

<b>Matsentralen</b>	NGO, Norway	Framtiden i våre Hender ("future in our hands") and Matsentralen are two separate non-governmental organisations based in Norway. Our contact person has conducted research on retail food waste in Norway on behalf of Framtiden i våre Hender and currently works for Matsentralen, a network of seven foodbanks across Norway. The research for Framtiden was conducted qualitatively through interviews with supermarket managers to gain insight in the way they handled their food waste. Framtiden requested the research to increase the pressure on politicians to draft food waste legislation and it succeeded in this regard: the report put a lot of pressure on supermarkets and politicians to change. The research results showed that while 98% of supermarkets in Norway have a designated area of the store to promote food with short shelf-lives with discounts up to 50%, only 48% of supermarkets donate their surpluses to charity with many supermarket managers. In short, the research suggested that a legislative approach might be necessary to support and encourage further collaboration between and within supermarket chains.	Paula Capodistrias
<b>Fruta Feia</b>	NGO, Portugal	Fruta Feia is an organization based in Portugal that does not work with supermarkets, but they buy "ugly fruit" directly from the farmers and offer basket-based subscriptions to their customers which they deliver throughout Portugal. Their initiative bypasses the retail sector completely. Their motto is "gente bonita come Fruta Feia" or "beautiful people eat ugly fruit": their link is directly between consumers and the ugly fruit that would have been wasted by farmers. Their claim is that 30% of fruit produced in Portugal is wasted because of its size. They currently have twelve delivery points, about 300 farmers signed up.	Maria Canelhas
<b>Humus Pro</b>	Project, France	Our main strategy is producing food, organic vegetables, and fruits for Brussels. The organic waste we manage because we want to develop a circular economy. We collect this organic waste with our car running on biogas and we compost it. Then we produce compost that can be used for fields and other cultures. Producing food in a circular way and make sure that everything is being used. The whole food chain should be made circular. The composting just started last year, so this just started. When collecting from our clients, we propose a complete service, and long time and to come back with the containers completely clean. This is not for free, they must pay to give their organic waste to us, so now we are testing if this is economically sustainable. We received some funds from Brussels which is why we can now try to launch the project; with less than 10 partners we collect more than 500 kg of organic waste per week.	Matthieu Hachez

<b>Last Minute Market</b>	Research and consultancy company	The Last Minute Market (LMM) links shops and producers (processing industries, food shops, retail stores and the like) who have unsold food which would otherwise be discarded with people and charities who need food (Last Minute Market, 2020) . Andrea Segrè started with this project in 1998. The University of Bologna developed SMM as a spin-off and it is now active in more than 40 Italian towns. LMM operates in the areas of unsold but edible food, unharvested vegetables, non-conform seeds, un-used catering products, unsold books, and now also unused pharmaceuticals (Last Minute Market, 2020).	Andrea Segrè
<b>Lipor</b>	Environmental NGO, Porto, Portugal	LIPOR is an environmental NGO in Porto, Portugal. They are currently involved as a stakeholder in the EUW in Porto, though their current project is unrelated to food waste. However, they have also done a EUW in 2016 related to food waste, with the project "dose certa" as the product. 'Dose Certa' is a project aimed at improving environmental practices and optimisation in 29 catering establishments in the greater Porto area. What they do is the following: they create improvement plans by analysing and assessing the practices of each establishment, reducing losses and consequently costs. They help catering establishments in creating more sustainable menus. They have also organized the "Embrulha" or "box it" project: handing out cardboard boxes to participating restaurants that these restaurants can then offer to their customers to take some of their food home in a doggy-bag. The packaging is biodegradable and free of charge, this project is aimed at reducing leftovers in restaurants.	Susana Freitas
<b>Foodcloud</b>	Digital platform, Ireland	Foodcloud uses a customized technology platform to link businesses with surplus food to local charities and community groups in need. Currently, FoodCloud connects over 3.400 supermarkets to more than nine-thousand charity partners in Ireland and the UK via two innovative approaches. The first is a smartphone app where supermarkets can upload what surplus food they have left at the end of the day. The second approach uses three warehouses in Dublin, Cork, and Galway to rescue larger quantities of surplus food from businesses across the food supply chain, including supermarkets, farmers, and food processors. The surplus food is either delivered by or collected from the business and stored and then redistributed to FoodCloud's network of charities in more manageable quantities.	Emma Walsh
<b>Lovin Spoonfuls</b>	Boston, USA (United States of America)	Lovin' Spoonfuls is the first organization of its kind in Massachusetts and the largest food rescue agency in New England. Established in 2010, Lovin' Spoonfuls serves over 40 cities and towns in Greater Boston, Metro West, and Hampden County, and works with more than 235 partners. We are committed to increasing awareness on topics related to food waste and hunger, as well as equipping the community we serve with the knowledge that empowers	Lauren Palumbo

