epa Research

Report No. **511**

Optimised Plus – Food Waste Collected from Apartments (OptiFood)

Authors: Celia Cremin, Percy Foster, Freya Bartels, Michele Giavini, Enzo Favoino

Lead organisations: Foster Environmental, ARS Ambiente and Scuola Agraria del Parco di Monza

www.epa.ie

Rialtas na hÉireann
Government of Ireland

Environmental Protection Agency

The EPA is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

The work of the EPA can be divided into three main areas:

Regulation: Implementing regulation and environmental compliance systems to deliver good environmental outcomes and target those who don't comply.

Knowledge: Providing high quality, targeted and timely environmental data, information and assessment to inform decision making.

Advocacy: Working with others to advocate for a clean, productive and well protected environment and for sustainable environmental practices.

Our Responsibilities Include:

Licensing

- Large-scale industrial, waste and petrol storage activities;
- Urban waste water discharges;
- The contained use and controlled release of Genetically Modified Organisms;
- Sources of ionising radiation;
- Greenhouse gas emissions from industry and aviation through the EU Emissions Trading Scheme.

National Environmental Enforcement

- Audit and inspection of EPA licensed facilities;
- Drive the implementation of best practice in regulated activities and facilities;
- Oversee local authority responsibilities for environmental protection;
- Regulate the quality of public drinking water and enforce urban waste water discharge authorisations;
- Assess and report on public and private drinking water quality;
- Coordinate a network of public service organisations to support action against environmental crime;
- Prosecute those who flout environmental law and damage the environment.

Waste Management and Chemicals in the Environment

- Implement and enforce waste regulations including national enforcement issues;
- Prepare and publish national waste statistics and the National Hazardous Waste Management Plan;
- Develop and implement the National Waste Prevention Programme;
- Implement and report on legislation on the control of chemicals in the environment.

Water Management

- Engage with national and regional governance and operational structures to implement the Water Framework Directive;
- Monitor, assess and report on the quality of rivers, lakes, transitional and coastal waters, bathing waters and groundwaters, and measurement of water levels and river flows.

Climate Science & Climate Change

- Publish Ireland's greenhouse gas emission inventories and projections;
- Provide the Secretariat to the Climate Change Advisory Council and support to the National Dialogue on Climate Action;
- Support National, EU and UN Climate Science and Policy development activities.

Environmental Monitoring & Assessment

- Design and implement national environmental monitoring systems: technology, data management, analysis and forecasting;
- Produce the State of Ireland's Environment and Indicator Reports;
- Monitor air quality and implement the EU Clean Air for Europe Directive, the Convention on Long Range Transboundary Air Pollution, and the National Emissions Ceiling Directive;
- Oversee the implementation of the Environmental Noise Directive;
- Assess the impact of proposed plans and programmes on the Irish environment.

Environmental Research and Development

- Coordinate and fund national environmental research activity to identify pressures, inform policy and provide solutions;
- Collaborate with national and EU environmental research activity.

Radiological Protection

- Monitoring radiation levels and assess public exposure to ionising radiation and electromagnetic fields;
- Assist in developing national plans for emergencies arising from nuclear accidents;
- Monitor developments abroad relating to nuclear installations and radiological safety;
- Provide, or oversee the provision of, specialist radiation protection services.

Guidance, Awareness Raising, and Accessible Information

- Provide independent evidence-based reporting, advice and guidance to Government, industry and the public on environmental and radiological protection topics;
- Promote the link between health and wellbeing, the economy and a clean environment;
- Promote environmental awareness including supporting behaviours for resource efficiency and climate transition;
- Promote radon testing in homes and workplaces and encourage remediation where necessary.

Partnership and Networking

- Work with international and national agencies, regional and local authorities, non-governmental organisations, representative bodies and government departments to deliver environmental and radiological protection, research coordination and science-based decision making.

Management and Structure of the EPA

The EPA is managed by a full time Board, consisting of a Director General and five Directors. The work is carried out across five Offices:

1. Office of Environmental Sustainability
2. Office of Environmental Enforcement
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.

epa Research

Report No. **511**

Optimised Plus – Food Waste Collected from Apartments (OptiFood)

Authors: Celia Cremin, Percy Foster, Freya Bartels, Michele Giavini, Enzo Favoino

Lead organisations: Foster Environmental, ARS Ambiente and Scuola Agraria del Parco di Monza

What did the research aim to address?

This research aimed to address the environmental challenge of low food waste segregation in Irish apartment buildings. In 2023, only approximately 3380 tonnes of food waste were collected from apartments compared with over 50,000 tonnes of residual waste. This gap highlights an opportunity to advance Ireland's circular economy and strengthen progress towards its EU municipal waste recycling targets, by improving food waste segregation in apartments and therefore overall recycling rates.

The project sought to identify a range of interventions and test these among apartment residents to determine which methods most effectively encourage food waste segregation. The study is particularly relevant for policymakers, waste management authorities, property managers and apartment residents, as it provides scalable, evidence-based strategies to enhance recycling behaviours specifically for apartment settings. Its innovative approach, combining behavioural psychology with practical waste infrastructure, offers a replicable model that could substantially increase food waste collection from apartment buildings nationwide.

What did the research find?

The research found that simple, targeted behavioural "nudges" can improve food waste segregation in apartment buildings. This research identified an intervention that achieved a 143% increase in food waste collected, averaging 1.93 kilograms of food waste per apartment per week. If scaled nationally, these results indicate that, by 2030, an additional 42,000 tonnes of food waste could be collected annually from apartments, representing a contribution of 1.26% towards Ireland's EU municipal waste recycling target.

Stakeholder engagement was central to the project, with a focus group comprising waste collectors and representatives from the National Waste Collection Permit Office, the Southern Region Waste Management Office, The Housing Agency, the Apartment Owners' Network and the project steering committee. The research findings were incorporated into a standardised toolkit that provides practical operational guidance for waste management and suggested motivational messaging for apartment settings. While the trials were limited to two cities, the results show strong potential for national scalability.

How can the research findings be used?

The research found that simple, targeted behavioural "nudges" can improve food waste segregation in apartment buildings. This research identified an intervention that achieved a 143% increase in food waste collected, averaging 1.93 kilograms of food waste per apartment per week. If scaled nationally, these results indicate that, by 2030, an additional 42,000 tonnes of food waste could be collected annually from apartments, representing a contribution of 1.26% towards Ireland's EU municipal waste recycling target.

Stakeholder engagement was central to the project, with a focus group comprising waste collectors and representatives from the National Waste Collection Permit Office, the Southern Region Waste Management Office, The Housing Agency, the Apartment Owners' Network and the project steering committee. The research findings were incorporated into a standardised toolkit that provides practical operational guidance for waste management and suggested motivational messaging for apartment settings. While the trials were limited to two cities, the results show strong potential for national scalability.

Project code: 2022-GCE-1166

EPA RESEARCH PROGRAMME 2021–2030

Optimised Plus – Food Waste Collected from Apartments

(2022-GCE-1166)

EPA Research Report

Independent scientific research funded by the Environmental Protection Agency

Prepared by

Foster Environmental, ARS Ambiente and Scuola Agraria del Parco di Monza

Authors:

Celia Cremin, Percy Foster, Freya Bartels, Michele Giavini and Enzo Favoino

ENVIRONMENTAL PROTECTION AGENCY
An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle, Co. Wexford, Ireland

Telephone: +353 53 916 0600 Fax: +353 53 916 0699
Email: info@epa.ie Website: www.epa.ie

ACKNOWLEDGEMENTS

This report is published as part of the EPA Research Programme 2021–2030. The EPA Research Programme is a Government of Ireland initiative funded by the Department of Climate, Energy and the Environment. It is administered by the Environmental Protection Agency, which has the statutory function of co-ordinating and promoting environmental research. This study was co-funded by Foster Environmental, ARS Ambiente and Scuola Agraria del Parco di Monza.

The authors would like to acknowledge the members of the project steering committee, namely Pauline McDonogh (Southern Region Waste Management Office), Izabela Litewska (formerly Polish Ministry of Health), Sirpa Kurppa (Natural Resources Institute Finland), Odile Le Bolloch (EPA) and Jean Clarke (formerly Department of Climate, Energy and the Environment). The authors would also like to acknowledge the support of the Research Project Managers on behalf of the EPA, namely Niamh McCormack and Dorothy Stewart.

We particularly want to thank the management and staff of Barna Recycling who facilitated the trials conducted by the team, namely Sean Curran, Aideen Barrett, Bernard Flaherty, Pádraig Sullivan and Campbell Finnie. In addition, City Bin and Mr Binman helped us secure locations for trials and assisted us. We are also grateful to the property management agents and owners' management companies (Ocean Property Management, M&C Property and Respond) for facilitating access to apartments, allowing us to conduct the trials.

The guidance provided by the members of the focus group was invaluable and we thank them for their contribution: Pauline McDonogh (Southern Region Waste Management Office), David Rouse (The Housing Agency), John Dunne (Irish Waste Management Association), Aideen Barrett (Barna Recycling), Brian Lyons (Clean Ireland Recycling), Joe Cleary (Mr Binman), Allen Morgan (Apartment Owners' Network), Josephine Lee (National Waste Collection Permit Office), Joanne O'Rourke (Eastern Midlands Waste Region), Kathleen Walet (Ocean Property Management), Fergul Costello (Respond) and Niall McLoughlin (Department of Climate, Energy and the Environment).

DISCLAIMER

This report is based on research carried out/data from March 2023 to December 2024. 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.

EPA RESEARCH PROGRAMME 2021–2030
Published by the Environmental Protection Agency, Ireland

ISBN: 978-1-80009-370-6 April 2026

Price: Free Online version

Project Partners

Percy Foster
Foster Environmental
Enfield
Co. Meath
Ireland
Tel.: +353 86 8129260
Email: percy@foster.ie

Celia Cremin
Foster Environmental
Enfield
Co. Meath
Ireland
Tel.: +353 86 8129260
Email: celia@foster.ie

Freya Bartels
Foster Environmental
Enfield
Co. Meath
Ireland
Tel.: +353 86 8129260
Email: freya@foster.ie

Michele Giavini
ARS Ambiente
Gallarate
Lombardy
Italy
Tel.: +39 3487 811749
Email: giavini@arsambiente.it

Enzo Favoino
Scuola Agraria del Parco di Monza
Monza
Lombardy
Italy
Tel.: +39 3353 55446
Email: favoinoenzo@gmail.com

Contents

List of Figures

List of Tables

Executive Summary

This research project explored how simple yet targeted behavioural “nudging” interventions could enhance food waste segregation in apartment buildings. In 2023, approximately 50,677 tonnes of residual waste and only 3381 tonnes of food waste were collected nationally from apartments in Ireland, highlighting that there is significant potential to increase the level of source segregation of food waste in Irish apartments.

This study conducted four phases of trials (14 trials in total, involving over 600 apartments in Galway city and Limerick city), with each phase building on lessons learned to optimise subsequent interventions. The final phase, the validation phase, tested a fully refined intervention package.

This validation phase demonstrated a 143% increase in food waste collected, achieving an average of 1.93 kilograms of food waste collected per apartment per week. This intervention included provision of a 10-litre vented caddy, an educational leaflet, a supply of compostable caddy liners, a 2-minute conversation with at least 75% of residents in the apartment buildings, placement of a large 140-litre food waste bin near the apartment block entrance and a 5-week campaign of motivational flyers delivered to each occupant’s postbox.

Based on the validation phase findings, it is estimated that, if these nudging strategies were implemented across all apartment buildings nationally, approximately 42,000 tonnes of food waste could be collected annually by 2030, with an estimated contamination level (i.e. non-organic waste in food waste bins) of just 1.4%. This would represent a 1.26% contribution towards Ireland’s EU municipal solid waste recycling target (55% by 2030).

This study provides strong indications that simple and targeted behavioural strategies, especially those that make food waste source segregation more convenient and personally engaging, can significantly improve food waste segregation rates in apartment settings. Key drivers of success included physical bin placement near entrances and ongoing motivational messaging.

The integration of these measures into relevant policy and guidance documents could support long-term improvements of national food waste recycling rates, which would deliver both environmental and economic benefits. These findings lay the groundwork for a standardised national food waste segregation service in apartment buildings, supporting Ireland’s move towards a more circular economy.

1 Introduction

This project was carried out as part of the EPA Research Programme 2021–2030. The project, titled "Optimised Plus – Food Waste Collected from Apartments", involved conducting exploratory intervention trials to determine successful methods for improving food waste segregation among residents of apartment buildings in Ireland.

1.1 Background

The EU Waste Framework Directive established a target recycling rate of 55% for municipal waste by 2025, increasing to 60% by 2030 and reaching 65% by 2035. Currently, Ireland recycles 41% of its municipal waste (EPA, 2024). This indicates that considerable improvements in Irish recycling rates are required to meet the EU's legally binding targets.

Enhancing source segregation of food waste from residual waste presents a significant pathway to improve Ireland's recycling rates (RPS Group, 2023).

While houses have benefited from interventions such as the provision of food waste caddies and compostable bin liners, and educational campaigns to improve food waste source segregation, research on how these measures translate to apartment settings is limited, particularly in Ireland. Studies discussed in this report highlight that apartment residents often face challenges with waste segregation due to factors such as waste area limitations and high resident turnover.

A key distinction between apartment settings and houses is that apartment residents are less influenced by cost-based segregation incentives due to shared waste systems and the difficulty of applying variable waste charges in communal bin set-ups (Carey *et al*., 2008). This is because waste disposal in apartment settings is typically covered by an annual management charge, which remains largely unaffected by individual segregation habits.[1]

The landscape of residential housing in Ireland is evolving, with a notable increase in purpose-built apartments. This trend is evident from the fact that between 2016 and 2022, 15% of newly constructed homes were apartments, a significant rise from just 3% between 1971 and 1980 (Central Statistics Office, 2023a). Currently, approximately 8.3% of the Irish population lives in apartments. However, under the recently published National Planning Framework (Government of Ireland, 2025), the government has committed to increasing the housing stock by 50,000 units annually until 2040. Given that around half of these new dwellings are planned for urban and city centre areas, with a target of delivering 50% within existing city footprints on brownfield and greenfield sites in the form of compact apartments (Government of Ireland, 2024a), this could result in the construction of approximately 25,000 new apartments each year through to 2040. This indicates that more of the population will be living in apartments going forward (Conefrey and Staunton, 2019; Housing Agency, 2019). This demographic shift highlights the need for targeted research and effective waste management strategies specifically designed for apartment settings.

1.2 Project Objectives

The key objectives of this research were to:

- conduct food waste collection trials in Irish apartments to determine which methods most effectively encourage resident participation in food waste source segregation and result in higher volumes of food waste collected with minimal contamination (e.g. non-organic waste in food waste bins);
- recommend the ideal collection model and an educational toolkit for use in existing and future apartments in Ireland, following consultation with key stakeholders.

1 Typically, 20% to 30% of apartment-dwellers are owner-occupiers, who do directly meet waste management costs through the annual management charge paid to the owners' management company. Renters/tenants, who make up 70% to 80% of apartment-dwellers, do not directly pay the waste management cost – their landlord does, also through the charge paid to the owners' management company. There is therefore a split incentive between (i) landlords and owner-occupiers, and (ii) renters: the former may be open to cost-based incentives, whereas the latter may not.

2 Literature Review

2.1 Food Waste Segregation in Irish Apartments

In January 2024, the government mandated that all households across Ireland receive a dedicated biowaste (food and garden waste) bin collection service (Government of Ireland, 2024b). It is apparent that additional measures are needed beyond simply providing food waste collection services to improve food waste segregation rates. In 2008, recognising this growing requirement to provide appropriate waste management for apartments, a study on food waste management in apartments was completed. The study highlighted the persistent challenges of educating apartment residents about food waste segregation, given the transient nature of apartment living and increasingly diverse language backgrounds of residents. The study concluded that effective food waste collection in apartments was hindered by issues relating to the storage and collection of the waste. However, the researchers also concluded that successful food waste management is achievable if it is considered at the early stages of apartment design (Carey *et al*., 2008). Since this study, very little research has been conducted on food waste segregation in apartment settings in Ireland. However, the Dublin Apartments Brown Bin Project, funded by the Department of Climate, Energy and the Environment, demonstrated that the provision of food waste caddies to apartment residents positively encouraged them to partake in food waste segregation (Eastern Midlands Regional Waste Management Office, 2020). As with houses, simple and low-cost interventions may also be effective at increasing food waste segregation rates in apartment settings.

More research is needed to identify effective actions that will increase food waste segregation in Irish apartments. The Government of Ireland, in its Waste Action Plan for a Circular Economy, recognised this lack of understanding around the effective management of food waste source segregation in apartment settings. It has specifically committed to working with the Department of Housing, Local Government and Heritage to make regulatory changes in planning and tenancy laws to ensure that apartment residents are provided with appropriate infrastructure to support improved food waste segregation (Government of Ireland, 2020).

As part of the 2022 National Household Municipal Waste Characterisation study commissioned by the EPA, waste from apartment buildings was analysed within the broader context of household waste. The results showed that food waste made up the largest portion of residual waste, accounting for 41%. This high percentage is not surprising, as many apartments still lack separate food waste collection. Food waste was significantly more prevalent in residual waste samples from apartments than in those from houses, where food waste made up an average of 14% of the residual waste bin contents. The researchers suggested that, because apartments tend to have limited space available for waste segregation (both within the apartments and communally), it can be difficult for residents to segregate food waste (RPS Group, 2023).

Data[2] from the National Waste Collection Permit Office shows that in 2023 waste collected from Irish apartments included 50,667 tonnes of residual waste, 12,985 tonnes of dry recyclables, 1192 tonnes of glass and 3381 tonnes of food waste. This is an overall segregation rate of 26%, including contamination, with food waste accounting for only 5% of the total.

In addition to the quantity of food waste segregated, it is also important to consider the contamination of the food waste collected. Contamination refers to non-organic waste in food waste bins. Contamination in food waste bins is a significant concern, as it increases processing requirements, raises operational costs and reduces the quality of the end products made from recycled food waste (food waste is commonly used as feedstock for composting and anaerobic digestion). The presence of contaminants, particularly plastics,

2 2023 annual return data was validated by the Regional Waste Management Office (RWMO) on behalf of the Waste Enforcement Regional Lead Authorities (WERLA).

can compromise these processes and lead to the introduction of pollutants into the environment. It is important to substantially reduce contamination levels to protect soil quality and ensure the production of high-value compost and digestate (Foster *et al*., 2024). A review of the available literature on waste from Irish apartments found no published data on contamination levels in food waste bins.

