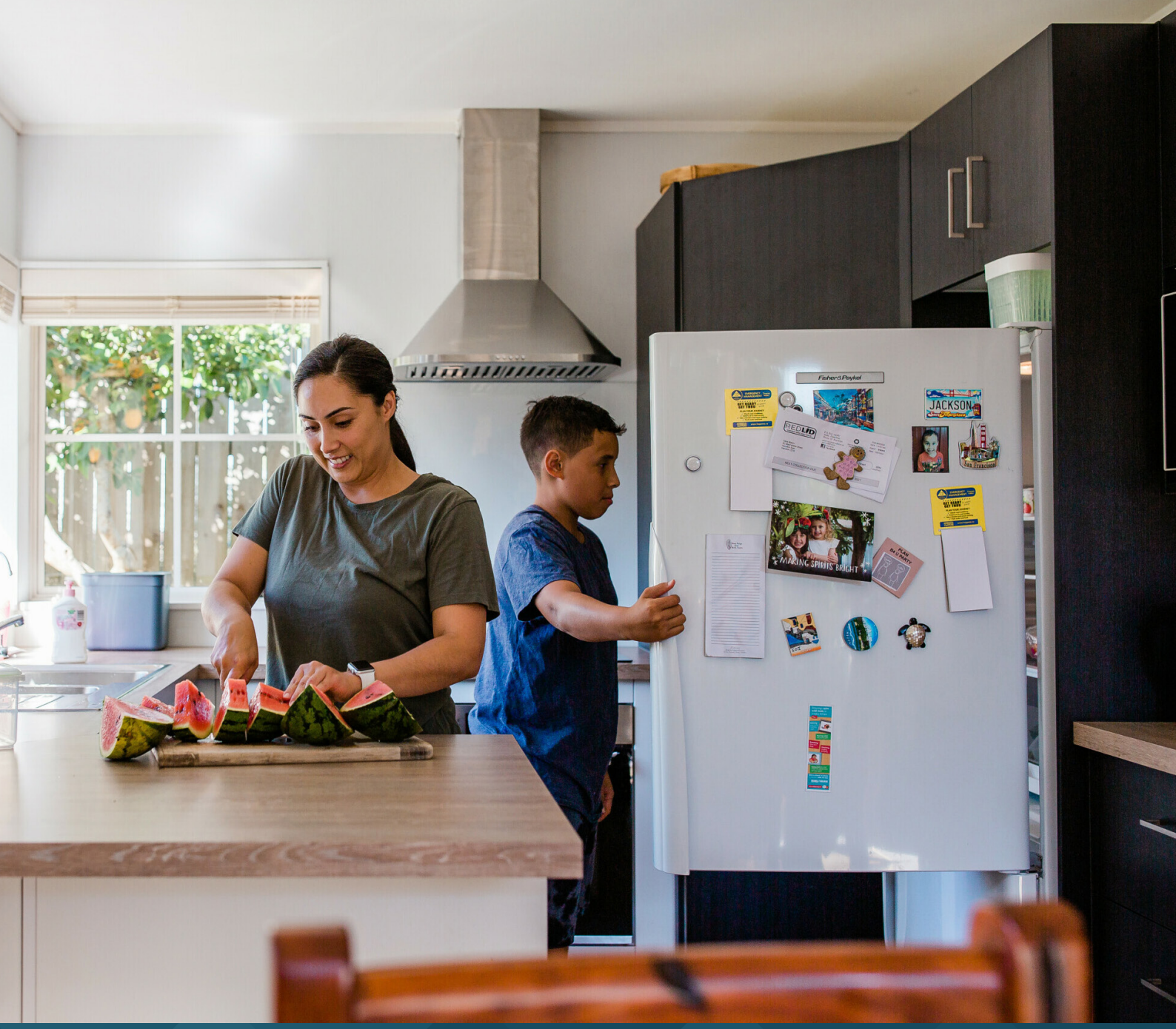

LITERATURE REVIEW

Reducing household and business food waste

Effectiveness of organic waste reduction initiatives

Ministry for the Environment
Manatū Mō Te Taiao

Te Kāwanatanga o Aotearoa
New Zealand Government

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Introduction

This literature review identifies successful organic waste reduction initiatives that have been trialled and evaluated internationally. The review focuses on three specific actions identified in Aotearoa New Zealand's first emissions reductions plan:

- action 15.1.1: Encouraging behaviour to prevent waste at home – specifically food and garden waste
- action 15.1.2: Enabling businesses to reduce food waste
- action 15.1.3: Supporting participation in improved kerbside collections.

The review considers behavioural initiatives and interventions. It largely excludes traditional levers for change, such as purely technological fixes, process improvements, or economic incentives and disincentives.

Summary of key findings

The research highlights several themes:

- A narrow focus on information sharing is not sufficient to change behaviour.
- There is value in interactive capability-building activities that better equip households and businesses to reduce food waste.
- Measurement matters. Measuring food waste helps people to realise the extent of their food waste contribution and can drive positive change.
- The desired behaviour needs to be easy. People need to have the right tools and receive timely reminders of what to do.
- A large body of literature supports using social norms to drive behaviour change.
- Behaviourally informed initiatives, such as gamification, commitment devices, and emotive feedback, are emerging as ways to support positive change.