		<p>them to feed themselves and their families. Each weekday, our team of highly trained and passionate Food Rescue Coordinators picks up from more than 75 vendor partners in our fleet of refrigerated trucks and delivers the product to non-profit agencies across Massachusetts. Our focus is rescuing perishable, nutritious food — fruits and vegetables, dairy, proteins, and prepared foods — to help meet the nutritional needs of food insecure individuals in our communities. We pick up culled product from grocery stores, produce wholesalers, farms, and farmers markets. We deliver to over 160 non-profit partners, including homeless shelters, crisis centres, food pantries, after-school programs, veterans service agencies and senior centres that feed hungry people across Greater Boston, Metro West, and Hampden County</p>	
<b>Yonodesperdicio</b>	Food sharing App, Spain	<p>Yonodesperdicio, translates to “I do not waste”, it is a community committed to tackling household food waste through local food exchange. Its 750-odd users take pictures of the items as well as information like quantity location and expiry date and can link up with others to swap items. Members can also share recipes and tips to prevent food waste.</p>	Teresa de Febrer
<b>Zero Desperdicio</b>	NGO, Portugal	<p>Founded in January 2011 by nine volunteer citizens. It is a non-profit association, with the objective of transforming the world through the prevention of waste production in all areas of industry, commerce and consumption, and the adoption of behaviour associated with environmental responsibility: recovery, recycling, and innovation. The practices include continuous monitoring and coordination of all stages of the process, establishment of bridges between all agents - donor and receiver entities, establishment of protocols with different cities, companies, parishes, and development of awareness campaigns. In European Union scale, its strategy is to develop a new platform dedicated to Circular Economy, adjusted to various recycling channels.</p>	Liliana Dias
<b>Zero Waste Europe</b>	NGO in based in Brussels	<p>Zero Waste Europe is an NGO and knowledge hub. They work on a wide range of projects and policy areas to advance zero waste management strategies. The interviewed parties include Enzo Favoino and Pierre Condamine. Enzo has 30 years-experience in waste management. He has also been monitoring and supporting the implementation of biowaste strategies in Malta along with other waste management delegations. He is the Scientific Coordinator at Zero Waste Europe. Pierre Condamine is a Waste Policy Officer at Zero Waste Europe.</p>	Enzo Favoino and Pierre Condamine
<b>Porta Palazzo</b>	Market, Turin, Italy	<p>The main objectives of this project are to reduce food waste through collection and distribution of unsold food, increasing reuse, recycling of materials, and furthering the city’s social inclusion agenda. It is organised by an NGO, Eco dalle Citta. The project requires political commitment and the coordination of multiple city departments. The success of this project relies on the Market vendors themselves. This project has had a significant impact by reducing the</p>	Guilio Baroni & Sonia Migliore

		total waste to 45% to 77% being sorted in the market area. The project can represent an initial step towards social, cultural, and economic integration for some.	
<b>M. Buisman</b>	Germany	Assistant Professor in Retail Analytics at WHU-Otto Beisheim School of Management. Research author on topics such as Dynamic shelf life (DSL) and Discounting.	Marjolein Buisman

## ANNEX II – SUGGESTED STRATEGIES FOR THE ROADMAP

**Table 2 Suggested strategies based on the outcomes of the Policy and Stakeholder, Food Practices and Technology and Infrastructure expert reports.**

Focus	Suggestion or strategy	Limiting factors towards successful implementation	Advantages	Estimated feasibility in Malta
<b>Policy and governance</b>	Create robust legislative framework for env. issues, including food waste	<ul style="list-style-type: none"> <li>• Non-binding nature of European agreements on food waste</li> <li>• Lack of political will</li> </ul>	Any objectives formulated would be obligatory	Low-Medium
	Centralising and integrating different government bodies	<ul style="list-style-type: none"> <li>• Lack of transparency in the administrative system</li> <li>• Maltese political Landscape</li> </ul>	<ul style="list-style-type: none"> <li>• Clear designation of duties</li> <li>• Increased structure and coordination</li> </ul>	Low
	Addressing insufficient food donation legislation	Food donations are not high on the political agenda	Raising awareness for food waste and its interconnection to other societal issues	Low
<b>Supermarkets</b>	Eliminate take-back agreements	Uncertainty on whether they reduce or encourage food waste	Obliges supermarkets to be more efficient with the produce they buy from suppliers	Low
	Discount stickers on products close to expiry date	In theory, discounting may transfer the responsibility to households, but this strategy of discounting is seemingly not common in Malta.	Win-win: supermarkets reduce waste and retain some profit margin	Low - Medium
	Separate waste packaging to stimulate organic waste treatment	<ul style="list-style-type: none"> <li>• Unclear whether waste streams are currently separated</li> <li>• Multitude of prior private waste</li> </ul>	<ul style="list-style-type: none"> <li>• Reduces load on landfills</li> <li>• More waste can be repurposed or recovered</li> </ul>	Low

Retail sector and supply chain		carrying arrangements • No legal obligation to sort waste		
	Develop strategies specific to the preference of each supermarket	<ul style="list-style-type: none"> <li>• Food practices vary between supermarkets</li> <li>• Developing new strategies for every supermarket can be cost-in-effective</li> </ul>	<ul style="list-style-type: none"> <li>• Allows focus on the driving forces of every individual retailer, to engage with them more effectively and accurately</li> </ul>	Medium
	Voluntarily lowering the prices especially by smaller supermarkets	Voluntary measures are less successful if not back by regulatory policies.	Allow supermarkets to improve their own practices	Medium
	Reduce the barriers for effective food waste management in supermarkets	Relevant policy frameworks and infrastructural elements need to be in place to influence waste management in the supermarket.	Encourage effective waste management	Medium
	Suboptimal food product use (suboptimal, i.e. misshapen fruits or vegetables)	<ul style="list-style-type: none"> <li>• Consumers in Malta prefer good-looking produce</li> <li>• Limited shelf space</li> <li>• Possible Reputation loss for retailers that sell ugly produce</li> <li>• Ugly produce must be competitive with good-looking produce</li> <li>• Requires significant effort to set up networks between farmers and consumers/retailers</li> </ul>	<ul style="list-style-type: none"> <li>• Saves good, edible food from being landfilled</li> <li>• Reduces load on landfills</li> <li>• Gives farmers a fairer price for their second-class products</li> <li>• Increased consumer awareness on their foods' origin</li> </ul>	Medium
	Monitoring of food waste	<ul style="list-style-type: none"> <li>• Lack of political will</li> <li>• Lack of unified method</li> </ul>	Creating a data set is required to monitor which strategies are most effective	Low
	Use spoilage prevention packaging (Modified atmosphere packaging by filling Nitrogen gas; or intelligent packaging by dynamic techniques)	<ul style="list-style-type: none"> <li>• Increased costs for retailers and suppliers</li> <li>• Consumer attitudes</li> </ul>	• Prolong products' shelf lives to avoid spoilage and waste	Low
	Combination of advanced logistics and cold chain management,	• Must be integrated with storage and transportation process	• Prolong products' shelf lives to avoid spoilage and waste	Low

