

FoodPath – Investigating Behavioural Interventions to Reduce Food Waste in Irish Households

Authors: Colum Gibson, Eileen Mitchell, Keelin Tobin, Alberto Longo, Sarah O'Connor and Elizabeth Gold



Environmental Protection Agency

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3. Office of Evidence and Assessment
4. Office of Radiation Protection and Environmental Monitoring
5. Office of Communications and Corporate Services

The EPA is assisted by advisory committees who meet regularly to discuss issues of concern and provide advice to the Board.

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Lead organisations: The Clean Technology Centre, MTU Cork and Queen's University Belfast

Identifying pressures

Food waste is a global issue with significant economic, social and environmental impacts. An estimated one-third of food produced globally is lost or wasted, with an estimated contribution of 8–10% of global greenhouse gas emissions. United Nations Sustainable Development Goal (SDG) 12.3 has a specific target of a 50% reduction in food waste generated at the retail and consumer levels by 2030. As a signatory to the SDGs, Ireland is taking steps to reach this goal through the government's Climate Action Plan, the Waste Action Plan for a Circular Economy and, more recently, the establishment of the National Food Waste Prevention Roadmap. Recent EPA estimates suggest that Ireland generated approximately 750,000 tonnes of food waste in 2022, with 29% of this originating from households.

Informing policy

Household food waste generation is influenced by several socio-economic factors, behaviours and attitudes. Consequently, preventing food waste is multifaceted, nuanced and complex. Behaviour change interventions represent one way to address the issue; however, the findings from this research suggest a need to apply behavioural interventions designed to facilitate the implementation and development of food waste reduction policy. The FoodPath research team built upon the extensive work carried out under the EPA's Stop Food Waste programme over the past decade and identified and implemented food waste prevention interventions based on best practices to encourage changes in consumer behaviour. The FoodPath interventions were analysed and evaluated to measure their impact on household food waste generation. The findings informed recommendations on facilitating behaviour change, providing pathways to achieve large-scale reductions in food waste volumes at the household level.

Developing solutions

This research investigated current state-of-the-art methodologies, at both national and international levels, to assess consumer behaviour change approaches and, more specifically, how these apply to food waste prevention. This review, coupled with interviews conducted with national and international practitioners, informed the development of two intervention models. Intervention A was designed to empower individuals to prevent and reduce food waste at the household level using tools, nudges and targeted messaging via their local waste collector. Intervention B took a broader approach and targeted the changing of social norms through community engagement via local stakeholders. The outcomes from intervention A suggest that it may be a viable and cost-efficient model for reducing household food waste. The quantitative results for intervention B show that it was not as successful. Nonetheless, the current extent of interest in community-led food waste initiatives suggests that this approach should be viewed as an important precursor, which, when coupled with other national awareness-raising campaigns, could amplify the impacts associated with the targeted approach developed in intervention A.

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EPA Research Report

Prepared for the Environmental Protection Agency

by

The Clean Technology Centre, MTU Cork and Queen's University Belfast

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This report is based on research carried out/data from July 2020 to July 2023. More recent data may have become available since the research was completed.

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 issue with significant economic, social and environmental impacts. An estimated one-third of food produced globally is lost or wasted, contributing 8–10% of global greenhouse gas emissions. United Nations Sustainable Development Goal (SDG) target 12.3 specifies a 50% reduction in food waste generated at the retail and consumer levels by 2030. As a signatory to the SDGs, Ireland is taking action through the government's Climate Action Plan, the Waste Action Plan for a Circular Economy and the establishment of the National Food Waste Prevention Roadmap. Nonetheless, Ireland still generates a significant amount of food waste. EPA estimates state that Ireland generated approximately 753,000 tonnes of food waste in 2021, with 29% of this originating from households. Ireland is currently on track to miss its SDG target of a 50% reduction in consumer-level food waste, which includes households.

The reasons behind household food waste are multifaceted and nuanced, and preventing food waste is complex. Although there is a long-standing interest in behavioural interventions to address the issue, states and municipalities have limited experience of applying behavioural interventions, and current policies are either underdeveloped or require improvement. In recognition of this, FoodPath aimed to build on extensive work carried out by the EPA's Stop Food Waste programme and identify and implement food waste prevention interventions based on best practices to encourage changes in consumer behaviour.

Initially, the research team investigated current state-of-the-art methodologies, at national and international levels, in consumer behaviour change and specifically food waste prevention, and conducted interviews with national and international practitioners. Subsequently, two interventions were designed using an internationally recommended framework that stipulated framing the methodologies in a defined theoretical basis, using systems thinking and incorporating transparent evaluation methods. One of the interventions was designed to empower individuals to prevent and reduce food waste at the household level using tools, nudges and targeted messaging delivered by the local waste collector.

The second intervention took a broader approach and aimed to change social norms through community engagement. The delivery model of both interventions was informed by stakeholders, and the evaluation methods included both quantitative (using waste collection data) and qualitative (employing householder surveys) assessments with controls in place to allow comparison of the results.

Intervention A, which targeted individuals and their management of food at home, supplied home food waste kits in collaboration with local waste collectors. The quantitative results were positive, with a 16% reduction in food waste generated between the pre- and post-intervention assessments. This was the result of less waste being presented in the brown bins and less food waste included in the mixed and recyclable waste streams (which suggests improved waste segregation). In comparison with the control group, for which food waste increased by 16% over the same period, the results (which were sustained 9 months post intervention) are noteworthy. Results from a parallel qualitative assessment were inconclusive.

Intervention B was framed around a collaborative community approach, aimed at changing social norms through information provision, training and engagement. The quantitative results showed that total food waste volumes per household actually increased by 10% between the pre- and post-intervention assessments. However, in the control area, food waste increased by even more (16%). The qualitative findings for intervention B were positive overall, in particular for actions carried out towards the end of the intervention when a degree of local momentum and ownership had been generated.

Although improvements have been made nationally in terms of reducing food waste generation per person, analysis of data shows that our current annual rate of food waste reduction (3.5% per person) is insufficient to achieve the SDG target, and the required rate is now 5.6% per person. This indicates that several "step change improvements" are needed. The outcomes from intervention A suggest that it may be a viable, cost-efficient model to consider. Although

the quantitative results for intervention B were not as encouraging, community-led food waste initiatives remain popular, and this approach, coupled with

other national awareness-raising campaigns, could complement intervention A and increase the impact of its targeted approach.

1 Introduction

1.1 Background

Food waste is a global issue that countries across the world are working to address, although food waste and its prevention are complicated topics. The issue of food waste occupies a unique space in the public consciousness and is intricately linked with wider sustainability issues. It interacts with areas such as global consumption, health, land use and food security, in addition to raising questions of moral philosophy, hunger and the industrialisation of food production. Food waste continues to attract considerable attention in academic (Quested *et al.*, 2013; Reynolds *et al.*, 2019; Schanes *et al.*, 2018) and popular (Bloom, 2010; Stuart, 2009) literature, as well as in policy at European, national, organisation and community levels (DCCAE, 2019; DECC, 2022; EPRS, 2016; Government of Ireland, 2015). Major retailers, food brands and other manufacturers have also been engaged with the topic through innovations in products, packaging and labelling (Schanes *et al.*, 2018). Notwithstanding this growth in focus, the problem of food waste is widely recognised as one that has yet to be adequately addressed, with the Food and Agriculture Organization of the United Nations (FAO, 2011) estimating that 1.3 billion tonnes of food is wasted globally each year. In 2019, the Intergovernmental Panel on Climate Change highlighted that approximately 25–30% of all food produced worldwide is lost or wasted (IPCC, 2019).

1.2 Food Waste Prevention

Reductions in the current levels of food waste being generated worldwide will allow a relative reduction in global food production levels and therefore allow significant improvements in terms of carbon emissions and broader environmental and social impacts (Hawkins, 2017; Quested *et al.*, 2013). National, regional and business food waste reduction targets have been in place in many countries since the 2010s, and the United Nations Sustainable Development Goal (SDG) target 12.3 specifies a 50% reduction in consumer food waste (which includes retail and distribution, food service and households). Ireland

has been taking steps to reach this goal through the government's Climate Action Plan, the Waste Action Plan for a Circular Economy and, more recently, the establishment of the National Food Waste Prevention Roadmap. However, Ireland continues to generate significant levels of food waste. Recent EPA estimates state that Ireland generated approximately 753,000 tonnes of food waste in 2021, with 29% of this total originating from households (EPA, 2023). Despite the implementation of government policies, Ireland is not currently on track to reach the SDG of a 50% reduction in food waste at the consumer level.

1.3 Food Waste Prevention at the Household Level

With food waste reduction targets less than 10 years away, consumer-facing campaigns and/or interventions must be ramped up to have the necessary impact to achieve those targets. Notwithstanding the reductions that have been achieved since introducing the Stop Food Waste programme in 2010, as with other governments around the world, there is a growing realisation nationally that current policy intervention methods are not effective enough. It is acknowledged that behavioural interventions can have an impact on household actions and help reduce food waste, although countries and municipalities have limited experience with applying such behavioural interventions for reducing consumer food waste, and current policies either are underdeveloped or require significant improvement (Reynolds *et al.*, 2019). In addition, the use of behavioural interventions to address food waste is a relatively new concept and has not been explored as much as in other areas such as health promotion, diet, climate action and energy conservation. For instance, in healthcare, behaviour change interventions have been successful at changing health outcomes, such as preventing and stopping people engaging in harmful or risky behaviours (e.g. smoking), encouraging protective healthcare behaviours (e.g. applying sunscreen) and promoting effective self-management of diseases (e.g. monitoring blood glucose concentrations)

(Mantzari *et al.*, 2015). Such interventions are discussed in greater depth in work package (WP) deliverable 1A. More research is required to understand which type of behavioural interventions work best in mitigating the generation of food waste at the household level.

Therefore, this research project aimed to identify best practices in consumer behaviour change, investigate how these can best be applied to the growing area of food waste prevention, and explore the effectiveness and feasibility of several different approaches taken to tackle food waste at a local level.

2 Methodology

Throughout this research project, the project team aimed to bring together insights from across the disciplines involved in behavioural science, including sociology, psychology and behavioural economics. By combining them with an analysis of the best practices available on food waste prevention, the team designed a set of effective consumer-focused food waste prevention interventions that were then tested in the field.

While there are numerous recent and emerging articles and reports dealing with concepts around food waste prevention (e.g. the drivers, determinants, barriers, motivations, attitudes), there are still relatively few that provide detailed information on the interventions along with quantified results of the effectiveness of those actions. Recent reviews of this area have recommended a number of key elements for inclusion in any intervention. These include:

- identify what constitutes food waste;
- develop a theoretical basis for the interventions to be trialled;
- identify measurement methods in line with international standards to measure the effectiveness of interventions.

With these in mind, the main steps employed in this research included the following:

- review academic studies and existing initiatives on consumer behaviour change applied to the

broader areas of environment and personal lifestyle changes;

- review national and international best practice on interventions, and the theoretical tools used, that specifically targeted a reduction in consumer food waste;
- through a series of interviews, compile expert insights to support the best practice reviews with information from practitioners on the practicalities of running interventions and on lessons learnt from previous work;
- based on the research carried out, and the input from national and international experts, design a number of food waste prevention interventions, linked to relevant existing theories, with associated data collection plans for quantification of the impact;
- implement the interventions as designed and assess their effectiveness with the quantitative and qualitative measurement methods identified;
- based on the results of the interventions, make recommendations for future policy and interventions in Ireland.

Please note that separate detailed reports on each of the three elements of the background research, the intervention design and the intervention evaluations are available at <https://ctc-cork.ie/projects/food-path-research-project/>.

3 “Best Practice” Review

The initial research involved a literature review of international and national best practices that combined an exploration of knowledge from well-established areas of research such as health promotion, diet, climate action and energy conservation, alongside the developing field of food waste prevention.

3.1 Review of Relevant Consumer Behaviour Change Studies and Interventions

Changing consumers’ behaviour patterns is seldom a straightforward process. While there are many contributing factors associated with changing behaviours, evidence indicates that individuals may, at times, make decisions that are not in their best long-term interests and that they do not always behave rationally to maximise their well-being (Michie *et al.*, 2011). It is perhaps unsurprising, then, that traditional educational programmes and mass media campaigns that strive to promote practical food waste guidelines and attitudes by simply disseminating information often fail to produce the intended behaviour change. The purpose of this examination of established behaviour change interventions applied in the environment, energy and healthcare sectors was to determine if any similarities or differences exist, draw parallels and determine how best to use this evidence when implementing behaviour change policies in the food waste sector.

Based on this review of national and international published behavioural intervention studies, Table 3.1 summarises some of the main types of interventions commonly in use.

3.2 Best Practice Interventions to Reduce Household Food Waste

The level of work and research on food waste prevention is rapidly increasing (Schanes *et al.*, 2018), although there are still relatively few detailed interventions with quantified results. When published studies are accompanied by evaluated interventions, there is a reliance on self-reporting by study participants to measure impact. This is the

case across intervention types and reporting media. While of course some evaluation is better than no evaluation, this approach has intrinsic limitations. A significant review of current best practices regarding food waste prevention was gathered through the EU project Refresh, which set out to design policy recommendations and support systems for the EU. A key recommendation from some of the more recent studies suggests that, when designing food waste prevention interventions, these should, where possible, be established through the lens of existing behaviour change models (Reynolds *et al.*, 2019). This was the approach applied throughout this research project.

Based on the review of high-level best practices for food waste prevention at both national and local levels, some of the broad elements identified as being present in all include:

- a clear definition of food waste;
- a basis in established theory;
- use of design thinking and logic mapping;
- a detailed plan for evaluating the effect of the actions taken.

3.2.1 Types of food waste prevention interventions

As noted previously, efforts to tackle the generation of food waste at a household levels are happening around the world. Some of these projects or interventions are being carried out by researchers and are being reported in the scientific literature, while many more are being carried out by local governments and community organisations, where they are less commonly represented in the scientific or even grey literature. To gather a full picture of existing food waste prevention interventions, a broad online search was carried out in addition to the literature review. A selection of existing food waste prevention interventions is presented in Table 3.2 with the interventions organised according to type [based on work by the Refresh project and others (Pelt *et al.*, 2020; Wunder *et al.*, 2019)].