2.2 Barriers and Obstacles to Food Waste Segregation in Apartments

2.2.1 Resident accountability

Shared waste infrastructure and a lack of personal responsibility for cleanliness or correct sorting can create a sense of anonymity around waste disposal. As a result, residents may be less inclined to make the time and effort needed to manage waste properly, leading to more food waste being disposed of in mixed residual waste bins (RPS Group, 2023). In practical terms, the latest national municipal waste characterisation project, carried out by RPS Group (2023), found that simply providing a food waste bin does not appear to significantly improve food waste segregation in apartment settings. To address this issue, it seems that additional targeted measures are needed to encourage accountability and behavioural changes that promote better food waste source segregation.

In addition, in apartment complexes, waste collection is managed similarly to commercial waste, with communal bins serving all residents rather than there being an individual waste collection for each household. As a result, residents are not charged directly for their waste disposal; instead, the cost is incorporated into an annual management charge. This can create challenges in encouraging individual accountability for waste segregation and recycling efforts. When a flat rate is charged for waste disposal, there is less financial motivation to sort waste properly.

2.2.2 Lack of awareness and education

It appears that lack of awareness and education in relation to correct food waste source segregation practices is a significant barrier in apartment settings. The presence of food waste in the residual waste stream is much higher in apartment settings (41%) than in conventional houses (14%) (RPS Group, 2023). Although this suggests that the infrastructure for food waste segregation in apartments is inadequate, the research also suggests that, even where organic waste collection services are provided, residents often do not understand that items such as meat and dairy products can be included in food waste bins. Consequently, this food waste is frequently misplaced in residual waste bins or recycling bins (RPS Group, 2023). To address these issues, it is recommended that clear and consistent communication be developed to establish positive social norms around segregation and enhance understanding of what can and cannot be placed in food waste bins (Allison *et al*., 2022).

Supporting this approach, a study in China demonstrated that using volunteers to deliver firm messaging to residents successfully changed behaviour and improved food waste segregation (Xu *et al*., 2016). These findings highlight the benefits of effective education and awareness campaigns to improve segregation practices in apartment settings.

2.2.3 Infrastructure

Infrastructure and accessibility play a vital role in the effectiveness of food waste source segregation in apartment complexes. However, competing priorities during the design of waste facilities, such as the demand for additional parking spaces, can often result in inadequate infrastructure being provided for the residents. Even when an adequate number of bins for food waste segregation is provided, factors such as poor standard of cleanliness, inconvenient placement and difficulties accessing the bins can deter residents from using them correctly. These challenges highlight the need for well-planned waste management systems that prioritise both functionality and ease of use to encourage greater participation in food waste segregation.

A survey conducted by VOICE (2021) found that apartment residents' primary concerns regarding food waste segregation are bad odours and the risk of infestation by pests such as rats or flies. These concerns can be alleviated through appropriate infrastructure and effective waste management practices. For example, Carey *et al*. (2008) strongly recommend the weekly collection of food waste from bins to support successful food waste segregation in apartment settings. In addition, many apartment

developments have limited space for waste segregation, and bins can often be inconveniently located. When communal bins are not easily accessible, residents are more likely to dispose of all waste in a single bin rather than properly segregating it (RPS Group, 2023).

2.2.4 Regulation for waste areas in apartments

There is currently no statutory requirement governing the design of waste storage areas for apartments in Ireland. This lack of regulation has proven to be a barrier, as it has left apartment developers without an enforceable standard to follow during construction. However, in July 2025 the guidelines for planning authorities in respect of planning design standards for apartments were updated to include more specific guidance in relation to waste management in apartment developments (DHLGH, 2025).

Other available guidance includes that of the Office of the Planning Regulator, which has a practice note (PN03) on planning conditions relating to waste storage. This states the following:

> A plan containing details for the management of waste (and, in particular, recyclable materials) within the development, including the provision of facilities for the storage, separation and collection of the waste and, in particular, recyclable materials [within each house plot and/or for each apartment unit] shall be submitted to, and agreed in writing with, the planning authority prior to commencement of development. Thereafter, the agreed waste facilities shall be maintained, and waste shall be managed in accordance with the agreed plan.
>
> Office of the Planning Regulator (2022)

This note highlights that the management of waste should be a key consideration at the formative stage of the design process. This has been set out in the following guidelines for planning authorities: *Sustainable Residential Development in Urban Areas – Guidelines for Planning Authorities* and the associated *Urban Design Manual – A Best Practice Guide* (DEHLG, 2009a,b); *Sustainable Urban Housing: Design Standards for New Apartments – Guidelines for Planning Authorities* (DHLGH, 2022); and *Planning Design Standards for Apartments – Guidelines for Planning Authorities, 2025* (DHLGH, 2025). While waste management is a consideration, more specific guidance on what constitutes suitable infrastructure for managing waste in apartment settings would be beneficial.

2.2.5 Enforcement

The Government of Ireland (2020) and the authors of the latest national municipal waste characterisation project (RPS Group, 2023) agree that infrastructure in apartments must support effective waste collection systems. This is evident in the enhanced food waste and commercial waste regulations introduced in 2023 and 2024, respectively, in which infrastructure that supports the segregated collection of materials in apartment buildings is now legally required. Additionally, targeted enforcement campaigns should be implemented to reduce contamination in bins from apartments.

2.3 Methods to Improve Food Waste Source Segregation

Improving food waste source segregation infrastructure is a crucial step towards increasing overall recycling rates and meeting targets set by the EU (European Union, 2023). However, as already described, improving infrastructure alone is not sufficient; behaviour change is also necessary. Even with state-of-the-art segregation systems in place, it has been shown that the effectiveness of waste management programmes relies heavily on residents' adherence to proper sorting and disposal practices. For example, Germany, long considered a leader in waste recycling, still finds that recycling bins contain residual waste at levels between 20% and 40% (Zentrale Stelle Verpackungsregister, 2025). In addition, Metcalfe *et al*. (2012) found that simply providing bins for food waste collection is insufficient to ensure effective policy implementation. The authors argue that "policy objects", such as bins, should be approached with greater consideration for their symbolic, relational and material influence on behaviour.

Nudges are a tool that has been shown to work well alongside legislation because they change how

choices are presented, making people more aware of their decisions. Nudging is defined by Thaler and Sunstein (2008, p. 6) as “any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid”.

This indicates that legislation designed to increase the rate of food waste recycling can be supported through well-designed systems that encourage food waste source segregation rather than by using penalties and fines for undesirable behaviour.

However, the use of nudging as a policy tool has faced some scrutiny. Hansen and Jespersen (2013) critique Thaler and Sunstein’s (2008) work for not emphasising the importance of transparency in nudge theory. A key ethical consideration is the distinction between transparent and non-transparent nudges. Transparent nudges allow individuals to recognise and assess the influence, giving them the freedom to accept or reject them, while non-transparent nudges subtly shape behaviour without people realising it. Nudges can be categorised based on whether they act on conscious or subconscious decision-making processes. Type 1 nudges influence automatic behaviours, whereas Type 2 nudges involve conscious decision-making. In public policy, transparent and deliberate nudges (Type 2) are generally more acceptable, whereas non-transparent nudges, particularly those targeting automatic behaviours (non-transparent Type 1), raise ethical concerns about manipulation (Hansen and Jespersen, 2013; Sunstein, 2016). Recognising these differences is essential for designing interventions that are both effective and ethically sound.

A key project set out to explore these concepts of nudging with the aim of improving food waste source segregation rates in apartments in the Netherlands (VANG Household Waste, 2020). This project aimed to identify effective methods for improving the source separation of organic waste in urban high-rise buildings. The project reviewed literature on nudging methods for changing behaviour and used this information to create a framework for testing various nudging techniques. These techniques were trialled in multi-unit complexes in the Netherlands to explore their effect on food waste segregation. The framework is based on behavioural models and grounded in various well-cited scientific traditions, and emphasises three key components: capacity; personal and social motivation; and opportunity. Effective waste separation programmes require well-designed infrastructure and facilities that are visible, accessible and supportive, bridging the gaps between capacity, motivation and practical application. This study showed that, in the Netherlands, separation of organic waste from high-rise buildings constitutes 1.5 percentage points of the national waste separation rate (based on the results of the most effective non-combined intervention) (VANG Household Waste, 2020). The framework is outlined in Figure 2.1. Using this framework, a number of suitable and ethical nudging interventions were devised by the VANG Household Waste project team, which are outlined in Figure 2.2. Building on the success of this exploratory work, it is believed that these suggested interventions could help address the low rates of food waste segregation in apartment settings in Ireland.

2.4 Nudging Interventions

A general framework for encouraging pro-environmental behaviour, such as food waste

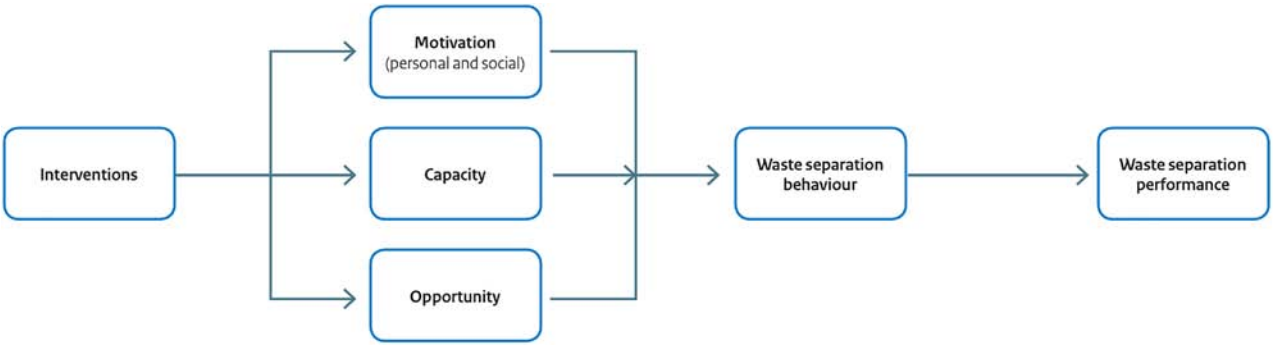

Figure 2.1. General framework developed from data derived from the VANG Household Waste literature review. Source: VANG Household Waste (2020).

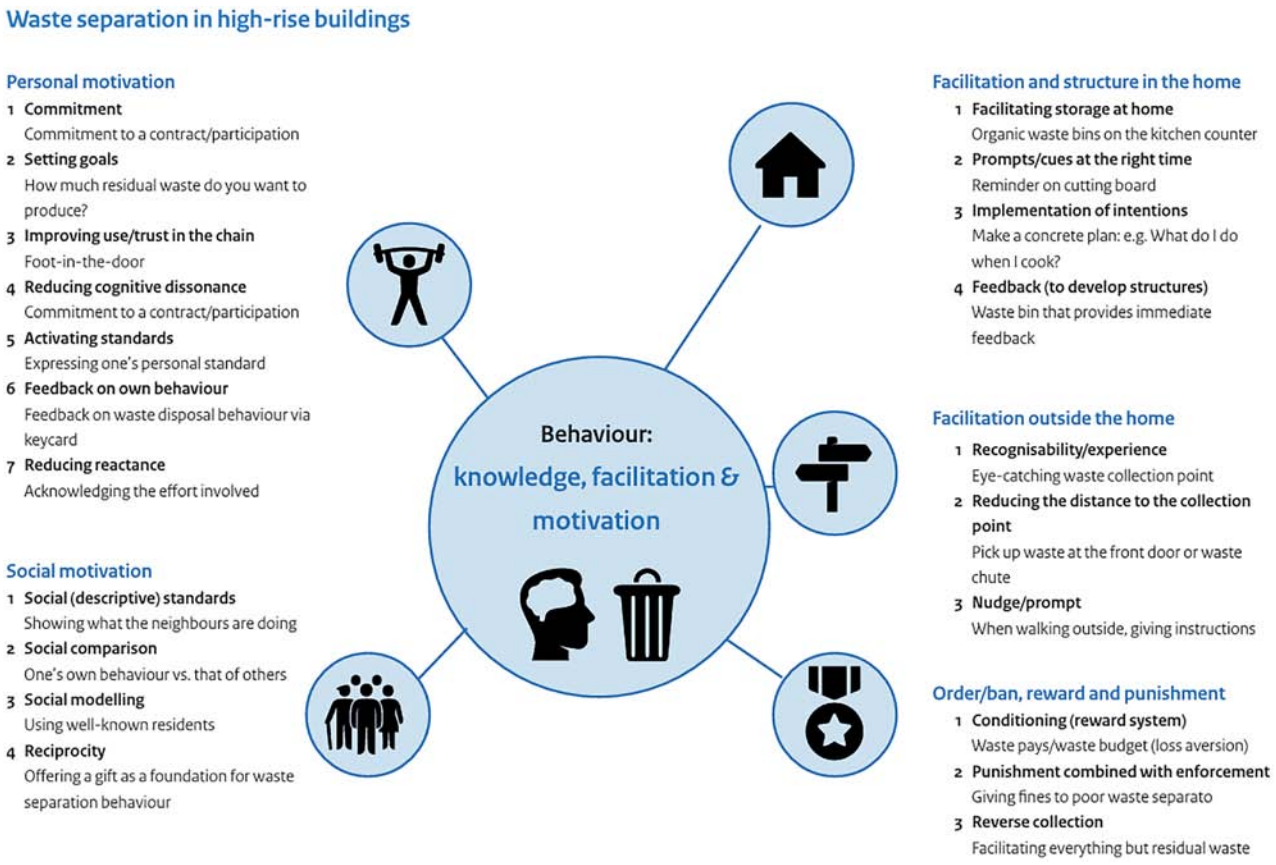

Figure 2.2. Overview of the most promising nudging interventions for apartments as proposed by the VANG Household Waste project team. Source: VANG Household Waste (2020).

recycling, has been proposed by Steg and Vlek (2009), building on the book *Nudge* by Thaler and Sunstein (2008). This framework involves identifying the behaviour to be changed, examining the factors underlying this behaviour, designing an intervention to change the behaviour and, finally, evaluating the effects of these interventions. Utilising this framework, trials can be designed to use nudging techniques to encourage food waste segregation in apartment settings.

Macklin *et al*. (2023) emphasise the need for nudges and interventions to be interdisciplinary, integrating sociology, infrastructure and psychology. Informed by the VANG Household Waste project, and other examples from Ireland and abroad, a review of various nudging trials and schemes was conducted to identify effective strategies that could potentially be used to inform best practice for enhancing food waste segregation behaviours among Irish apartment residents. The nudging techniques identified as examples are explored in this review.

2.4.1 Provision of educational materials

This is a very basic form of nudging, where the desired behaviour is simply highlighted to the intended recipient. There is no alteration of the choice architecture or provision of tools. As a result, this type of nudge is regarded as the weakest, since it depends solely on the recipient's ability to self-motivate based on the given information. Provision of educational materials does not necessarily need to include persuasive messaging, only facts and information. Simply providing information and drawing attention to an issue can function as a nudge. By making subconscious behaviours conscious, this approach grants individuals greater autonomy over their actions (Hausman and Welch, 2010; Calo, 2013).

There is also evidence that educational messaging does not necessarily need to be directly delivered to residents to have a significant effect; it only needs to be visible and instructive. For example, Shearer *et al*. (2017) demonstrated that a simple educational sticker placed on a wheelie bin lid can increase food waste collection by up to 20%.

Educational materials can play a fundamental role in helping people understand the purpose of their actions. Knowledge and understanding of their role can help sustain motivation over time (Norgaard, 2009; Pongiglione, 2014). For example, Knickmeyer (2020) conducted an extensive review of waste management in high-density urban areas and found that education, combined with regular and tailored communication, is highly effective in making residents aware of their unconscious behaviours. However, it must also be noted that excessive use of educational materials can lead to feelings of helplessness if the necessary facilities and tools to act are not provided (Dai *et al*., 2016).

2.4.2 Provision of a basic package

The VANG Household Waste study explains that a "basic package" (BP) includes labelled wheelie bins and a vented caddy bin, compostable bin liners for the caddy, instructional materials, and information on environmental and personal benefits to encourage participation (VANG Household Waste, 2020). This BP is designed to support behaviour change by addressing motivation, capacity and opportunity, the three key factors influencing successful waste separation. Provision of the BP ensures households have proper waste separation facilities, provides clear instructions on how to separate waste correctly, and highlights the benefits of waste separation. The VANG Household Waste team provided this BP to all groups within the study, confirming this nudging intervention as an essential tool for increasing household food waste segregation.

Examples from across Europe demonstrate how provision of a BP has led to improved food waste segregation rates. Several speakers at the LIFE BIOBEST workshop in Barcelona in 2023 highlighted how Spanish municipalities have used a BP model in various trials across the country where door-to-door collection is implemented. At the Waste in Progress Conference at Palau de Fires in Girona in 2022, several presenters highlighted how a BP was implemented in their municipalities with successful outcomes in terms of increases in the food waste collected (Brambilla *et al*., 2024). In Sligo, Ireland, a BP was supplied to houses and was successful in encouraging residents to recycle their food waste, as many households did not have a kitchen caddy before the trials (Gillen *et al*., 2019).

2.4.3 Reach everyone (door-to-door visits)

"Reach everyone" is a nudging technique in which the BP (as described above) is delivered to the doors of households, and the householder who answers the door is given a minute-long introduction to food waste segregation. This technique has been successfully trialled in Sligo city, Ireland (Gillen *et al*., 2019). The researchers observed that an added benefit of this trial was the engagement between residents and the delivery crew, allowing for the collection of valuable feedback. The trial managed to reduce the amount of contamination in food waste bins from 23% of the total weight down to 1%. It was also noted that when no educational conversation was held, confusion about the correct use of the kitchen caddy was common (Gillen *et al*., 2019).

At the Waste in Progress Conference in 2022, the VANG Household Waste project team presented details of its success in reaching 20,000 apartments in the Netherlands through a BP and conversations with residents. The trials combining these different nudging techniques showed great success in increasing food waste segregation. It must also be noted that there are also studies that appear to indicate the waning potential of the "reach everyone" nudging technique over time. For example, a study in Sweden showed that the benefits of providing information through a brief conversation with apartment residents were short-lived (Bernstad *et al*., 2013). Therefore, the long-term impact of any nudging techniques must be considered.