<b>Waste management</b>	and dynamic pricing and dynamic shelf life (DSL)	<ul style="list-style-type: none"> <li>• While countries like Norway have seen success with DSL, it unknown whether it is applied in Malta and research on its applicability is needed.</li> <li>• Legislative issue: sensors in food packaging are illegal</li> </ul>			
	Addressing limited storage and cooling facilities	<ul style="list-style-type: none"> <li>• High costs</li> <li>• It is unknown which locations in Malta have the capacity for this</li> </ul>	<ul style="list-style-type: none"> <li>• Food's shelf life is preserved</li> <li>• Food waste is reduced</li> </ul>	Low	
	Off-site: De-packaging units	<ul style="list-style-type: none"> <li>• Expensive solution</li> <li>• Technical difficulties</li> </ul>	Facilitates waste separation		Medium
	Centralised food waste collection system	<ul style="list-style-type: none"> <li>• Fragmented administration</li> <li>• Lack of political will</li> <li>• No coalitions formed by NGOs nor retailers</li> </ul>	<ul style="list-style-type: none"> <li>• Would set island-wide standards for all to adhere to</li> <li>• Easier waste stream monitoring</li> </ul>		Low
	On-site: composting, anaerobic bio digestion	<ul style="list-style-type: none"> <li>• Land limitations</li> <li>• Bio-digesters keep failing</li> </ul>	More efficient re-use of waste		Low
	Insect-based bioconversion (Mealworms and black soldier fly)	<ul style="list-style-type: none"> <li>• Expensive to implement</li> <li>• Legal difficulties surrounding insect use in human/animal nutrition</li> <li>• Cultural norms surrounding insect consumption</li> </ul>	Enable food and feed production in densely populated area		Low
<b>NGOs and food banks</b>	Establish effective coordination system between stakeholders in the supply chain	No coordinated cultivation practices and non-formalised agreements with the middleman market	Managing food waste across the supply chain		High

	Voluntary agreements supplementing hard law requirements	<ul style="list-style-type: none"> <li>• Retailers hesitant to cooperate unless economic benefits are demonstrated</li> <li>• Food waste is not seen as a priority by the Maltese government</li> </ul>	Positive reinforcement and cooperative agreement generally work better than hard law, i.e. legal requirements	Medium
	<p>Creating a centralized food bank network through:</p> <ul style="list-style-type: none"> <li>• Data sharing</li> <li>• Applications/software to share most important stocking data</li> <li>• Legal framework construction</li> </ul>	<ul style="list-style-type: none"> <li>• Current fragmentation of food bank operation</li> <li>• Requires transparency and collaboration between food banks and retailers</li> <li>• Data sharing gaps between food donors and food banks</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure food safety by trackable histories and sources.</li> <li>• Have been proved helpful by Malta food bank foundation</li> <li>• Once in place, this would make donation and redistribution quite simple</li> </ul>	Medium

**Table 3 Suggested strategies based on initiatives in foreign countries and their applicability in Malta.**

Focus	Suggestions	Limiting factors towards successful implementation	Advantages	Feasibility in Malta
<b>Policy and governance</b>	Legally require "best before" dates on products, or "best before, but good after"	<ul style="list-style-type: none"> <li>• Political will</li> <li>• Requires international support from food importers</li> </ul>	<ul style="list-style-type: none"> <li>• More incentive to go for the "older" products.</li> <li>• Relatively easy to implement, not a very intrusive measure to retailers</li> </ul>	High
	Campaigns against food waste, specific per target group	<ul style="list-style-type: none"> <li>• Funding, thereby it is long term measure</li> <li>• Must be specifically targeted to be effective</li> </ul>	Raises awareness amongst consumers and increases pressure on government or retailers to change their practices	High
	Research to increase the pressure on politicians to draft food waste legislation.	<ul style="list-style-type: none"> <li>• Lack of waste stream data</li> <li>• Little commitments from government &amp; current politicians</li> </ul>	Creating legislation is a powerful tool to combat food waste, i.e. by obligating food donation or by obligating waste stream separation	Medium

