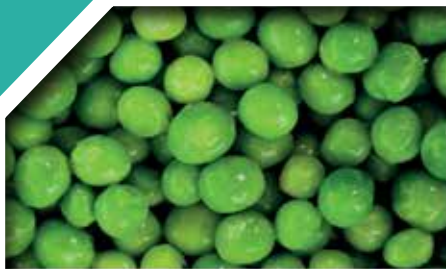


# Reducing Commercial Food Waste in Ireland

Authors: Sarah Broderick and Colum Gibson



## ENVIRONMENTAL PROTECTION AGENCY

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- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

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**EPA RESEARCH PROGRAMME 2014–2020**

# **Reducing Commercial Food Waste in Ireland**

**(2015-RE-MS-6)**

## **EPA Research Report**

End of project report available for download on <http://erc.epa.ie/safer/reports>

Prepared for the Environmental Protection Agency

by

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The EPA Research Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

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# Executive Summary

Food waste is a global problem that has environmental, social and economic consequences. According to the hierarchy of waste management, prevention is the most favourable action to take when trying to manage food waste. The commercial sector, which refers to food wholesale, retail and service, accounts for 17% of food waste in European countries. Within developed countries, the commercial sector has been identified as a stage in the food system with some of the best potential for food waste reduction.

Through a mapping exercise using national data, it was found that the two leading sources of commercial food waste in Ireland are accommodation (mainly hotels; 24%) and food retail (23%). The remainder covers various other sub-sectors of food service, including food service/restaurants (17%) and workplace canteens (10%). These sub-sectors were chosen for detailed food waste analysis in this research project and were broadly categorised according to food service (which included hotels, restaurants and workplace canteens) and food retail. In total, 52 on-site food waste composition analyses were carried out in 45 businesses from these sub-sectors across Ireland. The waste composition analyses were conducted in line with international standards, namely the Food Loss and Waste (FLW) Standard and FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies) waste quantification methodology.

The results from these assessments show that, in the food service sector, approximately two-thirds of all food waste is avoidable. Of the total waste, vegetables (11%), bread (9%), meat (8%) and potatoes (7%) make up the largest avoidable food waste fractions. Total food waste was compared with the number of covers (people served) to generate sectoral benchmarks. The food waste benchmark is highest for hotels (0.383 kg/cover). Full-service restaurants produce less waste than hotels (0.263 kg/cover), and quick-service restaurants produce less waste again (0.155 kg/cover). Workplace canteens have the lowest food waste level of the sub-sectors studied (0.08 kg/cover), although they still have a high potential for food waste reduction (avoidable food waste for

canteens was estimated at 83% of the total food waste generated). Plate waste was the largest source of food waste in the hotel (41%) and canteen (41%) sub-sectors, whereas preparation waste was the largest source of food waste for the full-service restaurant (44%) and quick-service restaurant (45%) sectors. However, unserved food was also a large source of food waste in the canteen (40%), hotel (27%) and quick-service (26%) sub-sectors.

The compositional food waste results for each sector were compared with indicative food purchasing costs gathered from a number of the participating businesses. Based on these, a food waste cost, ranging from €2.73/kg (quick-service restaurants) to €3.50/kg (workplace canteens), based solely on food purchase cost, was estimated. Applying these values to the estimated national food waste quantities indicates that the purchasing costs of wasted food for the main food service sub-sectors are €160 million for hotels, €94 million for restaurants and €73.5 million for canteens. This equates to annual costs well in excess of €300 million for the food service sector as a whole.

Retail stores were separated into two categories, depending on whether or not ready-to-eat, prepared-in-store food (referred to in this document as “serve-over”) is sold. Retail food waste was categorised according to the Codex General Standard for Food Additives, one of the categorisation systems recommended in the FLW Standard. The results of the waste composition analyses for food retail show that, of the food wasted, vegetables (21%), fruit (16%), bread (13%) and meat (11%) are the primary constituents. Overall, the fresh produce section of food retail (“fruit and veg”) is the largest source of waste. Other sources, such as chilled food, food from the deli (where present) and food from the bakery, were also major waste sources. It is apparent that foods with a higher level of perishability are wasted in larger quantities than foods with longer shelf-lives.

The total food waste recorded was compared with the size of the store and scaled up for a year, to create a food retail waste benchmark (in kg/m<sup>2</sup>/year). The level of food waste generated by food retail businesses with serve-over is higher (23 kg/m<sup>2</sup>/year) than that

for businesses with only conventional retail offerings (19 kg/m<sup>2</sup>/year). Food waste costs similar to those estimated for the food service sub-sectors were not estimated because of the commercially sensitive nature of the information required.

In addition to the fieldwork carried out, an extensive literature review of international best practice on food waste was undertaken. This started during the early stages of the project but continued throughout to capture the many food waste policy/programme changes that occurred. In terms of initiatives, Ireland, through the Environmental Protection Agency's (EPA) National Waste Prevention Programme and, more recently, Bord Bia's Origin Green programme, has been active in this sphere for over a decade. Consequently, many of the best practices, in terms of

measurement and communication programmes, are already in place.

In order to ensure that Ireland builds on the existing national expertise and meets the global food waste reduction target set out by United Nations Sustainable Development Goal (SDG) 12.3, the main recommendation is that a formal national food waste policy, with a supporting implementation strategy, is developed. This should be led by the EPA and include a number of key government departments and agencies. The implementing strategy would encompass the existing work carried out by various stakeholders, co-ordinate and inform the collation of national food waste statistics, and provide targeted support to key sectors.

# 1 Introduction

This study identifies significant food waste-generating commercial sectors in Ireland; investigates the quantity, character and sources of food waste in these sectors; compiles best practice in terms of food waste quantification and prevention; and develops sectoral food waste benchmarks.

The work was proposed to address the lack of detailed information on food waste in commercial businesses in Ireland. There is currently no formalised national food waste recording system despite the fact that an estimated 1 million tonnes of food waste is generated annually. This includes food wasted from processing, distribution, commerce and household consumption, of which 17% is attributed to commerce. It excludes farm-level food losses and fishing discards, on which there is almost no information (Stenmarck *et al.*, 2016).

This study not only improves the overall estimates of national food waste, but also provides fine-level detail on the types of food wasted and the reasons for that waste, as well as estimates for the cost of such food waste to each sector.

An extensive review of food waste quantification methodologies and guidance documents was carried out to inform the best methodology for use. Primary food waste data collection was performed through detailed, on-site, waste composition analyses. Assessments were carried out in food service and food retail businesses across Ireland. Food waste was

measured according to food type and waste type or source.

In total, 52 waste composition analyses were carried out in 45 commercial food businesses between June 2016 and September 2018. In addition to waste composition analyses, the project team gathered best practices in food waste prevention while on site. This information, along with the results of an international best practice review, has been used to develop food waste prevention guidance materials, published as part of this project (see <https://foodwastecharter.ie/>). The full research report is available at the Environmental Protection Agency's (EPA) Secure Archive for Environmental Research Data (SAFER) website.

This study provides (for the first time) meaningful and extensive information on the composition and sources of food waste in Ireland's commercial food sector. It provides information and best practices for those working in the food industry and relevant policymakers to facilitate a reduction in food waste, as well as reductions in its associated negative environmental, climate change, social and economic impacts.

In light of recently agreed international standards on food waste (FLW Protocol, 2015; Tostivint *et al.*, 2016), as well as the 2019 European Union (EU) Delegated Act on food waste monitoring (EC, 2019), this research is both timely and very important.

## 2 Commercial Food Waste Mapping

There is currently no formal, food waste-specific reporting system for the commercial sector in Ireland. In order to estimate the total food waste generated by sector, a food waste mapping analysis of national data, from a range of sources, was carried out. At the time that this mapping was carried out (2016), the best available commercial waste data were from the national waste characterisation study of 2008 (EPA, 2009). An updated study was completed at the end of 2018 (EPA, 2018). The mapping results presented here were cross-referenced against the results of the 2018 report. This corroborated the sectors identified by the original mapping exercise.