Part 1:

Preventing food waste at home

Target behaviours

There are many opportunities to prevent household food waste – meal planning, shopping, storage and meal preparation, and then disposing of food waste. The target behaviours at each stage are described below and in figure 1, as illustrated in the Champions 12.3 Consumer Guide (Champions 12.3, 2022).

Planning

Food waste is generated when households do not use their perishable ingredients before the use-by date, and when meals are prepared but not eaten in their entirety. Households can reduce food waste by planning their meals and their food shopping. Target behaviours include:

- taking an inventory of the food available in the home prior to shopping
- planning meals, including meals that have shared ingredients
- making a shopping list
- ensuring householders communicate with each other to prevent double-up purchases

(Karunasena, Pearson, Nabi and Fight Food Waste CRC 2020; Schanes, Dobernig and Gozet, 2018).

Shopping

Households frequently purchase more food than they need, which drives food waste. There are many reasons for this including:

- a strong identity as a 'provider'
- shopping in a hurry which leads to impulse purchases
- purchasing food in bulk or in oversize packaging
- accommodating preferences of household members
- mitigating guilt about unhealthy purchases by purchasing a large quantity of healthy, perishable food (known as the compensation effect) (Schanes, Dobernig and Gozet, 2018)
- food waste tends to go up when people do a bigger shop, less frequently, rather than a smaller, more frequent shop (Schanes, Dobernig and Gozet, 2018;).

Target behaviours to reduce food waste include:

- shopping with a list
- avoiding shopping in a hurry
- using online shopping services and food boxes in order to prevent impulse buying (Karunasena, Pearson,Nabi and Fight Food Waste CRC, 2020; We are what we do, n.d.)
- shopping more frequently.

Storing

Storing food in an appropriate manner can extend its shelf life and reduce food waste. Target behaviours include:

- following guidance about how to store the food
- organising food from oldest to newest in the fridge or pantry to encourage the consumption of products before they expire
- organising food by frequency of use, for instance, so that high-use products are clearly visible
- understanding how to store fresh produce so it lasts longer eg, whether in the fruit bowl or in the fridge wrapped or unwrapped, and freezing food to extend its shelf life.

(Karunasena, Pearson,Nabi and Fight Food Waste CRC, 2020; Schanes, Dobernig and Gozet, 2018).

Preparing

Households may generate a large volume of food waste at the preparation stage - if they fail to use ingredients that are close to expiring, if they prepare meals that go uneaten, or if they unnecessarily peel or discard parts of vegetables eg, broccoli stalks. Target behaviours include:

- cooking smaller meals more frequently
- preparing meals with foods that are soon to expire, and eating the oldest foods first
- preparing meals that align with people's preferences, particularly with children who tend to have more limited palates and who contribute significantly to food waste volumes
- preparing an appropriate amount of food - which requires an understanding of portion size, and the use of tools such as measuring cups
- where possible, cooking with the whole food, for instance, roasting vegetables with the skin on.

(Karunasena & Pearson, 2022; Karunasena, Pearson,Nabi and Fight Food Waste CRC, 2020; Schanes, Dobernig and Gozet, 2018; We are what we do, n.d.)

Consuming and disposing

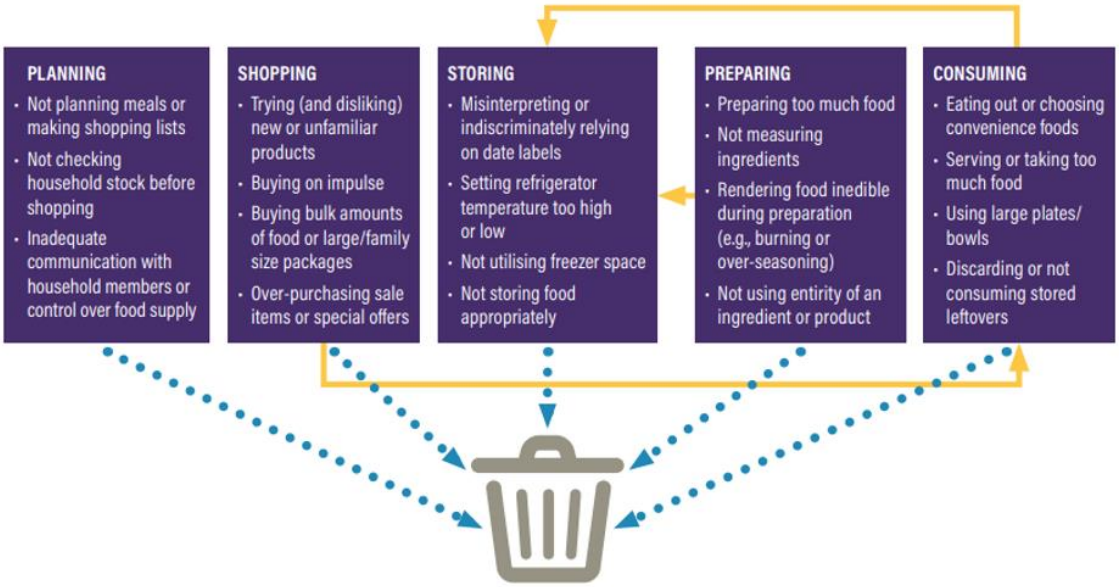
This includes 'reusing' and consuming food that has already been prepared or disposing of food waste in a way that retains the some of the value of the resource. "Reusing leftovers is considered one of the most effective strategies to combat food waste at the household level" (Schanes, Dobernig and Gozet, 2018, p.984)