While this review attempted to gather insights on best practices from a variety of sources, there was

Table 3.1. Summary of some of the main behaviour-based interventions currently in use

| Intervention type | Example | Description of how intervention works |
|----------------------|---|--|
| Behavioural | Challenging the perception that food waste is not an individual responsibility | Using a survey to understand food awareness levels and perceptions |
| | Addressing low food waste awareness | Using a survey to look at which interventions work better |
| | Challenging the feeling that food waste is not a big problem | Testing message framing strategies, for instance, to see if the way in which a message is worded can influence decisions |
| | Message framing | |
| | Incentives | |
| Socio-demographics | Having children | Investigating who in the household is primarily responsible for cooking most meals and grocery shopping |
| | Type of household | |
| | Main person responsible for household shopping | Examining whether low-income families waste more of certain food products |
| | Number of young people in household | |
| | Household income | |
| Social influence | Food waste recyclers encouraging their neighbours either to reduce their food waste or to “recycle” their food waste | This relies on the notion that people are more likely to take action if information is provided by someone in their social network. The stronger the ties in their social network, the more likely the information will affect behaviour, e.g. if everyone in their family/ social bubble separates food waste for recycling, they are more likely to accept this social behaviour |
| Commitment contracts | Signing a community pledge to help reduce food waste levels | Publicly binding someone to a behaviour has been linked to the need for consistency and social pressure to adhere to the commitment |
| Social modelling | A couple showing their neighbours how to plant vegetables | People are more likely to commit to something if they see other people undertaking the behaviour in person |
| Nudges | Reminders for people to perform food waste-preventing behaviours | Breaking a behaviour down into small achievable steps |
| | | Setting goals |
| | | Signposting progress |
| | | Acknowledging and congratulating small successes |
| | | Sending reminders and alerts |
| | | Framing the benefits of the desired behaviour in a certain way |
| | | Highlighting the immediate benefits of the desired behaviour |
| | | Addressing common barriers by providing easy solutions |
| Information | Providing information and instructions on how to improve food handling | Providing tips and tricks on how to plan a meal, prolong shelf life, increase inventory overview and estimate food safety |
| Social media | Using a media platform to provide feedback – provide people with information about the amount of food they have wasted or saved | Providing continuous feedback seems to work better than giving it within a fixed time interval (daily or weekly) |
| Mass media | Using mass media programmes to encourage more people to be aware of food waste | Combining mass media campaigns with programmes in schools or the community, or both |
| | | Ensuring that the campaign designer specifies the target audience to ensure better tailoring of the campaign to that audience's demands and interests |

Table 3.1. Continued

| Intervention type | Example | Description of how intervention works |
|-------------------|---|--|
| Making it easy | Placing recycling bins in a convenient location Using smart fridges or advanced storing equipment or packaging | Changing situational conditions can make it easier for people to perform food waste-preventing behaviours |
| Competition | Providing information on how much local neighbourhoods recycle or reduce food waste | Providing comparative feedback, in which people receive information not only on their own behaviour but also on that of others |

typically a lack of material evaluating the effectiveness of larger-scale interventions (e.g. widespread information campaigns). Consequently, it is difficult to draw reliable conclusions about the efficacy of such approaches when it comes to food waste. With this in mind, the best practices explored in this report are those that were explicitly stated as such in the source material, rather than those that could be inferred by the authors from the parameters under which they were applied. Of course, not all food waste prevention interventions are reported in peer-reviewed literature, or indeed even through websites or published reports. Many actions are implemented at a community or local authority level, or in some cases by private organisations. However, without access to information on how these interventions were evaluated, it is difficult to draw reliable conclusions or insights into their efficacy. Hence, the next phase of preliminary research involved a series of interviews with targeted stakeholders to elicit first-hand experience of and practical insights on food waste prevention initiatives.

3.3 Stakeholder Interviews

Through the best practice review and input from the steering committee, a number of individuals directly

involved in the implementation or organisation of food waste prevention-based initiatives were identified and interviewed. The purpose of these semi-structured interviews was to support the existing FoodPath best practice review. The interviews were also useful for discovering information on food waste prevention that may not have been formally reported, in particular information on the practicalities of running interventions and on lessons learnt from previous work. Interviews were conducted between April and June 2021 with 10 individuals working in Ireland, Northern Ireland, Scotland, England, Canada and Finland as government advisers, senior officials, experts and stakeholders actively engaged in food waste prevention schemes. The semi-open structure of the interviews allowed interviewees to elaborate on particular areas that they regarded as being important in relation to food waste interventions – both successful and unsuccessful. Ethical approval was granted by the Queen's University Belfast Faculty of Biological Sciences Research Ethics Committee.

Table 3.3 provides an overview of the main expert insights, with a more detailed report on these findings available at the project home page.

Table 3.2. Summary of some of the most relevant intervention methods used in this research

| Intervention type | Overview | Limitations |
|-------------------|--|---|
| Information | <p>One of the most common approaches to food waste prevention involves the provision of information alone</p> <p>There are typically two categories of information-based approaches:</p> <ul style="list-style-type: none"> • “attitude–behaviour” – by providing information, one can first change attitudes, which in turn leads to changes in behaviour • “economic self-interest” – assumes that individuals will assess the information they are given and make choices that benefit them economically <p>Provision of information as part of a wider campaign is a crucial aspect of behaviour change, and recommendations to improve information-based campaigns include:</p> <ul style="list-style-type: none"> • the use of positive messaging • focusing on abilities rather than raising awareness of the issue • careful consideration of the narratives used | <p>Failure to recognise the strong influence of many of the social and psychological factors is sometimes referred to as the “intention–behaviour gap”</p> <p>It is now widely accepted that information-based interventions on their own are not an optimal mechanism for achieving behaviour change</p> <p>They are still widely implemented, especially by government and institutional actors, since they are relatively easy and visible, and often those contracted to run and manage such campaigns are creative or advertising agencies rather than behaviour change experts</p> |
| Social influence | <p>Fields of behaviour change and sociology show that social influence has the capacity to change behaviour. There are several forms of interventions based on social influence:</p> <ul style="list-style-type: none"> • Social norms in information and feedback provision – the potential of a social norm to influence behaviour is dependent on the group or setting. There are various categories of social norms that exist at both a collective and individual level, including injunctive, descriptive, collective and perceived norms • Block leaders and social networks – based on Rogers’ theory of diffusion (Rogers, 1962), this approach is based on effective information sharing when relayed by influential members of a shared social network (rather than by someone outside that social network) • Public commitments – shown to be an effective engagement approach, with people more likely to carry out a noted behaviour because of an aversion to behaving inconsistently with a “promise” • Modelling – involves the demonstration of desired behaviours or the clear indication that the person presenting the information engages in the behaviour themselves (e.g. online cooking demonstrations) • Social comparison in feedback provisioning – provides individuals with information on their own performance and also that of others relative to them. This builds on people’s tendency to compare themselves with others to help make sense of their own opinions and behaviours | <p>The potential of a social norm to influence behaviour is dependent on the group or setting</p> <p>To use social norms for food waste interventions, situations could be created in which the desired food waste prevention behaviour is observable</p> <p>Examples include community fridges and food sharing. It can be difficult for this type of approach to be carried out effectively in a meaningful way</p> <p>Research shows that, if people make a commitment to something, they are more likely to carry out the behaviour in question, particularly if their commitment is public. However, it can be challenging to bring about that public commitment in the first place</p> <p>The current extent of information that people are exposed to makes it difficult to compete in this space – “the attention economy”</p> <p>Some people respond to social comparison more than others</p> |
| Psychology based | <p>Psychology-based interventions are most commonly designed using the theory of planned behaviour as a framework</p> <p>An example of a psychology-based intervention for food waste prevention is the use of cognitive dissonance, which involves generating a mental conflict that occurs when one’s beliefs do not line up with one’s actions. It is meant to precipitate an uncomfortable state of mind that leads to behaviour change</p> | <p>The evidence base to support the effectiveness of such interventions is limited</p> |

Table 3.2. Continued

| Intervention type | Overview | Limitations |
|---|--|---|
| Economic instruments | <p>Shift food consumption practices towards more sustainable alternatives</p> <p>To date, this has not really been applied to deal with food waste at the household level (but it is becoming more common in the commercial arena)</p> <p>Altering pricing for waste disposal is an economic or regulatory option that may influence food waste generation (as is the case in Ireland)</p> <p>The cost of food is thought to play a role in the levels of food waste at a consumer level, although there is no conclusive evidence</p> | <p>From a waste enforcement point of view, increased disposal costs have the potential to encourage incorrect segregation, illegal dumping and backyard burning. Incentivised charging also penalises cooking from scratch, as this produces more preparation waste</p> |
| Regulations | <p>Similar to economic instruments, these have been introduced for businesses but not for households</p> <p>Where regulations have been introduced, they have typically dealt with the segregation and management of food waste</p> | <p>Although food waste prevention regulations have been implemented in the commercial and processing sectors, they have not yet been introduced for targeting household-level food waste</p> |
| Nudges and organisation of choice architecture | <p>Nudging is a process of changing behaviour that does not involve coercion</p> <p>Rather than convincing people to consciously change how they behave, nudging uses automatic cognitive processes to achieve the desired behavioural outcome</p> <p>Nudges have been shown to be successful in preventing consumer-level food waste in food service settings, but there is not yet much evidence at the household level</p> | <p>The use of nudges raises an ethical question – because they are designed to direct behaviour, they may be considered manipulative</p> |
| Voluntary agreements | <p>Voluntary agreements are self-determined commitments or pacts with qualitative and quantitative objectives</p> <p>The flexible and collaborative nature of voluntary agreements makes them very effective tools for food waste prevention in the supply chain</p> <p>They are not useful with consumers, other than having the potential for consumer recognition for food businesses</p> | <p>Voluntary agreements are considered an area of food waste prevention warranting further research</p> |
| Information and communications technology (ICT) | <p>Integration of technology into food waste prevention is expected to broaden the scope of interventions</p> <p>These technologies can act as prompts, and in other instances they allow skill sharing or the provision of information</p> <p>So far they have focused on both household food infrastructure and relevant food behaviours (e.g. meal preparation, food shopping and the use of food already in the home)</p> <p>The potential to use gamification is currently being explored but is still relatively nascent</p> | <p>Further evidence to support the effectiveness of ICT in interventions is required</p> |

Table 3.3. Summary of stakeholder interviews

| Element for consideration | Description | Implications |
|---|--|---|
| Preliminary research | Research on the behaviours, attitudes and motivations of and barriers faced by the targeted group at the intervention design stage could include preliminary surveys, pilot projects, focus groups or making use of existing data | Preliminary research is an important first step for successful interventions |
| Target audience | <p>Interventions should have a clear target audience focused on the most wasteful segment of society, identified as:</p> <ul style="list-style-type: none"> • Young wasters – most interviewees noted young people, young families or single person households as the key demographics for interventions • Mushy middle – a large cohort of the population that is neither committed to food waste prevention nor completely uninterested – the middle 60% of the population | <p>A focus on younger people has the added benefit of reaching people when they are at the beginning of their food journey</p> <p>If budget or other constraints do not allow such a targeted approach, careful consideration should be given to choosing a message that is most likely to resonate with the widest cohort within the audience</p> |
| Messaging | <p>Message – messaging should be clear, simple and, ideally, attractive to participants, framing the key messages around food waste positively</p> <p>Focused – behaviour change interventions should be focused on discrete behaviours that can be clearly communicated</p> | Where possible, targeted behaviours should be presented as life enhancing, rather than as additional tasks or responsibilities for an already busy population |
| Messenger | The person or group seen to be delivering the message is important. It was noted that individuals tend to respond better to messages around behaviour change when the message comes directly from a peer or somebody with a similar background | The person, group or tone used to deliver the intervention message must be relatable for the target audience. Several interviewees noted that interventions linked to community engagement, peer-to-peer interactions and interventions involving a social element worked best |
| Continuity | Respondents reported that, during past successful campaigns, the positive impact of the intervention was diminished once the organisation withdrew from the community and the support network receded | The importance of good partner organisations to access communities and to continue to provide support was emphasised |
| Evaluation | Evaluation is a crucial part of any intervention, as it allows the outcomes to be quantified and the successes and limitations to be reviewed. However, evaluation can be difficult to enact when working on changing household food waste habits, many of which occur in the privacy of the home | Evaluation should be considered from the earliest stages of intervention design. Some methods of evaluation discussed by respondents included waste composition analysis, self-report surveys , comparing case studies , and subjective evaluation based on the attitudes of participants |
| Holistic – considering the wider food environment | The need for a holistic or system-based approach was referred to in every interview. Taking a behavioural economics perspective, the choice environment (the real-world situations that affect individuals' chosen actions) for food waste presents a notable barrier to the internalisation and uptake of positive behaviours across communities. Domains of the choice environment include the food retail environment and infrastructure, restaurants and food takeaway businesses | Cultural attitudes to food and food waste are important to consider. Although food waste is regarded as a universally negative phenomenon, the fact that food is so cheap and readily accessible lessens the perceived impact of throwing it away. Interviewees also stressed the importance of empowering the communities they worked in to understand the position of their household food waste within the wider socio-economic and environmental contexts |

Table 3.3. Continued

| Element for consideration | Description | Implications |
|---------------------------------------|---|--|
| COVID-19 and food waste interventions | The COVID-19 pandemic had a profound effect on everyone's daily lives, including wide-reaching impacts on food consumption and household food behaviours. Some interviewees suggested that the tone of messaging could be changed to make it more friendly and helpful. Another recommendation was to focus interventions on food waste behaviours that have improved because of COVID-19, e.g. the increase in home food preparation, improved meal planning and the use of shopping lists | Online engagement can provide flexibility and incorporate multiple learning styles. Online workshops may work well, as they fit better into people's busy schedules. Online classes are also typically cheaper to run than face-to-face engagement. Some interviewees also noted that it was not always possible to conduct online workshops, especially for those who did not have access to the internet, and that online sessions do not foster the same face-to-face connections |

4 Behavioural Intervention Methods

Following on from the best practice review and expert interviews, and from project team and steering committee meetings, it was agreed to design and pilot two interventions in two separate locations. With these considerations in mind, two study areas were identified based on criteria determined by the research team and informed by a series of variables. These included area size, likely availability of waste data, access to pre-existing active community groups, amenable waste collectors and the provision of a small brown bin collection service [this was an important determinant, as larger brown bins are often used to provide a co-mingled food and garden waste collection, as evidenced by the results of the 2018 national waste characterisation campaign (EPA, 2018)]. The potential effects of cultural, geographical and socio-economic variables across the study areas were also considered. A description of the intervention designs is provided in the following sections, with more details available in the full WP3 report (Mitchell, no date). Through piloting these two interventions, it was proposed to make comparisons between their effectiveness, with a view to informing future work to ensure that Ireland meets SDG target 12.3.

Based on the recommended elements outlined in the best practice review, the following approaches were chosen:

- Intervention A – this intervention was designed to empower individuals to prevent and reduce food waste at the household level by using tools, nudges and targeted messaging provided by their local waste collector.
- Intervention B – this intervention targeted collective social norms through community engagement via local stakeholders to prevent and reduce food waste at the household level.

4.1 Intervention A – At the Individual Household Level

After careful consideration and examination of the literature, it was decided that this intervention would focus primarily on influencing individual household habits and would target communication through direct

contact with householders in a specific location (i.e. the confines of their own home) using a behavioural nudge in the form of a food kit or food waste pack. The design of this intervention aligns with the findings of another recent Irish study, The Food Waste Recycling Project 2018–2020 (My Waste, 2023), which recommended that every waste collector in Ireland develop a communications campaign for households on why and how to separate waste.