Two distinct methods were applied in the mapping exercise: a “sectoral profile method” and a “sectoral factor method”. For the former, the primary sources of data used were the most recent EPA National Waste Report (EPA, 2014) and the 2008 EPA National Waste Characterisation Study (EPA, 2009). While the 2008 study examined all wastes, relevant food waste information was extracted from the raw data. For the sectoral factor method, sectoral waste factors from the 2008 study (e.g. food waste per employee number) were combined with national statistics from different sources, such as the Central Statistics Office, Irish Hotels Federation and Fáilte Ireland, to generate sectoral food waste estimates (see Table 2 of the

full report for a full reference list of national statistics used).

The results of both methods are depicted in Figure 2.1. The sectoral profile method estimates total commercial food waste per annum at 205,000 tonnes, whereas the sectoral factor method gives an estimate per annum of 191,000 tonnes. Thus, both methods result in figures that are relatively similar to the value of 170,000 tonnes of commercial food waste per annum in Ireland based on EU food waste estimates, as reported in the FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies) project (Tostivint *et al.*, 2016).

Notwithstanding the relative similarities of these estimates, empirical data would undoubtedly provide a more robust quantification of national commercial food waste. In light of the 2019 EU Delegated Act on food waste monitoring, it is imperative that Ireland introduces a co-ordinated, national approach to food waste data collection that involves collaboration between government agencies, sectoral bodies and waste management stakeholders.

The overall trend in food waste results by sector across the two methods are similar, although there are some notable differences in results (e.g. the food service, healthcare and education sectors). The combination of results from different sources

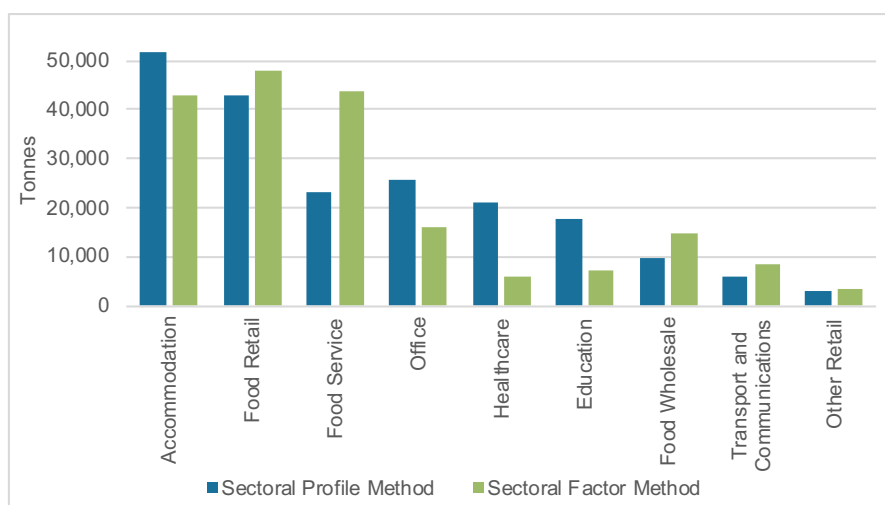


Figure 2.1. Estimated annual commercial food waste in Ireland by sector.

and years, along with limited data, inevitably adds to the degree of uncertainty. However, it is anticipated that taking the average of the results generated by both methods provides a reasonable estimate of commercial food waste.

Based on these results, the four main sectors [according to the broad NACE (Nomenclature of Economic Activities) classification] selected for further investigation were:

- accommodation (NACE 55);
- food retail (NACE 47.2);
- food service/restaurants (NACE 56);
- services/offices (NACE 64–84).

These sectors account for an estimated 75% of total commercial food waste in Ireland. Following the identification of these broad NACE sectors, the most appropriate way to classify them, in accordance

with relevant industry convention, was examined. Based on stakeholder feedback, the identified NACE sectors were categorised into food service (including accommodation and services/offices) and food retail. These two broad sectors were then divided into the following sub-sectors:

- food service sector:
  - accommodation/hotels;
  - full-service restaurants;
  - quick-service restaurants;
  - workplace canteens;
- food retail sector:
  - supermarkets;
  - convenience retail.

A total of 52 waste compositional analyses were carried out in 45 commercial food businesses across these sub-sectors, between June 2016 and September 2018.

### 3 Food Waste Quantification Methodology Review

It is widely accepted that one of the most important first steps in tackling the global food waste problem is accurate and detailed measurement of the waste (Herszenhorn *et al.*, 2014; Champions 12.3, 2016; Tostivint *et al.*, 2016). The complexity of and variation in the global food system allows for numerous methods for the quantification of food waste. In order to effectively evaluate and compare national food waste data, there is a need for the harmonisation of food waste measurement and reporting methodologies (Tostivint *et al.*, 2016). Therefore, prior to the on-site analysis work, a best practice review of international food waste quantification methodologies was carried out.

Since 2012, two main initiatives have developed international standardised food waste reporting methods. The first, FUSIONS, was an EU FP7 project that ran from 2012 to 2016. FUSIONS involved 21 project partners from 13 countries across the EU. The project aimed to reduce food waste in Europe through improved EU-wide food waste quantification, deeper knowledge of the potential of social innovation to reduce food waste and the development of guidelines for a common European food waste policy. The project developed the FUSIONS Food Waste Quantification Manual (Tostivint *et al.*, 2016), a focused document for EU Member States with guidance on how to carry out food waste studies. The primary objective of FUSIONS was to allow EU Member States to quantify national food waste over 1 calendar year. The project laid out a standard approach for direct food waste quantification at each stage in the food chain, how to combine these sectoral quantifications at a national scale and how to report these national results in a format that was consistent with that used by other Member States.

The second international standardised food waste reporting method – the Food Loss and Waste (FLW) Accounting and Reporting Standard (FLW Protocol, 2015) – was developed by the World Resources Institute (WRI) in 2016. Unlike FUSIONS, which is primarily about the methods employed to gather data, the FLW Standard focuses on providing guidance on food waste reporting. The FLW Standard has several mandatory requirements and includes key recommendations relating to time frame, material types, destinations and boundaries.

In addition, relevant scientific literature was also reviewed to gather information on previously applied food waste quantification methods and results. In total, approximately 50 peer-review articles were analysed, providing an overview of the quantification methods employed by some of the most relevant studies. All of the included studies used direct weighing, carried out either by research teams or by existing kitchen staff. Several of the studies accompanied this with other quantification methods, including material flow analysis, interviews, questionnaires and focus groups.

The literature review extended beyond peer-reviewed articles to numerous official reports, guidance documents and methodologies on food waste quantification, including *Reducing Food Waste in Irish Healthcare Facilities* (CTC, 2014); *Less Food Waste More Profit – A Guide to Minimising Food Waste in the Catering Sector* (Creedon *et al.*, 2010); *The Ultimate Guide: Monitoring and Measuring Food Waste* (Resource Efficient Scotland, 2018); *Waste in the UK Hospitality and Food Service Sector* (Parfitt *et al.*, 2013); and *Where Food Waste Arises within the UK Hospitality and Food Service Sector: Spoilage, Preparation and Plate Waste* (WRAP, 2013a).

## 4 Project Methodology

Following the best practice review, an existing methodology previously developed by the Clean Technology Centre (CTC, 2014) was compared with relevant international standards and protocols, before being amended accordingly. The quantification methodology employed addresses the requirements set out in both the FUSIONS and the FLW standards.