Target behaviours include:

- storing leftovers appropriately in the fridge or freezer, so that they can be eaten at a later date
- preparing meals with leftovers - which requires knowledge about how to do this safely
- preparing meals from partially used ingredients
- disposing of food waste by feeding it to animals, or by diverting it to a worm farm or the compost if food is inedible or remains uneaten

(Karunasena, Pearson, Nabi and Fight Food Waste CRC, 2020; Schanes, Dobernig and Gozet, 2018; We are what we do, n.d.).

Figure 1: Key stages and behaviours



Behaviour-change initiatives

Behaviour-change initiatives reviewed can be clustered into three broad categories:

- **campaigns and events** that raise awareness of the issue
- **information sharing and capability-building** initiatives that build people's capability to prevent food waste
- **tools, prompts or nudges** that make it easier for people to engage in the target behaviour.

However, the boundaries are somewhat artificial, as, for instance, a campaign could raise awareness, teach householders how to plan a weekly shop, and provide prompts such as a shopping list.

Media campaigns and events

Campaigns aim to raise awareness of food waste as an issue, and to change consumer behaviour, often by providing 'tips and tricks' about how to reduce food waste in the home. There tends to be a strong focus on planned shopping behaviours, and on preparing meals that use up leftovers. However, the full spectrum of target behaviours (listed above) may be covered in campaign materials. Campaigns may also provide people with tools to enable behaviour change - for instance, portion-planning tools (WRAP 2022b) or shopping list templates.

Campaigns are typically led by NGOs, often in collaboration with national regulators or local government, and with private sector partners. Delivery occurs via a range of channels including websites, apps, brochures and printed material. People may be rewarded for their participation with free giveaways, such as tote bags and fridge magnets. A small number of

campaigns include more investment-heavy approaches. For instance, print, radio or television advertisements may be funded; Italy has a 'Chef save the food' cooking show which teaches householders how to make meals out of leftovers (see Caldeira, De Laurentiis and Sala, 2019), and a UK charity hosts 'Feed the 5000' events, in which a communal feast is served to 5,000 people, using food that would have been wasted (Global Feedback Ltd, 2022).

Examples of well-known national campaigns include - Love Food Hate Waste; Denmark's 'Stop Wasting Food' campaign (Stop Spild Af Mad); the Netherlands 'Becky' campaign; and the 'Too good to waste' campaigns from the United States. In some instances, smaller-scale campaigns have been led by retailers (eg, Young et al, 2017).

Information-sharing and capability-building initiatives

Information-sharing initiatives focus on building people's knowledge base, for instance, by teaching them about the environmental impacts of food waste, and the types of food that are commonly wasted. Information sharing can either be passive or active. Passive approaches include the production of standard information which is shared with members of the public, either via printed materials or online. For example, in Aotearoa New Zealand, local councils have set up stalls at markets, supermarkets, and A&P shows to share information on food waste or demonstrate simple recipes for using up leftovers.

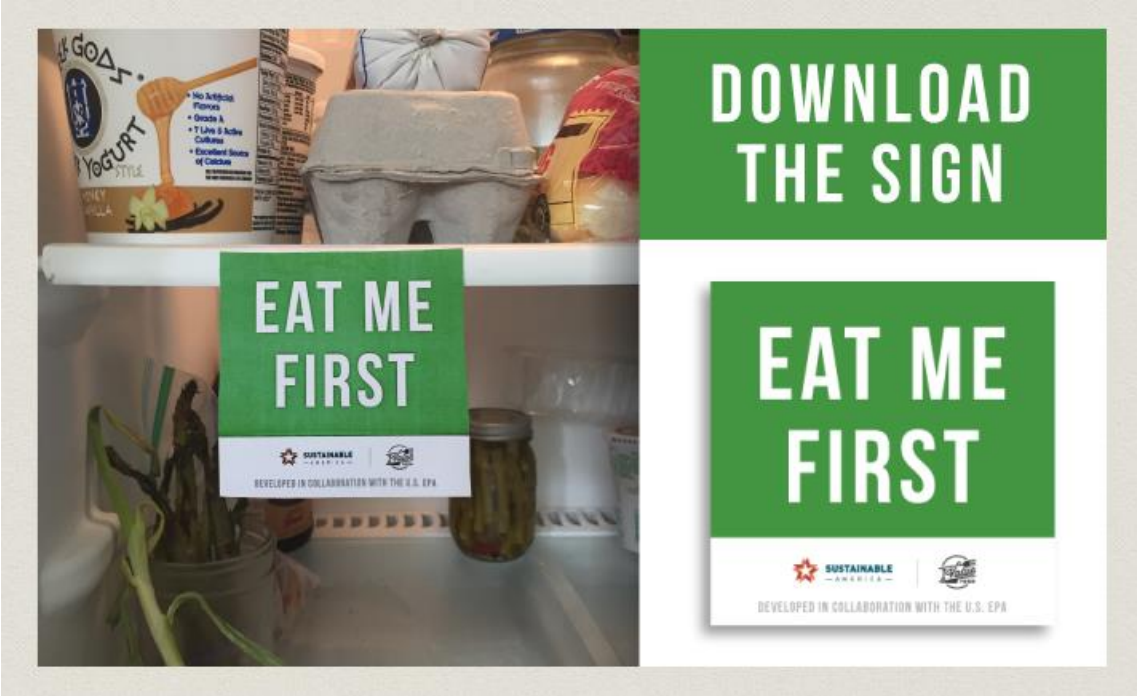
Capability-building initiatives tend to be more interactive in smaller groups, often with face-to-face engagement that equips households to engage in waste-prevention activities. For instance, Love Food Hate Waste UK runs community-based cooking lessons to teach people how to prepare meals with leftovers, and training workshops to teach people how to shop, store, prepare and use up food in order to minimise food waste (Yamakawa et al, 2017).