2.4.4 Constant tutoring (frequent provision of educational materials and presence at waste areas)

This nudging technique focuses on the personal motivation of householders. A BP is delivered to their doors, and at regular intervals a person with educational materials and leaflets is stationed near the waste areas. This person answers any questions residents may have and encourages them to separate their waste streams correctly.

Regularly teaching and reminding apartment residents about the desired behaviour through a consistent presence in their apartment block can keep it at

the forefront of their minds. It also helps reduce misinformation and confusion, while encouraging a sense of commitment through residents engaging directly with a physical person (Yang *et al*., 2025). Xu *et al*. (2016) placed volunteers at waste stations for 4 hours a day over a 3-month period to educate apartment residents in Shanghai, China, about food waste segregation in a high-density urban setting. They found that this was key to ensuring a personal sense of accountability and reinforcing the message over a longer period.

2.4.5 Motivational messages

Providing information to participants with the intention of encouraging a desired behaviour is a key aspect of nudging. Positive reinforcement plays a vital role in supporting this approach. It has been proven that using positive messages (e.g. "You have increased the amount you recycle – well done!") instead of negative ones increases participation in the desired behaviour. Using real-life data to keep participants up to date on their improvements is also shown to reinforce motivation. Feeling positive about a behaviour change can keep residents motivated and engaged in the task, so messaging is designed in such a way as to encourage and reinforce the behaviour (Congiu *et al*., 2025).

In addition, the continuous delivery of specific information using techniques such as comparison and goal setting through regular communication with residents has been shown to increase the likelihood of continued desired behaviours in food waste segregation (Garcés *et al*., 2002; Ling *et al*., 2023). For example, the Dublin Apartments Brown Bin Project used regular reminders and posters in apartment complex hallways, including social comparison communications that compared different blocks of apartments with one other. This approach helped to maintain residents' motivation over the long term. The researchers believe that, while this technique was not the sole focus of the study, it may have contributed to the overall success of the project (Eastern Midlands Regional Waste Management Office, 2020). Similarly, Spanish trials in Andalusia and Catalonia (Brambilla *et al*., 2024) showed that sending letters to remind residents to segregate waste was important for the continued segregation of waste. Overall, there appears to be much demonstrated success of this nudging technique, and this should be considered when looking to implement strategies in the Irish apartment context.

2.4.6 Reduce capacity for residual waste

This nudging technique is based on the idea that reducing capacity for residual waste encourages people to minimise the amount of residual waste they produce. Lotti *et al*. (2023) demonstrated that visual cues or environmental changes like this are most effective when accompanied by information to explain the changes. This type of nudge brings subconscious behaviours, such as residual waste production, to the forefront of individuals' awareness. In the United Kingdom, Abbott *et al*. (2011) found an inverse relationship between residual waste collection rates and segregation behaviours. They observed that reducing the frequency of residual waste collection led to an increase in segregation rates. However, they also highlighted that sufficient space for segregation and food waste is essential for the success of this nudge, as is strong enforcement to prevent the dumping of residual waste in recycling bins.

In Ireland, it is common to have a biweekly collection service, where biowaste and recycling waste are collected together every 2 weeks and residual waste is collected on the alternate weeks. Increasing the frequency of food waste collection to a weekly schedule is considered an effective intervention for improving recycling and food waste separation (Williams and Cole, 2013).

2.4.7 Convenience

Convenience nudging is a type of nudging that sets out to improve access to the required infrastructure. DiGiacomo *et al*. (2018) found that food waste source segregation could be increased in apartments by up to 147% simply by bringing food waste bins closer to apartment doors. This nudge aims to make the desired behaviour the easiest and cleanest option for the resident. Having a food waste bin outside the waste area removes the often inhibiting factor of the "dirty" waste storage area. Ludwig *et al*. (1998) found that, on academic campuses, it was simple to increase aluminium recycling rates simply by changing from a single large bin in the hallway to individual ones spread across separate classrooms. In this example, rearranging the choice architecture and appealing to

students' desire to conserve energy can be described as convenience nudging – removing obstacles and making the most desirable option the easiest (Thaler and Sunstein, 2008). Convenience nudging has been shown to promote good segregation behaviours. For example, McCoy *et al*. (2018) showed an increase in pro-environmental behaviour through simply placing the relevant receptacles in more practical locations. However, every aspect of the process should be considered; for example, New Zealand's Ministry for the Environment (2023) notes that even carrying a container back to their apartment after going to the waste area is an effort for residents: many bring the container with them on their way out of the apartment rather than making a designated trip to the waste area. Residents would prefer to use a receptacle that can be placed into the bin with the waste, such as a compostable bag or, in the case of recycling waste, a cardboard box. Bearing these convenience measures in mind when designing trials is vital to ensure their success.

In New York, an Italian food waste collection model was trialled over a 12-week period. The trial demonstrated that the proximity of the disposal point was the most important factor in driving up participation and, therefore, capturing food waste. Some buildings had bins on each floor, and these were the buildings that experienced the greatest increase in capture. During the trial, food waste capture increased by 400% in one building compared with before the trial, when residents had to take waste to the basement. The provision of compostable caddy liners was also shown to make a significant difference. Residents in one building were provided with an unlimited supply of compostable bin liners, and this resulted in a 420% increase in capture. This also had a positive impact on reducing contamination of the food waste bin, especially by plastic bags. A resident survey carried out after the trial supported the trial results, finding that the convenience of a bin on their floor was the element of the system that encouraged residents the most to separate their food scraps rather than putting them down the chute with their other waste (Consorzio Italiano Compostatori, 2018).

2.4.8 Rewards

Rewards are a controversial type of nudge where financial or other incentives are used to encourage desired behaviours. It has been found that reward-based nudges are best implemented in tandem with self-motivating elements that activate the goal-setting nature of humans (Erez, *et al*., 1990; Lipson, 2014; Yang *et al*., 2025). Setting goals is not seen as a long-term solution, as it does not tie the behaviour to the residents' social norms, their sense of belonging or any other permanent behaviour-changing element (Li *et al*., 2021; Yang *et al*., 2025).

Li *et al*. (2017) found that incentives could be used to encourage food waste segregation to a certain extent in a large-scale study in Nanjing, China. After the incentives stopped, they found that the residents' motivation levels did not fall, as they had built habits and were personally motivated following their behaviour change.

2.5 Conclusion

This literature review of food waste source segregation, with a focus on apartment settings, reveals both progress and significant areas for improvement. Ireland's shift towards more sophisticated waste management practices, as articulated in policies such as the Waste Action Plan for a Circular Economy, underscores a commitment to higher recycling rates and reduced landfill use. However, despite these advances, food waste source segregation rates remain suboptimal, particularly in apartment settings, where unique challenges persist. The review highlights that while those living in houses have benefited from targeted interventions like the provision of food waste caddies and educational campaigns, these measures may face limitations when applied to apartments. The distinct demographic and infrastructural characteristics of apartment buildings, such as higher resident turnover, limited space and centralised waste management, require a more tailored approach. It appears that some comparatively simple operational arrangements and/or low-cost nudging interventions, informed by behavioural science and with demonstrated success in other settings, represent promising strategies to enhance food waste source segregation in Irish apartments. Implementing these interventions alongside improved infrastructure and education could result in significantly higher food waste segregation rates in Ireland's apartments.

3 Methodology

Given the relatively limited research on improving food waste source segregation rates in Irish apartments, this project is primarily an exploratory study. This study employs a mixed-methods approach, integrating qualitative and quantitative research techniques to evaluate the effectiveness of various nudging strategies to improve food waste collection rates in Irish apartments. In addition to completing experimental nudging intervention trials, this research project also includes comprehensive stakeholder engagement, policy review and limited economic analysis.

This research was primarily conducted in apartment developments around Galway city, largely due to the support provided by Barna Recycling. Establishing a strong working relationship with Barna Recycling was essential to ensure access to waste areas, bins and waste collection schedules, enabling the successful implementation of the nudging intervention trials. In addition to the support provided by Barna Recycling, the project team also worked closely with a few property management agencies and owners' management companies to ensure that the project team had the approval and access to conduct the various nudging intervention trials within the chosen apartment buildings.

The project team designed a series of nudging interventions to trial in Irish apartment settings. The design of the nudging intervention trials was primarily informed by international experiences, particularly from Italy (where two project team members are industry experts) and the Netherlands, specifically the VANG Household Waste study (2020). Additionally, the trials were informed by the extensive personal experience of key project team members and members of the project steering committee, and input from focus groups with key stakeholders. To ensure a comprehensive range of perspectives, key stakeholders from the food waste recycling industry, local authorities and the EPA were actively engaged throughout the project. Four steering committee meetings and three focus group[3] sessions were conducted to gather input, refine the interventions and effectively translate the findings into meaningful recommendations so that, if implemented, they would have a meaningful effect on food waste source segregation rates in Irish apartments.

3.1 Nudging Intervention Trials

These trials were designed to identify the optimum approach for increasing food waste collection with reduced contamination from apartments in Ireland. Each trial was conducted in a different set of apartments located across Galway city. The trials were based on similar trials conducted internationally, as discussed in the literature review. The final intervention, serving as a validation phase, was conducted in an apartment building in Limerick city. Overall, the study consisted of three phases of trials followed by the final validation intervention. This study took place from October 2023 to December 2024. It is important to note that each phase of nudging intervention trials is built upon the findings of the preceding trials. This approach was intentional, as the trials were exploratory in nature. This allowed insights to be retested and refined as needed. It is important to note that these research trials are primarily qualitative rather than quantitative. Given the numerous variables at play (e.g. apartment resident demographics, seasonal changes), the findings should be interpreted as indicative of trends rather than as conclusive or statistically significant changes in food waste segregation rates.

The premise of each trial was consistent: first, establish a baseline measurement of the weight of food waste being recycled by a set of apartments; next, implement the intervention, and then record the weight of food waste collected weekly for a minimum of 6 weeks, with food waste bin weights measured prior to each weekly collection. Six weeks was considered a reasonable trade-off between the limitations posed by available time and resources,

3 These comprised waste collectors, the National Waste Permit Collection Office, the Southern Region Waste Management Office, The Housing Agency and the Apartment Owners' Network.

including the need to implement as many trials as possible in a relatively short period, and the need to ensure that outcomes were meaningful and reliable. In fact, evidence from previous trials suggests that most relevant changes in behaviour occur within the first 4 weeks. Therefore, a 6-week period was likely to be sufficient to capture any meaningful changes in segregation behaviour and capture rates, or the lack thereof. All weighing was carried out using calibrated Jadever JWI-3000 floor weighing scales. The objective was to measure any changes in food waste segregation compared with the baseline following the implementation of the nudging technique. The specific activities of each intervention trial from the three phases and the validation intervention are outlined in detail in Table 3.1. It should be noted that one of the trials in phase 2 refers specifically to social housing. In Ireland, social housing refers to publicly supported rental accommodation provided at below-market rates to individuals and households that cannot afford to secure housing through the private sector; it encompasses housing owned and managed directly by local authorities, accommodation facilitated through long-term leasing or subsidy schemes, and homes administered by non-profit approved housing bodies. In each case, the aim is to ensure affordable, secure housing for those in need (Housing Agency, 2025). In all other trials, the apartments referred to are privately owned/operated. Prior to each intervention trial, property management agents were consulted to confirm the suitability of apartments for inclusion in the trials. A key consideration was the number of apartments within each block. The aim was to include a minimum of 30 apartments per trial. This is based on the idea that 30 data points should provide enough information to make a statistically sound conclusion about a population (Leanscape, 2023). All the trials were conducted with apartments that had already had a weekly food waste collection in place for about a year and where limited education was provided at the time of introduction of the service.

Once the apartments were deemed suitable and permission was received to conduct the trials, arrangements were made to access the apartment blocks and waste areas, and permission was sought to install signage on the wall behind the food waste bins. Barna Recycling was also consulted to ensure that the project team was aware of the collection schedule. It was essential to conduct the initial and weekly food waste weighing as close as possible to the collection time, ensuring consistency in the food waste bin weight measurements. Two weeks before the intervention, letters were distributed to the apartment residents by placing them in their postboxes. These letters informed the residents about the trials taking place and advised them that they would be receiving a BP in the next week (an example letter is presented in Appendix 3). All apartments received a BP no matter what intervention trial they were part of. The BP distribution involved delivering a 10-litre vented food waste kitchen caddy (with an informational sticker on it), 30 compostable bin liners and an educational leaflet to each apartment. In the waste area, signage was installed, stickers were placed on bins and food waste bins were powerwashed.

Additionally, to assess the level of contamination in the food waste bins, waste characterisations were conducted both before and after each trial. The pre-trial waste characterisation was conducted in the week before the BP roll-out to assess the contamination rate in the food waste bins before any intervention. This characterisation was completed on all the food waste in the food waste bin prior to its collection. The food waste from each bin was separated into the following components: organics (food/garden waste), tissue/newspaper, cardboard, compostable bin liners, conventional plastic bags, other plastic, metal, glass and other waste. Each component was weighed to determine the overall composition of the food waste bins (i.e. the percentage of organic waste and the percentage of various contaminants). All weighing was carried out using calibrated Jadever JWI-3000 floor weighing scales. In the final week of each nudging intervention trial, a post-trial waste characterisation was performed. This post-trial waste characterisation was completed in the same manner as the pre-trial waste characterisation, which allowed for a direct comparison of contamination levels before and after the intervention.

3.2 Analysis of Nudging Intervention Findings

The findings from the nudging intervention trials were analysed to identify the emerging trends observed for each of the nudging interventions. As previously stated, the nature of this research was exploratory and iterative; therefore, the trends observed led the

Table 3.1. Detailed description of each nudging intervention trial by phase

Phase	Dates	Intervention	Description
1	October to December 2023	BP	Each apartment received the BP. The BP was left at the front door of the apartment. BPs that were not brought into the apartment were collected a week later.
		Leaflet	Each apartment received an informational leaflet through the letter box at the start of the trial.
		Motivational message	Each apartment received a motivational communication leaflet through the letter box each week. The motivational communication changed each week.
		Reach everyone (door to door)	Instead of leaving the BP at the door of each apartment, the project team members knocked on the door of each apartment to hand residents the BP in person and to provide brief instructions on how to use it. A resident was met from over 75% of the apartments in the trial.
		Constant tutoring	The tutoring was conducted in a location where a pop-up tent or table could be placed near the waste area, ensuring visibility without causing any obstruction. The messaging used was positive, providing up-to-date waste data and feedback on contamination. A project member completed this for the trial on two occasions, lasting 2 hours each time. This allowed the project team member to provide direct feedback to any residents who approached them.
		Rewards	Each apartment received a communication at the beginning of the trial that stated that if the apartments collectively reached a food waste segregation rate of 75% by the end of a 6-week trial, a €200 voucher would be donated to a local school/sports club.
2	April to June 2024	Food waste bin at entrance	The food waste bin was moved from the waste area to be closer to the main entrance doors of the apartment building. It was well identified with signage. The project team moved the bin back to the waste area prior to bin collection days.
		Reduced capacity for residual waste	The apartment residents were informed that there was going to be a reduction in the number of residual waste bins in the waste area. A residual waste bin was removed.
		Social housing BP	A BP was supplied to social housing apartments. Each apartment received a BP. The BP was left at the front door of the apartment. BPs that were not brought into the apartment were collected a week later.
		Reach everyone and motivational message combined	The team members knocked on the door of each apartment to hand residents the BP in person and to provide brief instructions on how to use it. A resident was met from over 75% of the apartments in the trial. In addition, each apartment received a motivational communication each week. The motivational communication changed each week.
3	September to October 2024	Food waste bin at entrance	The food waste bin was moved from the waste area to be closer to the main entrance doors of the apartment building. It was well identified with signage. The project team moved the bin back to the waste area prior to bin collection days.
		Motivational message	Each apartment received a motivational communication leaflet through the letter box each week. The motivational communication changed each week. Examples of these motivational communications are presented in Appendix 4.
		Reach everyone and motivational message combined	The project team members knocked on the door of each apartment to hand residents the BP in person and to provide brief instructions on how to use it. A resident was met from over 75% of the apartments in the trial. In addition, each apartment received a motivational communication leaflet through the letter box each week. The motivational communication changed each week. Examples of these motivational communications are presented in Appendix 4.
Validation	November to December 2024	Reach everyone, motivational message and food waste bin at entrance combined	The project team members knocked on the door of each apartment to hand them the BP in person and to provide brief instructions on how to use it. A resident was met from over 75% of the apartments in the trial. In addition, each apartment received a motivational communication leaflet through the letter box each week. The motivational communication changed each week. Examples of these motivational communications are presented in Appendix 4. In addition, the apartments selected for this trial also had their waste area very close to the apartments' main entrance. Therefore, this also served as a "food waste bin at entrance" intervention.

development of each subsequent phase and the final validation phase. Because of the differences in baseline weight data from each trial, each of the results were standardised to the same baseline. Standardising the baseline weights allowed for the relative change (RC) in food waste segregation to be observed, allowing for direct comparison between each of the trials conducted.

The RC observed during the validation phase was extrapolated to estimate the potential impact of implementing the nudging techniques for food waste collection rates across all Irish apartments. This analysis also considered the potential contribution to Ireland's overall recycling obligations in relation to the EU's municipal solid waste (MSW) targets. Additionally, a theoretical analysis was conducted to provide a crude illustration of the cost savings that could be achieved by apartments if these nudging techniques were implemented. Observations and qualitative feedback from focus groups, steering committee meetings and interactions with key industry experts were utilised to develop a standard service for managing food waste segregation in Irish apartments. These insights also informed the design of an ideal waste storage area. However, the proposed waste area will require further field testing before it can be considered for recommendation. This serves as a promising starting point for future research.

3.3 Limitations

While the findings from this research provide valuable insights, it is important to acknowledge the study's limitations. A key limitation was the absence of a control group, which made it impossible to determine absolute effects or establish statistical significance. As a result, the findings can only suggest trends that may indicate the potential success or failure of the interventions.

The 6-week duration of the trials, while sufficient for initial assessment, may not have been long enough to fully account for other factors that could affect the outcomes. External factors such as seasonal variations, resident turnover and different levels of resident engagement may have influenced the results. These factors should be considered when interpreting the findings, as they may limit the extrapolation of the results.

4 Findings and Analysis

This chapter presents the findings from the nudging intervention trials, examining the effectiveness of different nudging strategies in encouraging apartment residents to participate in food waste source segregation and in ensuring that the food waste collected has a low level of contamination. The findings are presented by trial phase, with each phase's findings displayed in tables and graphs to highlight key behavioural changes observed. A summary of all phases is provided, along with the findings from the waste characterisations, which indicate the levels of contamination. A view of the sustained impact of some of the trials is also presented with some key observations.