Intervention A involved issuing a food kit to a cohort of the local population and comparing their food waste levels with a similarly sized control group that did not receive the kit. The food kit was designed to offer practical tools and behaviour-specific tips, together with regularly prompting households to make the most of the food they have and reduce their food waste in such a way that they would feel part of a collective action (taken by households in their locality).

In addition, to gather demographic data and to understand more about household food waste habits in the designated area, a questionnaire was developed to support intervention A. The full survey is available in the WP4 report, with the intervention design shown in Figure 4.1.

4.1.1 Implementation

The success of this approach was contingent on the goodwill and support of the waste collector (Clean Ireland). Clean Ireland has been active in its support for and communication of food waste prevention and proper waste segregation for many years and so was an ideal partner in this project. Once involved, Clean Ireland provided invaluable input in terms of:

- identification of a suitable waste collection route;
- the practical design of the intervention;
- distribution of the food waste kits;
- communications with the intervention group via text message/email;
- providing access to waste samples from the appropriate collection route;
- sharing of data sets for the waste collected on the bin route.

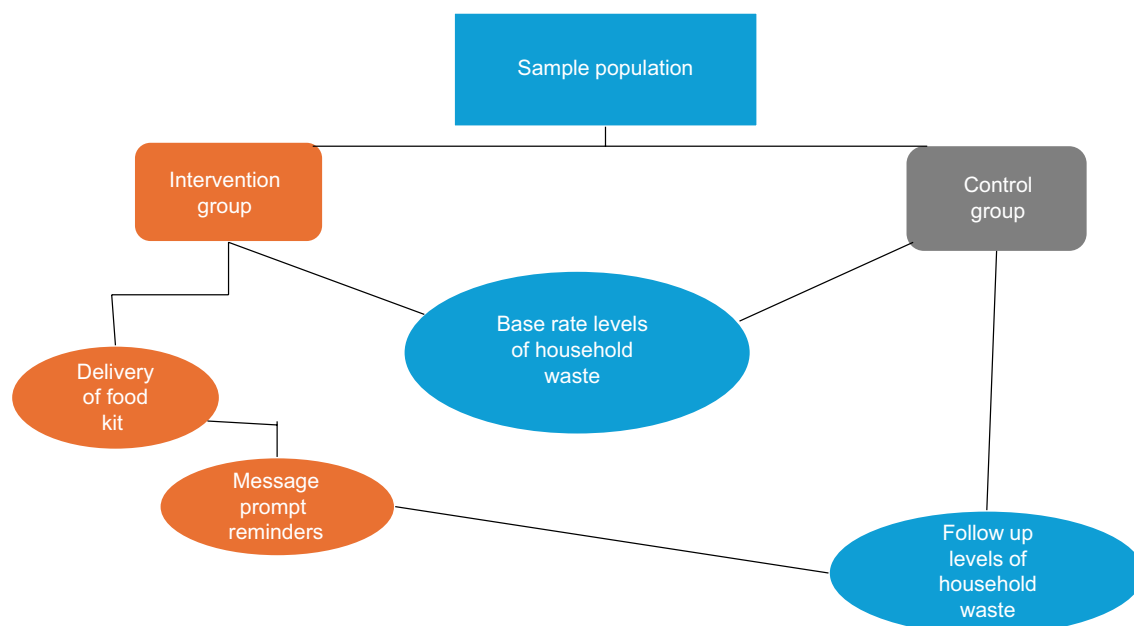


Figure 4.1. Overview of the design of intervention A.

Based on initial discussions with the waste collector, an intervention period of 14 weeks was agreed – 4 weeks before the intervention, 6 weeks of the intervention and 4 weeks after the intervention concluded. A randomised controlled trial was conducted to monitor food waste reduction in households in Ennis, County Clare, with two areas randomly assigned to the intervention or the control. In tandem with the local waste collector, it was arranged to issue the food waste kit to half the households (about 160) on one of its collection routes. The control group was made up of the other half of that collection route (about 160 houses). The route chosen was a relatively mature one where household occupancy was deemed to be relatively stable, ensuring that the same people were likely to be involved throughout.

An estimation of total food waste generated from the brown bin, general waste bin (through direct measurement surveys of the food waste within this waste stream) and dry recyclables (using national food waste content figures) was the main method by which the effectiveness of this intervention was assessed. These data were assessed for both the control and the intervention groups before, during, immediately after and 6 months after the intervention.

4.1.2 Food waste kit

In the creation of the food waste kit, the main behaviours contributing to food waste in Ireland,

as articulated by the national Stop Food Waste programme, were considered. This identified a number of activities under five broad areas: knowing your food waste, planning, shopping, storing and cooking, and reuse. To positively influence household behaviour, the tools and associated messaging were designed to be life enhancing, rather than additional tasks or responsibilities for an already busy population. They were also designed to maintain the freshness of food and help save time and money.

The contents of the kit were consequently designed to be practical, action focused and skill based, accompanied by specific prompts/commitments using inclusive language around the overall message of “make the most of the food you have” (Figure 4.2). The final contents of the kit included:

- **A thermometer (suitable for fridge and freezer).** Fridge temperature is a critical factor in food preservation and, considering the variability that exists in fridge temperature dials, which people do not always understand, this tool aimed to help people understand the settings and get it right. The messaging associated with this item included a recommendation to pass the thermometer on to someone else if not needed or when finished with it.
- **Silicon lids/covers.** These can be used to cover opened/cut food items (e.g. half an onion/apple/lemon/avocado, opened yoghurt, tin of beans).



Figure 4.2. Leaflet accompanying the food waste kit issued to the intervention group.

These items were selected because they offer a “second life” to commonly discarded products that have been opened but not fully consumed. They are durable and reusable.

- **Printed freezer labels.** Given the propensity to put food in the freezer and forget about it, these labels encouraged recipients of the kit to get into the practice of dating and labelling food going into the freezer so that it is recognisable when frozen and thus can be used effectively.
- **Fridge magnet with shopping list.** Produced under the EPA Stop Food Waste programme, this encouraged meal planning and generating a list before going shopping.
- **Food measure.** This 100-mL scoop was useful for measuring out specific portions. It could be used for items such as rice or oats. It was helpful in preventing the preparation of excess servings.
- **Stop Food Waste pocket guide.** Produced by the national Stop Food Waste programme, this contained extensive information for householders, presented in a friendly tone.

The food kit was put together in a recyclable brown cardboard box similar to the ecommerce boxes that householders are familiar with, echoing the sentiment of Paul van der Werf, one of the stakeholders interviewed during the research phase. In his expert interview describing his Ontario research project (van der Werf *et al.*, 2020), which strongly influenced intervention A, he stated:

... it was very important for me to not put it just in a Manila envelope and get it mixed in with the rest of the mail. I wanted something ... I wanted it to look like a present. So, here's this little box waiting for you.

The messaging contained in the communications was devised with social influence in mind so that the recipients of the kits and associated communications would feel connected to other people in the same area (along the same waste collection route) working towards a common goal. The text messages sent by the waste collection company were to act as reminders and prompts to take specific actions on food waste prevention. The wording of the text messages can be found in the WP4 report.

4.2 Intervention B – At the Community Level

As with intervention A, this intervention was informed by the best practice review, discussions with the experts interviewed, input from the project team and guidance from the steering committee. Shifting societal norms and behaviours through peer-to-peer interactions within a community setting was identified as an appropriate approach for intervention B. The aim of this intervention was to facilitate local people to gain a deeper understanding of the food waste being generated locally and develop solutions collectively to prevent or reduce household food waste, putting these ideas into practice to find out what impact could be made.

Thus, through a co-design process with active local stakeholders, a series of community-led actions were identified that leveraged local interest and capacity while integrating the food waste prevention expertise of the project team members (who had previously run the Stop Food Waste programme for a decade and had extensive community outreach experience). Conscious of the importance of local ownership and flexibility in terms of actions, the initial design of this intervention aimed to provide a broad plan that would be refined based on the resources available.

4.2.1 Implementation

To compare the results of intervention A and intervention B, Irish towns of comparative size were required, as well as willing stakeholders. Skibbereen, County Cork, and Ennis, County Clare, were selected. For intervention B, Skibbereen, County Cork, was chosen, as it had an invested local authority, an engaged waste collector and a range of active community organisations that were animated by the topic of food waste.

Once the area had been identified, an initial scoping exercise identified prospective community-based partner organisations that the project team then engaged with. In collaboration with these organisations, mapping of all relevant local stakeholders was carried out and those identified were approached and invited to participate in a facilitated workshop aimed at co-designing a draft intervention plan for food waste prevention and reduction at

the household level in the community with support from the FoodPath team. A trained facilitator guided the process and a graphic harvester captured the discussion and agreed actions (Figure 4.3).

Based on the co-designed nature of this intervention, local participants were invited to plan a calendar of events and activities, dovetailing with existing local organisations and actions while putting an emphasis on food waste prevention and reduction. The premise of this community-led approach was that it would aim to target multiple points of contact through different communication and interaction channels. Therefore, local stakeholders, who are empowered and actively involved, become integral and trusted peers circulating information via existing networks such as meetings, events, newsletters, social media, podcasts and word of mouth.

4.2.2 Community activities

It was envisaged that this approach would change community-wide values through social influence and aim to support and emphasise the shared values within the community. To fulfil this, a key initial finding from the co-design process was that care should be taken to frame the messaging positively, especially as this intervention coincided with the COVID-19 pandemic, a very trying time for all.

With that in mind, an initial branding exercise was carried out and promotional materials were developed based on local waste statistics and input from the initial stakeholder engagement. This branding formed the basis of all subsequent work carried out and was available to all local stakeholders to use in their local communications. In addition, the project team provided material development support as needed. Although



Figure 4.3. Graphical representation of the community-led plan developed for Skibbereen taking on Food Waste.

much informal sharing of materials and information took place, Table 4.1 summarises the main organised actions that were carried out.

4.3 Outcome Measurement

The effectiveness of the interventions was assessed quantitatively (based on waste collection data) and qualitatively (based on attitudinal surveys and semi-structured interviews).

4.3.1 Quantitative assessment

For both interventions, waste collection data were the main source of empirical information used to examine the efficacy of the pilot interventions. In order to measure the total food waste volumes produced, the following were assessed:

- direct measurement of brown bin (separately collected food waste) weights;
- general waste bin weights, with any food waste content present evaluated through waste compositional analysis.

The characterisations of the general waste bins were carried out in accordance with the recommended national methodology and performed on the household general waste bins before and after the interventions had taken place in both areas. These data were used

in the calculation of total food waste disposed of and provided insights into whether there had been any changes in waste management practices as a result of the interventions.

For intervention A, the total quantity of food waste produced by households in both the intervention and the control groups was examined by assessing the weights of bins collected at three different points in time:

1. A baseline of food waste volumes was produced prior to the intervention.
2. The volumes of food waste produced during the intervention period were monitored.
3. After the conclusion of the intervention, food waste was examined at three different time points – immediately afterwards, 3 months later and 6 months later. This allowed an evaluation of what behaviour changes, if any, were sustained over time.

The information gathered for intervention B was similar in that separately collected food waste data and the food waste element of the general waste collection (determined through characterisation studies) were evaluated. These evaluations were also carried out before, during and after the intervention period. However, owing to the nature of intervention B, the

Table 4.1. Outline of activities and when they took place

| Activity | Date activity took place |
|--|--------------------------|
| Brand development | February 2022 |
| Launch of initiative through local information stands | March 2022 |
| Podcast featuring “Skibbereen taking on Food Waste” | March 2022 |
| Composting and food waste workshop | April 2022 |
| Initial waste characterisation survey | April 2022 |
| Promotional videos | May 2022 |
| Information stand at local events | 21 June 2022 |
| First drafts of recipe booklet | September 2022 |
| Reuse week with Cycle Sense | October 2022 |
| Food waste training for householders | November 2022 |
| Social media campaign in the run up to Christmas | December 2023 |
| Online “Stop Food Waste Challenge” with transition year students | January 2023 |
| <i>Young Chef Recipes</i> booklet release | February 2023 |
| Information talk about food waste to transition year students | February 2023 |
| Final waste characterisation survey | March 2023 |
| Blog post by transition year students | April 2023 |

viability of these quantitative data as an effective form of evaluation was anticipated to be limited.

Food waste measurement method

National evidence indicates that, regardless of the presence or absence of a brown bin collection service, food waste is not always segregated correctly. This outcome was reported in 2018, when 20% of the general waste collected from households (in kerbside bins) and 10% of the mixed dry recyclables (MDR) collected were found to be food waste (EPA, 2018). An updated set of national figures produced by the EPA (2023) shows that little has changed since 2018. Consequently, it was important to consider the proportion of food waste present in the general waste bins collected during this work. The waste characterisation (or waste compositional analysis) involved gathering 2 weeks of waste from general waste bins (these bins were collected biweekly in both cases) and assessing a representative sample. This representative sample of waste (typically > 100 kg) was selected in accordance with the EPA's national waste characterisation methodology (EPA, 2018), which is based on the coning and quartering method.

Coning and quartering is a method that is used to reduce a large sample size for measurement without creating any bias. In this case it involved gathering the full sample of waste together and separating it out into four sections, then taking one of the four sections and repeating the first step until a sample size of 100 kg was reached. This sample was then assessed to determine the total proportion of food waste present in that representative sample.

To establish an accurate baseline, the analyses were conducted before the food waste kit was distributed in Ennis and outside the tourist season in Skibbereen.

4.3.2 Qualitative assessment

Reducing food waste is not a one-off event – it requires a sustained change in behaviour. Such change is linked to awareness of, and individual attitudes to, food and its wastage. Therefore, in an effort to supplement the quantitative data, a supporting qualitative survey was used to understand the attitudes of those who participated in the intervention to determine whether they exhibited changes in their food waste habits after the intervention concluded.

In addition, semi-structured interviews with key participants in the interventions were conducted to understand the process employed and its impact from the perspective of purposefully selected research participants.

Survey questionnaires

The qualitative survey, which was carried out before and after each intervention, was linked to a national survey carried out by the company Behaviour & Attitudes on behalf of the EPA in 2020 (Odile le Bolloch, Food Waste Prevention Team Lead, EPA, 16 October 2020, personal communication). Subsequent reports are available here. By using the same questions, a comparison could be made between the answers given to certain questions by the project participants and those given in the national survey. Ethical approval was sought, and granted, from the Research Ethics Committee of the Faculty of Medicine, Health and Life Sciences at Queen's University Belfast. The survey was developed online using Qualtrics survey software.