Tools, prompts, nudges and 'consumer challenges'

Tools, prompts and nudges as a category refers to all initiatives that aim to make it easier for people to engage in a target behaviour, but that do not focus on information sharing or education. The focus is on creating an enabling context. Examples could include:

- tools that support planning and shopping - for instance, shopping lists, chalk boards, menu planning tools, and measuring cups that encourage people to cook appropriate portion sizes (We are what we do, n.d.)
- products that mean shoppers can buy only what they need – for instance, single-serve packages of food (Hebrok and Boks, 2017), or bulk bin refills
- technologies that make it easier for households to use up their food before it spoils – for instance, smart fridges that colour code the contents by date (Hebrok and Boks, 2017); smart labels that change colour when opened and give a visual indication of shelf life (We are what we do, n.d.)
- prompts that remind householders to eat their open, partially used ingredients or leftovers – for instance 'Eat me first' labels (see fig 2); or encourage consumers to reduce their food waste when dining - for instance, when restaurants offer a doggy bag. (Refer to the section on Preventing food waste from businesses for more on this)
- 'consumer challenges' that ask people to commit to a target behaviour for a set period of time, to help trigger habit change and to make the target behaviour more of a social norm. For instance, the 'Love a List' challenge by Love Food Hate Waste Victoria encourages people to use and stick to their shopping list, while grocery shopping.

Figure 2: Eat me first reminder from Sustainable America



The evidence base: What works?

Although a wide range of interventions have been proposed and rolled out, there is a relative lack of evidence about what works to reduce household food waste, and why (Stöckli, Niklaus and Dorn, 2018; Reynolds et al, 2019). Academics have called for the evidence base to be strengthened, which should include long-term evaluations of behaviour-change interventions (eg, Stöckli, Niklaus and Dorn, 2018).

The evidence available indicates that:

- information sharing alone is generally ineffective
- community engagement and capability-building initiatives are generally effective
- multi-pronged campaigns are effective
- measuring household food waste drives behaviour change
- tools and prompts are useful add-ons
- consumer challenges show promise, but the evidence base is light
- there is evidence in favour of a range of behavioural insights - such as norms, emotive messaging that taps into loss aversion, gamification and commitment devices.

Information sharing alone is generally ineffective

In their review of the food waste literature, Stöckli, Niklaus and Dorn (2018) found information-based interventions are the most common initiative for reducing household food waste, "even though evidence indicates that this intervention type is relatively ineffective". Similarly, Barker et al's 2021 review found that disclosure alone, or revealing the environmental costs of food waste, was not effective at changing food waste behaviour at the household level.

Information-based interventions can be somewhat effective when they are delivered in an intensive manner. For instance, a Netherlands-based study challenged 100 households to live 100 per cent waste free for 100 days (Van der Werff et al, 2019). (This initiative straddles 'information provision' and 'challenges', as described below.) Participants received weekly information and assignments about food waste, and they could share food waste tips with others. Food waste was minimised in the intervention group, however the changes in behaviour were limited (ibid).

Information-based interventions are also more likely to succeed when they are paired with another form of intervention – for instance, measuring food waste, or using a tool or prompt (both described below). This likely explains why an Arizona-based study found that online education effectively reduced household food waste, because participants were taught how to measure their food waste as part of the programme (Wharton et al, 2021).

Community engagement and capability-building initiatives are generally effective

The evidence indicates that community engagement and capability building initiatives generally lead to improvements in household food waste behaviours. For instance, community-based training and events run by Love Food Hate Waste UK have led to significant reductions in household food waste, and these initiatives are generally cost effective (Yamakawa et al, 2017). Similarly, a field experiment conducted by Romani et al (2018) found that educating people about meal planning, while providing recipes and an Excel tool for menu planning, led to a significant reduction in food waste – a result partially driven by an improvement in the consumers' perceived meal planning skills.