	Legal removal of bulk discounts	<ul style="list-style-type: none"> <li>Political will</li> <li>Intrusive, non-competitive move against free market capacity of supermarkets</li> </ul>	<ul style="list-style-type: none"> <li>It becomes less profitable to dump</li> <li>Stimulates to look for alternatives/waste prevention</li> </ul>	Medium/high
<b>Supermarkets</b>	Smartphone app where supermarkets can upload what surplus food they have left at the end of the day, then a recipient can collect it	<ul style="list-style-type: none"> <li>App development costs</li> <li>Requires sufficient collection infrastructure</li> <li>Small costs for supermarkets</li> <li>Supermarkets need to cooperate</li> </ul>	<ul style="list-style-type: none"> <li>Direct link between donor and recipient</li> <li>Food safety can be fostered</li> <li>Community building</li> <li>Success already proved in other countries</li> </ul>	High
	Selling selected vegetables in loose weights instead of per package so people can buy what they need	<ul style="list-style-type: none"> <li>Requires support from suppliers</li> <li>Supermarkets might be hesitant to implement</li> </ul>	<ul style="list-style-type: none"> <li>Success proven in other countries, e.g. Denmark</li> <li>Reduces waste as fewer bulk packets get thrown away because of one ugly vegetable in a bunch</li> </ul>	Medium
<b>Retail sector and supply chain</b>	Producing food first for hospitality and retail sector. Then, collect their organic waste for composting. Offer a complete service, participants (retail sector) must pay to cooperate.	Lots of organising to get this working, complex system. Getting retail sector involved	Improving reputation can be reason for retail sector to cooperate. Fully repurpose food waste.	Low
<b>NGOs and food banks</b>	Link shops and producers with surplus food to people and charities who need food	Requires infrastructure & NGO willing to organise this coordination	Direct links between donor and receiver creates steady, long-lasting link	High
	Buying "ugly fruit" directly from the farmers and offer basket-based subscriptions to their customers.	Building up an infrastructure network is required. Lots of effort for only a part of the solution.	Preventing food waste in the earliest stage, chance to keep price of the ugly fruit below "normal" fruits, fair price for farmers	Medium
	Create an overarching organisation to coordinate the foodbanks and map donors and recipients: umbrella network of foodbanks, that will donate to charities	<p>Lacking infrastructure</p> <p>It is crucial for an actor to start this project and potentially oversee it.</p>	Fragmentation will be eliminated, simplified coordination between supermarket and foodbank	Medium

<b>Pitkalija / small retailers</b>	Collect unsold food at the end of a market day and donate this directly to those in need via a market stand or donate it to food bank close-by	Middlemen retailers are challenging to persuade: It is important find a way to convince them to join the project.	No infrastructure required, just volunteers; community building; low-tech solution	High
	Creating improvement plans by analysing and assessing the practices of individual organizations. Then reducing food losses and costs.	On individual organisation level, hard to make a significant, nation-wide change	Plans made in good cooperation so: reasons for retail sector to cooperate	High
	Picking up potential food waste and deliver it to people in need, voluntary with a fleet of trucks.	Must be funded by government or donations	Easy to start small and expand. No reasons for retail sector to not cooperate	High

## ANNEX III – COMMUNICATION METHODS

**Table 4 Communication methods and examples.**

<b>Communication Methods</b>	<b>Examples</b>	<b>Brushed or targeted</b>
<b>Community engagement</b>	Build on on-going relationships: Posters in supermarkets.	Targeted
	Influence culture: Maltese food culture fair with an emphasis on zero waste.	Targeted
	School of Sustainability which is currently initiated by FoEM: Scaling up the current programme	Targeted
<b>Online</b>	FoEM website: updating the website with food waste statistics and reports of successfully completed projects and current budding initiatives.	Broad brushed but capable of communicating detailed information
<b>Social media</b>	More competitions like their Instagram challenge. Also, success stories (to share that projects sometimes bear fruit) and attention-grabbing stories (to stress the need for action).	Targeted
	FoEM could launch a Food waste App comprising the amount of people that could be fed with food wasted and monetary losses for consumers or even businesses.	Broad brushed
<b>External communication with businesses</b>	FoEM could take an initiative to start projects with supermarket managers and can act as a conduit between food waste producer and potential donor.	Targeted
<b>External communication with governmental actors</b>	FoEM could participate in policy development, project work. They also need support from the government to facilitate projects work with businesses.	Targeted

### INTRODUCTION

Initially two surveys were setup both specifically for a different target audience, the first one being targeted towards supermarket managers, the other being targeted towards consumers. However, as the voluntary turnout of supermarket managers turned out to be only three respondents, no statistical analysis could be applied to this survey. The rest of this section will thus be dedicated to the consumer survey only. Though this does not mean the supermarket manager survey does not have its qualitative use.

The data classification and handling can be summarised in the following steps:

- For sampling the data, Google Forms was used. For data handling, Microsoft Excel was used for organising the data and SPSS was used to perform statistical tests.
- The total response consisted of 259 responses.
- During the data handling 4 responses were taken out because these respondents filled out that they didn't live in Malta
- Within individual questions, multiple-choice responses that included "I don't know, or other" were taken out of the data set as they could not be ranked in ordinal analyses. But they still provided valuable information in a qualitative sense.

### DISCUSSION/LIMITATIONS

Ideally, the sampled population for the survey should as closely resemble the real population to create a representative analysis. In terms of sample size, this could be said to have been achieved. As for a population of 490000, aiming for a confidence level of 95%, with a response rate of 259 respondents we managed to achieve an acceptable margin of error of 6%. This establishes that results provided are likely not attributed to mere variability. However, the methods of sampling that we used by distributing them solely online did open the doors for a bias. This bias entails that people with a strong opinion who already value food waste are more likely to fill out the survey, which may give skewed results of the true opinion of the 'average' Maltese person. Aside from this bias we also saw a higher fill out rate amongst females than males (See figure 1.), although we have no reason to believe this should skew the results. Nevertheless, the sampled population did see a fairly normal distribution amongst various age groups (see figure 2), and since we cannot alleviate the response bias by confronting randomly selected people on streets due to COVID-19 restrictions, online distribution still remained the best method available.

13. What is your gender?

259 responses

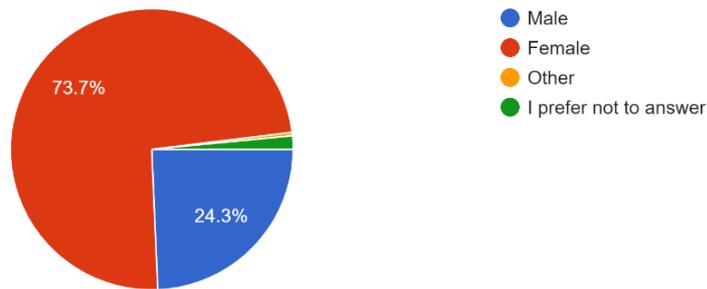


Figure C1. A pie chart of the gender distribution amongst the consumer survey respondents.