To assess attitudes to household food waste in the intervention areas, the project team developed a seven-page questionnaire to obtain information on self-reported quantities of food waste, intentions to avoid food waste, personal attitudes, perceived health risks, perceived behavioural control, personal and subjective norms, knowledge of use-by dates and of food storage, household planning habits and the "good provider identity" [this refers to a person purchasing and providing enough food to ensure that everyone in the household has a sufficient amount (Schanes *et al.*, 2018)]. Findings from WP2, involving stakeholder consultation interviews, helped in the design and development of the survey (Figure 4.4). Note that "food waste" is defined as all foods in a household that are discarded in a waste or bio-waste bin, composted or fed to animals. The survey was developed with the aim of being completed in under 15 minutes. For the full survey, see the WP4 report.

4.4 Scalability

Considering the established nature of the national Stop Food Waste programme, there was a clear understanding from the outset, through the 2019 EPA research call and initial steering committee



ENNIS QUESTIONNAIRE

Introduction

Be in with a chance to WIN a €100 one4all voucher by just completing this survey. In May you received a FoodKit to try to help you tackle food waste in your home. From May 18th until June 22nd you received texts giving tips on how to use each item in the kit. The following survey is to hear your opinions about the Food Kit.

The data collected from this survey will be used for statistical analysis and to inform policymakers and future research. The survey should take approx. less than 10 minutes to complete. Your participation is voluntary, and your responses will remain strictly confidential and anonymous. Thank you for your time.

| | | | | | | | | | | | | | | | | |
|---|---|------------------|---|--------------|--|-------------------------------|---|---|---------------------------------|----------------------------------|------------------------|---|------------------------|------|------------------------|--|
| Q1 | Did you find that the food kit helped you during the previous 6 weeks? Yes No | | | | | | | | | | | | | | | |
| Q2 | At home, do you currently separate your food waste from other household waste (e.g. with a brown kitchen caddy)? Yes No | | | | | | | | | | | | | | | |
| Q3 | If yes, did you separate your food waste before receiving the kit or did the kit influence you to start separating your food waste? | | | | | | | | | | | | | | | |
| | 1. Yes, I have always separated my food . | | | | | | | | | | | | | | | |
| | 2. I started separating my food after receiving the kit. | | | | | | | | | | | | | | | |
| Q4 | When it comes to food waste, do you think you are more concerned, less concerned or at the same level of concern since you received the food kit? | | | | | | | | | | | | | | | |
| | 1. More Concerned. 2. No Change 3. Less Concerned. | | | | | | | | | | | | | | | |
| Q5 | Do you think the level of food waste you throw away has lowered in the previous 6 weeks? Please select one. | | | | | | | | | | | | | | | |
| | 1. Yes, by a little. 2. No. 3. I don't know. | | | | | | | | | | | | | | | |
| Q6 | Up to 30% of the waste in the average household bin consists of food. Do you think you are below, above, or in line with this average? | | | | | | | | | | | | | | | |
| | 1. Above average. 2. In line with the average. 3. Below average. | | | | | | | | | | | | | | | |
| Q7 | How would you personally rate yourself on a scale of 1 -10 at managing food waste, with 1 being poor and 10 being fantastic? | | | | | | | | | | | | | | | |
| | 0 1 2 3 4 5 6 7 8 9 10 | | | | | | | | | | | | | | | |
| Q8 | What types of food do you throw out in your household most often? Please rank your top four answers 1 - 3, with 1 as the most commonly wasted item. | | | | | | | | | | | | | | | |
| | <table border="1"> <tr> <td>Bread/bakery</td> <td>Store-cupboard dried ingredients (e.g. rice, pasta, flour, lentils,</td> </tr> <tr> <td>Vegetables</td> <td>Store-cupboard canned/jar food products</td> </tr> <tr> <td>Fruit</td> <td>Frozen food</td> </tr> <tr> <td>Meat/fish</td> <td>Potatoes</td> </tr> <tr> <td>Dairy</td> <td>Breakfast cereals</td> </tr> <tr> <td>Salad</td> <td>Other (please specify)</td> </tr> <tr> <td>Eggs</td> <td></td> </tr> </table> | Bread/bakery | Store-cupboard dried ingredients (e.g. rice, pasta, flour, lentils, | Vegetables | Store-cupboard canned/jar food products | Fruit | Frozen food | Meat/fish | Potatoes | Dairy | Breakfast cereals | Salad | Other (please specify) | Eggs | | |
| Bread/bakery | Store-cupboard dried ingredients (e.g. rice, pasta, flour, lentils, | | | | | | | | | | | | | | | |
| Vegetables | Store-cupboard canned/jar food products | | | | | | | | | | | | | | | |
| Fruit | Frozen food | | | | | | | | | | | | | | | |
| Meat/fish | Potatoes | | | | | | | | | | | | | | | |
| Dairy | Breakfast cereals | | | | | | | | | | | | | | | |
| Salad | Other (please specify) | | | | | | | | | | | | | | | |
| Eggs | | | | | | | | | | | | | | | | |
| Q9 | Which of these food issues most concern you? Please rank your top three answers 1 - 3, with 1 as the issue that concerns you the most. | | | | | | | | | | | | | | | |
| | <table border="1"> <tr> <td>The cost of food</td> <td>Food miles - the distance that food travels</td> </tr> <tr> <td>Wasting food</td> <td>ingredients in food (e.g. salt, fat, sugar, additives)</td> </tr> <tr> <td>How long fresh food lasts for</td> <td>Food poisoning (e.g. Salmonella, E. coli)</td> </tr> <tr> <td>The way that food products are packaged</td> <td>Genetically Modified (GM) foods</td> </tr> <tr> <td>Supermarkets running out of food</td> <td>The welfare of animals</td> </tr> <tr> <td>Food product labelling (e.g. 'use by' date, storage instructions)</td> <td>No concerns</td> </tr> <tr> <td></td> <td>Other (please specify)</td> </tr> </table> | The cost of food | Food miles - the distance that food travels | Wasting food | ingredients in food (e.g. salt, fat, sugar, additives) | How long fresh food lasts for | Food poisoning (e.g. Salmonella, E. coli) | The way that food products are packaged | Genetically Modified (GM) foods | Supermarkets running out of food | The welfare of animals | Food product labelling (e.g. 'use by' date, storage instructions) | No concerns | | Other (please specify) | |
| The cost of food | Food miles - the distance that food travels | | | | | | | | | | | | | | | |
| Wasting food | ingredients in food (e.g. salt, fat, sugar, additives) | | | | | | | | | | | | | | | |
| How long fresh food lasts for | Food poisoning (e.g. Salmonella, E. coli) | | | | | | | | | | | | | | | |
| The way that food products are packaged | Genetically Modified (GM) foods | | | | | | | | | | | | | | | |
| Supermarkets running out of food | The welfare of animals | | | | | | | | | | | | | | | |
| Food product labelling (e.g. 'use by' date, storage instructions) | No concerns | | | | | | | | | | | | | | | |
| | Other (please specify) | | | | | | | | | | | | | | | |
| Q10 | Do you do any of the following before you go shopping since receiving the kit? | | | | | | | | | | | | | | | |
| | Checked what was already in the fridge to see what I needed to buy. | | | | | | | | | | | | | | | |
| | Checked what was already in the cupboards to see what I needed to buy. | | | | | | | | | | | | | | | |
| | Checked what was already in the freezer to see what I needed to buy. | | | | | | | | | | | | | | | |
| | Made a list of the food I needed to buy. Planned most of the meals I/we wanted to cook. | | | | | | | | | | | | | | | |



ENNIS QUESTIONNAIRE

| | | |
|-----|--|--|
| Q11 | Which object in the food kit did you find most helpful? | |
| | Measuring Scoop. | |
| | Silicone Lids. | |
| | Fridge Thermometer. | |
| | Freezer Labels. | |
| | Pocket Guide. | |
| | Shopping List Magnet. | |
| Q12 | Which object in the food kit did you find least helpful? | |
| | Measuring Scoop. | |
| | Silicone Lids. | |
| | Fridge Thermometer. | |
| | Freezer Labels. | |
| | Pocket Guide. | |
| | Shopping List Magnet. | |
| Q13 | Which object(s) in the food kit will you definitely continue using? | |
| | Measuring Scoop. | |
| | Silicone Lids. | |
| | Fridge Thermometer. | |
| | Freezer Labels. | |
| | Pocket Guide. | |
| | Shopping List Magnet. | |
| Q14 | Did you find the texts useful? | |
| | Yes. No. | |
| Q15 | Please indicate your gender: Male Female Non-Binary Third Gender. | |
| Q16 | Who in your household is responsible for most of the food shopping? | |
| | Me. | |
| | Someone else. | |
| | Both me and other people. | |
| Q17 | What age are you? | |
| | Between 25 and 34. | |
| | Between 35 and 44. | |
| | Between 45 and 54. | |
| | Between 55 and 64. | |
| | Between 65 and 74. | |
| | 75+ | |
| Q18 | How many members of your family (including yourself) live in the same household? | |
| Q19 | Which of the following options best describes the house in which you live? | |
| | Apartment Block. | |
| | Terrace. | |
| | Detached House. | |
| | Semi-Detached House. | |
| | Town House. | |

Thank you again for your time and responses

If you'd like to go into the draw to win a 100 euro gift voucher enter your details below (all information will be kept private).

Figure 4.4. Front pages of the Skibbreen taking on Food Waste survey and the Ennis survey.

meetings, that scalable approaches are required to amplify the impacts of the national programme. Therefore, each of the interventions aimed to explore how this could best be achieved by making use of local infrastructure and support services – the latter being the local waste contractor in the case of intervention A and the local community in the case of

intervention B. In addition, the project team aimed to ensure that, for both interventions, every effort was made to align all communications, outreach materials and interactions with the messages that underpin the national programme. Consequently, while individual approaches were explored, they were carried out with future replication under the umbrella of the national programme in mind.

5 Results from Behaviour Change Interventions

5.1 Intervention A – Ennis

5.1.1 Ennis waste characterisation

The pre-intervention waste characterisation survey of the general waste bin collection, which took place the week before the kits were distributed in Ennis in May 2022, showed that 31.6% of waste in that waste stream was food waste (Figure 5.1). This dropped to 29% in the post-intervention characterisation, which took place after the conclusion of the 6-week communication campaign associated with the distribution of the food waste kit. It had been intended to assess the waste from the control and intervention groups separately but, owing to waste collection issues, the waste from both groups was characterised as one sample, similar to the pre-intervention characterisation. Therefore, these results are not truly representative of the post-intervention general waste. These data were then used to help estimate the total food waste generated for each household. In addition, as a project-specific characterisation survey was not conducted for the MDR stream, the figure from the national

characterisation study (EPA, 2018), of 3% food waste present in the MDR, was applied.

5.1.2 Food waste data

Clean Ireland provided waste collection data from the Ennis collection route chosen for intervention A. The data provided by Clean Ireland were broken down into five waves between April 2022 and April 2023. These waves, their associated dates, the actions carried out with the intervention group and the dates of the waste characterisations are presented in Table 5.1. For each data set, waste data were collected for two groups – an intervention group consisting of 142 households and a control group consisting of 137 households. Firstly, the characteristics of the different waste streams – food waste, mixed general waste and MDR – were compiled. The proportion of food waste within the non-food waste streams was estimated by applying the food waste percentages determined by waste characterisation to the mixed general waste and MDR weights. Clean Ireland uses 60-L brown bins for its organic waste collections, which are specifically

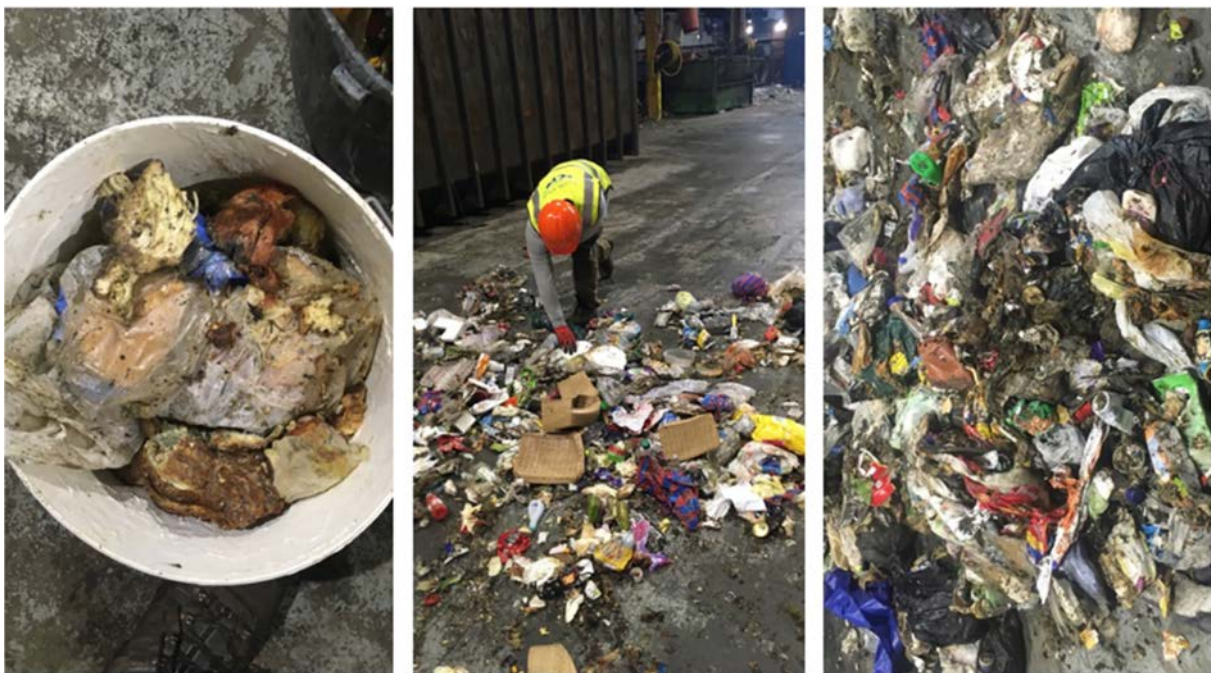


Figure 5.1. Measuring the food waste content of the general waste stream in Ennis in May 2022.