Community engagement likely succeeds because it involves face-to-face interaction and because community-based initiatives help to create social norms around food waste (Yamakawa et al, 2017). The most effective initiatives also involve frequent engagement with stakeholders (United States Environmental Protection Agency, 2016). However, community engagement is not always effective. Community-based workshops may have low levels of attendance if people have scheduling conflicts or they are unable to access childcare (Soma, Li and Maclaren, 2020), and door-to-door engagement is not recommended as it is not cost-effective (Yamakawa et al, 2017). Given these limitations, intervention designers should test and refine their community engagement strategies over time.

Multi-pronged campaigns are effective

As noted earlier, food waste campaigns aimed at households tend to be multi-faceted, and include media content or events, capability-building initiatives, and the provision of tools and prompts. As such, it is not possible to delineate the impact of a specific tactic and to track its effectiveness. Campaigns also tend not to publish effectiveness data, and the data that is available is often incomplete (Caldeira, De Laurentiis and Sala, 2019).

Despite these limitations, multi-pronged campaigns appear to be effective in driving behavioural change.

- According to the UK's Love Food Hate Waste campaign, seven out of ten citizens who engage with the campaign go on to change their behaviour (WRAP, 2022a), and from 2007 to 2012, the amount of avoidable food and drink waste generated by households in the UK (at the aggregate level) decreased by almost one quarter (Yamakawa et al, 2017).

- The Netherlands 'Becky' campaign led to a recorded drop in solid food waste from 30.4kg in 2016, to 26.5kg in 2019 (Karunasena et al, 2020). The volume of purchased food that was then wasted also decreased from 13.6% in 2010 to 9.5% in 2019; however, these results cannot all be attributed to the campaign (ibid).
- The United States 'Food: too good to waste' campaigns were associated with reductions in preventable food waste – between 11 and 48 per cent reduction by weight, and between 27 and 39 per cent reduction by volume (United States Environmental Protection Agency, 2016).

Finally, there is some evidence that campaigns which rely solely on social media channels are not as effective as those that include a face-to-face component (United States Environmental Protection Agency, 2016; Young et al, 2017).

Measuring household food waste drives behaviour change

One of the most consistent findings in the literature is that households who measure food waste are more likely to reduce their food waste (eg United States Environmental Protection Agency, 2016; Yamakawa et al, 2017).

> "It is thought to be necessary that people recognise the amount of food waste they actually throw away before accepting some advice on skills and tips for food waste prevention" (Yamakawa et al, 2017, p.11)

Without measurement, households often assume that they produce minimal volumes of waste (J. Marshall, personal communication, 22 August 2022; M. Mirosa, personal communication, 25 August 2022), so they feel they aren't part of the problem. As Dr Miranda Mirosa explains -

> "when you start to ask people to measure or separate their waste, eg, for audit or kerbside collection – that can be a successful behaviour change intervention, because what is invisible becomes visible. The invisibility of waste is problematic" (ibid).

Measurement helps to raise awareness of the volume of food waste produced, and activate feelings of waste aversion, or a dislike of feeling wasteful (United States Environmental Protection Agency, 2016). Measuring food waste also acts as a form of feedback, and people are more likely to change their behaviour when they receive prompt and personalised feedback (Thaler and Sunstein, 2008).

Many of the campaigns described above include kerbside rubbish bin audits as part of their methodology for measuring and making the amount of food waste visible to householders .

Tools and prompts are useful add-ons

Providing tools or prompts can increase the effectiveness of campaigns or capability-building initiatives. As a review of US-based campaigns found:

> "The evidence on the effectiveness of specific strategies and tools indicates that strategies associated with a tool are considered more useful than those without a tool" (United States Environmental Protection Agency, 2016, p.25)

In terms of specific tools and prompts, research advocates for the value of shopping lists. One study found that using a shopping list led to a per-capita reduction in food waste of approximately 20 per cent (Schanes, Dobernig and Gozet, 2018). Similarly, Sustainability Victoria's 'Love a List' challenge, which encouraged people to voluntarily sign up to write an

accurate shopping list and to stick to it, led 87 per cent of participants to achieve a self-reported reduction in food waste (Reynolds et al, 2019). Over half of participants chose to keep using their list, after the four-week challenge (ibid). This speaks to the efficacy of the list as a tool and possibly the efficacy of the challenge design.

Emerging evidence is in favour of technologies that make it easier for people to identify what they have in their fridge, and when the food is set to expire. For instance, a colour-coded fridge has the potential to cut food waste by 25 to 50 per cent, according to early consumer testing studies (described in Hebrok & Boks, 2017).

Consumer challenges show promise, but the evidence base is light

There is relatively little evidence on the efficacy of consumer challenges as they specifically relate to food waste minimisation. As noted in earlier sections, the 'Love a List' challenge prompted consumers to stick to a shopping list and drove 87 per cent of participants to achieve a self-reported reduction in food waste (Reynolds et al, 2019); and a Netherlands-based challenge, in which 100 households were tasked with living waste-free for 100 days, led to some minimisation in food waste (Van der Werff et al, 2019).