The sampling strategy used was a non-probability-based quota sampling method known as convenience sampling. In order to reduce the potential for sampling bias, businesses were recruited through a variety of channels, with a wide geographical spread and with attempts to cover a variety of business types, sizes, market segment, etc. In addition, the assessments were carried out both on weekdays and during weekends to address the potential variability. The sectoral investigations took place over a 2-year period, thus taking into account seasonal variability. The scope of the assessments included all edible food (i.e. avoidable food waste) and associated inedible parts (i.e. unavoidable food waste<sup>1</sup>) disposed of over a full day of operation in each business.

In total, 52 waste composition analyses were carried out in food service and food retail businesses in Ireland. The on-site waste composition analysis methodology varied between food service and food retail businesses. In the food service sector, waste was captured at source before disposal and was almost exclusively unpackaged. This ensured accurate results as food waste segregated post disposal cannot always be identified with confidence. A potential consequence of this type of assessment is the “observer effect” (discussed in section 5.2).

Each food service assessment lasted 1 full working day. Depending on business operations, this varied from approximately 8 to 16 hours. The composition of food waste in food service was categorised according to (1) food type (bread, salad, meat, fish, etc.), (2) serving style (where relevant) and (3) waste source

(preparation waste, plate waste, unserved food waste and residual waste). The source of food waste gives insight into the potential reasons for the waste.

In the food retail sector, food was mostly recorded post disposal but pre collection, i.e. from within on-site waste bins. Packaging weights were estimated and deducted where applicable. Food retail surveys were carried out over 1 day, typically 6–8 hours. Retail food waste was categorised according to the Codex General Standard for Food Additives (one of the categorisation systems recommended by the FLW Protocol, 2015).

Edible food and associated inedible parts were included in the scope. Because of variations in the methodologies employed for each sector it was possible to separate and record inedible (unavoidable) food wastes in the food service sector only. Within food service, milk was the only drink included. Water, tea, coffee, soft drinks and alcohol were all excluded. In food retail, beverages were included. The end destination of food waste was confirmed at each business assessed in the project and recorded if it varied from the norm.

In an effort to identify the cost of food waste for the food service sub-sectors, sectoral stakeholders were surveyed to provide purchasing costs per kilogram for the main food categories. These costs were then applied to the food waste profiles to produce sector-specific estimates of the cost of food waste. Unavoidable food wastes were included in the profiles but were assigned a zero cost in these calculations. Therefore, the final values reflect the purchasing costs of avoidable food waste only and do not include other costs such as waste disposal, staff time and cooking. This method was applied to food service only as the equivalent information for retailers was unavailable because of its commercially sensitive nature.

More details of the on-site methodology are provided in the appendices to the main project report (see <http://erc.epa.ie/safer/reports>).

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<sup>1</sup> The unavoidable food waste category was included for the food service sector only. It was classified based on what foods are commonly considered as “unsuitable for human consumption” in this industry, for example vegetable peelings, fish skins, animal bones and leftovers from stock production.

# 5 Food Waste in the Irish Food Service Sector

For the purposes of this research, the Irish food service sector was broken down according to the sub-sectors estimated to produce the largest quantities of food waste. These were hotels, full-service restaurants, quick-service restaurants and workplace canteens.

In order to compare food waste generation across these sub-sectors, the results of the waste compositional analyses were compared with a measure of activity within each business to create a benchmark value. The measure used was the number of people served, or “covers”. This is a metric that is widely available and understood across the food service industry. The results for each sub-sectoral benchmark are therefore given as food waste per cover.

Finally, in an effort to quantify the costs associated with avoidable food waste, indicative purchasing costs were gathered and applied to the sectoral food waste profiles.

## 5.1 Results

The sources of food waste vary between all of the sub-sectors studied (Figure 5.1). In hotels, plate waste is proportionally the largest source of food waste (41% of total food waste). In full-service and quick-service restaurants, preparation waste is the leading source of food waste (44% and 45%, respectively). Unserved food waste is highest in canteens (40% of total), where a high proportion of food is pre-prepared.

Figure 5.2 shows that the ratios between avoidable and unavoidable food waste in full-service (62:38)

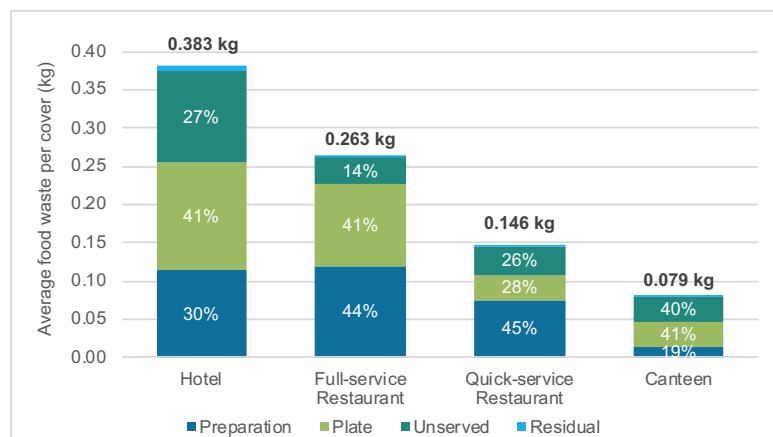


Figure 5.1. Sectoral food waste profiles including food waste per cover.

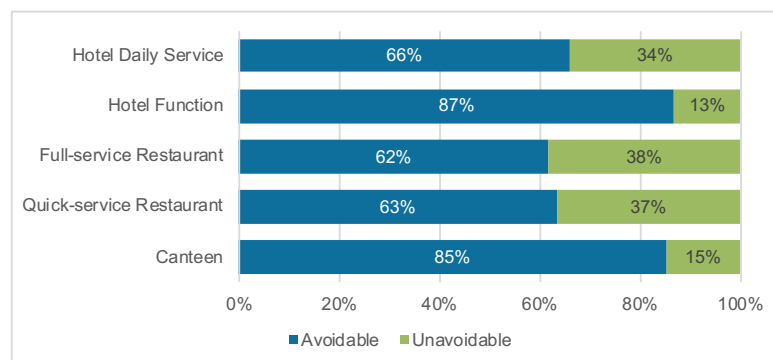


Figure 5.2. Mean avoidable and unavoidable food waste for all sub-sectors studied.



and quick-service restaurants (63:37) are very similar. The hotel daily service ratio deviates only slightly from this (66:34), whereas the ratio for hotel functions is quite different (87:13). Canteens have a similar level of avoidable waste as hotel functions (85:15).

Some of the variation in these results could be attributed to different levels of in-house food preparation among the sub-sectors. For example, workplace canteens typically purchase a higher proportion of pre-prepared ingredients than full-service restaurants.

Figure 5.3 summarises the detailed food waste composition results for the four sub-sectors included in this study. Although the composition of food waste varies between each sub-sector, some trends can be seen.

On average, vegetables are the most commonly wasted food type (11%), followed by bread (9%), meat (8%) and potatoes (7%). Dairy, eggs, fish and fruit make up approximately 2% or less of total food waste in all sub-sectors. Desserts and milk make up a similarly low proportion of food waste for every

sub-sector other than quick-service restaurants, where they make up 6.5% and 4.5% of food waste, respectively. The provision of milk jugs on tables and the high proportion of dessert sales compared with main meal sales in cafes is a possible cause of this trend. Cereal waste is a much larger component of food waste in canteens (13%) than in any other sector (approximately 3%). This is probably influenced by the large quantities of unserved porridge that are common in workplace canteens. A similar result is observed for potato waste in hotels (11% in hotels vs 3–7% in other sectors).

The cost of food waste varies between sub-sectors and ranges from €2.73/kg for quick-service restaurants to €3.50/kg for workplace canteens (Table 5.1). By applying these values to the estimated national quantities of food waste (see Figure 2.1), the purchasing costs associated with wasted food were estimated for the different sub-sectors. These indicate that the costs of food waste are €160 million for hotels, €94 million for restaurants and €73.5 million for canteens. This equates to an annual cost well in excess of €300 million for the food service sector as a whole.