Table 5.1. Summary of the amount of food waste (mean kg per household per collection) for each period (wave) during intervention A

| | Wave 1 (pre intervention) 10 April–10 May 2022 | | Wave 2 (during intervention) 11 May–22 June 2022 | | Wave 3 (post intervention) 23 June–23 July 2022 | | Wave 4 (post intervention + 3 months) October 2022 | | Wave 5 (post intervention + 9 months) April 2023 | |
|---------------------------------------|---|-----------------|---|------------------|--|------------------|---|------------------|---|-----------------|
| | Initial characterisation of general waste | | | | Characterisation of general waste | | | | | |
| Type of waste | I | C | I | C | I | C | I | C | I | C |
| General waste | 14.94 (12.16) | 14.2 (12.49) | 14.74 (11.31) | 14.49 (10.94) | 14.31 (11.44) | 12.71 (10.77) | 13.16 (11.73) | 5.47 (5.91) | 13.52 (12.58) | 18.23 (9.64) |
| MDR | 11.45 (7.22) | 7.71 (6.28) | 6.21 (5.34) | 6.18 (3.57) | 8.99 (6.23) | 9.56 (6.11) | 6.62 (7.35) | 12.96 (11.81) | 7.49 (6.66) | 7.51 (6.61) |
| Brown bin (food) | 4.01 (4.28) | 3.8 (4.38) | 3.48 (3.98) | 3.9 (4.3) | 3.44 (4.01) | 4.3 (5.02) | 4.51 (4.85) | 6.97 (5.81) | 3.32 (3.9) | 4.09 (4.9) |
| General waste (food ^a) | 4.72 (3.84) | 4.49 (3.95) | 4.66 (3.57) | 4.58 (3.46) | 4.15 (3.32) | 3.69 (3.12) | 3.99 (3.56) | 1.66 (1.79) | 4.10 (3.81) | 5.52 (2.92) |
| MDR (food) | 0.34 (0.22) | 0.23 (0.19) | 0.19 (0.16) | 0.19 (0.11) | 0.27 (0.19) | 0.29 (0.18) | 0.20 (0.22) | 0.39 (0.35) | 0.22 (0.20) | 0.23 (0.20) |
| Total food | 9.08 (5.59) | 8.52 (5.86) | 8.33 (5.28) | 8.66 (5.08) | 7.86 (5.32) | 8.27 (5.73) | 8.70 (6.29) | 9.02 (6.35) | 7.64 (5.73) | 9.84 (4.14) |

Note: Data for main intervention actions and mean weight (kg) of waste per household per collection for MDR, brown bin and general waste streams for intervention (I) and control (C) groups (standard deviations shown in parentheses). Intervention group: no further information was provided in waves 1, 3, 4 and 5; in wave 2, kit was received and there was regular communication by text message. Control group: no information was provided.

^aWaves 1 and 2 used the initial characterisation result of 31.6% to calculate the food waste content of the mixed wastes, wave 3 used the post-intervention value of 29%, and waves 4 and 5 used an average value of 30.3%.

advertised for food waste only. In addition, as garden wastes tend to be bulkier and are typically produced in relatively large volumes, 60-L bins (as opposed to the larger 140-L brown bins) were chosen to help minimise the amount of garden waste present in the brown bin stream. Therefore, the weights of the brown bins were attributed to food waste. Aggregating the food waste values for the three waste streams allowed the total food waste for both control and intervention groups to be calculated for the five waves considered. Table 5.1 shows, for each wave and group, the mean weight and standard deviation of the food waste collected. The standard deviation (shown in parentheses in the table) indicates the amount of variation or dispersion of data in that group. It indicates how much individual households' food waste values in one group differ from the mean value within that group.

The impact of the intervention was explored by evaluating the differences in mean food waste values

across intervention and control groups for different waves of the data collection. As the data collected within each group followed a normal distribution, the *t*-test was appropriate for measuring differences in mean values between groups.

Firstly, paired sample *t*-tests were conducted on the data for the intervention group to compare the data before and after the food waste kit was distributed to the intervention group in wave 2. These within-sample *t*-tests compared the mean values of food waste in wave 1 in the intervention group before the administration of the food waste kit with the mean values of food waste in the same group after the distribution of the food waste kit in waves 2–5. For these within-sample *t*-tests in the intervention group, the null hypotheses and the alternative hypotheses were as follows:

- **Null hypothesis (H_{0w}).** There is no significant difference in mean food waste values within the

intervention group before and after the food waste kit is administered (or mean food waste did not decrease over time after the administration of the food waste kit in the intervention group).

- **Alternative hypothesis ($H1_w$).** There is a significant difference in the mean food waste values within the intervention group before and after the food waste kit is administered (or mean food waste decreased over time within the intervention group after the administration of the food waste pack).

This hypothesis was tested four times, as food waste in wave 1 was compared with food waste in waves 2–5. If the output of these test reports, the p -value, was less than a chosen significance level (e.g. 0.10), then it was taken that there was a statistical difference between the groups. Otherwise, it could be concluded that the groups' mean food waste values were not statistically different.

Next, independent samples t -tests (between sample) were conducted to compare food waste data from the intervention group and the control group. For the between-sample t -tests, the null hypotheses and the associated alternative hypotheses were as follows:

- **Null hypothesis ($H0_{bz}$).** There is no significant difference in the mean food waste values between intervention and control groups in wave z , where z is equal to 1, 2, 3, 4 or 5.
- **Alternative hypothesis ($H1_{bz}$).** There is a significant difference in mean food waste values between the intervention and control groups in wave z , where z is equal to 1, 2, 3, 4 or 5.

A similar statistical assessment was then carried out on the between-sample t -tests. Again, where the p -value was less than the chosen significance level (e.g. 0.10), it was then taken that there was a statistical difference between the groups. Otherwise, it could be concluded that the groups' mean food waste values were not statistically different.

Analysis of food waste data

Although there was a small difference between the total amount of food waste generated by the control and intervention groups in the first wave, with the control group having less food waste than

the intervention group, this was the only time that occurred.

Mean food waste in the intervention group decreased from 9.08 kg per collection per household in wave 1 to 8.33 kg in wave 2. Using the within-sample paired t -test described above, this difference was statistically significant ($p < 0.01$). Mean food waste was also lower in waves 3, 4 and 5 than in wave 1. These differences were also statistically significant for waves 3 and 5 ($p < 0.01$ in both cases), but not for wave 4 ($p = 0.11$).

The results for wave 4 warrant some consideration. In wave 4, general food waste increased compared with wave 1 in the intervention group. However, it can be observed that food waste in the control group increased by an even larger amount in wave 4, suggesting that the increase in food waste in wave 4 was consistent for both groups and was not caused by the intervention. This may be related to external factors (e.g. pumpkins at Halloween), although the authors have no empirical evidence for this. In comparison, the food waste-only volumes for the control group increased consistently throughout the intervention period.

The food waste volumes in the general waste decreased consistently throughout the intervention period for the intervention group. A similar trend was not observed for the control group, as between waves 1 and 5 there was an overall increase in the food waste in the mixed waste bins. Note that, while the wave 4 mixed waste data for the control group were anomalous, that did not result in lower amounts of total food waste in comparison with the intervention group.

Table 5.1 indicates that, in wave 1, before the food waste kit was administered to the intervention group, mean food waste was slightly less in the control group (4.01 kg) than in the intervention group (3.80 kg). This difference was not statistically significant, as shown by a between-sample t -test ($p = 0.20$).

The between-sample analyses in waves 2, 3, 4 and 5 indicate that total food waste was lower in the intervention group than in the control group in all those waves. However, the differences are statistically significant only in wave 5 ($p < 0.01$). Based on these data, it was estimated that households in Ennis generate between 7.64 and 9.84 kg of food waste every 2 weeks. Based on an average of 8.74 kg, households in Ennis generate about 227 kg of food

waste annually, which equates to about 76 kg per person.

Intervention impact

To estimate the impact of the intervention, the differences in mean food waste observed across waves were calculated. Firstly, the data for the intervention group across the waves were examined, followed by a similar analysis for the control group. This method is termed a “within-group analysis”. Subsequently, the differences between the intervention and the control groups across the waves were compared, a process known as a “between-groups analysis”. Table 5.2 reports these differences. Panel (a) presents the differences in food waste in the food bin only between waves within the intervention group, within the control group and between the intervention and the control groups. Panel (b) presents the same assessments but this time for the total food waste (i.e. including brown bin, mixed and recyclable waste streams). All data, with *t*-tests carried out to measure the differences in mean values, are reported in the appendix of the WP4 report.

The results show that food waste only was on average 0.53 kg more in wave 1 than in wave 2 in the intervention group (evidenced by a positive number). This difference increased to 0.70 kg between waves 1 and 5. These differences were statistically significant across all waves using between-sample *t*-tests. The *t*-tests to compare the data between

waves 1 and 2, waves 1 and 3, waves 1 and 4, and waves 1 and 5 indicate *p*-values of 0.03, <0.01, <0.01 and equal to 0.06, respectively. Similar results were not found in the control group, where the amount of food waste was found to increase (evidenced by the negative signs in the control group section in Table 5.2).

When the total food waste values were examined (which includes food waste plus the food waste content of the general waste and recyclable waste streams), the differences between intervention and control groups were still more pronounced. The most important comparisons to be made are between wave 1 and waves 3 and 5 (corresponding to directly after the intervention and 1 year later, respectively). The comparisons between waves 1 and 3 and waves 1 and 5 both suggested that the reduction in total food waste within the intervention group was at least 1.2 kg per household every 2 weeks. In comparison, the control group showed a marginal reduction for wave 3 (0.25 kg) but a significant increase (1.3 kg) for wave 5. These results combined suggest that the intervention resulted in a 0.96 kg per household per collection reduction in food waste generated at wave 3 and a 2.75 kg per household per collection reduction in wave 5. It is important to note that these differences are statistically significant. Unpaired between-sample *t*-tests showed that these differences are statistically significant when comparing wave 1 with wave 2 (*p*=0.02), wave 1 with wave 3 (*p*=0.04) and wave 1 with wave 5 (*p*<0.01). These

Table 5.2. Differences in food waste generated (kg) within and between intervention periods

| Comparison | Intervention group: within-group differences | | Control group: within-group differences | | Between-group differences | |
|---|---|--------------------|--|--------------------|---------------------------|--------------------|
| | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation |
| (a) Food waste from food waste bins only | | | | | | |
| Wave 1 vs wave 2 | 0.53 | 2.75 | -0.09 | 2.53 | 0.63 | 0.31 |
| Wave 1 vs wave 3 | 0.57 | 3.40 | -0.49 | 3.51 | 1.06 | 0.41 |
| Wave 1 vs wave 4 | -0.50 | 3.06 | -3.17 | 7.24 | 2.67 | 0.66 |
| Wave 1 vs wave 5 | 0.70 | 3.75 | -0.28 | 6.40 | 0.98 | 0.62 |
| (b) Total food waste from food, mixed general waste and MDR bins | | | | | | |
| Wave 1 vs wave 2 | 0.75 | 3.55 | -0.14 | 4.01 | 0.89 | 0.45 |
| Wave 1 vs wave 3 | 1.22 | 4.21 | 0.25 | 4.81 | 0.96 | 0.54 |
| Wave 1 vs wave 4 | 0.38 | 4.29 | -0.50 | 6.96 | 0.88 | 0.69 |
| Wave 1 vs wave 5 | 1.44 | 4.99 | -1.31 | 6.72 | 2.75 | 0.71 |

findings are discussed in more detail in the intervention report (EPA, 2021).

Therefore, considering that a conservative estimate of the success of the intervention was a 1 kg reduction in food waste per household per collection (every 2 weeks), then the overall effect would be, at a minimum, a decrease of about 25 kg of food waste per household per year.

5.1.3 Qualitative assessment

Questionnaire

To supplement the quantitative assessment, a survey consisting of 19 questions was developed to assess attitudes and behaviours around household food waste. However, the questionnaire, which was circulated by text message and sent from Clean Ireland, resulted in very few responses, despite the offer of All4One vouchers. Consequently, the limited qualitative data received were not used as part of the overall analysis.

5.1.4 Discussion

The food waste data collected in Ennis indicate that the intervention was successful in reducing food waste among targeted households:

- The amount of food waste collected in the food waste bins presented by the intervention group decreased in waves 2, 3 and 5 when compared with the amount collected in wave 1.
- The amount of food waste collected in the food waste bins presented by the control group did not decrease in waves 2, 3, 4 and 5 when compared with wave 1 (in fact it increased).
- The total effect of the intervention was estimated to be a reduction of about 1 kg of food waste per household per collection (2 weeks, or 0.5 kg per week) in the short term. Data collected 9 months after the intervention finished show that, when compared with data collected from the control group, any improvements resulting from the intervention seem to have been sustained.

Further detail regarding these results is presented and discussed in the separate WP4 report.

5.2 Intervention B – Skibbereen

5.2.1 Skibbereen waste characterisation

As with intervention A, the direct measurement of food waste was one of the main methods by which the efficacy of the chosen intervention was assessed. Waste data were provided by the local waste collector, and included collection weights from the organic waste (brown bin), general waste and dry recyclable bin collections. Waste characterisation surveys of the general waste collected were used to determine the volumes of food waste present in this stream (Figure 5.2). These took place at the waste collector's premises in April 2022 and again in March 2023, to coincide with the beginning and end of the intervention. As with intervention A, a contributing factor in choosing Skibbereen was the use of 60-L

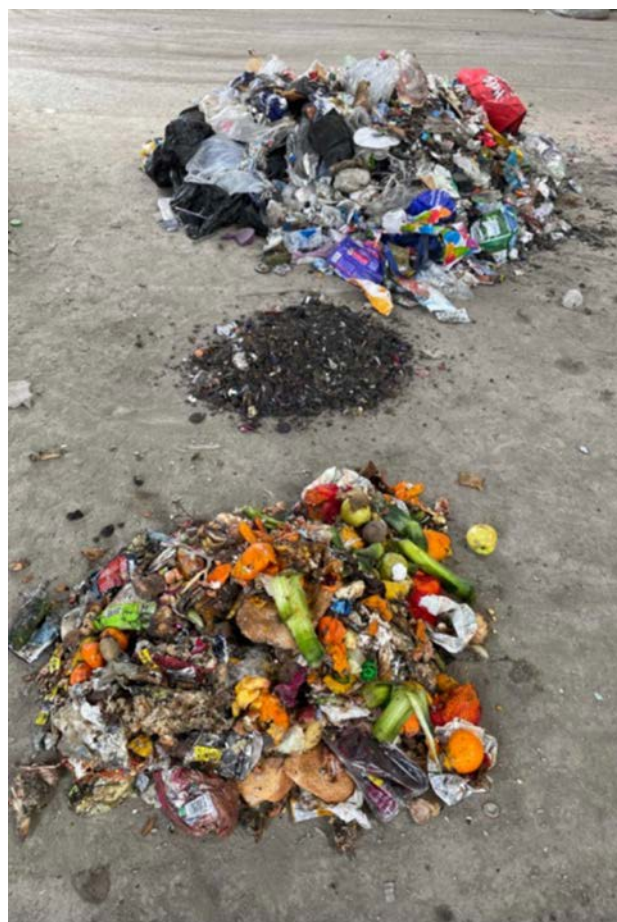


Figure 5.2. Breakdown of waste characterisation results from Skibbereen showing, from the top, general waste, fines (containing 60% organic content) and food waste.

brown bins that are specifically for food waste. This, along with the fact that garden waste tends to be bulkier and is typically produced in relatively large volumes, minimised the likelihood of garden waste being disposed of through this waste stream. As with intervention A, the surveys were carried out at the same time of the year, minimising the potential influence of external factors (e.g. generation of garden waste, changed eating habits, holiday season).