More generally, it is likely that a time-bound challenge will help to draw attention to food waste as an issue, and disrupt habitual behaviours (Heidbreder, Steinhorts and Schmitt, 2020). For example, researchers found that Plastic Free July drives a small but statistically significant reduction in consumption of single-use plastic, among those invited to participate versus controls who were not told about the challenge (ibid). The campaign is also more effective among people with a low 'pro-environmental identity', which suggests that these campaigns could be a first step in adopting a more sustainable lifestyle. Similar challenges, such as Dry July, in which people abstain from alcohol for the month of July, have been found to drive longer-term behaviour change in those who complete the challenge – with completion rates higher amongst females and those who join internet community groups related to the challenge (De Ternay et al, 2022).

More evidence is needed on the specific factors that make up an effective challenge – for instance, the ideal duration (eg, 1-week, 2-weeks, 1-month etc), and the breadth of target behaviours.

There is evidence for a range of behavioural insights

Campaigns and capability-building initiatives appear to be more effective when they incorporate one or more behavioural insights, as described below.

- **Social norms:** Interventions are most effective when they tap into existing social networks or create social norms around food waste behaviours (United States Environmental Protection Agency, 2016). As Barker et al (2021) summarise in their review of nudge interventions, "Four studies deemed reliable show interventions using nudges of social norms, reminders or social norms with disclosure were effective in changing food waste behaviours at the household level, while disclosure alone, i.e., revealing environmental costs of food waste, was not" (p.1).
- **Emotive messaging and loss aversion**: Individuals are motivated to reduce food waste when there is an emphasis on what they stand to lose, whether that means wasting

money, or tapping into an aversion to throwing away food (United States Environmental Protection Agency, 2016).

- **Gamification**: Gamification, or the introduction of game-like elements to encourage people to engage in an activity, appears to encourage households to reduce their food waste to a greater extent than the provision of passive information alone (Soma, Li and Maclaren, 2020). In this study, the 'game' was an online quiz about food waste and target behaviours, in which participants could earn points over time, and exchange these points for a grocery card. Food waste audits found the gamification treatment to be marginally more effective than the information-only approach, and a promising area for further study.
- **Commitment devices**: Making a public commitment to reduce food waste can lead to positive changes in behaviour. For instance, a German-based study encouraged households to make a public commitment and set specific waste-reduction goals (Schmidt, 2016). After four weeks, the interventions led to significant improvements in waste behaviours, relative to an 'information only' condition – although waste behaviours were self-reported (ibid). Commitment devices have also proven effective at reducing business food waste (see below in Commitments to reduce food waste across the supply chain). The mechanism of public commitment is likely to be one of the reasons that challenges work well because participants seek to uphold their publicly made commitments.

Recommended additional reading

- Champions 12.3 Consumer Guide: Champions 12.3 has collated the 'Changing behaviour to help people waste less food' guide to help key actors in the food system to focus on how they can help consumers reduce food waste through behaviour change. (See https://champions123.org/publication/champions-123-consumer-guide)
- Survey of Existing Consumer Products and Services which Reduce Food Waste. (See https://shiftdesign.org/content/uploads/2014/09/shift_Food-Waste_survey.pdf)

Preventing garden waste at home

Target behaviours

Households can engage in a range of techniques to reduce the volume of garden waste that they produce at home. This includes, but is not limited to:

- lawn-mowing techniques to trim rather than cut the grass short, followed by 'grasscycling' in which trimmings are spread back on the lawn
- planting native trees that grow at a slower rate and thus require less pruning
- planting evergreens rather than deciduous trees which shed their leaves
- planting perennials instead of annuals.

Behaviour-change initiatives

There appears to be very little research and evaluation on the effectiveness of interventions to reduce garden waste, at the household level. The literature largely focuses on encouraging at-home composting or composting collection schemes, once green waste has been produced, and reducing green waste in industrial processes (for example, see Inghels, Dullaert and Bloemhof, 2016).

The evidence base – what works?

Evidence for norms and commitment devices

Cobern et al's (1995) experimental research examined whether households could be prompted to adopt grasscycling behaviours, through commitment devices and social diffusion. The US-based research had three conditions:

- a control condition
- a commitment condition in which households committed to grasscycling rather than disposing of grass clippings
- a commitment-plus-diffusion-condition, in which households committed to grasscycling and to talking to their neighbours about that commitment.

Households in the commitment-plus-diffusion condition were significantly less likely to dispose of their grass clippings via the municipal waste collection, compared to the commitment and control groups.

White and Simpson's (2013) research sought to identify the most effective normative appeal, to encourage households to engage in grasscycling behaviours. They distinguished between **injunctive norms**, which have a moral overtone and highlight what people should or should not do; **descriptive norms**, which simply describe the common behaviours or norms, within a group; and **individual benefits**, ie, messaging which is not focused on a norm. Messages were

modified to draw attention to a collective identity, or an individual identity. For instance, the message ”Your neighbours want you to grasscycle” combines an injunctive norm with the activation of an individual identity. The message “Join others in your community in grasscycling” combines a descriptive norm with the activation of a collective identity. Messages effectively increased grasscycling behaviours when there was alignment - ie, when a focus on collective identity was combined with the injunctive or descriptive norm, and when the focus on individual identity was combined with an individual benefit. Messages were least effective when there was a mismatch. For instance, when an injunctive ‘should’ message was combined with an individual benefit.