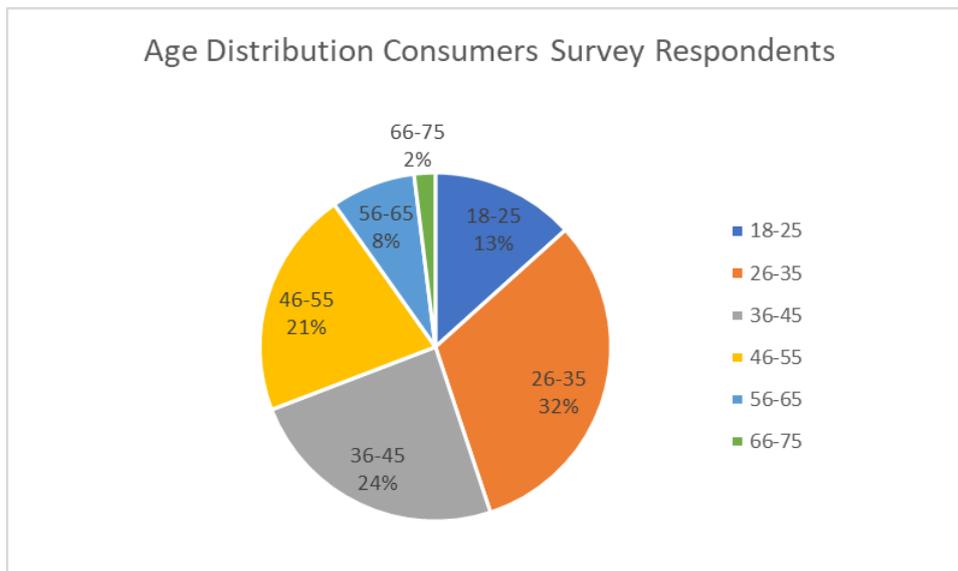


Figure C2. Age distribution amongst the consumer survey respondents. Age groups 16-17 and 75+ are excluded due to insignificant turnout in these categories.

DESCRIPTION OF ANALYSIS TABLES.

The appendices below present the tables that are referenced throughout the report. Where:

- N equals the number of respondents within a question (note that N varies as respondents that fill out 'I do not know' are not taken into account with the statistical test);
- $\beta$  equals the odds that the alternative hypothesis is incorrectly accepted (similar to the p value), which should be lower than 0.05 for a test to be regarded as statistically significant.
- M is denoted for the mean.
- SE is the standard error.
- F equals the test statistic for F-tests where a higher value leads to a lower  $\beta$ .

The tables present either T-tests that test for one specific variable to be significant. F tests which look at whether any of its categories show to be statically significant among its respondents. For the T tests, the question analysed is whether the response deviates from neutral answer, with the exception question 6, where the analysis tested whether the response deviated from 'never'. For the F tests, the

question is whether there is variability and correlation between age groups and their response to individual questions.

## SURVEY ANALYSIS

Table C1: SPSS T-Test regarding question 5

Question 5:	N	$\beta$ (Sig.)	M $\pm$ SE
To what extent do you agree with the following statements?			
<i>Donations to food banks are important</i>	251	< 0.00	4.76 $\pm$ 0.04
<i>It is the supermarkets sector's responsibility to donate food to social causes (e.g. food banks)</i>	251	< 0.00	4.31 $\pm$ 0.06
<i>Consumers contribute to supermarket food waste production</i>	242	< 0.00	4.12 $\pm$ 0.07
<i>I care about helping the supermarket to reduce its food waste</i>	245	< 0.00	4.43 $\pm$ 0.06
<i>I regularly buy products that are close to their best before dates for environmental reasons</i>	247	0.05	3.17 $\pm$ 0.09
<i>If it saves me money, I will buy products that are close to their best before dates</i>	247	0.04	3.19 $\pm$ 0.09
<i>I feel I have little power to reduce my own food waste contribution in supermarkets as a consumer</i>	251	< 0.00	4.17 $\pm$ 0.07
<i>I would like to be informed more on how I can reduce food waste</i>	241	< 0.00	4.35 $\pm$ 0.07
<i>Advertisement about food waste reduction could influence my shopping behaviour</i>	240	< 0.00	4.17 $\pm$ 0.07
<i>Loyalty schemes from the supermarkets (e.g. collecting points in order to get rewards) influence my shopping behaviour</i>	247	< 0.00	3.48 $\pm$ 0.10
<i>The supermarkets have responsibility to reduce food waste</i>	233	< 0.00	4.70 $\pm$ 0.05

Table C2: SPSS One-Way ANOVA F-test including question 5 in correlation with age

Question 5:	N	F	$\beta$ (Sig.)