The results of the first survey in 2022 showed that 30% of waste (by weight) in the household general waste stream was food, while in the second survey in 2023 this had decreased to 20%. These surveys, and the results that they generated, were used to calculate food waste data and for outreach and dissemination actions carried out as part of the intervention.

5.2.2 Skibbereen waste data analysis

KWD, the local waste collector, provided household bin weights from Skibbereen for the period January 2022 through to the end of March 2023. These were analysed to evaluate any impacts associated with intervention B. Data were stratified into four main waves:

1. pre intervention: January–March 2022;
2. initial intervention period: March–May 2022;
3. second intervention period: October–December 2022;
4. post intervention: January–March 2023.

There is a gap in the data between June and September 2022, as this was the height of the tourist season, which, it was determined, would have had an impact on waste generation figures. Consequently, this period was discounted from the analysis. Table 5.3 summarises the data collected for the different waste streams over the four waves and estimates the total food waste collected per account/ household every 2 weeks.

Over the intervention period (between waves 1 and 4), there was an increase in brown bin waste of about 3 kg per household (every 2 weeks). This was unanticipated. Initially, when wave 3 data were analysed, this increase was thought to be associated with increased volumes of garden waste in the autumn, in particular leaves. However, as this higher level of brown bin waste was maintained into the fourth wave (January–March 2023, when garden waste volumes would be low), this theory does not hold up. In addition, as the brown bins used in Skibbereen are smaller in volume than those used in Ennis, they tend to contain less garden waste and contain mainly food waste. As such, the data did not show any improvement (reduction in waste generated) over the intervention period. However, the effectiveness of this quantitative approach may be limited in such a community setting. This will be addressed in later sections.

Another potential explanation would be that segregation levels improved, with food waste being diverted from the general waste bins into the brown bins. The waste characterisations carried out on the Skibbereen general waste support this

Table 5.3. Average weight of waste collected (kg per household per collection) from households in Skibbereen over the intervention period

| Type of waste | Wave 1 (pre intervention) January–March 2022 | Wave 2 (initial phase of intervention) March–May 2022 | Wave 3 (second phase of intervention) October–December 2022 | Wave 4 (post intervention) January–March 2023 |
|------------------------------------|--|--|--|---|
| General waste | 17.17 | 17.70 | 17.86 | 17.99 |
| MDR | 9.49 | 10.57 | 9.71 | 9.10 |
| Brown bin (food) | 6.98 | 7.39 | 10.35 | 10.07 |
| General Waste (food ^a) | 5.32 | 5.49 | 5.54 | 3.60 |
| MDR (food ^a) | 0.29 | 0.32 | 0.29 | 0.27 |
| Total food waste collected | 12.59 | 13.2 | 16.18 | 13.94 |

^aFood waste content calculated based on waste characterisation results carried out in Skibbereen in April 2022 (food waste=30%, applied for waves 1–3) and 2023 (food waste=20%, applied for wave 4). The national average of 3% was used in similar calculations for MDR.

suggestion – food waste reduced from 30% of the general waste stream in April 2022 to 20% in April 2023. Applying these results, the food waste content of the general waste stream decreases by about 2 kg per collection between waves 1 and 4. However, it is important to note that the overall volumes of general waste did not decrease and were consistently about 17 kg per household per collection. Therefore, while the empirical results suggest that food waste in the general waste stream reduced with a corresponding increase in food waste in the brown bin, the fact that this was not accompanied by a decrease in the amount of general waste does not fully support this conclusion.

Mixed dry recycling volumes showed that, while there was quite a large degree of variance in the volumes presented by different households, the average dry recycling volume of 9.65 kg every 2 weeks, did not change much across collections. These variations across collections appeared to be driven by some households disposing of large amounts of mixed dry recycling waste at different collection times. Consequently, in terms of the food waste content associated with these volumes, it was relatively consistent over the four waves.

Combining the results from the food waste, general waste and recycling collections indicates that the overall volumes of food waste managed through the local waste collection service increased slightly over the period of the intervention, from 12.6 to 13.9 kg per household every 2 weeks. This was largely driven by the increase in the volumes presented in the brown bins, although this increase was offset by the decrease in the estimated food waste present in the mixed waste stream. This 10% increase between 2022 and 2023 equates to a weekly increase of about 0.68 kg, or 35 kg per household over a full year.

5.2.3 *Bantry waste data analysis*

To explore whether the trends in Skibbereen were consistent with other areas, similar data from another townland in the same geographical area were assessed over the same time periods as the interventions in Skibbereen. Bantry in County Cork is relatively close to Skibbereen (30 km) and the waste collector involved in the Skibbereen intervention was also the main collector in that area. The waste services it provides are consistent across both areas and the

demographic and household distributions are relatively similar. Therefore, Bantry was identified as an appropriate “control” area to compare with Skibbereen, and a similar examination to that described in section 5.1 was carried out.

The findings from this comparison indicated that, although Skibbereen had more food waste per household, the increase in the volume of food waste generated between waves 1 and 4 was larger in Bantry (16%) than in Skibbereen (11%). This suggests that, when compared with the local “control”, after the waste characterisation results were applied, intervention B could be viewed as relatively successful. However, owing to the limited efficacy of this type of data analysis for such an intervention, these results need to be treated with a high degree of caution.

While there is no definite reason for the increase in total food waste in either community, one possibility is that, because more people work from home since COVID-19, more food waste is generated in households. Anecdotal evidence from discussing these results with local stakeholders suggests that over the past year more people have been spending time in rural communities in West Cork, especially outside the tourist season, and that this may be a contributing factor. This included people making more use of holiday homes and locals who are now spending more time working from home. However, such speculation would need further investigation.

5.2.4 *Skibbereen waste data analysis – activity based*

Owing to the nature of this intervention, which involved engagement with a wide audience through a variety of local channels and mechanisms, it was difficult to assess which actions, if any, had a positive impact on the food waste volumes generated. To identify whether any of the actions could have had a direct impact, the amount of food waste generated by households within a radius of 0.5 km of the interventions was compared with the pre-intervention volumes (with ArcGIS Pro used for this analysis). This analysis did not provide any useful insights.

5.2.5 *Qualitative assessment*

As discussed in WP2, questionnaires can be a useful method for evaluating the effectiveness of

interventions, although they have some limitations. As this was an intervention aimed at effecting social norm-based changes within a community, surveys were used in tandem with the quantitative assessment and semi-structured interviews to qualitatively assess intervention B.

Two questionnaires were created for intervention B. The first (survey 1) was created for the beginning of the intervention to generate baseline data for the general Skibbereen area. The second (survey 2) was created to survey school communities after they had been targeted with the school-specific activities. This survey was distributed through primary and secondary schools via a letter to parents and via word of mouth. The response rate for this second survey (77 responses) was slightly higher than the response to survey 1 (65 responses). Although the number of responses was similar, the manner in which each survey was carried out differed. Survey 1 was non-targeted and involved considerable time spent on promotion. Considering the small number of responses for survey 1, survey 2 was targeted to those involved through schools. While the response rate for survey 2 was 20%, because of the way survey 1 was carried out it was not possible to compare response rates.

In 2021, the EPA commissioned a survey on food waste attitudes and behaviours in Ireland. This was the second survey the company Behaviour & Attitudes carried out to help develop a nationally representative understanding of Irish citizens' attitudes to food waste and food management behaviours (the first was undertaken in 2020). Some of the questions asked in that study were replicated during the surveys used in Skibbereen to allow comparison with the national findings. In general, the results of this study showed that, across similar questions, responses from people surveyed in Skibbereen were largely consistent with national results. This was taken to indicate that, in terms of overall attitudes, Skibbereen is an area representative of national sentiments towards food waste.

Survey 1 – public questionnaire distributed at beginning of intervention B

Survey 1 consisted of 17 questions, 13 of them focused on food waste and four based on demographics. The largest group to complete this

survey (33%) was between the ages of 55 and 64 (14% in the national study). This high voluntary response rate may be an indication of the level of interest in the food waste issue among this cohort locally. A total of 89% of people who answered survey 1 separate their food waste from other household waste. The same question was asked in survey 2, and 85% of respondents stated that they separate their food waste from other household waste.

Survey respondents were asked to estimate how much food they throw away each week: 57% of survey 1 respondents reported that they throw out a little food each week. This is consistent with the 59% found in the EPA-commissioned study.

In terms of reducing food waste, it is acknowledged that getting people to adopt good food reduction behaviours is still challenging, as many do not acknowledge that they are key contributors to the issue. This is corroborated by the Skibbereen survey results in which, despite the national volumes of food waste reported, about 60% of people reported throwing away “a little” food waste. While self-reporting and direct engagement with the evaluation process (e.g. questionnaires, food waste diaries) have been shown to under-report actual food waste (as noted in WP2), this is clearly an area that needs to be addressed in future local and national work. Intervention B attempted to address this with the series of videos, based on the waste characterisations carried out, that we promoted and disseminated locally.

Regarding the different food types, fruit, followed closely by vegetables and bread/bakery items, was the most common food type that people responding to survey 1 reported throwing away. This again was consistent with the national research commissioned by the EPA in 2021 and also shows consistency with other international studies (e.g. WRAP, 2018).

When exploring people's main concerns about food issues, the way that food products are packaged was the food issue people were most concerned about, followed by wasting food and the environmental impact of food. In the national study, the price of food, food waste and food ingredients were the top three. It is interesting to note that, while food waste is a major concern, other issues (e.g. packaging) seem to be more important. This points to an interesting challenge when it comes to getting messaging to resonate with

the public, as what may be deemed important at a national level may be different from issues considered important at local level.

Regarding the results of the Skibbereen survey, the concerns about food packaging are interesting. This is likely to point to the concerns that people have about the increased levels of packaging recycling that they need to deal with after purchasing goods in supermarkets. While this is a legitimate concern, especially in an area where there is a tradition of eating local produce (which typically has less packaging), the positive implications of packaging for the food supply chain (e.g. extended shelf life) are often overlooked. However, from a communications perspective, it may be possible to use this concern to stimulate interest in food waste prevention (i.e. by reducing the amount of food wasted there will be less packaging waste generated).

When looking at the food waste issue specifically, 17% of people in Skibbereen said that the “waste of resources” was their primary concern. This was followed by financial implications (13%) and the impacts of food waste on climate change (11%). Interestingly, no-one said that they had “no concerns”. These results are somewhat different from the national results in which the strongest responses to food waste were remorse (“people go hungry”) and about financial loss (“wasted money”) followed by the unnecessary packaging waste from uneaten food.

In general, although some specific results from survey 1 differ slightly from the national Behaviour & Attitudes survey, they are broadly similar, and the Skibbereen findings corroborate the findings from the national survey. This points to consistency of issues and identifies Skibbereen as typical.

Survey 2 – targeted questionnaire distributed to families involved in school-related projects at the end of intervention B

Survey 2 was a more targeted survey than survey 1 in that it targeted the Skibbereen school communities after they had been involved in actions directly related to intervention B. Consequently, this was used to determine the impact of the direct actions taken on attitudes to food waste.

Of those who participated in this survey, 71% had received a booklet or had been involved in the online food waste tool trials. This is reflected in the fact that the age group accounting for the highest proportion of responses (41%) was the 35–44 years group. Engagement with this cohort of people, who are typically difficult to engage with on food waste (as a result of busy lifestyles), was seen as a positive outcome and may point to an effective way of engaging with them in the future. In the EPA-commissioned Behaviour & Attitudes survey, only 21% of this demographic responded (however, that study did seek a representative spread of ages).

In this survey respondents were again asked to estimate how much food they threw away each week, with the results (in blue, Figure 5.3) being very similar to the results from the first survey. Interestingly, the percentage of those that claimed they threw no food out was lower (4%) in survey 2 (where people would have been made directly aware of food waste) than in survey 1 (15%).

When asked if they had heard about “Skibbereen taking on Food Waste”, 70% of respondents answered that they had. People were asked to describe how, in their household, the issue of food waste is addressed: 49% of people reported that it is “important to

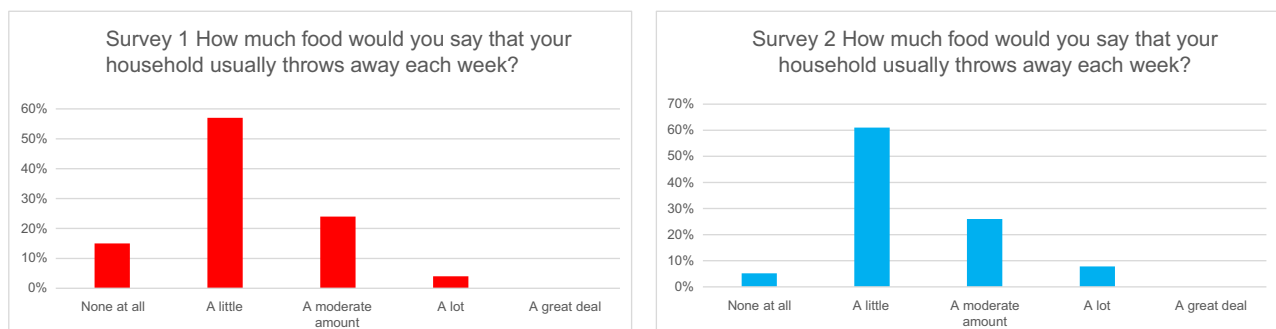


Figure 5.3. Survey 1 (left) and survey 2 (right) responses regarding estimated relative quantities of food discarded each week.

them – they are always trying to minimise it”, with an additional 34% having taken some reduction measures and 12% wishing to do something about their food waste. This is an improvement on the national study, in which the corresponding responses were 13%, 49% and 30%, respectively. This suggests that the impact of the targeted interventions appears to be positive.

This is corroborated by the profiles shown in Figure 5.4, which show the levels of concern about food waste people reported before and after being involved in the targeted school-based actions. Prior to receiving the intervention (the *Young Chef Recipes* booklet), 40% of people expressed moderate concern and 22% expressed “a lot” of concern. After the experience of their children being actively involved in food waste-based projects, this had shifted to 22% of people expressing moderate concern and 39% expressing “a lot” of concern. This result shows the positive impact that active involvement of school-aged children in community-based food waste projects can have in stimulating interest and understanding of the issue of food waste.

Among those who received the *Young Chef Recipes* booklet, 65% reported that it had changed their view of food waste, with 100% reporting that they would try the recipes in the booklet.

In addition to the qualitative results, people were also asked what their thoughts on “Skibbereen taking on Food Waste” were, and below are some of the answers:

- “It’s a great idea, it should be done in all towns, villages, townlands, households.”
- “A brilliant initiative and the timing is spot on. People need to save money on their groceries

now more than ever and like to do their bit for the environment too.”

- “Great idea, should be spoken [about] in all schools.”
- “Very positive and raising awareness.”
- “It’s a good idea.”
- “This is a great idea as it has started from primary school and the power of children to influence adult activities is very powerful.”
- “It’s great, children are very involved in the home and more aware and conscious of waste.”
- “It’s fantastic, very beneficial to the environment.”
- “Great, already tried some recipes from the booklet.”