Part 2:

Preventing food waste from businesses

Target behaviours

Food loss refers to "food that gets spilled, spoilt or otherwise lost, or incurs reduction of quality and value during its process in the food supply chain before it reaches its final product stage" (UN Environment Programme, 2022). In contrast, food waste refers to food that makes it to the final product stage in a form that is fit for consumption, but that is not consumed (ibid). Food waste primarily occurs within food retail and hospitality (ibid).

Using this framing of food waste, retail and hospitality businesses can prevent food waste by preventing spoilage, preparation waste, and plate waste (NSW EPA, nd).

Spoilage refers to food that becomes damaged or that cannot be eaten because it is out of date and is potentially unsafe, or has decayed and is unfit for consumption (NSW EPA, nd). Spoilage can be reduced through process improvements such as:

- ordering and inventory management
- storage and handling (eg, packaging improvements that improve product shelf-life
- economic levers to ensure stock turnover (eg, reduced prices for soon-to-expire stock)
- flexible menus in hospitality venues.

(Huang et al, 2021; NSW EPA, nd; Okumus et al, 2020)

These improvements focus primarily on process, technology and economic levers, rather than behavioural interventions, meaning spoilage-related initiatives are not a key focus in this literature review.

Preparation waste refers to food that is discarded during the preparation of food for sale or consumption (NSW EPA, nd). Preparation waste in hospitality may include vegetable peelings and trimmings (J. Marshall, personal communication, 22 August 2022), or offcuts of meat. This type of waste can be minimised via alternative preparation methods like preparing vegetables with their skins on, or reusing offcuts and peels to make soup stock (ibid).

Plate waste refers to food that is served to customers but that is not eaten, and common sources of plate waste include servings of fries and garnishes (NSW EPA, nd). Plate waste can be reduced via interventions that encourage smaller serving sizes, remove side garnishes and that prompt diners to take their leftovers home.

Behaviour-change initiatives

Commitments to reduce food waste across the supply chain

Several countries have established voluntary, pan-industry campaigns or commitments focused on food waste reduction.

The United Kingdom's 'Courtauld Commitment', Norway's 'Negotiated Agreement on Food Waste Reduction', and the United States' 'Food Loss and Waste 2030 Champions' all seek to reduce food waste by 50 per cent by 2030, in alignment with the Sustainable Development Goals (Matvett, nd; United States Environmental Protection Agency, 2022; WRAPa, 2022). Participating organisations set their own targets, measure and report on their performance, and act to reduce their food waste volumes. This is known as the 'Target, Measure, Act framework'.

The UK and Norwegian agreements both emphasise the value of collaboration and capability building, as "measures at one point along the value chain may affect whether food is wasted or not, at another point along the chain. This means that the inclusion of [all industry players] . . . safeguards against disproportionate pressure on a single part of the entire food value chain" (One Planet Network, 2022). In the US programme, there appears to be less focus on collaboration to build capability; however, participating organisations can access technical support on an as-needed basis (United States Environmental Protection Agency, 2022). In the Norwegian agreement, the government helps to recruit public organisations and local government agencies, and the Ministry of Climate and the Environment is responsible for coordinating workstreams and ensuring joint reporting of results (Matvett, nd).

It is worth highlighting two other programmes that are now complete, but that functioned as large-scale commitment devices. Norway's CutFoodWaste2020 (or KuttMatsvinn2020) initiative sought to reduce food waste in the hospitality sector by 20 per cent over the period 2017–20 (European Commission, 2021). Again, the focus was on measuring waste and embedding improvements. Participating organisations had variable levels of capability, so the initiative also focused heavily on capability building and sharing best practice (Ostfold, circa 2020). Similarly, the United States Food Recovery Challenge was established by the Environmental Protection Agency, with a focus on measuring and reporting on food waste, but a unique angle in that organisations competed to win one of two annual awards (United States Environmental Protection Agency, 2022).

Initiatives to measure and reduce waste at the business level

Apps

A wide range of actions can reduce food waste at the business level. The most desirable action will depend on the specifics of the business, and the drivers of food waste. It is beneficial to first measure food waste across the production process, to pinpoint where waste is created and to start identifying solutions. Tools like the 'Waste Master' app can help in this regard. The app enables businesses to visualise and track food waste, so they can optimise operations and reduce food waste (Cited in Mattila, Mesiranta and Heikkinen, 2020). Other well-known apps include Leanpath and Winnow.

Training and toolkits

A number of programmes and toolkits have been created to assist businesses to reduce their food waste. These programmes typically provide guidance on first, how to measure, and then, how to reduce food waste.

Examples include:

- Unilever Food Services' 'Wise Up On Waste' Toolkit, to help foodservice operators to improve their food waste management practices (Unilever Food Services, 2022)
- the New South Wales Environment Protection Authority's 'Your Business is food' programme, in which participating organisations receive information, a toolkit, and prompts such as stickers, posters and coasters to encourage both customers and staff to change their behaviours. They also receive the support of a waste advisor who works alongside the business (NSW EPA; nd)
- the Smart Kitchen Initiative in the United States, led by a public agency. Medium and large-scale food service businesses, including colleges and hotels, receive a free one-year license for Leanpath, along with free training and support. In return, businesses commit to tracking their waste, setting targets and sharing their results (Mugica and Rose, 2019).