To add context and meaning to the findings, the validation findings are extrapolated to offer a theoretical perspective on the impact of a nationwide application of the nudging interventions. An analysis of the potential theoretical savings is also included. Beyond the trial results, this chapter includes insights from key industry stakeholders gathered through focus groups and meetings. These qualitative learnings, along with the analysis of the nudging intervention trials, contribute to the development of a standardised food waste management service for Irish apartment buildings and a suggested design for a standard waste storage area.

4.1 Nudging Intervention Trials

The analysis of each trial phase is presented in graphs displaying the weight of food waste collected per apartment per week, with their baselines standardised to 100, which easily highlights the percentage increase compared with 100; for example, a final number of 145 means a 45% increase. The data, originally recorded in kilograms, has been standardised to a baseline of 100. This standardisation allows for direct comparison between trials: it shows the RC observed between the baseline and the final week of the trial. The purpose of this is to account for variations in baseline data caused by factors such as seasonality and demographic differences among apartment residents. By standardising the baseline, the focus is placed on observing key behavioural changes and trends resulting from the different nudging interventions.

4.1.1 Phase 1

Phase 1 trialled the following nudging interventions: the BP, reach everyone (door-to-door visit), educational leaflet, constant tutoring (frequent presence at waste area, providing information to residents), motivational messaging and rewards. The findings of the phase 1 trials are depicted in Figure 4.1. In terms of observed behavioural change, i.e. the greatest increase in weekly food waste collected per apartment, the data indicates that the reach everyone intervention led to the greatest increase. The educational leaflet intervention resulted in the smallest increase in food waste collected per apartment per week. Initially, the constant tutoring trial had the highest increase in food waste capture, but by day 14 the capture of food waste decreased and, with another period of tutoring at the waste area, the level of food waste collected did not return to the high level recorded at the start of the trial.

4.1.2 Phase 2

Phase 2 trialled the following nudging interventions: food waste bin at entrance (the food waste bin was placed near the apartment building entrance), reduced capacity for residual waste, social housing BP, and reach everyone and motivational messaging combined. The findings of the phase 2 trials are depicted in Figure 4.2. In terms of observed behavioural change, i.e. the greatest increase in weekly food waste collected per apartment, the data indicates that the food waste bin at entrance intervention led to the greatest increase. The social housing BP intervention resulted in the smallest increase in food waste collected per apartment per week. As the reduced capacity for residual waste trial showed strong results, the research team conducted a simple survey of the residents to understand what may have led to the large increase in food waste segregation. No residents indicated that they were

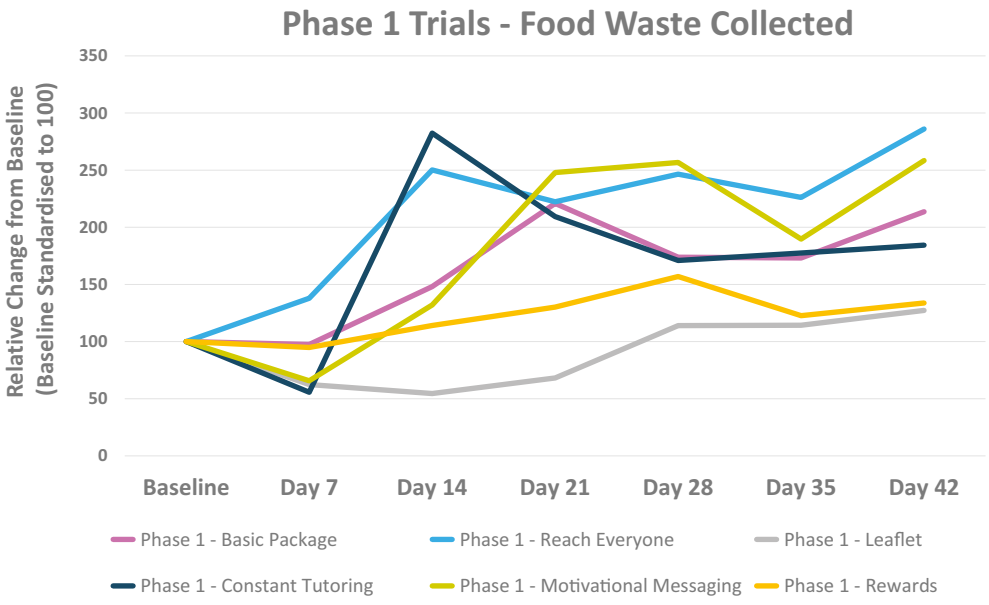

Figure 4.1. Phase 1 nudging trial intervention findings.

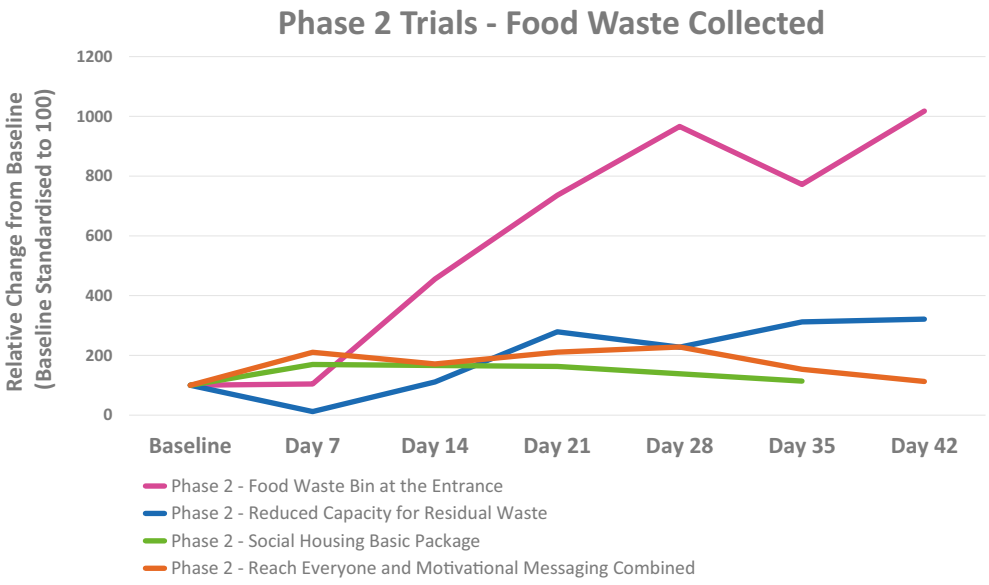

Figure 4.2. Phase 2 nudging trial intervention findings.

aware of a reduced capacity in residual waste storage in the waste area.

4.1.3 Phase 3 and the validation phase

Phase 3 trialled the following nudging interventions: food waste bin at entrance, motivational messaging, and reach everyone and motivational messaging combined. The validation phase measured the findings of reach everyone and motivational messaging combined with the food waste bin at entrance. The findings of the phase 3 trials and the validation phase are depicted in Figure 4.3. In terms of observed behavioural change, i.e. the greatest increase in weekly food waste collected per apartment, the data indicates that all three interventions resulted in a strong increase. The validation phase repeated the phase 3 interventions by combining the three strategies: reach everyone and motivational messaging combined with the food waste bin at entrance, demonstrating a cumulative increased effect on the amount of food waste collected per apartment per week.

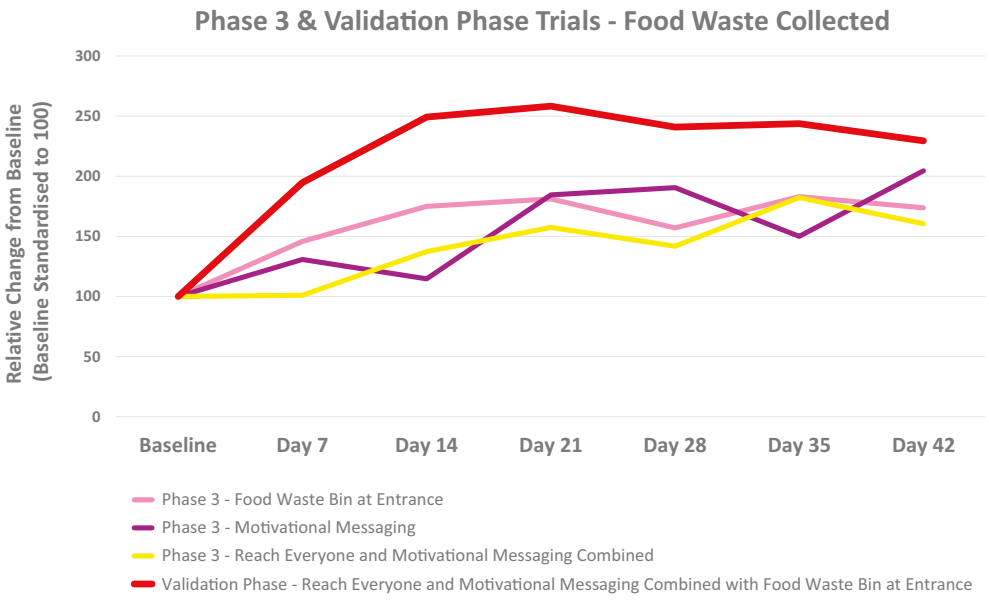

Figure 4.3. Phase 3 and validation phase nudging trial intervention findings.

4.1.4 Summary of all phases

For ease of comparison, Figure 4.4 shows the RCs observed across all nudging intervention trials on the same graph. This shows very clearly that the food waste bin at entrance intervention from phase 2, depicted by the solid pink line, resulted in the strongest behavioural change or biggest increase in food waste collected per apartment per week. The validation phase intervention, as depicted by the thick red line, also performed strongly.

To facilitate comparison with international levels of food waste segregation, it was also important to present the findings in kilograms per apartment per week. Viewing the results in this manner highlights the absolute increase or decrease in food waste collected per apartment per week as the trials progressed over the 6-week period. Figure 4.5 displays the kilograms

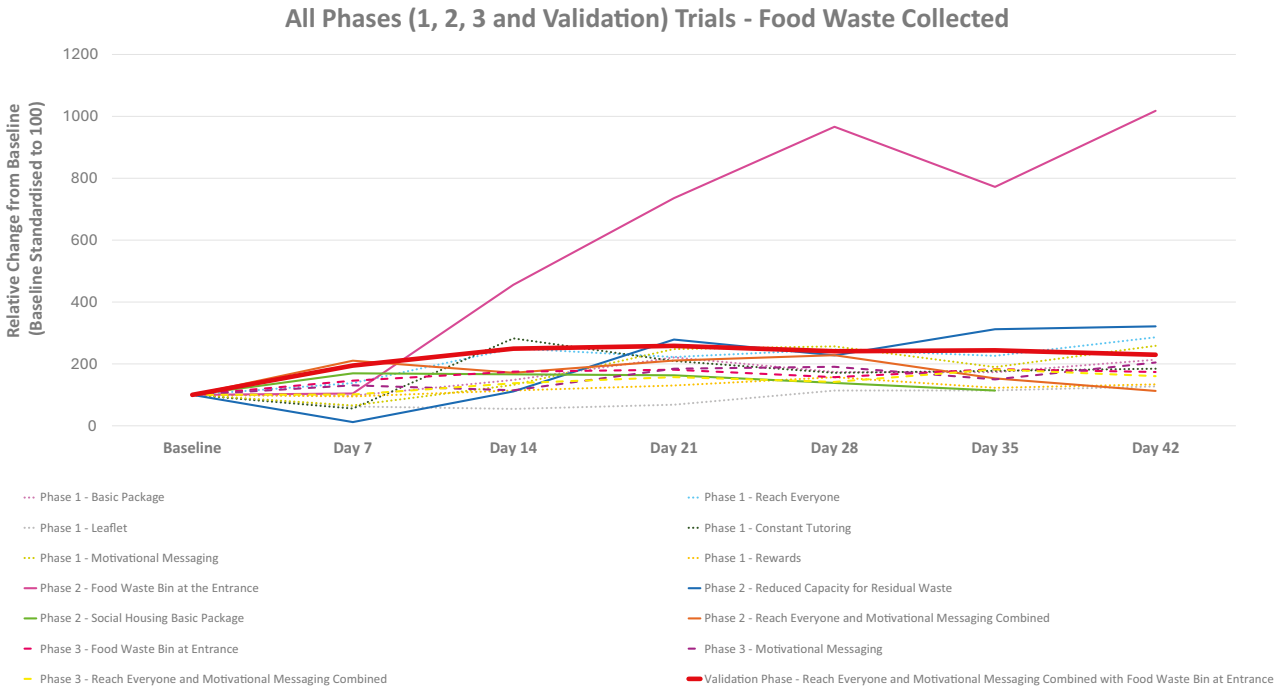

Figure 4.4. Nudging trial intervention findings for all phases.

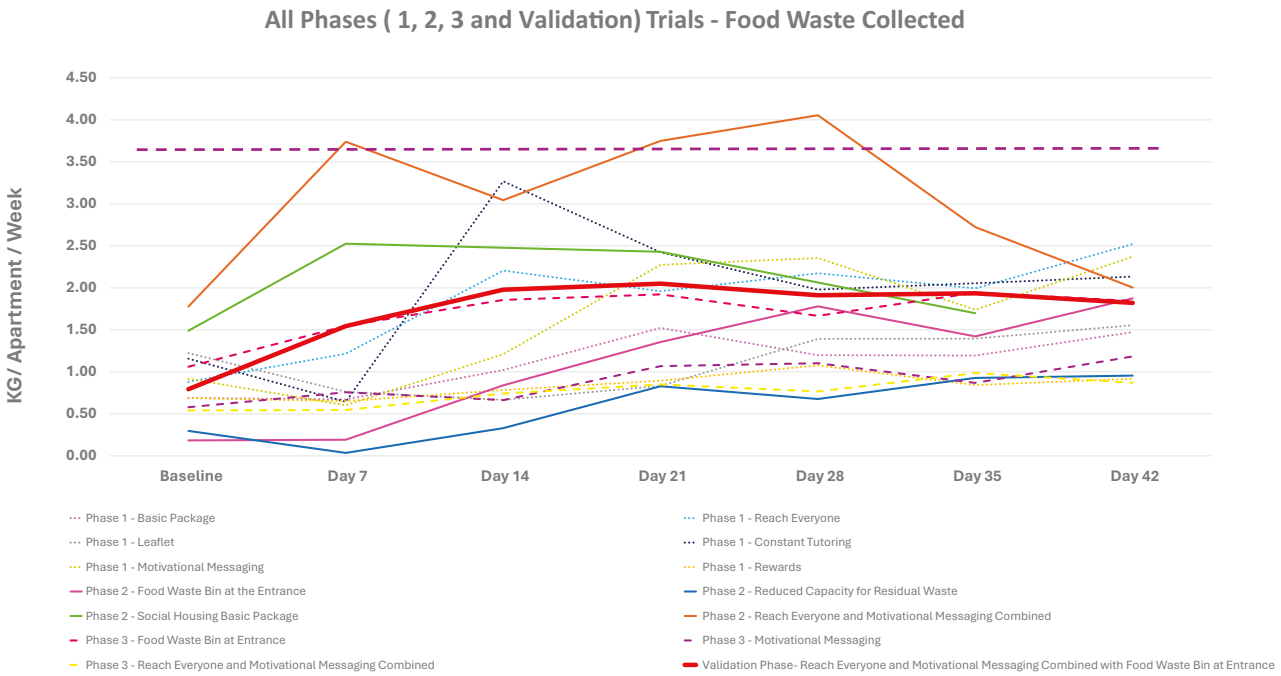

Figure 4.5. Nudging trial intervention findings for all phases, shown in kilograms per apartment per week. The 2019 rate of food waste collection observed in Milan, Italy, of 3.6 kilograms per apartment per week is also included as a reference point.

collected per apartment per week for all trials in a single graph. This graph also includes a dashed purple line at the 3.6 kilograms[4] per apartment per week mark. This represents the 2019 rate of food waste collection observed in Milan, Italy. Milan is currently the international leader in terms of food waste collection (Zero Waste Europe, 2021). The dashed purple line allows for comparison between the results of the nudging intervention trials of this study and the kilograms of food waste collected per household per week in Milan. As shown in Figure 4.5, when looking at the trials together, the variability between the nudging trial intervention baseline results compared with the day 42 results is reduced. In each case, the nudging trial intervention had a positive effect.

Tables 4.1 and 4.2 show the data points for each of the trials. Table 4.1 shows the average RC observed for each intervention trial. This table also provides a summary column at the end that details the average relative increase in food waste collected per apartment per week. The table is ranked in order of largest increase in food waste collected. Table 4.2 details the baseline and an average of the data points from day 21 to day 42 in kilograms per apartment per week observed for each of the interventions. The "Average minus baseline" column of Table 4.2 details the average increase in food waste collected per apartment per week. This table is ranked in terms of the greatest average increase in food waste collected per apartment per week. It is understood that behaviour change resulting from micro-scale interventions (such as in a single apartment block) can occur and become measurable from day 14 onwards following implementation (Grilli and Curtis, 2021). Therefore, in both tables, the average of the findings from day 21 to day 42 was used, as it is assumed that the behaviour change would have been adopted by day 14 of the intervention.

4.1.5 Contamination level

The findings from the pre- and post-trial waste characterisations are presented in summary form in Table 4.2. This table shows the contamination

4 This is based on the 110 kilograms of food waste collected per inhabitant in Milan, Italy, in 2019. Of this waste, 25% was from commercial sources (Zero Waste Europe, 2021). This indicates that 82.5 kilograms were from households. Considering that there are approximately 2.3 people per apartment (Statista Research Department, 2024), Milan collects 3.6 kilograms of food waste per apartment per week.

Table 4.1. All trials ranked based on highest average increase in food waste collected from the baseline (RC from standardised baseline of 100)

Phase	Trial	No. of apartments in trial	Average (day 21 to day 42)	Average minus baseline
2	Food waste bin at the entrance	38	873	773
2	Reduced capacity for residual waste	38	285	185
1	Reach everyone	49	245	145
Validation	Reach everyone and motivational messaging combined with food waste bin at entrance	133	243	143
1	Motivational messaging	40	238	138
1	BP	68	195	95
1	Constant tutoring	73	186	86
3	Motivational messaging	38	182	82
2	Reach everyone and motivational messaging combined	27	176	76
3	Food waste bin at entrance	68	174	74
3	Reach everyone and motivational messaging combined	37	161	61
2	Social housing BP	38	139	39
1	Rewards	37	136	36
1	Educational leaflet	27	106	6

levels observed in the trials both before and after the nudging intervention. It was shown in all trials for which data was available, regardless of the intervention, that contamination levels decreased post nudging intervention. Additional detail from the waste characterisations is depicted in Appendix 2. To illustrate the impact of providing residents with compostable bin liners, the results from the validation phase are presented in Figure 4.6. The pie charts demonstrate a clear reduction in the use of conventional plastic bags.