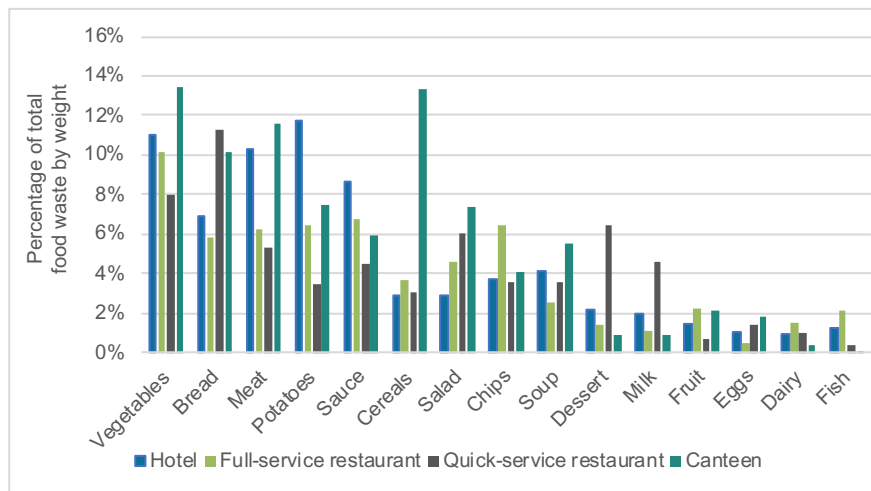


Figure 5.3. Composition of avoidable food waste for all sub-sectors.

Table 5.1. Food waste costs for Irish food service sub-sectors

	Hotels	Restaurants	Canteens
Total cost (€/kg)	3.38	2.82 <sup>a</sup>	3.50
Total national food waste (tonnes)	47,300	33,400	21,000
National cost of food waste (€)	160 million	94 million	73.5 million

<sup>a</sup>Average of the costs for full-service (€2.90/kg) and quick-service (€2.73/kg) restaurants.

## **5.2 Discussion and Observations**

The results of this research show that there is good potential for food waste reduction across the food service sector in Ireland. Approximately two-thirds of food waste is potentially avoidable, across all sub-sectors. Within each sub-sector some businesses are already performing better than others. Although there are more factors at play than the food waste types alone, these results are a promising sign that food waste in the sector can be reduced.

The most commonly wasted foods – vegetables, bread, potatoes and meat – are some of the foods that are most commonly served in Irish food businesses. Vegetables, potatoes and meat are also the foods that are typically associated with main meals. With this in mind it is understandable that these are the largest contributing food types to food service waste.

The “observer effect” is an unfortunate consequence of the waste composition analysis method used. Despite efforts to reassure kitchen staff and requests that all practices should remain the same, the presence of the project team in the kitchen almost certainly influenced staff behaviour. Taking this into account, it is likely that the results given above are an underestimate of the true levels of food waste.

In terms of benchmarking, there was some difficulty with consistency when determining the relevant number of covers served in each business. Although, in general, the concept of a cover is very well understood in the industry, the actual detail of what constituted a cover and what did not varied between businesses.

# 6 Food Waste in the Irish Food Retail Sector

The results from food retail businesses were categorised based on the presence or absence of serve-over food sales. “Serve-over” is an industry term for food that is served to customers over a counter. It includes the sale of food from butcher counters and deli counters and the sale of heated, ready-made meals. Offering serve-over food means that retailers are involved in the cooking and preparation of food, ready for direct consumption. It does not include in-store bakeries.

To allow for comparison between businesses, results were scaled up for 1 year and compared with shop size (in m<sup>2</sup>). Shop size is a common factor used when benchmarking the retail/food retail sector (e.g.

kWh/m<sup>2</sup>/year is used for energy). In this case it refers to the external area of the building.

## 6.1 Results

The “fruit and veg” section is the leading source of food waste for both retail types (34% for serve-over and 40% without serve-over; Figure 6.1). Chilled food is the next largest waste source for stores without serve-over (31%). The bakery is the second largest source of food waste in stores with serve-over (21%).

In terms of food types, vegetables and fruit are the leading sources of waste for both retail types (Figure 6.2). The most significant differences between

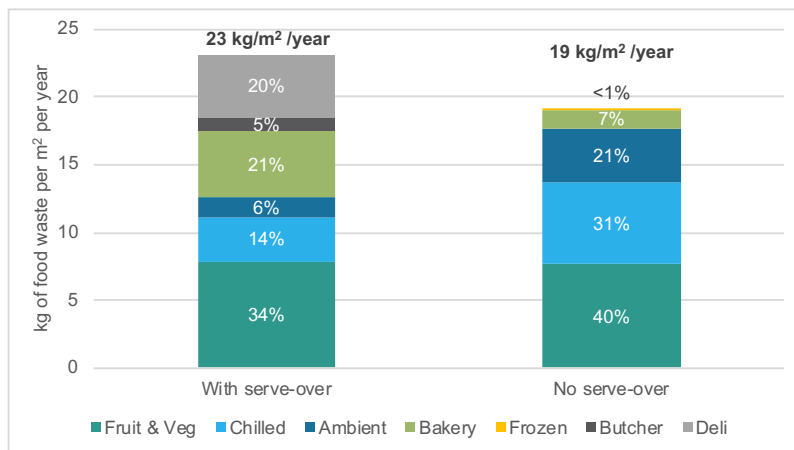


Figure 6.1. Food waste profiles for food retail including food waste per m<sup>2</sup> per year.

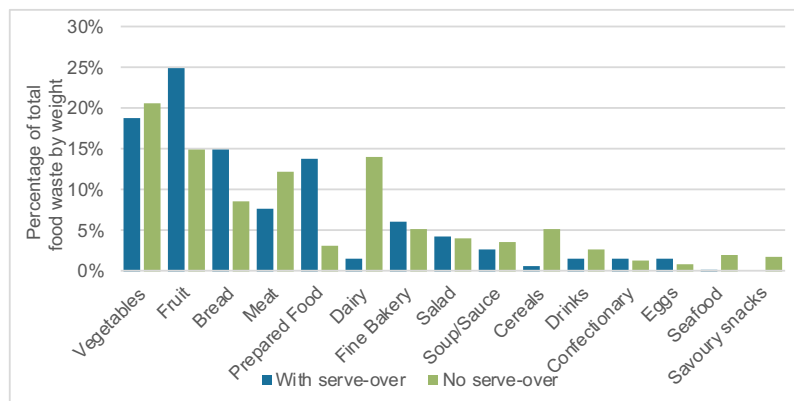


Figure 6.2. Retail food waste types for businesses with and without serve-over.

retail types are for prepared food, fruit and bread, which represent much higher proportions of total waste for businesses with serve-over. In businesses without serve-over, meat and dairy waste are much higher proportionally.

In accordance with findings of previous studies on food waste in the food retail sector, products with the highest perishability are those that are most commonly wasted (Pekcan, 2006; WRAP, 2008). Vegetables (20%), fruit (20%), bread (12%) and meat (10%) were found to be the leading sources of food waste in the food retail sector during this research. When analysed by source, the “fruit and veg” or fresh produce section of stores was the leading source of food waste for both types of retail businesses assessed.

## **6.2 Discussion and Observations**

The results show that offering serve-over foods increases the level of food waste in a food retail business. The exact sources of, or reasons for, the waste from the serve-over section were not examined in detail in this study and this is an area that should be considered for future work. The methodology used to assess food waste from the food retail sector, which entails using waste composition analysis post disposal, meant that waste from serve-over could be segregated only into broad categories (e.g. deli counter vs bakery). It was

not possible to accurately determine, for example, whether food waste was generated from preparation or unserved food or, in most cases, to separate the waste according to food type.

The serve-over section of food retail should be an area of focus for food waste prevention in the food service sector. Food from serve-over is processed and managed by staff to a much greater degree than conventional retail products, offering much more control and potential for intervention at an individual business level.