While these are not conclusive findings, they do point to the positive impact associated with this locally based and targeted approach. Through fostering a collective interest in the topic of food waste and bringing it into households in an engaging and encouraging manner, this intervention appears to have engaged the public in a positive way.

Semi-structured interview with local facilitator

At the end of intervention B, a semi-structured interview was held with the local facilitator, who was also chairperson of Skibbereen Tidy Towns. The questions asked are contained in the appendix of the WP4 report. The local facilitator was the main point of contact for the majority of the engagement actions applied during the later phases of intervention B and was in direct communication with each of the schools that created the *Young Chef Recipes* booklet and completed the online Stop Food Waste challenge.

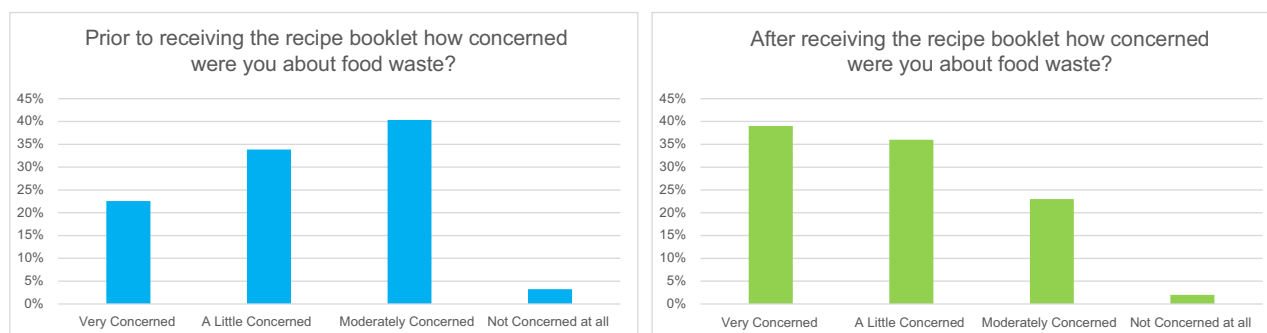


Figure 5.4. Survey 2 responses comparing the levels of concern regarding food waste before (left) and after (right) receiving the *Young Chef Recipes* booklet.

She reported that Tidy Towns lends itself well to being a lead partner in household food waste interventions because improving the town's performance for the annual Tidy Towns competition is a good motivation. Many Tidy Towns groups struggle with the sustainability aspects of their submission to the Tidy Towns competition, and initiatives to deal with food waste are a good fit.

The local facilitator felt that the topic (food waste) does not attract enough interest and should be incentivised in some way. For example, a special award linked to food waste might be one way to incentivise action. Similarly, providing a community-based toolkit to address food waste with a variety of options for towns and stakeholders to consider could also be beneficial.

Online project management and meeting applications/tools are very useful. For participants who are involved on a voluntary basis, it is necessary to facilitate what best suits their needs, and online meetings help in this regard. Similarly, online project management tools help, as all information is stored in one place and, should people become uninvolved (as happens with community-based work), information is not lost.

Considering what communication channels work best for interacting with the public, it was noted that, while social platforms and print media are good, in-person interactions are still the most effective.

It is intended that "Skibbereen taking on Food Waste" will expand and continue into the future, updating the *Young Chef Recipes* booklet every year in addition to generating an Irish language version with the local Gaelscoil. These activities will help sustain the local impact associated with intervention B.

5.2.6 *Qualitative assessment*

Unlike intervention A, the quantitative results for intervention B suggest that it did not succeed in reducing household food waste (notwithstanding the comparison with the local control area). This is possibly down to the design of the measurement method used and expecting a notable reduction for a whole sizeable community's volume of food waste in a relatively short period and with a relatively limited budget for an intervention with significant volunteer involvement.

However, the qualitative results suggest that changes in attitudes had occurred, and local people were more aware of food waste because of the community actions involved. This type of intervention needs to be viewed as part of a long-term, slow-burning intervention that could possibly have a greater impact, albeit more nebulous, than the Ennis one-off intervention (especially as the community have continued the campaign).

6 Discussion of Behaviour Change Interventions

The primary aim of both trials was to assess the amount of food waste generated by households and evaluate how it was affected by the interventions implemented over time and across the study areas. The hypothesis was that there would be a relative decrease in the amount of food waste generated in both study areas, during and after the interventions, when compared with the control areas.

6.1 Discussion of Intervention A – Direct Targeting of Households

The intervention applied in Ennis, County Clare, was based on the use of nudges, practical tools and associated prompts to precipitate changes in behaviour around food management and, consequently, the resulting levels of food waste generated at household level. This approach was designed not only to communicate directly with householders about their own practices but also to convey the message that their household was part of a wider project being conducted in the town. The kit was presented and their participation was encouraged in a positive manner – taking into account the fact that people tend to be motivated to do something if other people they know are doing it.

The intervention delivery was an important factor to take into consideration. The stakeholders interviewed during the research phase noted that the person, or group, seen to be delivering the intervention is important, since it was commented that interventions linked to community engagement and peer-to-peer interactions work best. Clean Ireland, the waste collector involved, has been an advocate of direct communication with its customers on food waste for many years and therefore has a positive relationship with them. Delivering the pack, and the associated messages, through such a trusted service provider, independent of other institutional stakeholders, was agreed to be the best option for this intervention. A degree of continuity was also noted as an important factor in an intervention's success by the experts interviewed during our research. This was achieved

by sending out the messages every Wednesday at the same time for the 6 weeks of the intervention rather than just sending out the kit on its own.

It had been hoped that the quantitative information gathered could be supported with associated qualitative results. Qualitative information for this kind of intervention can be difficult to obtain as, by design, the project team had minimal direct contact with the intervention participants. This approach was taken to test that the intervention was replicable, without the significant time requirements involved in interacting directly with householders. The qualitative questionnaire used in this instance was sent out through a link in a text message and garnered very few responses. It could be the case that this approach, at a time of heightened awareness of phishing, is not practical. However, if this type of intervention were to be repeated, sending out the survey as hard copy, either with the packs or separately at the end of the intervention period, and collecting the responses with the next waste collection could be a better option.

6.1.1 Results

In terms of the results, the calculations of final food waste generated were based on an assessment of the total amounts of food waste presented in brown bins compared with the food waste content of the general waste bins. One of the reasons that Clean Ireland was chosen was that it uses small brown bins and actively discourages garden waste being disposed of through its service. Therefore, the total weight of brown bins was attributed to food waste. For the general waste bins/collection, the waste characterisation results were largely in line with national findings and, while there was a small reduction observed in the level of food waste present in the general waste bins from the before and after surveys, these data could not differentiate between the intervention and control groups. It had been the intention to assess these waste streams separately after the intervention period but, unfortunately, due to miscommunications, these wastes were mixed during bin collection.

Overall, the food waste data collected in Ennis suggest that the intervention was successful in reducing food waste among the targeted households:

- Total food waste levels per household decreased after the intervention compared with the levels observed before the packs were sent out.
- In comparison, the food waste levels did not decrease by a statistically significant amount in the control group.
- The total effect of the intervention was estimated to be a reduction of about 1 kg of food waste per household per collection every 2 weeks, directly after the trial period. This equates to about 0.5 kg per week in the short term.
- Data collected 9 months after the intervention finished show that, when compared with the control group, the improvements made by the intervention group seem to have been sustained, with a reduction of 1.5 kg of food waste per household per collection compared with pre-intervention figures.

When comparing the improvements observed in the intervention group with those in the control group, the reduction in the level of food waste was even more pronounced at over 2.5 kg of food waste per household per collection.

6.1.2 Cost–benefit analysis

The items included in the intervention pack, as well as the messages and promotional materials, were designed and procured by the project team. Table 6.1 outlines the overall cost of the packs, excluding the design and organisational time involved in procurement and distribution.

Based on these estimates, the cost of rolling out this type of intervention to 1000 households in Ireland would be about €15,640, saving an estimated

26,000 kg of food waste annually (using the conservative 0.5 kg per household per week seen in the short term after the intervention). From the EPA's Stop Food Waste programme, it is noted that, on average, the cost of 1 kg of food waste is about €3. Therefore, for every €0.60 invested (the cost of preventing 1 kg of food waste), there is a potential €3 saving per household. Please note that these costs are accurate as at the beginning of 2023, and inflation and economies of scale are likely to have had an impact on current costs compared with the costs of the pilot intervention.

6.1.3 Intervention A conclusions

Overall, based on these results, this intervention seems to be a successful approach to reducing food waste in Irish households. The data suggest that, on average, a reduction of 0.5 kg (or 16%) in food waste generated per household per week was achieved when compared with the amount of food waste generated by the households in the control group immediately after the intervention. This level of improvement is lower than the 30% observed by van der Werf *et al.* (2020) in Ontario, although it is important to note that their intervention took place over a 2-week period and the longer term impacts were not reported. Importantly, in this research, it was found that the level of improvement was sustained 9 months after the end of the intervention, with the reduction increasing to 0.75 kg food waste per week compared with pre-intervention levels. Based on these results, and cognisant of our national targets, the research team suggest that this type of intervention could be an effective tool if rolled out widely, in collaboration with interested waste collectors and local stakeholders (e.g. local authorities, community organisations).

6.2 Discussion of Intervention B – Changing Norms through a Community-led Approach

Intervention B was based on changing social norms regarding food waste via a community-led approach. Once this intervention method had been selected, an engaged community in a small or medium-sized town was sought. Skibbereen in County Cork was chosen because of its active community and previous interest shown in the topic. Based on initial engagement workshops with the main local stakeholders, a

Table 6.1. Outline of the costs associated with the information kit used in intervention A

| Description | Cost (€) |
|------------------------------|-------------------|
| Total cost of 160 packs | 1903 |
| Cost of posting packs | 600 |
| Total cost (incl. VAT) | 2503 (incl. VAT) |
| Cost for one kit (incl. VAT) | 15.64 (incl. VAT) |

VAT, value added tax.

community-led plan was developed and put into action. The flexible nature of the initial plan was designed to invite stakeholders to contribute on their terms, which aimed to foster local ownership and grow working relationships.

By its nature, this participatory community-based approach proved more difficult and time-consuming to implement than intervention A. In addition, this intervention coincided with the COVID-19 pandemic. Although there was great enthusiasm for this intervention's approach, both within the team and in the community, COVID-19 affected every aspect of the intervention – from the ability to directly engage with stakeholders to conducting meetings in person and the availability and capability of key stakeholders to participate. This led to disruption throughout, affecting different aspects of the intervention's application, which meant that the local momentum required to inspire the community to coalesce around the topic never fully materialised.

Involving several local stakeholders in such community approaches is essential, but having a clear local project lead proved to be one of the most important factors for success in the later stages of the Skibbereen work (and this was missing at the outset). When addressing complex topics such as food waste, it is unrealistic to expect volunteers and community-based organisations that are not well resourced and/or have other priorities to fully commit to such initiatives. Therefore, it is not only desirable but imperative to tie into existing initiatives and preferably fund that participation directly.

The timing of any community initiative will always be important but for Skibbereen, an area in West Cork that is highly impacted by tourism and seasonal fluctuations in population size, this was especially noticeable. The original plan was to launch the initiative in October/November 2021 and have the intervention activities on the ground completed by June 2022 (the start of the main summer season). However, owing to delays in starting (largely related to COVID-19), by the time momentum was beginning to build after the initial engagement work, the summer had begun and many of the stakeholders involved had other priorities to attend to. During this summer period, people were slow to respond and take part in "Skibbereen taking on Food Waste", and it was only after the summer season was over and a dedicated

local coordinator was in place that successful intervention activities began to take effect.

6.2.1 Results

Measuring the effectiveness of a community-based intervention, such as that applied in Skibbereen, was always going to be challenging. The project team, with input from the steering committee, determined in advance that an evaluation of the average volumes of food waste produced per household should be an effective method, especially if a control group in the same general area was used as a reference. However, considering the size of the community assessed (over 400 households), the limited extent and duration of the intervention, and the many factors contributing to food waste generation at any one time, this approach may have been unrealistic for such a short-term evaluation. The quantitative results gathered in collaboration with the main local waste collector (accounting for an estimated 70% of households) did not show any demonstrable reduction in food waste. In fact, the total volume of food waste increased by an estimated 10% between waves 1 and 4. In comparison with the control area, where the same analysis indicated an increase of 16% in the total food waste generated, the Skibbereen results are indicative of an overall relative reduction in food waste. However, these results need to be treated with a degree of caution because of the many potential influencing factors that could impact community-wide food waste levels. The overall conclusion in relation to intervention B is that there was no meaningful reduction observed in food waste generation levels, although there was an apparent improvement in food waste segregation (i.e. more food waste found in the brown bin than in the mixed waste bin) over the period of the intervention.

The qualitative assessments undertaken for this work provided more useful and positive information than those for intervention A. As noted previously, two surveys were used, and while there were a number of similar questions, they served different functions. Some of the interesting findings were as follows: (1) the general attitudes of those who participated in the first survey were very much aligned with the results of the national survey commissioned by the EPA, suggesting that Skibbereen is representative of national values when it comes to food waste; (2) the results regarding the amount of food discarded had

shifted, positively, by the time the second survey took place; and (3) through involvement in the schools-focused work in the later stages of the intervention, there was a notable impact on people's attitudes and concerns regarding food waste as a consequence of their children's involvement.

6.2.2 *Intervention B conclusions*

While the qualitative results are not conclusive, they do point to the positive impact associated with this locally based and targeted approach. Through fostering a collective interest in the topic of food waste and bringing it into households in an engaging and encouraging manner, this intervention appears to have engaged the public in a positive way. This is evidenced by the activities undertaken in the later stages of the intervention by the local Tidy Towns group once a degree of local interest had been developed. These projects, which targeted families through engagement with schoolchildren and teenagers in transition year, proved to be very effective. This points to the importance of community-led interventions, as local stakeholders will typically have insights into, and appreciation of, the interest areas of the local community, as well as the contacts to bring about action. In addition, with the *Young Chef Recipes* booklet winning a "Pride in Our Community" award, there is a legacy impact that will become evident only in the future.

The quantitative results are difficult to interpret. The total volume of food waste per household increased in Skibbereen over the intervention period, although this was less than the increase observed in the local control area. That said, the design of the measurement method may well have been at fault, as expecting a notable reduction in a sizeable community's volume of food waste in a relatively short period and with a relatively limited budget for an intervention with significant staff/volunteer involvement may have been unreasonable. A more defined measurement of a subset of the overall community might have proved more informative.

A potential improvement in this experiment would therefore be an application of intervention A (i.e. sending out the food waste packs to a trial group and comparing results with a control group) during the later stages of intervention B (i.e. once local interest and awareness had been heightened). This would have

enabled the impact of pre-education and engagement to be determined and compared with the Ennis results.