4.1.6 Sustained impact of trials

To assess the long-term impact of the nudging interventions, periodic data collection continued for select apartment buildings that participated in the phase 1 trials. Figure 4.7 presents the long-term food waste weight data from Gleann Na Rí (GNR) apartment blocks 1, 2, 4 and 5 in Galway city, each of which was involved in one of the phase 1 trials. As shown in the graph, the benefits of each intervention were sustained to some degree for a full year following the initial 6-week trial. In each case the apartments were also provided with an additional supply of compostable bin liners. The first weight measurement taken after the supply of these additional compostable bin liners is marked with a green dot on the graph for each apartment block.

Additionally, GNR Block 1 was later included in a phase 3 trial of the food waste bin at entrance intervention in September 2024. The orange dot in Figure 4.7 indicates the baseline data of the phase 3 intervention. This intervention had a positive effect, increasing the amount of food waste collected per apartment. However, a decline is observed in November 2024, coinciding with the removal of the food waste bin from the entrance and its return to the waste area after the completion of the phase 3 trials.

Due to the perception that placing a food waste bin near the entrance of an apartment building might influence its use by residents, it was deemed valuable to extend the phase 2 food waste bin at entrance trial into the summer months. The objective was to assess whether proximity to the front entrance would lead to odour- or pest-related concerns. However, no such concerns were reported, and apartment residents continued to engage with the trial. The results of this extended trial are presented in Figure 4.8. At the time of the trial and upon analysing the trend, it was observed that a decline in food waste segregation was observed on day 63. In response, the project team decided to supply additional compostable bin liners to the apartments to assess the impact. Following the distribution of these liners, food waste segregation levels rebounded by day 70.

Table 4.2. All trials ranked based on highest average increase from baseline, and pre-trial and post-trial contamination rates

Phase	Trial	No. of apartments in trial	Baseline (kg/apartment/ week)	Average (day 21 to day 42) (kg/apartment/ week)	Average minus baseline (kg/apartment/ week)	Contamination pre-trial	Contamination post trial
2	Food waste bin at the entrance	38	0.18	1.61	1.42	3.0%	0.4%
2	Reach everyone and motivational messaging combined	27	1.78	3.13	1.36	No data	No data
1	Reach everyone	49	0.88	2.16	1.28	3.2%	3.0%
1	Motivational messaging	40	0.92	2.19	1.27	1.5%	1.2%
Validation	Reach everyone and motivational messaging combined with food waste bin at entrance	133	0.79	1.93	1.14	6.0%	1.4%
1	Constant tutoring	73	1.16	2.15	0.99	5.9%	4.3%
3	Food waste bin at entrance	68	1.06	1.84	0.78	No data	No data
1	BP	68	0.69	1.35	0.66	6.8%	1.1%
2	Social housing BP	38	1.49	2.06	0.57	6.1%	2.2%
2	Reduced capacity for residual waste	38	0.30	0.85	0.55	2.2%	1.7%
3	Motivational messaging	38	0.58	1.06	0.48	No data	No data
3	Reach everyone and motivational messaging combined	37	0.54	0.87	0.33	No data	No data
1	Rewards	37	0.69	0.93	0.25	3.5%	0.0%
1	Educational leaflet	27	1.22	1.29	0.07	5.1%	1.9%

Figure 4.6. Pie charts illustrating the percentage of conventional plastic bags found in the pre-validation phase and post-validation phase waste characterisations.

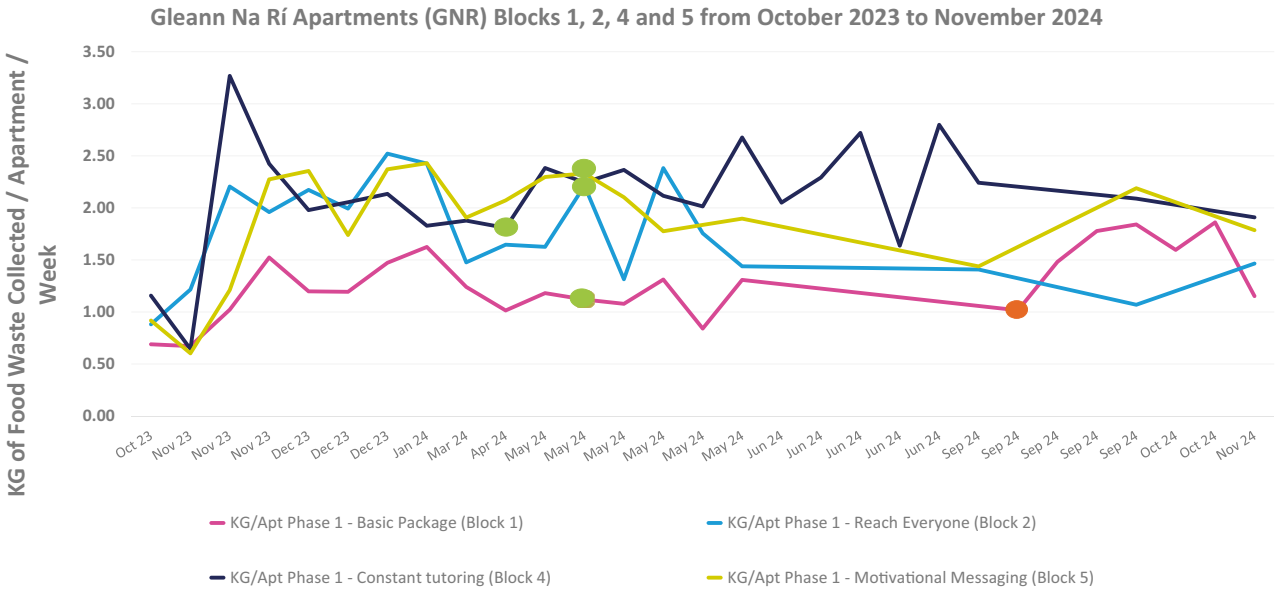

Figure 4.7. Year-long sustained impact of phase 1 trials. Apt, apartment.

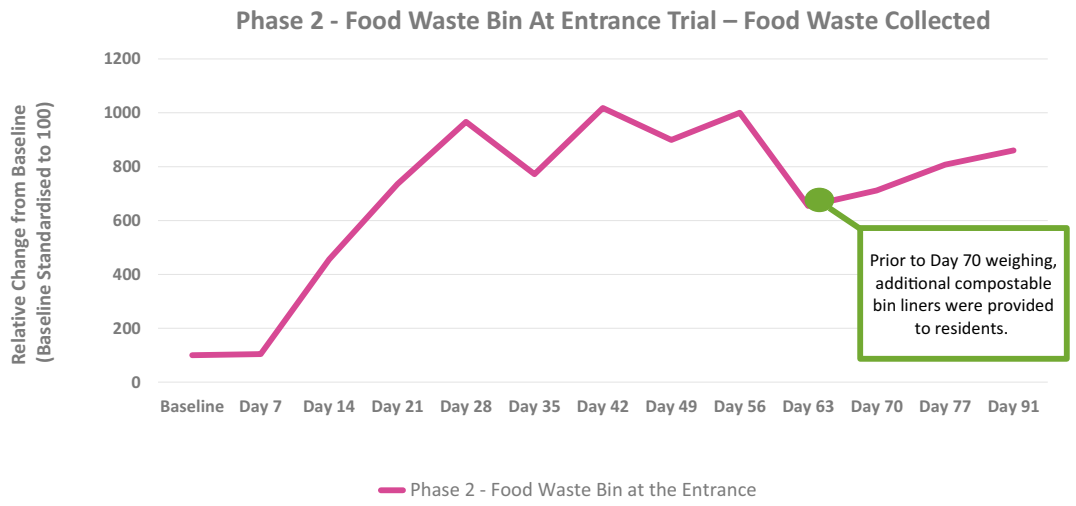

Figure 4.8. Sustained impact of Phase 2 food waste bin at entrance trial.

4.1.7 Extrapolation of findings to all of Ireland

The findings from the validation trial were used to estimate the potential increase in food waste collection if all apartment buildings in Ireland adopted the nudging techniques implemented in the validation phase. The validation phase showed that the weekly amount of food waste collected increased by 143%, with an average of 1.93 kilograms of food waste collected per apartment per week. This equates to roughly 37 kilograms per inhabitant per year based on the Irish average household size of 2.74 people (Central Statistics Office, 2023b). This figure compares favourably with current food waste capture rates across the EU. The average EU capture rate from domestic sources is around 20 kilograms per inhabitant per year, with the best food waste recyclers in the EU achieving up to 70 kilograms per inhabitant per year (Bio-based Industries Consortium, 2024). Therefore, even with the implementation of the validation phase interventions, there is still room for improvement.

The latest census shows there were 239,299 apartments in 2022.[5] According to Irish government projections,[6] 25,000 apartments will be built each year until 2040.

A total of 3381 tonnes[7] of food waste were collected nationally from apartments in 2023. If this study's proposed nudging interventions are implemented nationally, by 2030 approximately 42,000 tonnes of food waste (at a contamination level of approximately 1.4%) could be collected annually from apartments. This represents a contribution of approximately 1.26% towards Ireland's national MSW recycling target. This extrapolation exercise is shown in Table 4.3

4.1.8 Increased food waste source segregation – theoretical savings

We have provided an example in Table 4.4 to illustrate the potential savings that are achievable.

This example is based on the weight of food waste diverted from residual bins to dedicated food waste bins. The figures are drawn from observations made during our validation phase. Such savings could be realised under incentivised charging systems, which are commonly implemented in Ireland (Government of Ireland, 2021). As per the findings in Table 4.2, during the final validation phase each apartment recycled an average of 1.14 kilograms more food waste per week than before the trial. With 133 apartments in the building, this equates to 151.62 kilograms per week over the trial period. For the purposes of this exercise, it is assumed that this 151.62 kilograms per week of food waste is diverted to the correct waste stream from residual waste bins. Therefore, we can calculate a theoretical saving by comparing the cost of collecting this weight as food waste with the more expensive disposal of residual waste. There are several costs associated with collecting food waste, including the lift

Table 4.3. Extrapolation of validation phase findings to the national level

Year	Projected number of apartments[a]	Average kg of food waste collected per apartment per week (as per validation phase)	Potential weekly kg of food waste collected from Irish apartments (as per validation phase)	Potential yearly tonnes of food waste collected from Irish apartments (as per validation phase)
2024	264,299	1.93	510,097	26,525
2025	289,299	1.93	558,347	29,034
2026	314,299	1.93	606,597	31,543
2027	339,299	1.93	654,847	34,052
2028	364,299	1.93	703,097	36,561
2029	389,299	1.93	751,347	39,070
2030	414,299	1.93	799,597	41,579

[a]**The number of apartments in 2022 plus 25,000 additional apartments built per year.**

Table 4.4. Costs by waste stream, and potential savings from implementing nudging interventions that divert 151.62 kg of food waste from residual to food waste stream

	Costs		Savings		
Waste stream	Cost per kilogram	Total cost (for 151.62 kg of food waste)	Savings per week	Savings per annum	Savings per apartment per annum
Residual waste	€0.19	€28.81	–	–	–
Food waste	€0.09	€13.65	€15.16	€789.32	€5.93

5 https://www.cso.ie/en/releasesandpublications/ep/p-cpp2/censusofpopulation2022profile2-housinginireland/occupieddwellings/ (accessed 26 May 2025).

6 https://www.oireachtas.ie/en/debates/question/2025-03-20/36/ (accessed 26 May 2025).

7 Please note that the 2023 annual return data was validated by the RWMO on behalf of WERLA.

charge, the service charge and the cost per kilogram of waste. Table 4.4 outlines a simple example based on the costs per kilogram of collecting residual and food waste. The results of the validation phase show that implementing the nudging interventions could result in a saving of €790 per annum for an apartment building with 133 apartments. This does not take into account the additional potential savings from reduced residual waste generation, which could enable the optimisation of collection routes, nor the increased capture of dry recyclables, an effect that, according to the literature, often accompanies higher citizen participation in food waste segregation.

4.2 Standard Service for Food Waste Source Segregation in Irish Apartments

Table 4.5 outlines proposed the standard and optimal food waste source segregation service for apartment buildings in Ireland. The objective of this standard service is to help maximise the efficiency of food waste segregation while minimising contamination in apartment buildings across Ireland.

This standard service has been developed by combining insights observed from the nudging intervention trials with the experience and knowledge

Table 4.5. Service standard for food waste source segregation in Irish apartments

Item	Standard	Who is responsible
Waste storage area design	Standard waste area design that includes size, location, environmental health and safety considerations and access.	Developer/local authority planner
	Inspect the waste area upon completion to ensure compliance with planning permission.	Local authority planner
Food waste bin management	Provision of food waste bins: 140 litres, brown in colour.	Waste collector
	Bin labelled “Food Waste Only”.	
	1 food waste bin per 20 apartments.	
	Food waste bins collected weekly.	
	The food waste bin should be close to the apartment building entrance for best capture of food waste (where feasible).	Property management agent or owners’ management company and waste collector
	Cleaning of food waste bin three times per year.	Property management agent
	Continuous supply of compostable bin liners.	Owners’ management company/waste collector
	Cleaning of waste area weekly.	Property management agent
	Installation of mywaste.ie signage in the waste area.	Property management agent
	Contamination control – bin inspection.	Waste collector
Education and outreach	BP to be provided to each apartment unit, including food waste caddy bin, compostable bin liners and mywaste.ie instruction leaflet.	Waste collector provides the BP, and the property management agent facilitates the provision of the items to the apartments.
	BP is delivered to residents by calling at their doors and explaining the system. Target to reach one person from at least 75% of apartments. The BP is left at the door of the apartment when the resident does not answer. A week later, any uncollected BPs are collected by the team.	Waste collector and property management agent
	Once a year, the waste collector provides additional BPs to the property management agent, who, in turn, gives these to new residents. Property management agent also sends blanket motivational message to all residents.	Waste collector and property management agent
	Motivational messages sent to residents when implementing the system at the start and every week for 5 weeks (standard motivational communications are already drafted and are presented in Appendix 4).	Property management agent
Enforcement	Auditing to ensure that this standard is maintained in apartments. Perhaps there could be a quality assurance role for an independent body.	Independent auditing body or local authority

gained through consultations with key industry experts from the focus groups.

4.3 Ideal Waste Storage Area Design

We present an overview of a draft standard waste area design informed by key stakeholders in the industry and qualitative findings and learnings from monitoring the nudging intervention trials. The first step in offering guidance on how to design a suitable waste area is to understand the required bin storage capacity for the apartment building. Once the capacity of the waste area is understood, the design of the waste area can be planned accordingly. The draft design is a suggested standard waste area serving a block of 60 apartments, with space for five 1100-litre waste bins and three 140-litre bins. In this example, there is also a single 240-litre bin for an additional waste stream (e.g. glass).

The size of the waste storage area was calculated using a formula developed in this research project. It allows room to ensure no overlapping of bins and ample manoeuvring space, with clear and easy access to water and power sources.

The standard design and management approach is based on British Standard 5906:2005. This standard is already used as a reference in guidelines and waste bye-laws in Ireland.

Feedback from stakeholders in the focus group and from a wider written consultation with stakeholders in the waste and apartments sector has also been incorporated into the suggested design. For example, waste collectors highlighted that doorway design and overcrowding in waste areas can hinder their ability to efficiently use the space. Specifically, waste collectors noted that doors with raised thresholds make it difficult to move bins in and out of the area. Ideally, waste areas should be separate structures rather than integrated in underground parking garages. A key criterion to make a waste area convenient for residents is its location within 20–30 metres of the entrance of the apartment block. Figure 4.9 illustrates a proposed standard waste area layout that would serve 60 apartments. It must be acknowledged that this is a theoretical synthesis of the research findings, and it should be piloted and potentially refined before being considered for national policy implementation. If the design becomes national policy, it could be implemented by inclusion in an update to the guidance document *Planning Design Standards for Apartments: Guidelines for Planning Authorities*, *2025* (DHLGH, 2025). These guidelines are used by local authority planning offices to assess planning applications for new apartments.

Full details of the draft waste area design are provided in Appendix 1.

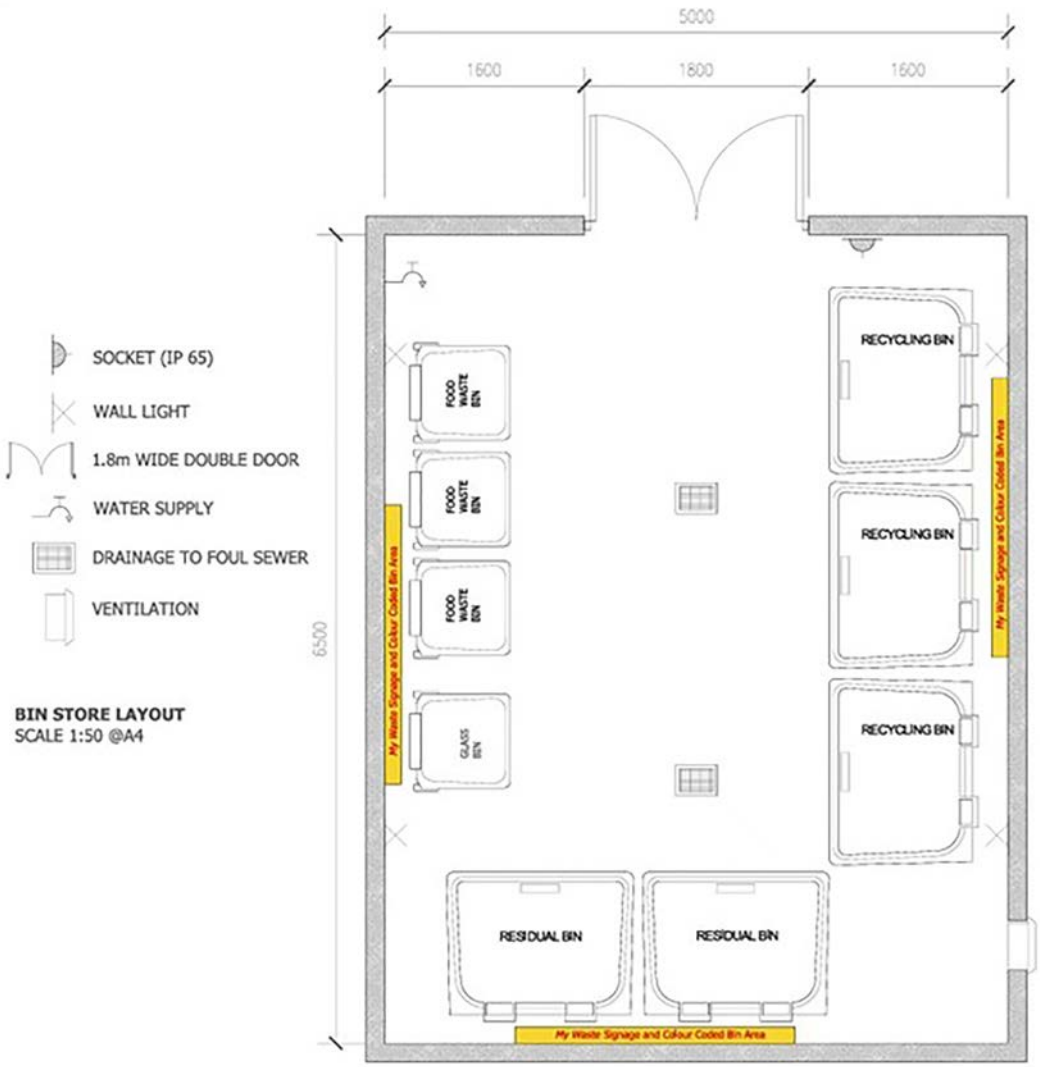

Figure 4.9. Standard waste area design.