ANOVA Table (in relation with age)			
<i>Donations to food banks are important</i>	251	2.587	0.010
<i>It is the supermarkets sector's responsibility to donate food to social causes (e.g. food banks)</i>	251	1.397	0.198
<i>Consumers contribute to supermarket food waste production</i>	242	0.966	0.456
<i>I care about helping the supermarket to reduce its food waste</i>	245	0.343	0.949
<i>I regularly buy products that are close to their best before dates for environmental reasons</i>	247	0.989	0.445
<i>If it saves me money, I will buy products that are close to their best before dates</i>	247	0.706	0.686
<i>I feel I have little power to reduce my own food waste contribution in supermarkets as a consumer</i>	251	1.398	0.198
<i>I would like to be informed more on how I can reduce food waste</i>	241	1.155	0.328
<i>Advertisement about food waste reduction could influence my shopping behaviour</i>	240	1.018	0.423
<i>Loyalty schemes from the supermarkets (e.g. collecting points in order to get rewards) influence my shopping behaviour</i>	247	2.239	0.025
<i>The supermarkets have responsibility to reduce food waste</i>	233	1.119	0.352

Table C3: SPSS T-Test regarding question 6

Question 6:	N	$\beta$ (Sig.)	M $\pm$ SE
Which of the following activities do you do when you are in the supermarket?			
<i>Buying food with close-to-expiry discount stickers</i>	248	< 0.00	2.81 $\pm$ 0.08
<i>Creating a shopping list before going to the supermarket</i>	249	< 0.00	2.01 $\pm$ 0.08
<i>Buying food whenever it is limited (just before it sells out)</i>	243	< 0.00	2.06 $\pm$ 0.06
<i>Date picking: choosing your fresh food based on the "best before" date</i>	255	< 0.00	3.28 $\pm$ 0.06
<i>Squeezing fruits or vegetables: to see the condition of the fruits or vegetables</i>	248	< 0.00	1.68 $\pm$ 0.06

Table C4: SPSS One-Way ANOVA F-test including question 6 in correlation with age

Question 6:	N	F	$\beta$ (Sig.)
Which of the following activities do you do when you are in the supermarket?			
<i>Buying food with close-to-expiry discount stickers</i>	248	2.088	0.038
<i>Creating a shopping list before going to the supermarket</i>	249	1.043	0.404
<i>Buying food whenever it is limited (just before it sells out)</i>	243	0.904	0.514
<i>Date picking: choosing your fresh food based on the "best before" date</i>	255	3.955	0.000
<i>Squeezing fruits or vegetables: to see the condition of the fruits or vegetables</i>	248	1.036	0.409

Table C5: SPSS T-Test regarding question 9

Question 9:	N	$\beta$ (Sig.)	M $\pm$ SE
To what extent would you agree that the following proposed solutions would decrease food waste in supermarkets?			
<i>More regulation for supermarkets to donate food waste to food banks</i>	253	< 0.00	4.64 $\pm$ 0.05
<i>A subsidy for supermarkets that donate food to food banks</i>	250	< 0.00	4.24 $\pm$ 0.07
<i>A tax for supermarkets that do not donate food waste to food banks</i>	246	< 0.00	4.12 $\pm$ 0.07
<i>A campaign to increase awareness among consumers about food waste of supermarkets</i>	251	< 0.00	4.59 $\pm$ 0.05
<i>A training program for supermarket employees to better handle waste-separation</i>	250	< 0.00	4.64 $\pm$ 0.05
<i>Oblige supermarkets to sell products that are close to their "best before" date for a lower price</i>	247	< 0.00	4.47 $\pm$ 0.06
<i>A mobile app that promotes discounted food when they are close to their "best before" date</i>	245	< 0.00	4.26 $\pm$ 0.07

<i>Giving supermarkets more freedom to come up with their own initiatives to reduce food waste</i>	239	< 0.00	4.42 ± 0.06
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Table C6: SPSS One-Way ANOVA F-test including question 9 in correlation with age

Question 9: To what extent would you agree that the following proposed solutions would decrease food waste in supermarkets?	N	F	β (Sig.)
<i>More regulation for supermarkets to donate food waste to food banks</i>	253	2.932	0.004
<i>A subsidy for supermarkets that donate food to food banks</i>	250	1.170	0.318
<i>A tax for supermarkets that do not donate food waste to food banks</i>	246	2.093	0.037
<i>A campaign to increase awareness among consumers about food waste of supermarkets</i>	251	2.154	0.032
<i>A training program for supermarket employees to better handle waste-separation</i>	250	1.896	0.071
<i>Oblige supermarkets to sell products that are close to their "best before" date for a lower price</i>	247	0.896	0.520
<i>A mobile app that promotes discounted food when they are close to their "best before" date</i>	245	2.530	0.016
<i>Giving supermarkets more freedom to come up with their own initiatives to reduce food waste</i>	239	1.627	0.129

## ANNEX C2 – CONSUMER AND SUPERMARKET MANAGER SURVEYS

### CONSUMER SURVEY

Included here is a transcription of the consumer survey as used to survey respondents. The surveys were distributed digitally using Google Forms.

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We are students from Wageningen University in the Netherlands, conducting research on behalf of the NGO Friends of the Earth Malta. By filling in this questionnaire, you will help us to analyse current food waste practices and to develop a plan to reduce food waste of supermarkets in Malta. The questionnaire will take approximately 10 minutes to fill out. By filling out this questionnaire you have a chance of winning a €15 voucher for One4All.

--> With **food waste** we mean here specifically, the 'unnecessary loss of edible food which has not passed its best before date but cannot be sold anymore'.

Thank you in advance

1. What supermarket do you visit more often?

- Local shops
- (Inter)national chains
- I do not go to the supermarket

2. What responsibility should the following parties have in reducing supermarket food waste?

	Not responsible	Hardly responsible	Neutral	Somewhat responsible	Very responsible
National government	<input type="radio"/>				
Local council(s)	<input type="radio"/>				
Non governmental organizations (NGO's)	<input type="radio"/>				
Consumers	<input type="radio"/>				
Supermarkets	<input type="radio"/>				

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3. If you think other parties have a high responsibility (that are not mentioned in question 2), who are you thinking about?