In some of the businesses assessed, staff noted that, by producing ready-made food in store, many of their short-dated or perishable food products can be redirected or incorporated into these meals. This is also the case for certain food products with damaged packaging or other small faults. If the management of food within the serve-over sections of food retail was improved, there would be the potential to reuse food from elsewhere in businesses, thereby reducing overall food waste.

It was observed during this work, and corroborated by the 2018 waste characterisation study (EPA, 2018), that significant volumes of food waste enter the general waste and mixed dry recyclable waste streams. Therefore, the food waste benchmarks reported here are probably an underestimate of the true levels of food waste in food retail.

## 7 Food Waste Prevention Best Practice Review

In order to inform potential initiatives and/or policies following this research, an extensive desk-top review of existing food waste prevention actions was carried out. This review focused on, but was not limited to, actions from within other EU Member States. In addition, Irish food waste prevention activities are summarised.

### 7.1 International Measures

In 2016, a framework for the evaluation of food waste interventions was developed as part of the EU project FUSIONS (Burgos *et al.*, 2016). The results of the international review are summarised in accordance with this framework.

National strategies involve high-level policies and programmes that focus on food waste prevention throughout a country. These are stand-alone strategies or can be part of a larger waste prevention strategy. For example, in response to their United Nations (UN) Sustainable Development Goal (SDG) target 12.3 obligations, the Australian government published a national strategy on food waste in late 2017 (UN, 2015; Commonwealth of Australia, 2017). This strategy outlines the current situation in Australia regarding the levels of food waste and existing measures to reduce them. The document recommends four target areas for future actions to prevent food waste: policy support, business improvements, market development and behaviour change. The Australian government has invested over AU\$1 million in the establishment of an independent organisation to co-ordinate the implementation of the strategy.

Market-based instruments are policy tools that encourage food waste prevention through non-legislative means. These instruments are commonly economic incentives, including government financial assistance (Burgos *et al.*, 2016). The Italian government implemented legislation in the late 1990s to promote the redistribution of surplus food from the food retail sector. This removed the requirement to pay income tax on the unsold food for food donation and removed the deduction of value-added tax (VAT) from such foods (Gazzetta Ufficiale, 1997, 1999). In

2016, Italy set up a national framework on food waste donation, streamlining the process of food donation and expanding the circumstances under which food waste can legally be donated (Gazzetta Ufficiale, 2016).

Regulatory instruments are orders from government that are supported by law, including mandatory management plans or licensing (Burgos *et al.*, 2016). A 2016 French law relating to the fight against food waste sets out a hierarchy of measures including waste prevention, use of the unsold products by donation or processing, food recovery for use as animal feed and agricultural compost and energy recovery by methanisation. It bans supermarkets (with a surface area of over 400 m<sup>2</sup>) from throwing away or destroying unsold food; instead, they are obliged to donate it to charities and food banks (Legifrance, 2016).

Voluntary agreements, sometimes referred to as co-regulation, are typically a form of co-operation between public administration and participating stakeholders, usually businesses (Cambueira, 2001; Burgos *et al.*, 2016). An international example is Champions 12.3, which was initiated in 2016. It is a coalition of executives from both public and private sectors, with secretariat support from the WRI and the government of the Netherlands. Champions 12.3 includes top representatives from leading businesses, national and international governments and environmental and resource efficiency groups, who commit to contributing towards achieving target 12.3 of the UN SDGs (Champions 12.3, 2016). The Courtauld Commitment was launched in the UK in 2005 by WRAP (Waste and Resources Action Programme) and is funded by the four governments of the UK. It is a voluntary commitment made by food retailers and major food manufacturers, brands and suppliers to reduce food and packaging waste (WRAP, 2013b).

Communication and campaign initiatives are varied and can be implemented by community groups, retailers, non-governmental organisations, public bodies and governments. They include the use of traditional or online media, events and training to

communicate and encourage behaviour change surrounding food waste (Burgos *et al.*, 2016).

Other successful measures include food-sharing platforms, community-based initiatives and technical solutions and are described in the full project report (see <http://erc.epa.ie/safer/reports>).

## **7.2 Irish Measures**

As a signatory of the UN SDGs, Ireland has made a commitment to reduce food waste by 2030. Ireland has been active in addressing food waste since 2005, when the first comprehensive national waste characterisation study identified the high levels of food waste generated. The updated 2008 waste characterisation report provided more specific information and, as a consequence, the EPA developed a number of programmes that are targeting food waste.

Ireland's National Waste Prevention Programme (NWPP), the first in the EU, was established in 2004. Implemented by the EPA, it serves as the core mechanism for the implementation of waste prevention policy in Ireland. Although Irish waste management policy includes food waste, and food waste has been identified as one of the five priority areas by the NWPP, there is no dedicated national food waste prevention policy or strategy (DECLG, 2012). A number of the NWPP initiatives that deal with commercial food waste include:

- The Food Waste Charter for Ireland, which was launched in 2017 at Ireland's national food waste event, the Forum on Food Waste. This initiative is based on voluntary agreements by companies to make a commitment to reduce their food waste. Five of the six major supermarket chains in Ireland signed the charter and, as a first step, committed to measuring and reporting their food waste (Stop Food Waste, 2017a; DCCAIE, 2018).
- The Local Authority Prevention Network (LAPN), which is a network and funding mechanism for staff of Irish local authorities to execute waste prevention projects within local communities or with local businesses. The initiative has supported several projects focusing on commercial food waste, in particular food service (LAPN, 2018).
- The Green Healthcare Programme (2010–2018), run in partnership with the Health Service

Executive, which was a sector-specific waste prevention programme. Much of the focus of this programme was on food waste prevention and reduction. Green Healthcare has produced a suite of materials on food waste quantification and prevention in the sector, including factsheets, case studies and guides (Green Healthcare, 2018).

- Stop Food Waste, which focuses primarily on food waste prevention at the consumer level. However, it has implemented some projects working with both individual businesses and groups of businesses within communities (Stop Food Waste, 2017b).

Other significant national initiatives include:

- Origin Green, launched in 2012 by Bord Bia, which provides a structure for Irish food and drink companies to showcase their commitment to sustainable food production. To become a member, companies must develop a sustainability action plan in which they commit to achieving ambitious and measurable sustainability targets (Bord Bia, 2018a). In 2016, the Origin Green programme expanded to include food retail and food service businesses, with food waste a mandatory target for these businesses (Bord Bia, 2018b).
- FoodCloud, which is a food redistribution charity that operates throughout Ireland. Food redistribution through food banks is a common approach to reducing food waste. However, FoodCloud has an innovative online platform that facilitates retailers to connect directly with local charities to donate surplus food. In addition, FoodCloud Hubs operate more traditional food banks where large donations from food processors and distributors can be accepted (FoodCloud, 2018).

## **7.3 Conclusions from the Best Practice Review**

Food waste is a systems problem: there is no single solution or one particular sector to target. To address such a complex and far-reaching issue, action needs to be taken at national and international levels. Focused campaigns, projects and solutions are necessary and can be effective, as shown by the examples above. However, these need to be

implemented collaboratively, over a sustained period of time and as part of a broader strategy that addresses all sectors of the food system.

The UN SDG 12.3 provides the global focus required for food waste prevention. Through this high-level policy agreement, targets have been set that, in the next decade, should lead to a more detailed understanding of, and reduction in, global food waste and loss. With improved measurement standards, and

the setting of reduction targets, it is anticipated that food waste prevention will become a central activity throughout the food chain. For this to happen, the aims of SDG 12.3 need to be written into national-level policy. Australia is one of the countries taking the lead on this, having developed a formal national strategy on food waste that includes policy, funding and technical support aspects. Ireland should follow suit and implement a food waste-specific national policy and a strategy to implement it.