5 Discussion

5.1 Effectiveness of Different Nudging Strategies Trialled

The results of the nudging intervention trials provide valuable insights into the relative effectiveness of various strategies to increase food waste segregation in Irish apartments while maintaining low contamination levels. Standardised RC comparisons and absolute measurements in kilograms per apartment per week revealed several key trends, helping to identify which interventions would be most effective if implemented at scale.

The validation phase tested a combination of three strategies: reach everyone, motivational messaging and food waste bin at entrance. Based on results from phases 1 to 3, these three interventions consistently demonstrated the strongest impact on resident behaviour. Among them, the food waste bin at entrance intervention stood out as particularly effective. Initially trialled in phase 2, it yielded a significant increase in food waste segregation, although this was likely to have been amplified by the very low baseline (0.18 kilograms per apartment per week). When repeated in phase 3 it remained effective, although the increase was more modest. These results support the idea that making waste collection infrastructure more visible and accessible serves as a powerful nudge for behaviour change.

The reach everyone intervention, which involved a brief (no more than 2-minute) door-to-door engagement with apartment residents,[8] also performed strongly in phase 1. The resulting increase in food waste collection suggests that personalised, direct contact is an effective way to encourage participation. This approach appears to act like a "flywheel", driving momentum until widespread involvement turns food waste separation into a social norm – what sociologists refers to as "peer pressure". This approach has also seen success elsewhere. A study by Xu *et al*. (2016) concluded that using volunteers to personally engage with residents and provide demonstrations over a 3-month period played a key role in establishing lasting food waste segregation habits. This emphasis on interpersonal contact is echoed in Bernstad *et al*. (2013), who assessed the impact of a "door-stepping campaign" in apartments in Sweden. While the quantitative difference in collected food waste between contacted and non-contacted households was not statistically significant, qualitative waste composition analyses revealed that households receiving oral information had higher source-separation accuracy and lower contamination levels.

Motivational messaging alone performed reasonably well in both phases 1 and 3 but proved even more effective when combined with infrastructure-based nudges (bin near the entrance) and interpersonal communication-based nudges (door-to-door knocking). This underscores the limits of relying solely on informational or emotional appeals without addressing physical or habitual barriers to proper segregation. Notably, the messaging strategy was refined between phases 2 and 3. With input from subject matter experts from the research project team, it was decided that more frequent and more assertive language should be adopted. Phrases like "You can do better!", "Apartments in Cork are recycling 50% more" and "Well done, you have increased your food waste recycling by 100%" were used as motivational messages on A5-sized flyers. Flyers were distributed weekly instead of fortnightly and their colour changed each week to signal a new message. These enhancements contributed to stronger and more consistent increases in food waste segregation in both phase 3 and the validation phase.

The findings of Dai *et al*. (2015) reinforce this conclusion, highlighting social norms and emotional engagement as the most influential factors driving behavioural change. The VANG Household Waste study also highlights the effectiveness of behavioural interventions such as setting group goals using feedback from residents and influencing attitudes through repeated, clear communication.

8 For example: "Hello, my name is Percy from Foster Environmental, here is your free food waste kitchen caddy and compostable bags. Place the food waste in the compostable bags and bring it down to the brown bin in your waste shed".

Both approaches were rated as highly effective in promoting waste separation, demonstrating the importance of goal setting, social reinforcement and consistent messaging alongside the provision of basic infrastructure (VANG Household Waste, 2020).

The promising results observed during the validation phase appear to be attributable to the cumulative effect of implementing the three distinct strategies in combination. This has also been seen in other contexts. For example, in Sweden, Linder *et al*. (2018) showed that providing infrastructure alone was not sufficient to increase food waste segregation; effective communication was also necessary. In their study, they provided a comprehensive educational leaflet in combination with effective infrastructure, which led to a statistically significant increase in food waste segregation. In contrast, the trials in this study showed limited impact from educational leaflets alone. However, combining easily accessible and visible infrastructure (such as prominently placed food waste bins) with motivational messaging appears to have a more robust and sustained impact on Irish apartment resident behaviour. This suggests that each type of nudge plays a vital role and that nudges are most effective when used in combination. While communication is essential, its impact is significantly enhanced when paired with strategically placed infrastructure, leading to more effective behaviour change interventions.

Other interventions trialled also offered important insights. The constant tutoring approach showed a strong initial impact but experienced diminishing returns after the first 2 weeks. This is likely to have been due to the insufficient number of food waste bins initially placed in the waste area. It is speculated by the research team that once residents observed bins overflowing, they were discouraged from continuing to recycle food waste. Even after additional bins were provided, the food waste segregation rate did not return to its earlier high. This effect was also highlighted in the VANG Household Waste study: "You want to motivate residents to separate their organic waste, but the organic waste container is always full. Residents will feel resistance when they try to exhibit the desired behaviour. The first thing to do is therefore to make sure the container is usable, before implementing any other interventions designed to reduce people's resistance or boost their motivation" (VANG Household Waste, 2020).

This trial was repeated during phase 2 on two separate occasions; however, the tutoring efforts did not reach enough residents. As a result, it was concluded that this intervention is not practically feasible in an Irish apartment setting. This suggests that, while temporary engagement at waste areas can prompt change, its novelty may wear off unless supported by dedicated resources. The educational leaflet was the least effective intervention in this study's trials, underscoring the limited impact of passive information strategies when used in isolation. This reinforces the broader point that awareness alone is often insufficient to drive behavioural change. The rewards scheme was also shown to be not very effective in these trials; the VANG Household Waste study had similar findings, showing that a rewards approach is not very practical and that its impact diminishes quickly over time, especially after the reward has been received.

Trials in social housing apartments were also included. These residents received the BP intervention. While the results did not indicate large-scale behavioural change (a 39% increase in weekly food waste segregation), a notable drop in food waste contamination was observed (contamination level dropped by 64%). This suggests that some level of impact can be readily achieved; however, further research is recommended to determine which additional strategies and supports are specifically required and are most effective in the context of social housing apartments.

In summary, the findings indicate that interventions rooted in convenience, visibility and personal engagement are the most effective for encouraging food waste segregation in Irish apartment settings. Future programmes should prioritise strategic infrastructure placement and scalable combinations of direct engagement and motivational support, rather than relying solely on passive measures like educational leaflets. The cumulative results from the validation phase suggest that layered approaches hold the greatest promise for achieving sustained and widespread behaviour change.

5.2 Benchmarking against Milan, Italy: A Leading Example in Food Waste Collection

Another notable insight emerged when comparing this study's results with the food waste segregation rates

achieved in Milan, Italy. Milan is considered one of the world's leaders in terms of food waste segregation. As an illustration, in 2019, 110 kilograms of food waste were collected per inhabitant in Milan compared with an EU average of 18.84 kilograms per inhabitant (Zero Waste Europe, 2021). Milan recycles food waste at a rate of 3.6 kilograms[9] per apartment per week. In comparison, the baseline food waste capture rate of the validation phase was 0.79 kilograms per apartment per week, which rose to an average of 1.93 kilograms per apartment per week by the end of the trial. These are meaningful results, and the implications of these findings are discussed in sections 5.5 and 5.6. In addition, the variability across all phases in this study decreased over time, suggesting that habit formation is possible relatively quickly, within 3–4 weeks of the intervention. This indicates a strong potential for well-designed nudging strategies to bring segregation behaviours in Irish apartment settings in line with high-performing international standards.

5.3 Contamination

A key objective of this research was to understand the impact of nudging strategies on contamination levels in collected food waste. To assess this, contamination levels were analysed before and after each intervention, with a focus on materials such as plastic, metal and other common contaminants. Overall, all trials demonstrated a positive effect in reducing contamination. The most significant improvement was a marked decrease in the use of conventional plastic bags, as seen in the validation phase results (Figure 4.6). The provision of compostable caddy liners, included in the BP, appeared to directly displace the use of conventional plastic bags. Similar outcomes were reported in the VANG Household Waste study, where the quality of collected organic waste improved to "sufficiently clean" in nearly all pilot programmes by the end of the intervention period. A detailed breakdown of contamination findings from all waste characterisations in this study is presented in Appendix 2.

5.4 Sustained Impact of Nudging Interventions and Long-term Engagement

The extended duration of this research project provided an opportunity to assess the long-term effects of the phase 1 trials over a 1-year period, as illustrated in Figure 4.7. Monitoring food waste collection in selected apartment buildings demonstrated that, overall, each intervention had a lasting impact. The findings suggest that once new segregation habits are established they can become sustained over time. However, the correct conditions need to remain in place to support the continuation of the desired behaviour. For example, as seen in Figure 4.7, the observed decline in segregation rates following the removal of the food waste bin from near the apartment building entrance highlights the importance of maintaining supportive infrastructure to sustain long-term behavioural change.

As shown in Figure 4.8, the extended phase 2 trial of the food waste bin at entrance intervention (bin placed approximately 4 metres from the entrance), which was conducted over the summer months, suggests that common concerns about odour and pests, often cited as barriers to placing food waste bins in accessible locations, were unfounded. Residents continued to engage in food waste segregation throughout the trial and extended trial period with no issues reported, further supporting the viability of placing a food waste bin near the entrance as a standard practice. In these trials, the food waste bin placed near the entrances was suitable for each context. However, it should be noted that this may not be feasible in all apartment buildings, particularly where entrances are not secured from the public or where bin placement could obstruct footpaths. Local context must be considered when applying this approach.

5.5 Extrapolation of Findings to All of Ireland

In 2023, a total of 3381 tonnes[10] of segregated food waste was collected nationally from apartments.

9 This is based on the 110 kilograms of food waste collected per inhabitant in Milan, Italy, in 2019. Of this waste, 25% was from commercial sources (Zero Waste Europe, 2021). This indicates that 82.5 kilograms were from households. Considering that there are approximately 2.3 people per apartment (Statista Research Department, 2024), Milan collects 3.6 kilograms of food waste per apartment per week.

10 Please note that the 2023 annual return data was validated by the RWMO on behalf of WERLA.

The findings from this project show that, if the findings from the validation phase were implemented at a national scale, by 2030, approximately 42,000 tonnes of food waste could be collected annually from apartments, with a contamination rate of around 1.4%. This would contribute approximately 1.26% towards Ireland's EU MSW recycling target.

Given Ireland's ongoing challenges in meeting its MSW recycling goals, this finding is particularly significant. It demonstrates clearly that relatively simple interventions can have a very meaningful impact on improving recycling rates and advancing national environmental objectives.

5.6 Increased Food Waste Source Segregation – Theoretical Savings

As per the validation phase, it was seen that implementing the service standard saved approximately €790 per year; this was based on an apartment block that contained 133 apartments (€5.93 savings per apartment). To put this into context, it has been established that the cost of the EN 13432–certified 20-litre compostable bags is approximately €5.40[11] for 100 bags for one apartment per year. Therefore, a significant portion of the costs associated with implementing the service standard could be offset by the savings generated.

In addition, it was seen in the phase 2 trial of the food waste bin at entrance intervention (see Figure 4.8) that when residents ran out of compostable bin liners their food waste segregation rates decreased. When these residents received additional compostable bin liners, their food waste segregation rates increased again. This implies that the continuous provision of compostable bin liners may have a beneficial effect on maintaining food waste segregation levels.

The reduced capacity for residual waste bin trial in phase 2 produced some interesting results. While it showed a strong weekly increase in food waste segregation, a closer analysis revealed that this effect was likely to have been inflated due to the very low baseline observed (0.30 kilograms per apartment per week). Additionally, although apartment residents were informed of the reduced residual waste capacity, residents were not aware that this had been the case when they were asked about it as part of a face-to-face survey. This suggests that the observed increase in food waste source segregation was most likely driven by the provision of the BP intervention rather than the reduced bin capacity itself.

However, existing evidence supports the idea that reduced residual waste capacity can promote better segregation. As people recycle more, their need for residual waste disposal naturally decreases. The Waste and Resources Action Programme (WRAP, 2020) has shown that restricting residual waste capacity often improves segregation performance, and that reducing collection frequency to fortnightly can also enhance cost efficiency. Therefore, in contexts where food waste segregation is being encouraged, it is advisable to also review and adjust residual waste services accordingly. This approach is further explored in the ideal waste storage area design outlined in Appendix 1.

5.7 Implications for Waste Management Policy and Practice

Extrapolating the findings of the validation phase to a national scale suggests significant potential for increasing food waste segregation in apartment buildings across Ireland. Theoretical estimates indicate that widespread adoption of these simple nudging interventions, as outlined in the proposed service standard for food waste segregation in Irish apartments, could substantially increase food waste diversion from the residual waste stream.

The outputs from this research (the service standard for food waste segregation in Irish apartments, and the ideal waste storage area design) were reviewed and discussed with a wide range of stakeholders. In addition, a 4-week written consultation was held with stakeholders in the apartment, policy and waste sectors. As discussed with these key stakeholders, the recommended avenue for introducing the service standard is the waste collection permit system, where certain elements of the standard, particularly those

11 Quotation for 10,000 bags supplied by a large European supplier of compostable bags in Ireland: 20-litre caddy sacks at €1.40 per roll (€5.60 per resident per year), 25 bags per roll, 16 rolls per carton, and approximately 20 pallets for annual supply based on 100 bags per resident. Delivery cost to be added, but, delivered at one time, this would add only a few cents per roll.

relevant to waste collectors, could be included as permit conditions.

Further improvements could also be achieved through the eventual implementation of the ideal waste storage area design in new apartments and potentially retrofitting older apartment waste areas, once the design has been piloted and refined. At this stage, the ideal waste storage area design, although informed by observations from these trials and by existing British and Irish standards, still needs to be piloted to ensure that the design is workable and appropriately standardised for different apartment contexts. Once piloted and refined, it could then be recommended for inclusion in an update to the guidance document *Planning Design Standards for Apartments – Guidelines for Planning Authorities, 2025* (DHLGH, 2025) issued under Section 28 of the Planning and Development Act, 2000 (as amended) and published by the Department of Housing, Local Government and Heritage.

This approach would contribute to both environmental sustainability and economic efficiency, mainly through reduced waste disposal costs. The financial analysis, as set out in section 5.6, reinforces the cost-effectiveness of these nudging interventions. By decreasing reliance on residual waste bins and increasing food waste segregation, apartment complexes can realise notable savings. These savings could potentially be used to fund a continuous supply of compostable bin liners for all Irish apartment residents, further supporting the longevity and effectiveness of the interventions.

6 Conclusions

The nudging intervention trials offer strong indications that simple, targeted behavioural strategies can significantly improve food waste source segregation in apartment buildings across Ireland.

The most effective intervention consists of:

- providing each household with:
  - a 10-litre vented caddy;
  - an educational leaflet;
  - a continuous supply of compostable bin liners;
- holding a brief 2-minute conversation with a resident from at least 75% of the apartments in an apartment block;
- placing a large 140-litre bin near the building entrance;
- reinforcing the intervention with a 5-week campaign in which motivational flyers are delivered to each resident's postbox.

The research found that making waste segregation more convenient and engaging, particularly through the placement of bins near the apartment block entrance and the use of motivational messaging, emerged as a key driver of behavioural change.

These findings provide a practical foundation for the development of a standardised food waste segregation service for Irish apartment buildings, supporting an additional 1.26% contribution to EU MSW recycling targets and the transition to a more circular economy.

7 Recommendations

Implement the service standard for food waste source segregation in Irish apartments:

- Adopt the proposed service standard as a national framework to support consistent, effective food waste segregation across apartment buildings in Ireland.
- Integrate relevant elements of the service standard, via the National Waste Collection Permit Office, into waste collection permit conditions, particularly those applicable to waste collectors, to help embed best practice into service provision.

Pilot and refine the ideal waste storage area design:

- Support the piloting of the ideal waste storage area design by the regional waste offices and a developer, informed by trial findings and existing standards, to test its practical application across different apartment types.
- Once refined, consider the design's inclusion as a requirement in planning conditions for new apartment developments, and explore opportunities to retrofit suitable elements into existing apartment complexes. Prioritise its inclusion in an update to the guidance document *Sustainable Urban Housing: Design Standards for New Apartments – Guidelines for Planning Authorities*, ensuring it filters through to local authority planning processes.

Encourage reinvestment of savings into supporting measures:

- Promote the use of savings generated to fund a continuous supply of compostable bin liners for apartment residents. This can help maintain engagement and ensure the long-term success of the interventions.

Review existing waste area infrastructure:

- Conduct a national review of apartment waste area infrastructure to identify areas where upgrades or retrofits could support improved segregation performance and alignment with the ideal waste area design.

Support continued stakeholder engagement and integration into policy:

- Maintain collaboration with local authorities, waste collectors, housing providers, property management agents, owners' management companies and residents to ensure that the roll-out of these interventions is practical, scalable and aligned with both user needs and policy objectives.

References

Abbott, A., Nandeibam, S. and O'Shea, L., 2011. Explaining the variation in household recycling rates across the UK. *Ecological Economics*, 70(11), 2214–2223.