\_\_\_\_\_

4. In your opinion, which of the following parties need to be **more active** in reducing food waste in supermarkets? (multiple answers possible)

- National government
- Local council(s)
- Non-governmental organizations (NGOs)
- Consumers
- Supermarkets
- Other: \_\_\_\_\_

5. To what extent do you agree with the following statements?

	Strongly agree	Somewhat agree	Neither disagree nor agree	Somewhat agree	Strongly agree	I do not know
Donations to food banks are important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is the supermarkets sector's responsibility to donate food to social causes (e.g.) food banks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consumers contribute to supermarket food waste production	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I care about helping the supermarket to reduce its food waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I regularly buy products that are close to their best before dates for environmental reasons	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If it save me money, I will buy products that are close to their best before dates	<input type="radio"/>					
I feel I have little power to reduce my own food waste contribution in supermarkets as a consumer	<input type="radio"/>					
I would like to be informed more on how I can reduce food waste	<input type="radio"/>					
Advertisement about food waste reduction could influence my shopping behaviour	<input type="radio"/>					
Loyalty schemes from the supermarkets (e.g. collecting points in order to get rewards) influence my shopping behaviour	<input type="radio"/>					
The supermarkets have responsibility to reduce food waste	<input type="radio"/>					

6. Which of the following activities do you do when you are in the supermarket?

	Never	Hardly ever	Some-times	Often	Every time	Not possible in my super-market
Buying food with close-to-expiry discount stickers	<input type="radio"/>					
Creating a shopping list before going to the supermarket	<input type="radio"/>					

Buying food whenever it is limited (just before it sells out)	<input type="radio"/>					
Date picking: choosing your fresh food based on the "best before" date	<input type="radio"/>					
Squeezing fruits or vegetables: to see the condition of the fruits or vegetables	<input type="radio"/>					

7. If you do date picking, how do you do it? (multiple answers possible)

- I select the product closest to its "best before" date
- I select the product furthest away from its "best before" date
- I select the product depending on when I plan to consume it
- Other \_\_\_\_\_

8. If you squeeze fruits/vegetables, why do you do it? (multiple answers possible)

- To check if it is still good
- To pick the freshest ones
- Other \_\_\_\_\_

9. To what extent would you agree that the following proposed solutions would decrease food waste in supermarkets?

	Strongly agree	Some-what agree	Neither disagree nor agree	Some-what agree	Strongly agree	I do not know
More regulation for supermarkets to donate food waste to food banks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A subsidy for supermarkets that donate food to food banks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A tax for supermarkets that do not donate food waste to food banks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

A campaign to increase awareness among consumers about food waste of supermarkets	<input type="radio"/>					
A training program for supermarket employees to better handle waste-separation	<input type="radio"/>					
Oblige supermarkets to sell products that are close to their "best before" date for a lower price	<input type="radio"/>					
A mobile app that promotes discounted food when they are close to their "best before" date	<input type="radio"/>					
Giving supermarkets more freedom to come up with their own initiatives to reduce food waste	<input type="radio"/>					

10. Do you have any suggestions for solutions?

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11. Do you think in general more action should be taken to protect the Maltese environment?

- Yes
- No
- I do not know

12. What is your age?

- <16
- 16-17
- 18-25
- 26-35
- 36-45
- 46-55

- 56-65
- 66-75
- >75
- I prefer not to answer

13. What is your gender?

- Male
- Female
- Other
- I prefer not to answer

14. What is your state of employment? (multiple answers possible)

- Working full-time
- Working part-time
- Currently unemployed
- Volunteer work
- Stay-at-home parent/guardian
- Student
- Retired
- I prefer not to answer
- Other \_\_\_\_\_

15. How did you find this questionnaire?

- Via friends or family
- On social media
- Via University of Malta
- Via Wageningen University
- Via Friends of the Earth Malta
- I prefer not to answer
- Other \_\_\_\_\_

16. Do you live in Malta?

- Yes
- No

17. Do you have any additional remarks/ideas about the topic or the questions?

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18. Please check the boxes that apply to you (multiple answers possible)

- I want to be informed about the outcomes of the research
- I want the chance to win a €15 voucher for One4All
- I do not want to be informed about the outcome, nor win a voucher

19. If you checked at least one of the boxes in question 18, please leave email address here.

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**Thank you very much. We appreciate that you took the time out to fill in this questionnaire. Your response is a valuable contribution to our research.**

**SUPERMARKET MANAGERS SURVEY**

*Below stands the transcription of the supermarket manager survey as conducted in Google Forms.*

We are students from Wageningen University in the Netherlands, conducting research on behalf of the NGO Friends of the Earth Malta. By filling in this questionnaire, you will help us to analyse current food waste practices and to develop a plan to reduce food waste of supermarkets in Malta. The questionnaire will take approximately 10-15 minutes to fill out. By filling out this questionnaire you have a chance of winning a €15 voucher for One4All.

--> With **food waste** we mean here specifically, the 'unnecessary loss of edible food which has not passed its best before date but cannot be sold anymore'.

Thank you in advance!