# 8 Conclusions and Recommendations

## 8.1 Conclusions

The issue of food waste is now high on both national and international agendas. Food waste has been targeted specifically in the UN SDGs and internationally agreed measuring protocols such as the FLW Standard and FUSIONS methodology that have been developed (FLW Protocol, 2015; UN, 2015; Tostivint *et al.*, 2016). In addition, the EU Circular Economy Package identifies food waste as a priority material stream and outlines actions for its measurement and prevention (EC, 2015; EPRS, 2017).

In line with the premise that “what cannot be measured, cannot be managed”, it is clear that generating food waste data, as a precursor to prevention, is now a priority. The current EU Waste Framework Directive (2008/98/EC; EU, 2008) obliges Member States to monitor the generation of food waste and to take measures to limit its generation. However, until recent years, there has been no harmonised method to measure food waste in the EU. This makes it more difficult for public authorities to assess its scale, origin and trends over time. Addressing this measurement deficit is an important step towards a better understanding of the problem. Through establishing a coherent monitoring and reporting system at an EU level, it will become feasible to set quantitative targets for the reduction of food waste. The 2019 European Delegated Act on food waste monitoring addresses this need (EC, 2019).

Based on the best available data, total food waste from the commercial sector in Ireland has been estimated by this research as approximately 230,000 tonnes per annum. The main sectors contributing to this food waste have been identified as food service (including hotels, restaurants and workplace canteens) and food retail (including supermarkets and convenience retail stores). These sectors account for approximately 49% and 24% of the estimated national commercial food waste, respectively. It is interesting to note that these are the same non-household sectors that are specified in SDG 12.3 (UN, 2015). Based on examining the

emerging protocols and programmes in the area of food waste measurement and prevention, an already evolved national food waste assessment methodology has been refined through this work to correlate with international standards. This was used to provide more detailed knowledge on the levels and types of food waste in the main sub-sectors of food service and food retail in Ireland.

As this is the first time that a broad range of food waste-producing sectors has been examined in detail in Ireland, there are a number of key results to be noted:

- In food service, hotels have the highest rate of food waste generation among the sub-sectors, with an average rate of 0.383 kg of food waste per cover. Full-service and quick-service restaurants have food waste values of 0.263 kg/cover and 0.155 kg/cover, respectively. The lowest food waste benchmark was calculated for workplace canteens, at just 0.08 kg/cover.
- On average, across food service, plate waste is the largest contributor, at 38% of total food waste, followed by preparation waste (34%) and unserved food waste (26%).
- Across all food service sub-sectors, avoidable food waste makes up over 60% of food waste.
- In food service, vegetables are the most commonly wasted food type (11%), followed by bread (9%), meat (8%) and potatoes (7%).
- The costs associated with food waste vary between €2.73/kg for quick-service restaurants and €3.50/kg for workplace canteens. When applied to national food waste estimates, these indicate that the purchasing costs of wasted food are €150 million for hotels, €98 million for restaurants and €82 million for canteens. This equates to an annual cost well in excess of €300 million for the food service sector.
- Within food retail businesses, the fruit and vegetable section is the largest source of food waste. When assessed by food type, vegetables (20%) and fruit (16%) are the two leading types of waste, followed by bread (15%) and meat (11%).



- The presence of serve-over offerings (i.e. the preparation of food on site) increases the level of food waste in food retail. This type of food waste is usually highly perishable, often having a shelf-life of just 1 day, and heated food is kept for only a number of hours before quality degrades and it is typically discarded. In addition, serve-over food waste is harder for businesses to systematically measure. It is usually disposed of as mixed food waste in food preparation areas and is often unpackaged and does not have a bar code.
- Although the largest food waste-producing sectors were evaluated, the results, particularly those for food service, are applicable to a much wider range of businesses (e.g. pubs, canteens in educational establishments).

In addition to the quantifiable results summarised above, further conclusions can be drawn from the literature reviews, on-site observations and stakeholder meetings. These are as follows:

- Measurement or quantification of food waste is a critical first step in effective food waste prevention (Herszenhorn *et al.*, 2014; Champions 12.3, 2016; Tostivint *et al.*, 2016). The detailed measurements carried out in this study identified numerous examples of readily avoidable food waste in all of the business sectors involved.
- Following each assessment, businesses were issued with detailed reports of the results and a list of site-specific recommendations and possible actions to reduce food waste. Anecdotal evidence from participating businesses suggests that food waste levels were somewhat reduced following the waste assessment and the subsequent issuing of a food waste report.
- Although the approach used to gather the data for this work is completely applicable to establishing the comprehensive baseline information required, it is not conducive to lasting prevention-based initiatives being applied in those participating businesses. The “fly-in-fly-out” nature of the assessments, the fine level of detail gathered (food was segregated into at least 16 categories) and the limited engagement with staff ahead of time are contrary to the approach needed for lasting, business-led changes. Such an approach should strive towards a continual improvement model that includes a combination of ongoing measurement, staff involvement and customer communication.
- A major barrier to food waste prevention across the commercial food industry is the hesitancy to make changes because of the potential for negative impacts on customer experience, brand or reputation. To be taken on board, any food waste prevention initiatives will have to address this issue from the outset. Communication with consumers about the importance of food waste prevention and other measures to change consumer attitudes towards food waste should be an important part of any future initiative (Pirani and Arafat, 2016).
- The generation of food waste in food service businesses is not typically the result of a lack of skill or knowledge on behalf of the staff. Food waste appears to be more driven by the culture and management priorities of a business. Simply supporting businesses to better identify the sources of food waste is not enough, even when paired with practical advice on how food waste can be reduced. Meaningful management buy-in and a shift in the sectoral attitude towards food waste is required.
- In general, although many food service businesses are aware that food waste is an issue, there is little sectoral dialogue about the topic. In fact, the main discussion around food waste is focused on the regulatory requirements (or costs of applying them) rather than the environmental, social and financial costs associated with wasting food.
- Even though segregated food waste services are legally required, many businesses still do not have these services in place. In addition, even in those that do have proper services in place, food waste is often mismanaged, with large volumes of waste ending up in the mixed residual (black bin) and mixed dry recyclable (green bin) waste streams, as well as down the drain.
- There are inherent differences between the magnitudes and capacities of the businesses within the two broad sectors studied. The Irish food retail sector is dominated by very large national or multinational companies, whereas the food service sector is still largely made up of small- to medium-sized enterprises, with 50 members of staff or less. Because of their size and structure, the major food retailers have a

higher capacity to implement waste management systems and procedures than much smaller food service businesses. In the government-driven Retail Action Group, with five of the most significant retailers having joined, approximately 70% of the market share is now reporting data centrally.

- Waste contractors currently report waste data to the National Waste Collection Permit Office (NWCPO) according to broad source (e.g. commercial, household) and waste type, based on the European Waste Catalogue. There is currently no sectoral information included in the national waste reporting system (e.g. reporting according to NACE). Consequently, it is not possible to scale up the sectoral food waste profiles generated by this research to produce national figures.