6.3 **How These Results Fit In With Achieving Ireland's Targets**

Ireland is one of the countries committed to achieving the United Nations SDGs, and, in line with target 12.3, needs to reduce food waste at the consumer level by 50% by 2030. The consumer level includes household food waste. Ireland, along with other EU countries, first reported its overall food waste volumes across the supply chain in 2021 (EPA, 2022). That report noted that household food waste accounted for 29% of total food waste, or about 221,000 tonnes (which equated to 44 kg per person). However, regarding target 12.3, the baseline year has yet to be agreed. Therefore, considering the 2018 waste characterisation results (EPA, 2018), it is likely that, at the time of committing to achieve target 12.3, Ireland's generation of food waste at the household level was closer to 250,000 tonnes. This is based on the organic content (including fines but excluding contamination) of the general waste, mixed dry recycling and brown bin wastes. On a per person basis, this equates to 52 kg.

Considering this, our 50% reduction target would require us to be generating less than 26 kg per person by 2030. With a projected population of 5.2 million, this equates to a total food waste target of about 135,000 tonnes. To explore how this may be achieved, the average annual improvement required has been estimated and is shown in Table 6.2.

Based on our 2016 food waste estimates, Ireland needs to achieve an annual rate of household food waste reduction of 4.5% per person every year until 2030. Our 2021 figures show that, while improvements have been made, the actual rate of reduction has been only 3.5%, compared with the required 4.5%. Therefore, from 2021, food waste needs to be reduced by 5.6% annually to hit our 50% target. As things stand, we need to accelerate efforts, and, in addition to our continual improvement, we will need to make a number of significant improvements along the way. The results of intervention A point to one such approach that has the potential to make a significant impact with a 16% improvement rate, equivalent to 3 years of our current continual improvement rate. While this may be costly to replicate nationally, the rate

Table 6.2. Ireland's progress towards the 2030 national food waste prevention targets

| | 2016 (baseline year) | 2021 (first year of national reporting) | 2030 (target year) |
|--|----------------------|---|-----------------------------|
| Total food waste | 250,000 tonnes | 221,000 tonnes | 135,000 tonnes ^a |
| Population | 4.83 million | 5.03 million | 5.2 million (projected) |
| Food waste per person | 52 kg | 44 kg | 26 kg |
| Current annual rate of reduction | | 3.5% | |
| Annual rate of reduction required to hit 2030 target | 4.5% | 5.6% | |

^aBased on food waste per person multiplied by projected population.

of return (for every €0.60 invested, a €3 saving will accrue) is certainly positive.

As noted in the previous section, the impact of the community-based awareness approach was not conclusive in terms of quantitative results. However, the qualitative findings and legacy effects of the

intervention in the area are positive. Under the right circumstances, where local communities have been “primed” through locally led awareness initiatives, these could be used in future projects to effect the type of large-scale reductions in food waste levels required by 2030.

7 Conclusions and Recommendations

In light of the global impact associated with food waste, and conscious of the challenging SDG target 12.3 that must be achieved by 2030, this research aimed to explore the effectiveness of tailored food waste prevention initiatives. Based on international best practices in food waste prevention and behavioural science, and informed by on-the-ground practitioners, the interventions were designed to test realistic models that built on existing local assets and, ultimately, could be replicated nationally. Based on the quantified and qualified findings from the interventions, as well as the experiences of the project team, we make the following recommendations to inform longer term policies, intervention initiatives and the associated measurement methods.

7.1 National Coordination and Policies

- There is an ever-growing body of international research and on-the-ground intervention work in the area of food waste prevention. More recently, and building on the work of the REFRESH project, the EU Food Loss and Waste Prevention Hub was established and provides a database of food waste prevention initiatives across the food supply and consumption chain, containing over 80 publications (including guides, papers and resources) specific to the household sector. These resources should be widely promoted and incorporated into the planning and application of national, regional and locally based work on food waste prevention and funding mechanisms.
- The recently published *National Food Waste Prevention Roadmap 2023–2025* acknowledges the role of community and community-based initiatives and networks that support reducing food waste in delivering the SDG target. With multiple actors now involved in this area, as well as emerging funding support (e.g. the Community Climate Action Programme), it is imperative that a coordinated approach is taken so that lessons from the past, as well as emerging research from elsewhere, are used to inform future actions. A national working group of those working in,

and funding, household/community food waste prevention (involving government departments, agencies and key stakeholders) should therefore be put in place. This would ensure that time is not lost through a fragmented approach (that repeats the mistakes of the past) and the existing interest, activity and funding in this area is applied in a coordinated fashion.

- The communications messages, outreach tools and statistics used during both interventions continually referred to the materials promoted through the national Stop Food Waste programme. Such an approach, which linked local initiatives with the national programme, ensured the consistency and credibility of the underlying messages promoted while still allowing for local creativity and tailoring. This was facilitated by the project team's knowledge of the national programme and its involvement through the steering committee. While this will not always be possible because of the limited service that the national programme can provide, institutional stakeholders and funders should ensure that local projects are aligned with the national programme where possible.

7.2 Intervention Learning Points

- Both interventions trialled as part of this research were based on specific behavioural theories and followed a recommended testing framework. While there were certain successful outcomes in each intervention case, these should be viewed as building blocks for future work, which will be needed when it comes to understanding how best to effect change locally to reduce the generation of food waste. Therefore, it is imperative that the results from these interventions are communicated nationally to relevant stakeholders and interested community-based actors.
- The use of existing networks/stakeholders will be essential if we are to accelerate the work already under way at a national level. In both interventions trialled, established networks/stakeholders were essential in delivering the interventions. In the

case of intervention A, the local waste collection company was a vital contributor and provided the mechanism for the distribution of the food waste kit. In intervention B, the well-established Tidy Towns group and local schools were suitable channels for public engagement. In both interventions, the willing involvement of the private waste collection companies greatly facilitated the process of gathering the data on which the effectiveness of the interventions was assessed.

- For future funding of community-level interventions aimed at reducing food waste, it is recommended that established groups/organisations are invited to apply for funding to support interventions from a range of specific options. It will take good judgement to get this right – a call that is too broad can lack focus, while an inflexible set of options may not appeal to community organisations and may ignore the specifics of a local context and innovative approaches. Therefore, supporting such funded initiatives with established technical and organisational support (e.g. a food waste prevention community toolkit based on a range of approaches with associated support materials) would help ensure the success of such projects and achieve a degree of national momentum and collaboration.
- It is important to acknowledge that food waste is a difficult topic to actively engage the public with – it is overwhelming and lacks the appeal of some other sustainability actions such as technology-based solutions (e.g. electric

vehicles, LEDs). Food waste prevention is multifaceted, and its everyday nature requires continual consideration and action. While there is a widespread appreciation of the seriousness of the issue, thanks to the national publicity surrounding the topic, converting this into action is challenging. This reflects the “value–action gap” which is common with many activities related to climate action. Combining food waste with other, more tangible and hands-on topics (e.g. home composting or cookery courses) was found to help in the case of the community-based approach in Skibbereen. The practice of incorporating food waste reduction initiatives into existing activities in other areas, for example, sustainable eating, healthy eating, climate action, cooking skills and community sustainability actions, should continue.

- For community-based interventions (such as intervention B) to be successful, it is crucial that an adequate budget is set aside to cover people’s time to manage and lead such projects. The success of community-based projects is often left to the volunteer effort of those involved, but, without having a paid local project leader for the duration of the project, the chances of success are much more limited. To this end, it is important that there is clarity about what funding is available for initiatives from the outset. This provides clarity to prospective collaborators who may not have the capacity to be involved without the prospect of funding or may be able to look to other avenues to cover overheads.

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Abbreviations

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|------------|---------------------------------|
| EPA | Environmental Protection Agency |
| MDR | Mixed dry recyclables |
| SDG | Sustainable Development Goal |
| WP | Work package |

An Ghníomhaireacht Um Chaomhnú Comhshaoil

Tá an GCC freagrach as an gcomhshaol a chosaint agus a fheabhsú, mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ar thionchar díobhálach na radaíochta agus an truailithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialáil: Rialáil agus córais chomhlíonta comhshaoil éifeachtacha a chur i bhfeidhm, chun dea-thorthaí comhshaoil a bhaint amach agus díriú orthu siúd nach mbíonn ag cloí leo.

Eolas: Sonraí, eolas agus measúnú ardchaighdeán, spriocdhírthe agus tráthúil a chur ar fáil i leith an chomhshaoil chun bonn eolais a chur faoin gcinnteoireacht.

Abhcóideacht: Ag obair le daoine eile ar son timpeallachta glaine, táirgiúla agus dea-chosanta agus ar son cleachtas inbhuanaithe i dtaobh an chomhshaoil.

I measc ár gcuid freagrachtaí tá:

Ceadúnú

- > Gníomhaíochtaí tionscail, dramhaíola agus stórála peitрил ar scála mór;
- > Sceitheadh fuíolluisce uirbigh;
- > Úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe;
- > Foinsí radaíochta ianúcháin;
- > Astaíochtaí gás ceaptha teasa ó thionscal agus ón eitlíocht trí Scéim an AE um Thrádáil Astaíochtaí.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil

- > Iniúchadh agus cigireacht ar shaoráidí a bhfuil ceadúnas acu ón GCC;
- > Cur i bhfeidhm an dea-chleachtais a stiúradh i ngníomhaíochtaí agus i saoráidí rialáilte;
- > Maoirseacht a dhéanamh ar fhreagrachtaí an údaráis áitiúil as cosaint an chomhshaoil;
- > Caighdeán an uisce óil phoiblí a rialáil agus údaruithe um sceitheadh fuíolluisce uirbigh a fhorfheidhmiú
- > Caighdeán an uisce óil phoiblí agus phríobháidigh a mheasúnú agus tuairisciú air;
- > Comhordú a dhéanamh ar líonra d'eagraíochtaí seirbhíse poiblí chun tacú le gníomhú i gcoinne coireachta comhshaoil;
- > An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Dramhaíola agus Ceimiceáin sa Chomhshaol

- > Rialacháin dramhaíola a chur i bhfeidhm agus a fhorfheidhmiú lena n-áirítear saincheisteanna forfheidhmithe náisiúnta;
- > Staitisticí dramhaíola náisiúnta a ullmhú agus a fhoilsiú chomh maith leis an bPlean Náisiúnta um Bainistíocht Dramhaíola Guaisí;
- > An Clár Náisiúnta um Chosc Dramhaíola a fhorbairt agus a chur i bhfeidhm;
- > Reachtaíocht ar rialú ceimiceán sa timpeallacht a chur i bhfeidhm agus tuairisciú ar an reachtaíocht sin.

Bainistíocht Uisce

- > Plé le struchtúir náisiúnta agus réigiúnacha rialachais agus oibriúcháin chun an Chreat-treoir Uisce a chur i bhfeidhm;
- > Monatóireacht, measúnú agus tuairisciú a dhéanamh ar chaighdeán aibhneacha, lochanna, uiscí idirchreasa agus cósta, uiscí snámha agus screamhuisce chomh maith le tomhas ar leibhéil uisce agus sreabhadh abhann.

Eolaíocht Aeráide & Athrú Aeráide

- > Fardail agus réamh-mheastacháin a fhoilsiú um astaíochtaí gás ceaptha teasa na hÉireann;
- > Rúnaíocht a chur ar fáil don Chomhairle Chomhairleach ar Athrú Aeráide agus tacaíocht a thabhairt don Idirphlé Náisiúnta ar Gníomhú ar son na hAeráide;

- > Tacú le gníomhaíochtaí forbartha Náisiúnta, AE agus NA um Eolaíocht agus Beartas Aeráide.

Monatóireacht & Measúnú ar an gComhshaol

- > Córais náisiúnta um monatóireacht an chomhshaoil a cheapadh agus a chur i bhfeidhm: teicneolaíocht, bainistíocht sonraí, anailís agus réamhaisnéisiú;
- > Tuairiscí ar Staid Thimpeallacht na hÉireann agus ar Tháscairí a chur ar fáil;
- > Monatóireacht a dhéanamh ar chaighdeán an aeir agus Treoir an AE i leith Aeir Ghlain don Eoraip a chur i bhfeidhm chomh maith leis an gCoinbhinsiún ar Aerthruailliú Fadraoin Trasteorann, agus an Treoir i leith na Teorann Náisiúnta Astaíochtaí;
- > Maoirseacht a dhéanamh ar chur i bhfeidhm na Treorach i leith Torainn Timpeallachta;
- > Measúnú a dhéanamh ar thionchar pleananna agus clár beartaithe ar chomhshaol na hÉireann.

Taighde agus Forbairt Comhshaoil

- > Comhordú a dhéanamh ar ghníomhaíochtaí taighde comhshaoil agus iad a mhaoiniú chun brú a aithint, bonn eolais a chur faoin mbeartas agus réitigh a chur ar fáil;
- > Comhoibriú le gníomhaíocht náisiúnta agus AE um thaighde comhshaoil.

Cosaint Raideolaíoch

- > Monatóireacht a dhéanamh ar leibhéil radaíochta agus nochtadh an phobail do radaíocht ianúcháin agus do réimsí leictreamaighnéadacha a mheas;
- > Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as tasmí núicléacha;
- > Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta;
- > Sainseirbhísí um chosaint ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Ardú Feasachta agus Faisnéis Inrochtana

- > Tuairisciú, comhairle agus treoir neamhspleách, fianaise-bhunaithe a chur ar fáil don Rialtas, don tionscal agus don phobal ar ábhair maidir le cosaint comhshaoil agus raideolaíoch;
- > An nasc idir sláinte agus folláine, an geilleagar agus timpeallacht ghlan a chur chun cinn;
- > Feasacht comhshaoil a chur chun cinn lena n-áirítear tacú le hiompraíocht um éifeachtúlacht acmhainní agus aistriú aeráide;
- > Tástáil radóin a chur chun cinn i dtithe agus in ionaid oibre agus feabhsúchán a mholadh áit is gá.

Comhpháirtíocht agus Líonrú

- > Oibriú le gníomhaireachtaí idirnáisiúnta agus náisiúnta, údaráis réigiúnacha agus áitiúla, eagraíochtaí neamhrialtais, comhlachtaí ionadaíocha agus ranna rialtais chun cosaint comhshaoil agus raideolaíoch a chur ar fáil, chomh maith le taighde, comhordú agus cinnteoireacht bunaithe ar an eolaíocht.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil

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

1. An Oifig um Inbhuanaitheacht i leith Cúrsaí Comhshaoil
2. An Oifig Forfheidhmithe i leith Cúrsaí Comhshaoil
3. An Oifig um Fhianaise agus Measúnú
4. An Oifig um Chosaint ar Radaíocht agus Monatóireacht Comhshaoil
5. An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tugann coistí comhairleacha cabhair don Ghníomhaireacht agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

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