Allison, A.L., Lorencatto, F., Michie, S. and Miodownik, M., 2022. Barriers and enablers to food waste recycling: a mixed methods study amongst UK citizens. *International Journal of Environmental Research and Public Health*, 19(5), 2729.

Bernstad, A., la Cour Jansen, J. and Aspegren, A., 2013. Door-stepping as a strategy for improved food waste recycling behaviour – evaluation of a full-scale experiment. *Resources, Conservation and Recycling*, 73, 94–103.

Bio-based Industries Consortium, 2024. *Bio-waste Generation in the EU: Current Capture Levels and Future Potential – 2nd Edition*. Available online: https://biconsortium.eu/sites/biconsortium.eu/files/publications/Bio-waste%20generation%20in%20the%20EU%20Current%20capture%20levels%20and%20future%20potential%202024_0.pdf (accessed 26 May 2025).

Brambilla V., Confalonieri A., Krutova I., Lopez E., Giavini M. and Ricci M., 2024. *Life Biobest D3.1: Guideline on the Separate Collection of Bio-waste*. Available online: https://zerowasteeurope.eu/library/guideline-on-the-separate-collection-of-bio-waste/ (accessed 21 May 2025).

Calo, R., 2013. Code, nudge, or notice? *Iowa Law Review*, 99, 773.

Carey, C., Phelan, W. and Boland, C., 2008. *Organic Waste Management in Apartments – Final Report*. Available online: https://www.epa.ie/publications/research/waste/ERTDI-No71_WEB-final-with-cover.pdf (accessed 25 March 2025).

Central Statistics Office, 2023a. Census of population 2022 profile 2 – housing in Ireland. Available online: https://www.cso.ie/en/releasesandpublications/ep/p-cpp2/censusofpopulation2022profile2-housinginireland/occupieddwellings/#:~:text=Just%203%25%20of%20the%20dwellings,built%20since%20the%202016%20census (accessed 25 March 2025).

Central Statistics Office, 2023b. Press statement census 2022 results profile 2 – housing in Ireland. Available online: https://www.cso.ie/en/csolatestnews/pressreleases/2023pressreleases/pressstatementcensus2022resultsprofile2-housinginireland/ (accessed 6 February 2026).

Conefrey, T. and Staunton, D., 2019. Population change and housing demand in Ireland. *Central Bank of Ireland Economic Letter*, 14, 1–16.

Congiu, L., Botta, E. and Zoli, M., 2025. Biases and nudges in the circular economy: a review. *Ecological Economics*, 233, 108579.

Consorzio Italiano Compostatori, 2018. Food waste collection: CIC brings the Italian model to New York. Available online: https://www.compost.it/wp-content/uploads/2019/08/Comunicato-stampa-EN-Food-waste-collection-CIC-brings-the-Italian-model-to-New-York-.pdf (accessed 21 May 2025).

Dai, Y.C., Gordon, M.P.R., Ye, J.Y., Xu, D.Y., Lin, Z.Y., Robinson, N.K.L., Woodard, R. and Harder, M.K., 2015. Why doorstepping can increase household waste recycling. *Resources, Conservation and Recycling*, 102, 9–19.

Dai, Y.C., Lin, Z.Y., Li, C.J., Xu, D.Y., Huang, W.F. and Harder, M.K., 2016. Information strategy failure: personal interaction success, in urban residential food waste segregation. *Journal of Cleaner Production*, 134, 298–309.

DEHLG (Department of the Environment, Heritage and Local Government), 2009a. *Sustainable Residential Development in Urban Areas – Guidelines for Planning Authorities*. Available online: https://assets.gov.ie/static/documents/e1423c6d-sustainable-residential-developments-in-urban-areas-guidelines-for-planning-a.pdf (accessed 30 January 2026).

DEHLG (Department of the Environment, Heritage and Local Government), 2009b. *Urban Design Manual – A Best Practice Guide*. Available online: https://www.opr.ie/wp-content/uploads/2019/08/1999-Urban-Design-Manual-1.pdf (accessed 30 January 2026).

DHLGH (Department of Housing, Local Government and Heritage), 2022. *Sustainable Urban Housing: Design Standards for New Apartments – Guidelines for Planning Authorities*. Available online: https://assets.gov.ie/static/documents/sustainable-urban-housing-design-standards-for-new-apartments-guidelines-for-planning-.pdf (accessed 30 January 2026).

DHLGH (Department of Housing, Local Government and Heritage), 2025. *Planning Design Standards for Apartments – Guidelines for Planning Authorities, 2025*. Available online: Planning_Design_Standards_for_Apartments_080725_FINAL.pdf (accessed 30 July 2025).

DiGiacomo, A., Wu, D.W.L., Lenkic, P., Fraser, B., Zhao, J. and Kingstone, A., 2018. Convenience improves composting and recycling rates in high-density residential buildings. *Journal of Environmental Planning and Management*, 61(2), 309–331.

Eastern Midlands Regional Waste Management Office, 2020. *The Dublin Apartments Brown Bin Project*. Available online: https://apartmentownersnetwork.org/wp-content/uploads/2022/02/northwood-report-erwa-brown-bins.pdf (accessed 25 March 2025).

EPA (Environmental Protection Agency), 2024. Ireland's recycling rate has not improved in a decade: it is time to move away from a wasteful linear economy. Available online: https://www.epa.ie/news-releases/news-releases-2024/irelands-recycling-rate-has-not-improved-in-a-decade-it-is-time-to-move-away-from-a-wasteful-linear-economy-.php#:~:text=The%20report%20shows%20that%20over,55%20per%20cent%20by%202025 (accessed 25 March 2025).

Erez, M., Gopher, D. and Arzi, N., 1990. Effects of goal difficulty, self-set goals, and monetary rewards on dual task performance. *Organizational Behavior and Human Decision Processes*, 47(2), 247–269.

European Union, 2023. *Ireland 2025 EU Waste Recycling Targets – State of Play*. Available online: https://op.europa.eu/en/publication-detail/-/publication/0fbf46b7-034e-11ee-87ec-01aa75ed71a1/language-en (accessed 25 March 2025).

Foster, P., Breton, T. and Bird, E., 2024. *Identifying the Source and Scale of Plastic in Compost Derived from Household and Commercial Food Waste*. Environmental Protection Agency, Johnstown Castle, Ireland.

Garcés, C., Lafuente, A., Pedraja, M. and Rivera, P., 2002. Urban waste recycling behavior: antecedents of participation in a selective collection program. *Environmental Management*, 30, 378–390.

Gillen, S., Byrne, M., Murtagh, P., Dunleavy, M., McGovern, D., Finan, R., Foster, P. and Breton, T., 2019. *Final Report: National Brown Bin Awareness Pilot Scheme in Sligo City*. Available online: https://www.cre.ie/web/wp-content/uploads/2010/12/National-Brown-Bin-Awareness-Pilot-Report-Sligo-30.01.2019.pdf (accessed 25 March 2025).

Government of Ireland, 2020. *A Waste Action Plan for a Circular Economy*. Available online: https://assets.gov.ie/86647/dcf554a4-0fb7-4d9c-9714-0b1fbe7dbc1a.pdf (accessed 25 March 2025).

Government of Ireland, 2021. Waste collection charges. Available online: https://www.gov.ie/en/publication/a467a-waste-collection-charges/ (accessed 27 March 2025).

Government of Ireland, 2024a. *Sustainable Residential Development and Compact Settlements – Guidelines for Planning Authorities*. Available online: https://www.gov.ie/en/department-of-housing-local-government-and-heritage/publications/sustainable-residential-development-and-compact-settlements-guidelines-for-planning-authorities/ (accessed 26 May 2025).

Government of Ireland, 2024b. Brown bins to be rolled out to all households in Ireland. Available online: https://www.gov.ie/en/department-of-climate-energy-and-the-environment/press-releases/brown-bins-to-be-rolled-out-to-all-households-in-ireland/ (accessed 25 March 2025).

Government of Ireland, 2025. *National Planning Framework: First Revision*. Available online: https://cdn.npf.ie/wp-content/uploads/National-Planning-Framework-First-Revision-April-2025.pdf (accessed 26 May 2025).

Grilli, G. and Curtis, J., 2021. Encouraging pro-environmental behaviours: a review of methods and approaches. *Renewable and Sustainable Energy Reviews*, 135, 110039.

Hansen, P.G. and Jespersen, A.M., 2013. Nudge and the manipulation of choice: a framework for the responsible use of the nudge approach to behaviour change in public policy. *European Journal of Risk Regulation*, 4(1), 3–28.

Hausman, D.M. and Welch, B., 2010. Debate: to nudge or not to nudge. *Journal of Political Philosophy*, 18(1), 123–136.

Housing Agency, 2019. *Apartment Living in Ireland 2019 – National Study of Irish Housing Experiences, Attitudes and Aspirations in Ireland*. Available online: https://www.housingagency.ie/publications/apartment-living-ireland-2019 (accessed 6 February 2026).

Housing Agency, 2025. Social housing support overview. Available online: https://www.housingagency.ie/housing-information/social-housing-support-overview (accessed 28 August 2025).

Knickmeyer, D., 2020. Social factors influencing household waste separation: a literature review on good practices to improve the recycling performance of urban areas. *Journal of Cleaner Production*, 245, 118605.

Leanscape, 2023. The importance of identifying the right sample size for business improvement. Available online: https://leanscape.io/the-importance-of-identifying-the-right-sample-size-for-business-improvement/ (accessed 20 May 2025).

Li, C., Huang, Y. and Harder, M., 2017. Incentives for food waste diversion: exploration of a long term successful Chinese city residential scheme. *Journal of Cleaner Production*, 156, 491–499.

Li, C., Wang, Y., Li, Y., Huang, Y. and Harder, M.K., 2021. The incentives may not be the incentive: a field experiment in recycling of residential food waste. *Resources, Conservation and Recycling*, 168, 105316.

Linder, N., Lindahl, T. and Borgström, S., 2018. Using behavioural insights to promote food waste recycling in urban households – evidence from a longitudinal field experiment. *Frontiers in Psychology*, 9, 352.

Ling, M., Xu, L. and Yang, H., 2023. Direct and spillover effects of social norm nudges for household recycling: a longitudinal field experiment. *Sustainable Production and Consumption*, 42, 423–433.

Lipson, B., 2014. The effects of task difficulty and reward opportunity on motivation. *The Huron University College Journal of Learning and Motivation*, 52(1), 102–120.

Lotti, L., Barile, L. and Manfredi, G., 2023. Improving recycling sorting behaviour with human eye nudges. *Scientific Reports*, 13(1), 10127.

Ludwig, T.D., Gray, T.W. and Rowell, A., 1998. Increasing recycling in academic buildings: a systematic replication. *Journal of Applied Behavior Analysis*, 31(4), 683–686.

Macklin, J., Curtis, J. and Smith, L., 2023. Interdisciplinary, systematic review found influences on household recycling behaviour are many and multifaceted, requiring a multi-level approach. *Resources, Conservation & Recycling Advances*, 18, 200152.

McCoy, K., Oliver, J.J., Borden, D.S. and Cohn, S.I., 2018. Nudging waste diversion at Western State Colorado University: application of behavioral insights. *International Journal of Sustainability in Higher Education*, 19(3), 608–621.

Metcalfe, A., Riley, M., Barr, S., Tudor, T., Robinson, G. and Guilbert, S., 2012. Food waste bins: bridging infrastructures and practices. *The Sociological Review*, 60(2), 135–155.

Ministry for the Environment, 2023. *Best Practice Communications for Waste Minimisation: A Guide to Support Effective Behaviour Change within Households*. Available online: https://environment.govt.nz/assets/publications/Waste/Best-practice-communications-for-waste-minimisation.pdf (accessed 9 February 2026).

Norgaard, K.M., 2009. Cognitive and behavioral challenges in responding to climate change. *Policy Research Working Paper*, No. WPS 4940, World Bank.

Office of the Planning Regulator, 2022. *OPR Practice Note PN03 – Planning Conditions*. Available online: https://publications.opr.ie/view-planning-practice-file/Njk= (accessed 30 January 2026).

Pongiglione, F., 2014. Motivation for adopting pro-environmental behaviors: the role of social context. *Ethics, Policy & Environment*, 17(3), 308–323.

RPS Group, 2023. 2022 *Household Kerbside Municipal Waste Characterisation*. Available online: https://www.epa.ie/publications/monitoring--assessment/waste/national-waste-statistics/2022-Household-Municipal-Waste-Characterisation-Report-(RPS,-2023).pdf (accessed 25 March 2025).

Shearer, L., Gatersleben, B., Morse, S., Smyth, M. and Hunt, S., 2017. A problem unstuck? Evaluating the effectiveness of sticker prompts for encouraging household food waste recycling behaviour. *Waste Management*, 60, 164–172.

Statista Research Department, 2024. Average number of people per household in Italy from 2010 to 2025. Available online: https://www.statista.com/statistics/790978/average-size-of-households-in-italy/ (accessed 20 May 2025).

Steg, L. and Vlek, C., 2009. Encouraging pro-environmental behaviour: an integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317.

Sunstein, C.R., 2016. People prefer system 2 nudges (kind of). *Duke Law Journal*, 66, 121.

Thaler, R.H. and Sunstein, C.R., 2008. *Nudge: Improving Decisions about Health, Wealth, and Happiness*. Yale University Press, New Haven, CT, USA.

VANG Household Waste, 2020. Improving waste separation in high-rise buildings. Available online: https://vang-hha.nl/kennisbibliotheek/improving-waste-separation-high-rise-buildings/ (accessed 25 March 2025).

VOICE, 2021. *Upgrading Shared Bin Experience Project*. Available online: https://apartmentownersnetwork.org/wp-content/uploads/2021/05/use-report-final-05-03-21.pdf (accessed 25 March 2025).

Williams, I.D. and Cole, C., 2013. The impact of alternate weekly collections on waste arisings. *Science of the Total Environment*, 445, 29–40.

WRAP (Waste and Resources Action Programme), 2020. *Comparing the Performance and Costs of Collection Schemes*. Available online: https://www.wrap.ngo/sites/default/files/2020-08/WRAP-consistency-comparing-performance-cost-collection-schemes.pdf (accessed 20 May 2025).

Xu, D.Y., Lin, Z.Y., Gordon, M.P.R., Robinson, N.K.L. and Harder, M.K., 2016. Perceived key elements of a successful residential food waste sorting program in urban apartments: stakeholder views. *Journal of Cleaner Production*, 134, 362–370.

Yang, Z., Jin, D., Huang, H., Zheng, X., Liu, S. and Wang, A., 2025. Nudging Health Behavior Change Among Home-Based Cardiac Rehabilitation Patients: A Scoping Review. *Journal of Multidisciplinary Healthcare*, 1639–1653.

Zentrale Stelle Verpackungsregister, 2025. Recycling starts with sorting: new data, positive trends and remaining challenges in packaging recycling. Available online: https://www.verpackungsregister.org/en/foundation-authority/press-media-section/newsdetail/recycling-starts-with-sorting-new-data-positive-trends-and-remaining-challenges-in-packaging-recycling (accessed 6 February 2026).

Zero Waste Europe, 2021. The story of Milan: successfully collecting food waste for over 1.4 million inhabitants. Available online: https://zerowastecities.eu/wp-content/uploads/2021/11/Milan-Case-Study-1.pdf (accessed 20 May 2025).

Appendix 1 Draft Standard for Waste Storage Area Design for Future Apartments in Ireland

A1.1 Introduction

This is an overview of a draft ideal waste storage area design informed by key stakeholders in the industry and qualitative findings and learnings from monitoring the nudging intervention trials. The first step in offering guidance on how to design a suitable waste area is to understand the required bin storage capacity for the apartment building. Once the capacity of the waste area is understood, the design of the waste area can be planned accordingly.

The draft design is a suggested standard waste area serving a block of 60 apartments, with space for five 1100-litre waste bins and three 140-litre bins. In this example, there is also a single 240-litre bin for an additional waste stream (e.g. glass). The size of the waste storage area was calculated using a formula developed in this research project. It allows room to ensure no overlapping of bins and ample manoeuvring space, with clear access to water and power sources. The standard design and management approach is based on British Standard 5906:2005. This standard is already used as a reference in guidelines and waste bye-laws in Ireland.

A1.2 Capacity Calculation

Using observations from the nudging intervention trials and guidance from British Standard 5906:2005, the proposed size, location and design features of the waste areas are proposed in this section. As the British Standard was written several years ago, current waste production levels, segregation rates and targets have been considered, and a calculator has been developed to work out the required capacity of current and future Irish apartment waste areas.

The nudging trial interventions provided an indication of the average production of residual and segregated waste from several apartment blocks in Galway city. Based on the end-of-trial data, which reflects the benefits of implementing the nudging interventions, the minimum number of food waste bins required for a given number of apartments was determined. The findings of this analysis are shown in Table A1.1.

In discussion with our focus group, it was suggested that a reduced capacity for residual waste would encourage segregation of waste, as this has seen success in European trials (personal communication; M. Giavini, ARS Ambiente, Italy, May 2025). Therefore, we suggest a 30% reduction in residual waste storage, along with an increase in dry recycling, and that food waste storage capacity remains unchanged. The resulting configuration is detailed in Table A1.2. It should be noted that the configuration results in a residual waste level of 73.3 litres per apartment per week (this is the bin volume of 1100 litres divided by 15, the number of apartments served by one bin). While this represents an improvement, it remains a conservative target. To align with European recycling targets, a more ambitious benchmark of 40 litres per apartment per week should be considered and trialled.

In Table A1.3, a calculation is presented to estimate the floor space required for an apartment complex serving any number of apartments. However, we realise that scaling the calculation to serve more

Table A1.1. Required number of bins per number of apartments

Bin type	Bin volume (litres)	No. of apartments served by one of each bin
Food waste	140	20
Residual	1100	10
Dry recycling	1100	15

Table A1.2. Reduced residual waste level considered

Bin type	Bin volume (litres)	No. of apartments served by one of each bin
Food waste	140	20
Residual	1100	15
Dry recycling	1100	10

Table A1.3. Waste area capacity calculator

Bin type	Variable							
	A	B	C	D	E	F	G	H
	No. of apartments in proposed complex	Collection schedule (times collected per week)	Bin volume (litres)	No. of apartments served per bin	Floor space required per bin (bin size ×3, to allow manoeuvring) (m²)	No. of bins required ((A/D)/B)	Floor space required for each bin type (F × E) (m²)	Total floor space required (sum of all values of G) (m²)
Food waste			140	20	2.4			
Residual			1100	15	4.5			
Dry recycling			1100	10	4.5			
Additional (e.g. glass)								
All bins								

User to add relevant values for variables A and B for each bin type (food waste, residual, dry recycling and additional) and calculate the values of variables F, G and H accordingly.