## **8.2 Recommendations**

Based on the results of this research project, interactions with the participating businesses and sectoral stakeholders and a review of international best practice in the area of food waste prevention, a number of key recommendations can be made:

1. To ensure that Ireland builds on the existing national expertise and meets the global food waste reduction target set out by UN SDG 12.3, the main recommendation is that a formal national food waste policy, with a supporting implementation strategy, be developed. The scope of this policy should encompass the entire food chain. This policy should be developed by the EPA in consultation with a number of key departments, including the Department of Communications, Climate Action and Environment (DCCAE), the Department of Agriculture, Food and the Marine, the Department of Education and Skills, the Department of Business, Enterprise and Innovation and the Department of the Taoiseach.
2. Based on the national food waste policy, a 5-year food waste prevention strategy should be developed and implemented. This should be co-ordinated by the EPA and would identify the required actions, assign responsibilities, set targets and ensure regular reporting of progress. Sufficient funding should be assigned by government to assist implementation of the strategy.
3. The strategy should be reviewed after 5 years, with quantification and qualification of commercial food waste and assessments of the benchmarks identified in this study, as well as estimates for other relevant sectors within the food chain.
4. A dedicated national food waste data group should be established to ensure that food waste quantities are measured as accurately and consistently as possible. This should include the EPA, Central Statistics Office, DCCAE, Origin Green and NWCPO. Co-ordinating the data collected by national agencies, and ensuring that the various datasets are compatible, would greatly improve the potential application of existing data.
5. The current national waste characterisation methodology is designed to provide statistically robust information on the character of waste from different sectors (EPA, 2018). However, changing current waste contractor reporting to the NWCPO to include the assignment of waste collected to relevant NACE sectors would be a significant improvement. This would allow sectoral profiles (such as those generated here) to be assigned to national waste generation statistics. This in turn would facilitate national reporting requirements, as well as providing more accurate sectoral data to inform prevention-based policies and programmes/campaigns.
6. Awareness is an important element of any waste prevention initiative. The results of this study have been incorporated into sector-specific communication materials. These should be widely promoted and distributed through relevant stakeholder groups such as the Irish Hotels Federation, the Restaurants Association of Ireland, Origin Green and the Retail Action Group.
7. Even with the provision of support documents and information, many businesses are unlikely to effect long-standing change without direct support. Funding and technical support needs to be provided through appropriate stakeholder channels. Ireland's Food Waste Charter and Origin Green programmes are already working in this area and should be appropriately supported. As has been identified through this research, and internationally, intervention-based programmes need to run over a sustained period and involve direct staff engagement.

8. A food waste prevention training programme for food service and food retail sub-sectors should be developed and implemented. This could include a continuing professional development element for existing staff, as well as curriculum materials for formal third-level courses.
9. Improving food waste segregation should be included in the remit of any future commercial food waste prevention and measurement initiatives. Such initiatives will not be fully effective without improvements to the current standards of food waste segregation in Irish businesses (see EPA, 2018).
10. Because of the diversity of businesses within the food service sector, food waste prevention initiatives should be implemented at a sub-sectoral level. When targeting sub-sectors, the results of this research should be considered, along with other influencing factors such as sub-sector size and presence of representative bodies.
11. Although not one of the main sources of food waste in the food retail sector, initial efforts in this sector could focus on “serve-over” food, which is produced in-house and consequently has the potential to be managed differently.

# References

- Bord Bia, 2018a. Retail and Foodservice Sustainability Charter. Version 4. Bord Bia, Dublin.
- Bord Bia, 2018b. Origin Green Member Companies. Available online: <https://www.origingreen.ie/who-is-involved/origin-green-companies/> (accessed 13 November 2018).
- Burgos, S., Gheoldus, M., Vittuari, M., Politano, A., Piras, S., Aramyam, L., Valeeva, N., Wenbon, M., Hanssen, O.J., Scherhauer, S., Ottmer, R., Silvennoinen, K., Paschali, D., Braun, S., Sceh, B. and Ujhelyi, K., 2016. *Policy Evaluation Framework*. EU Fusions, Stockholm.
- Cambugueira, M.F.M., 2001. Voluntary agreements as an environmental policy instrument – evaluation criteria. *Journal of Cleaner Production* 9: 121–133.
- Champions 12.3, 2016. About. Available online: <https://champions123.org/> (accessed 20 November 2018).
- Commonwealth of Australia, 2017. *National Food Waste Strategy: Halving Australia's Food Waste by 2030*. Government of Australia, Canberra.
- Creedon, M., Cunningham, D., Hogan, J. and O'Leary, E., 2010. *Less Food Waste More Profit – A Guide to Minimising Food Waste in the Catering Sector*. Cork Institute of Technology Press, Cork, Ireland.
- CTC (Clean Technology Centre), 2014. *Reducing Food Waste in Irish Healthcare Facilities: Results, Guidance and Tips from a 3-Year Programme*. Cork Institute of Technology Press, Cork, Ireland.
- DCCAE (Department of Communications, Climate Action and Environment), 2018. Major Irish retailers sign up to government's Food Waste Charter. Available online: <https://www.dccae.gov.ie/en-ie/news-and-media/press-releases/Pages/Major-Irish-Retailers-Sign-Up-to-Government%E2%80%99s-Food-Waste-Charter.aspx> (accessed 19 November 2018).
- DECLG (Department of the Environment, Community and Local Government), 2012. A Resource Opportunity, Waste Management Policy in Ireland. DECLG, Dublin.
- EC (European Commission), 2015. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Closing the loop – an EU action plan for the Circular Economy. COM (2015) 0614 final, 2.12.2015, Brussels.
- EC (European Commission), 2019. Commission Delegated Decision (EU) of 3.5.2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste. COM(2019) 3211 final, 3.5.2019, Brussels.
- EPA (Environmental Protection Agency), 2009. *Municipal Waste Characterisation Surveys 2008 – Final Report*. EPA, Johnstown Castle, Ireland.
- EPA (Environmental Protection Agency), 2014. *National Waste Report 2012*. EPA, Johnstown Castle, Ireland.
- EPA (Environmental Protection Agency), 2018. *Non-household Waste Characterisation Campaign – Final Report*. EPA, Johnstown Castle, Ireland.
- EPRS (European Parliamentary Research Service), 2017. *Towards a Circular Economy – Waste Management in the EU*. EPRS, Brussels.
- EU (European Union), 2008. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. OJ L 312, 22.11.2008, p. 3–30.
- FLW Protocol (Food Loss and Waste Protocol), 2015. *FLW Protocol Accounting and Reporting Standard (FLW Standard). Appendix A*. Available online: [http://flwprotocol.org/wp-content/uploads/2017/05/FLW\\_Standard\\_final\\_2016.pdf](http://flwprotocol.org/wp-content/uploads/2017/05/FLW_Standard_final_2016.pdf) (accessed 25 November 2018).
- FoodCloud, 2018. FoodCloud. Available online: <https://food.cloud/> (accessed 23 August 2018).
- Gazzetta Ufficiale, 1997. Decreto Legislativo 4 dicembre 1997, n. 460. Riordino della disciplina tributaria degli enti non commerciali e delle organizzazioni non lucrative di utilità sociale'. Available online: <http://www.gazzettaufficiale.it/eli/id/1998/01/02/097G0489/sg> (accessed 23 November 2018).
- Gazzetta Ufficiale, 1999. Legge del 13 maggio 1999, n. 133. Disposizioni in materia di perequazione, razionalizzazione e federalismo fiscal. Available online: <http://www.parlamento.it/parlam/leggi/99133l.htm> (accessed 23 November 2018).