1. How much more action should be taken to protect the Maltese environment?

	1	2	3	4	5	
Nothing	<input type="radio"/>	<b>A lot</b>				

2. To what extent do you agree with the following statements?

	Strongly agree	Somewhat agree	Neither disagree nor agree	Somewhat agree	Strongly agree
Reducing food waste is important from an environmental perspective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing food waste is important from a cost benefit perspective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My supermarket wants to do more to reduce food waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other parties are hindering my supermarket from reducing food waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Which of the following do you do you think are the main cause(s) of food waste generation in supermarkets? (multiple answers possible)

- Poor storage condition in warehouses (e.g. lack of continuous cool chain, insufficient ventilation)
- Poor storage condition on shelves (e.g. inappropriate temperature)
- Poor transportation conditions (e.g. inflicting damage during transportation)
- Inappropriate packaging (e.g. crushed vegetables because of a lack of protection)
- Mismatch between supply and demand
- Lack of effectiveness of promotions (e.g. no attention being paid to discount close to best-before-date labelling)
- Consumer behaviour in supermarkets
- Other: \_\_\_\_\_

4. What responsibility should be the following parties have in reducing supermarket food waste?

	Not responsible	Hardly responsible	Neutral	Somewhat responsible	Very responsible
National government	○	○	○	○	○
Local council(s)	○	○	○	○	○
Non governmental organisations (NGO's)	○	○	○	○	○
Consumers	○	○	○	○	○
Supermarkets	○	○	○	○	○

5. If you think other parties should have a high responsibility, who are you thinking about? Motivate your answer

\_\_\_\_\_

6. How much does your role in reducing food waste as a supermarket depend on other parties?

	1	2	3	4	5	
Not at all	○	○	○	○	○	<b>Completely</b>

7. How would you define the relationship with other parties regarding supermarket food waste reduction?

	Very limiting	Slightly limiting	Neutral	Slightly helpful	Very helpful	I have no relationship with this party
National government	<input type="radio"/>					
Local council(s)	<input type="radio"/>					
Non governmental organisations (NGO's)	<input type="radio"/>					
Consumers	<input type="radio"/>					
Supermarkets	<input type="radio"/>					

8. Could you please elaborate on how other parties help or prevent you from reducing supermarket food waste?

---

9. According to you, which parties should be responsible for organising donations to supermarket food waste to food banks? (multiple answers possible)

- National government
- Local council(s)
- Non governmental organisations ("NGOs")
- Consumers
- Supermarkets
- Other \_\_\_\_\_

10. In your supermarket, how much **food waste** is approximately separated from its packaging?

- Nothing
- Less than half
- Half
- More than half
- All

11. Which of the following activities to reduce food waste are applied in your supermarket? (multiple answers possible)

- Food rotation (e.g. putting food with the nearest best before date in the front)
- Putting discount stickers on products that are close to expiring

- Special product display (highlighting food close to its best before date by moving it to a more visible shelf)
- Having a demand-supply monitor (e.g. only order food when needed)
- There are no activities to reduce food waste in the supermarket I work for
- Product demonstration (let customers taste certain foods)
- Giving tips to consumers on how to use overripe food
- Other \_\_\_\_\_

12. What happens to the food in your supermarket once it has passed its best before date? (multiple answers possible)

- It is landfilled
- It is incinerated
- It is used for biodigestion
- It is used for animal feed
- It is donated to social organisations (e.g. food banks, homeless shelter)
- It is donated to informal social causes (e.g. distributing directly to people in need)
- It is returned to farmers (take-back-agreements)
- It is converted to other products (e.g. use in salad bar)
- I do not know
- Other \_\_\_\_\_

13. What percentage of food waste in your supermarket is donated to food banks or other social causes? Please make a rough estimate.

- 0%
- 1-20%
- 21-40%
- 41-60%
- 61-80%
- 81-100%
- I do not know

14. In your supermarket, which of the following facilities do you use? (multiple answers possible)

- Source separation equipment (e.g. bin, labelling of different food waste streams)
- De-packaging units (e.g. machineries to separate the packages and food waste)
- On-site process facilities in your supermarket (e.g. composters, dehydrators, digesters)
- Collection service (e.g. trucks from waste companies)
- I do not have any of them
- I do not know
- Other \_\_\_\_\_

15. To what extent would you agree that the following proposed solutions would decrease food waste?

	Strongly agree	Somewhat agree	Neither disagree nor agree	Somewhat agree	Strongly agree	I do not know

More regulation for supermarkets to donate food waste to food banks	0	0	0	0	0	0
A subsidy for supermarkets that donate food to food banks	0	0	0	0	0	0
A tax for supermarkets that do not donate food waste to food banks	0	0	0	0	0	0
A campaign to increase awareness among consumers about food waste of supermarkets	0	0	0	0	0	0
A training program for supermarket employees to better handle waste-separation	0	0	0	0	0	0
Oblige supermarkets to sell products that are close to their "best before" date for a lower price	0	0	0	0	0	0
A mobile app that promotes discounted food when they are close to their "best before" date	0	0	0	0	0	0
Giving supermarkets more freedom to come up with their own initiatives to reduce food waste	0	0	0	0	0	0

16. Are there any other solutions to reduce food waste in supermarkets that you can come up with?

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17. Do you monitor how much food waste your supermarket produces?

- Yes
- No, because it is too much work
- No, because we cannot (technical or financial limitations)
- No, for other reasons

18. How much food waste do you produce on a weekly basis in kg? (estimations or intervals are fine if no exact number can be given)

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19. How much do you produce on a weekly basis in m<sup>3</sup>? (estimations or intervals are fine if no exact number can be given)

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20. Is your supermarket affiliated with a (inter)national chain?

- Yes
- No
- I prefer not to answer

21. How old are you?

- 18-25
- 26-35
- 36-45
- 46-55
- 55-65
- >65
- I prefer not to answer

22. What is your gender?

- Male
- Female
- Other
- I prefer not to answer

23. Do you have any additional remarks/ideas about the topic or the questions?

---

24. Please check the boxes that apply to you (multiple answers possible)

- I want to be informed about the outcomes of the research
- I want the chance to win a €15 voucher for One4All
- I do not want to be informed about the outcome, nor win a voucher

25. If you checked at least one of the boxes in question 24, please leave your email address here.

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**Thank you very much. We appreciate that you took the time out to fill in this questionnaire. Your response is a valuable contribution to our research.**