Table A1.4. Example: a waste area serving 60 apartments with biweekly collection of recycling and residual waste and weekly collection of food waste

Bin type	Variable							
	A	B	C	D	E	F	G	H
	No. of apartments in proposed complex	Collection schedule (times collected per week)	Bin volume (litres)	No. of apartments served per bin	Floor space required per bin (bin size ×3, to allow manoeuvring) (m²)	No. of bins required ((A/D)/B)	Floor space required for each bin type (F × E) (m²)	Total floor space required (sum of all values of G) (m²)
Food waste	60	1	140	20	2.4	3	7.2	
Residual	60	2	1100	15	4.5	2	9.0	
Dry recycling	60	2	1100	10	4.5	3	13.5	
Glass	60	1	240	60	2.4	1	2.4	
All bins								32.1

Table A1.5. Roles and responsibilities

Role	Responsibility
Developer	Design of waste segregation areas
Local authority	Enforcement of planning conditions
Owners' management company	Signage and security installation, and compliance with any bye-laws

than 90 apartments leads to very large waste area suggestions, as it will always aim to ensure ample manoeuvring space and keep access to the bins clear. The developer must know two variables before building the development: the number of apartments that the waste area will serve and the collection schedule of the waste management company responsible for the complex. These are variables A and B, respectively.

The calculation gives values for variables F and G, which are used to calculate the number of waste receptacles required and the floor space needed for these to be comfortably accessed and manoeuvred. Column H shows the total floor space required, which is the sum total of column G. The intention is that this table is to be used by developers to help them calculate the size of the waste area required for the proposed apartment complex. Blank cells should be completed by the developer.

The calculator also allows for additional bin types to be included, for example a glass bin.

In Table A1.4, an example calculation is presented for the floor space required for an apartment complex serving 60 apartments.

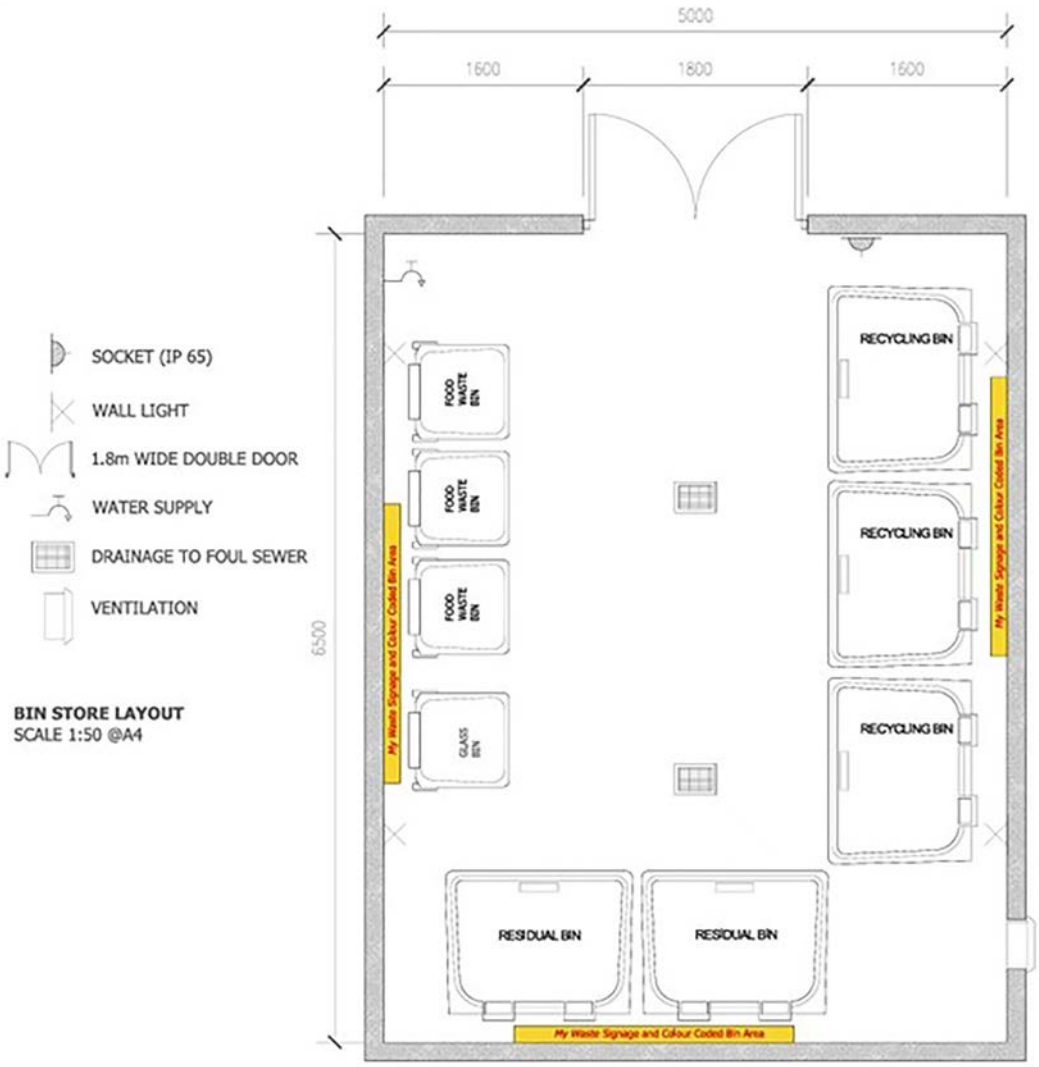

Figure A1.1. Draft design of waste storage area.

A1.3 Discussion: Waste Storage Area Design Plan

Figure A1.1 illustrates the proposed layout for a standard waste area serving 60 apartments, based on the capacity calculations detailed in Table A1.2. Table A1.6 outlines the key design considerations for this waste area. This design ensures ample space for easy manoeuvring of bins and includes provision for an additional 240-litre bin (labelled “glass bin” in Figure A1.1), which could be used for glass or any other future waste streams that may need to be accommodated. The waste area also incorporates access to water and electricity, with sufficient room to access power sockets and the water supply, ensuring comfortable space for multiple users to access bins simultaneously.

Feedback from stakeholders in the focus groups has been incorporated into the design. For example, waste collectors have highlighted that doorways and overcrowding within waste areas can hinder their

Table A1.6. Draft standard

Item	Standard	References
Frequency of collection	High-volume waste streams should be collected more frequently than low-volume waste, i.e. residual waste and recycling should be collected more regularly to save space.	BSI (2005)
Location	It is suggested that the waste area be a separate structure from the apartment blocks, and not in the underground parking garage.	BSI (2005)
	Apartment block door should not be further than 20–30 m from the waste area.	
Access for residents	Access for residents (including wheelchair access) must consider slope and width of path: • standard steepness; • minimum width of 1.5 m for access path.	BSI (2005); BSI (2018)
	The door is locked, with only residents given access.	
	Access to bins should not be blocked by other waste receptacles at any time.	
Doorway	Vented door with no lip. Minimum 1.8 m wide for bin access. Doors open outwards. Access controlled through keycard/key/code.	–
Access for waste collectors	The turning circle of waste truck must be considered if waste area is accessed by collector company.	BSI (2005); Dún Laoghaire–Rathdown County Council (2020)
	No raised threshold in the doorway obstructing the wheels of bins.	
	Access to bins should not be blocked by other waste receptacles at any time.	
	There should be an independent building for waste, but if not possible, use the underground parking garage.	
	If waste area is in the underground garage, then bins must be left outside the parking garage to be collected.	
	If bins to be left at kerbside, then they must not obstruct the path.	
	Management must ensure bins are wheeled out and then back following collection.	
Water supply and drainage	There must be access to water in the waste area.	BSI (2005); Carey *et al.* (2005)
	There must be a hand washing facility.	
	There must be a drain at the lowest point of the waste area.	
	Waste water must drain to a foul sewer.	
Lighting	Adequate sensor-controlled lighting must be provided.	BSI (2005)
Roofing	Waste areas should have a roof to avoid vermin around open receptacles. The roof will also prevent rainwater from entering waste receptacles and increasing run-off. Dry mixed recyclables are also damaged through rainfall.	None thus far
Security	Cameras can be installed to ensure that any poor sorting or dumping of electrical waste or furniture is discouraged.	Dún Laoghaire–Rathdown County Council (2020)
	Fire detection and alarm systems and nuisance control should be considered.	
Signage	There should be detailed signs showing what material can go in each bin; worn signs must be replaced to ensure readability and the signs must be updated to reflect the latest recycling guidelines.	BSI (2005); Dún Laoghaire–Rathdown County Council (2020)

BSI, British Standards Institute.

ability to efficiently use the space. Specifically, waste collectors noted that doors with raised thresholds make it difficult to move bins in and out of the area. Additionally, it was pointed out that many waste areas lack space for expanding waste streams or increasing recycling capacity, should the need arise. Our design also considers current waste production rates, recycling targets and best practices to encourage greater recycling participation.

Further design considerations include the need for a roof to protect waste from rain and prevent bins from filling with water. Effluent and wastewater run-off should also be avoided. Ideally, waste areas should be separate structures rather than integrated into underground parking garages.

A key criterion to make the waste area convenient for use by residents is its location within 20–30 metres of the entrance of the apartment block. Within the area, food waste and recycling bins should be the most accessible and easy to use.

A1.4 Recommendation

This is a theoretical exercise, and the design needs to be piloted at a new apartment complex before becoming national policy. If the design becomes national policy, it could be implemented by inclusion as an update to the guidance *Planning Design Standards for Apartments – Guidelines for Planning Authorities, 2025* (DHLGH, 2025). These guidelines are used by local authority planning offices to assess planning applications for new apartments.

A1.5 Bibliography for Appendix 1

BSI (British Standards Institute), 2004. Standard No. 840. Mobile Waste Containers. Part 1, Containers with 2 wheels with a capacity up to 400 l for comb lifting devices, dimensions and design. Part 2, Containers with 4 wheels with capacity up to 1300 l with flat lid(s), for trunnion and/or comb lifting devices, dimensions and design. BSI, London.

BSI (British Standards Institute), 2005. Standard No. 5906. Waste Management in Buildings – Code of Practice. BSI, London.

BSI (British Standards Institute), 2009. Standard No. 8300. Design of Buildings and Their Approaches to Meet the Needs of Disabled People. BSI, London.

BSI (British Standards Institute), 2018. Standard No. 8300. Design of an Accessible and Inclusive Built Environment: Buildings – Code of Practice. BSI, London.

Carey, C., Phelan, W. and Boland, C., 2005. *Organic Waste Management in Apartments*. Environmental Protection Agency, Johnstown Castle, Ireland.

South Dublin County Council, 2015. *Dublin Waste Plan – Appendix C: Guidelines for Waste Storage Facilities*. Available online: https://www.sdcc.ie/en/services/environment/recycling-and-waste/waste-management-plan/ (accessed 6 February 2026).

Dún Laoghaire–Rathdown County Council, 2020. *Guidance Notes for Waste Management in Commercial and Residential Developments*. Dún Laoghaire, Ireland.

Kildare County Council, 2015. *Eastern-Midlands Region Waste Management Plan 2015–2021*. Available online: https://kildarecoco.ie/YourCouncil/Publications/Environment/WasteManagementPlans/Evaluation%20of%20Kildare%20Waste%20Managment%20Plan/ (accessed 6 February 2026).

Local Government Ireland, 2024. *National Waste Management Plan for a Circular Economy 2024–2030 – Volume 1: Current Situation and Challenges*. Available online: https://mywaste.ie/sustainability/circular-living/national-waste-management-plan-for-a-circular-economy-2024-2030/ (accessed 6 February 2026).

West Regional Authority, 2010. *Regional Planning Guidelines for the West Region*. Available online: https://www.nwra.ie/wp-content/uploads/Planning-Guidelines-for-the-West-Region.pdf (accessed 6 February 2026).

Appendix 2 Waste Characterisation Details

Table A2.1 shows a breakdown of the waste characterisation results of each trial where data is available.

Table A2.1. Waste characterisation results

			Total organic and compostable waste				Total contamination level			
			Pre-trial waste characterisation		Post-trial waste characterisation		Pre-trial waste characterisation		Post-trial waste characterisation	
Phase	Location	Trial type	kg	%	kg	%	kg	%	kg	%
1	GNR 1	BP	43.6	93.2	117.8	98.9	3.2	6.8	1.3	1.1
1	GNR 2	Reach everyone	41.8	96.8	125.6	97.0	1.4	3.2	3.9	3.0
1	GNR 3	Educational leaflet	60.0	94.9	138.5	98.1	3.2	5.1	2.7	1.9
1	GNR 4	Constant tutoring	79.4	94.1	88.7	95.7	5.0	5.9	4.0	4.3
1	GNR 5	Motivational messaging	40.1	98.5	102.4	98.8	0.6	1.5	1.2	1.2
1	Semple Mills	Rewards	24.5	96.5	21.2	100	0.9	3.5	0.0	0.0
2	Gort na Coirbe Left	Food waste bin at the entrance	7.2	97.0	45.6	99.6	0.2	3.0	0.2	0.4
2	Gort na Coirbe Right	Reduced capacity for residual waste	1.3	97.8	38.7	98.3	0.03	2.2	0.7	1.7
2	Fana Lair Left and Right	Social housing BP	38.1	93.9	83.3	97.8	2.5	6.1	1.8	2.2
4	Old Windmill Court	Reach everyone and motivational messaging combined with food waste bin at entrance	88.4	94.0	214.1	98.6	5.7	6.0	3.0	1.4
Average (%)			–	95.7	–	98.3	–	4.3	–	1.7

Appendix 3 Example of Notification Letter to Apartment Occupants

Foster ENVIRONMENTAL

Copper Beech House,

66 Delmere, Enfield,

Meath. Ireland

xx.xx.2025

Dear (name of Apartment Complex) Resident,

Foster Environmental will be starting next week a food waste recycling trial in your apartment block for 6 weeks. This trial is part of an Environmental Protection Agency funded research project on how to improve food waste recycling across apartments in Ireland.

We will be delivering a basic package to your apartment next week. This will consist of a food waste kitchen caddy, 25 compostable liners and an instruction leaflet. We encourage you to put all food waste into the brown caddy, using the green compostable liners to line the inside.

We will also be keeping you up to date with our research and informing you how you are performing during the six weeks.

Diverting food waste from landfill is very good for the environment because you avoid methane emissions, which contribute to global warming. You are also helping to increase the amount of compost and renewable energy generated. Composting food waste is an environmentally friendly way of returning the nutrients to the land.

If you have any questions or would like to know more about our research, feel free to contact us at [insert email address]

Yours Sincerely,

Foster Environmental

Figure A3.1. Example of a letter to notify residents of the changes for food waste management as per the standard service.

Appendix 4 Weekly Motivational Messages

Figure A4.1. Weekly motivational messages. The first image shows the message provided with the BP. The others show the messages provided in weeks 1, 2, 3, 4 and 5, respectively.

Appendix 5 Instruction Leaflet

Figure A5.1. Instruction leaflet provided to apartment residents.

Appendix 6 Images

Figure A6.1. BP used as part of all the trials and in the validation phase.

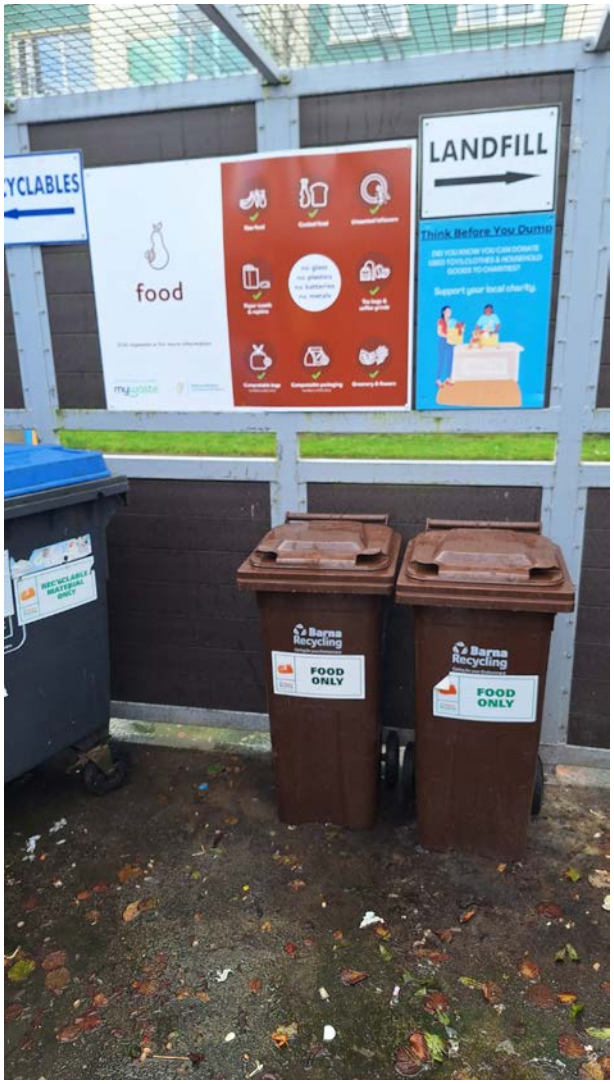

Figure A6.2. Example of a waste shed prepared in advance of the trials. Signs have been erected and the food waste bins powerwashed and labelled clearly.

Figure A6.3. Phase 2 food waste bin at entrance trial. For the duration of this trial and its extended period in the summer months of 2024, the food waste bin was placed in this location proximal to the apartment entrance door.

Figure A6.4. Example of waste characterisation.

Abbreviations

BP	Basic package
GNR	Gleann Na Rí
MSW	Municipal solid waste
RC	Relative change
RWMO	Regional Waste Management Office
WERLA	Waste Enforcement Regional Lead Authorities

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 truaillithe.

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 ardchaighdeáin, spriocdhírithe 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 peitril 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 Ghníomhú 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 taismí 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 chomhshaoil 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 Inbhunaitheacht 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.

EPA Research

Webpages: www.epa.ie/our-services/research/
LinkedIn: www.linkedin.com/showcase/eparesearch/
Twitter: @EPAResearchNews
Email: research@epa.ie