- Gazzetta Ufficiale, 2016. Legge 19 agosto 2016, n. 166. Disposizioni concernenti la donazione e la distribuzione di prodotti uvergne e farmaceutici a fini di solidarietà sociale e per la limitazione degli sprechi. Available online: <http://www.gazzettaufficiale.it/eli/id/2016/08/30/16G00179/sg> (accessed 23 November 2018).
- Green Healthcare, 2018. About. Available online: <https://www.greenhealthcare.ie/about/> (accessed 19 November 2018).
- Herszenhorn, E., Quedstedt, T., Eastel, S., Prowse, G., Lomax, J. and Bucatariu, C., 2014. Prevention and reduction of food and drink waste in businesses and households – guidance for governments, local authorities, businesses and other organisations. United Nations Environment Programme, Nairobi.
- LAPN (Local Authority Prevention Network), 2018. About LAPN. Available online: <https://localprevention.ie/about/> (accessed 19 November 2018).
- Legifrance, 2016. LOI No 2016–138 du 11 février 2016 relative à la lutte contre le gaspillage alimentaire. Available online: <https://www.legifrance.gouv.fr/eli/loi/2016/2/11/AGRX1531165L/jo/texte> (accessed 23 November 2018).
- Parfitt, J., Eatherley, D., Hawkins, R. and Prowse, G., 2013. *Waste in the UK Hospitality and Food Service Sector*. WRAP. Available online: <http://www.wrap.org.uk/sites/files/wrap/Overview%20of%20Waste%20in%20the%20UK%20Hospitality%20and%20Food%20Service%20Sector%20FINAL.pdf> (accessed 23 November 2018).
- Pekcan, G., Köksal, E., Küçükerdönmez, O. and Ozel H., 2006. *Household Food Wastage in Turkey*. Food and Agriculture Organization, Rome.
- Pirani, S.I. and Arafat, H.A., 2016. Reduction of food waste generation in the hospitality industry. *Journal of Cleaner Production* 132: 129–145.
- Resource Efficient Scotland, 2018. *The Ultimate Guide: Monitoring and Measuring Food Waste*. Resource Efficient Scotland, Stirling, UK.
- Stenmarck, Å, Jensen, C., Quedstedt, T. and Moates, G., 2016. *Estimates of European Food Waste Levels*. EU Fusions, Stockholm.
- Stop Food Waste, 2017a. *Food Waste Charter*. Available online: <https://stopfoodwaste.ie/resources/business/food-waste-charter/> (accessed 19 November 2018).
- Stop Food Waste, 2017b. About. Available online: <https://stopfoodwaste.ie/about/> (accessed 19 November 2018).
- Tostivint, C., Östergren, K., Quedstedt, T., Soethoud, H., Stenmarck, Å., Svanes, E. and O'Connor, C., 2016. *Food Waste Quantification Manual to Monitor Food Waste Amounts and Progression*. EU Fusions, and BIO by Deloitte, Neuilly-sur-Seine, France.
- UN (United Nations), 2015. *Transforming Our World: The 2030 Agenda for Sustainable Development*. United Nations General Assembly, Paris.
- WRAP (Waste and Resources Action Programme), 2008. *The Food We Waste*. WRAP, Banbury, UK.
- WRAP (Waste and Resources Action Programme), 2013a. *Where Food Waste Arises within the UK Hospitality and Food Service Sector: Spoilage, Preparation and Plate Waste*. WRAP, Banbury, UK.
- WRAP (Waste and Resources Action Programme), 2013b. *Courtauld Commitment 2: Household Food Waste*. WRAP, Banbury, UK.

# Abbreviations

<b>DCCAE</b>	Department of Communications, Climate Action and Environment
<b>EPA</b>	Environmental Protection Agency
<b>EU</b>	European Union
<b>FLW</b>	Food Loss and Waste
<b>FUSIONS</b>	Food Use for Social Innovation by Optimising Waste Prevention Strategies
<b>NACE</b>	Nomenclature of Economic Activities
<b>NWCPO</b>	National Waste Collection Permit Office
<b>NWPP</b>	National Waste Prevention Programme
<b>SDG</b>	Sustainable Development Goal
<b>UN</b>	United Nations
<b>WRI</b>	World Resources Institute

## AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL

Tá an Gníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaoil a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaoil a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

## Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

**Rialú:** Déanaimid córais éifeachtacha rialaithe agus comhlíonta comhshaoil a chur i bhfeidhm chun torthaí maíthe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.

**Eolas:** Soláthraimid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírthe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.

**Tacaíocht:** Bímid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaoil atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaoil inbhuanaithe.

## Ár bhFreagrachtaí

### Ceadúnú

Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaoil:

- saoráidí dramhaíola (*m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola*);
- gníomhaíochtaí tionsclaíocha ar scála mór (*m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta*);
- an diantalmhaíocht (*m.sh. muca, éanlaith*);
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe (*OGM*);
- foinsí radaíochta ianúcháin (*m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha*);
- áiseanna móra stórála peitрил;
- scardadh dramhuisece;
- gníomhaíochtaí dumpála ar farraige.

### Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil

- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhírú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a idíonn an ciseal ózón.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaoil.

### Bainistíocht Uisce

- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uisce idirchriosacha agus cósta na hÉireann, agus screamhuiscí; leibhéal uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

## Monatóireacht, Anailís agus Tuairisciú ar an gComhshaoil

- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil (*m.sh. tuairisciú tréimhsiúil ar staid Chomhshaoil na hÉireann agus Tuarascálacha ar Tháscairí*).

## Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn

- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis ceaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

## Taighde agus Forbairt Comhshaoil

- Taighde comhshaoil a chistiú chun brúnna a shainaitheint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

## Measúnacht Straitéiseach Timpeallachta

- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaoil in Éirinn (*m.sh. mórfheananna forbartha*).

## Cosaint Raideolaíoch

- Monatóireacht a dhéanamh ar leibhéal radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taimsí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

## Treoir, Faisnéis Inrochtana agus Oideachas

- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaoil ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaoil (*m.sh. Timpeall an Tí, léarscáileanna radóin*).
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosaint agus a bhainistiú.

## Múscailt Feasachta agus Athrú Iompraíochta

- Feasacht comhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

## Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil

Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:

- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair inní agus le comhairle a chur ar an mBord.

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### Identifying Pressures

An estimated 1 million tonnes of food waste is generated throughout the food system in Ireland annually. In addition to the lost economic value, this represents a massive waste of resources (land, water, materials), as well as producing associated greenhouse gas emissions. The commercial sector (food wholesale, food retail and food service) accounts for ~17% of food waste in European countries and has been identified as an area that has great potential for food waste reduction. In Ireland, the commercial sector generates an estimated 200,000 tonnes of food waste annually. Prior to this research there was little specific information on the sub-sectors involved, the types of food being wasted and the reasons for that waste being generated. Such information is required to prevent food waste, which, according to the waste management hierarchy, is the preferred option. In order to address this information deficit, food waste mapping of commercial sub-sectors was carried out across Ireland. It was found that four sub-sectors – food retail, accommodation, food service (i.e. restaurants) and workplace canteens – account for up to 75% of commercial food waste. These were investigated and reported on in detail.

### Informing Policy

Reducing food waste is a critical step to mitigating global climate change. Target 12.3 of the United Nations Sustainable Development Goals (SDGs) aims to halve food waste in the commercial sector by 2030. The revised 2018 European Union (EU) waste legislation, adopted as part of the Circular Economy Action Plan, requires Member States to monitor and report on food waste levels throughout the supply chain. Such information is essential for identifying where food waste is being generated, implementing food waste prevention programmes and tracking progress towards reduction targets. The 2019 EU Delegated Act on food waste monitoring provides a common methodology to support the quantification of national food waste. There is no dedicated national food waste prevention policy or strategy in Ireland. Food waste figures can be extracted from national waste data, but there is no specific reporting system in place for food waste. A formal national policy and food waste reporting system are required to ensure that Ireland builds on the existing national expertise and meets the global food waste reduction target set out by SDG 12.3, as well as upcoming food waste reporting requirements.

### Developing Solutions

This research refined the existing national food waste assessment methodology in line with international requirements and applied it to the main sub-sectors identified. A series of sectoral food waste profiles, benchmarks and food waste cost factors was developed – these are needed to ensure that specific sectors, and individual businesses, have the information, skills and tools required to facilitate food waste prevention initiatives. The main project findings have been developed into a suite of sector-specific materials for promotion through sectoral and national stakeholders. Key project recommendations are as follows:

- establish a dedicated national food waste data group to ensure that food waste quantities are measured;
- change current waste contractor reporting to include the assignment of waste collected to relevant business sectors (using the NACE classification);
- provide funding and technical support to help Irish commercial businesses proactively address food waste;
- develop a food waste prevention training programme for food service and food retail sub-sectors;
- implement food waste prevention initiatives in food service at a sub-sectoral level;
- focus initial efforts in the food retail sector on “serve-over” food, which is typically produced in-house.