Challenges

Challenges are also used to target and reduce business-related food waste. Participating organisations typically sign up to the challenge, measure their waste, and receive support to reduce that waste over time. Examples include:

- Denver's Food Waste Restaurant Challenge, which was piloted and then rolled out more broadly. In the pilot phase, restaurants were asked to adopt one of the recommended food waste prevention strategies, which related to measuring and preventing food waste, donating it, or composting (City and County of Denver, 2022). Restaurants were also encouraged to add a menu item from food that would have otherwise gone to waste. The pilot ran from 2019 to early 2020 (ibid).

  In the wider roll out, participating restaurants were expected to register, implement a minimum number of strategies (eg, five), either on an ongoing basis or for a limited time, depending on the tasks (Hoover, 2020). Participating restaurants received support from programme staff, including training in how to reduce restaurant food waste (Hoover, 2020).
- The Worldchefs Food Waste Challenge (worldchefs.org/a-challenge-to-all-chefs-on-world-food-day/) runs for three months on a rolling basis (ie, restaurants can enrol at any point in time). Participants step through a planned programme introductory webinar, measuring waste, setting goals, attending check ins, and then completing the programme (Worldchefs, 2021).

Messaging and nudges to reduce plate waste from diners

Hospitality businesses and educational institutions have tested a range of interventions to encourage consumers to reduce their plate waste. Many initiatives have been trialled at buffet services, perhaps because the reduction in consumption volumes and food waste does not result in reduced revenue for the operator, whereas initiatives to reduce the volume of food ordered from a menu could cut into a restaurant's bottom line.

Certain initiatives make it harder to over-serve yourself, such as the removal of dining trays at all-you-can-eat establishments, smaller plates at buffets, initiatives that make it clear if a meal comes with a side, and smaller portion sizes for side orders (eg, Freedman and Brochado, 2010; Kallbekken and Saelen, 2013; Mirosa 2019; Wang et al, 2022).

Other initiatives have focused on messaging. Messages typically contain information about the impacts of food waste on the environment, (eg, Manomaivibool, Chart-asa and Unroj, 2016; Wang et al, 2022; Whitehair, Shanklin and Brannon, 2013), and they may contain additional features that drive a more emotional response (Wang et al, 2022) or that establish social norms around food waste reduction (Manomaivibool, Chart-asa and Unroj, 2016).

Another branch of activity encourages diners to take their leftover food with them, by offering a doggy bag or reusable container by default. This intervention is often paired with an awareness campaign, such as the 'Do not waste it, take what is yours' campaign in Portugal (Caldeira, De Laurentiis and Sala, 2019) and Zero Waste Scotland's 'Good to go' campaign (Exodus Research Ltd and Techview Consultancy, 2014).

Redistribution of unsold food retail and hospitality

Redistributing unsold food, including retail goods and prepared but unsold meals, can also serve to reduce food waste (see Caldeira, De Laurentiis and Sala, 2019). Food redistribution may be facilitated by NGOs or redistribution may occur via food sharing platforms, where producers list discounted foods which can be purchased by consumers (Frey et al, 2017).

Although food-sharing platforms are primarily a technical and economic solution, they are included here because they make food redistribution easier, and ease is a key feature in behaviour change interventions. Examples include Olio and ResQ club. The Olio app (Frey et al, 2017) allows users to share a photo of food that might go to waste, along with a pickup location, and then match with people who will collect the food (Olio, circa 2022). Participating restaurants in Finland can use the ResQ Club app to sell leftover lunchtime meals to consumers, at a discounted price, along with a timeline of when the meal should be collected (described in Mattila, Mesiranta and Heikkinen, 2020).

Labelling initiatives to educate consumers about best-before and use-by dates

A significant proportion of food waste at the retail and household level occurs because producers and consumers throw out food that has passed its shelf life (Matvett, circa 2022). However, there is a difference between a use-by date and a best before date.

- A use-by date is the date by when a food item needs to be consumed for food safety reasons.
- A best-before date gives an indication of the quality of the food before an estimated time.

To counter this issue, producers in countries including Norway, Sweden, France and Germany have either adopted or are soon to adopt supplementary date labelling, to raise consumer

awareness of the difference between use-by and best-before dates (Matvett, circa 2022). The framing of 'best before, often good after' is widely supported by organisations.[1]

International businesses are also participating in campaigns such as 'Look, Smell, Taste, Don't Waste' run by the food waste NGO, Too Good to Waste. These businesses can add a specific label on their food that encourages consumers to reconsider whether a food is past its best-before date, by using their sense of sight, smell and taste (Too Good to Go International, circa 2021).

These initiatives straddle the boundary between 'business food waste' and 'household food waste'; and they could be arguably placed in both categories.

Figure 3: Danish labelling 'best before often good after'

The evidence base: What works?

Many business-related studies have occurred in complex, real-world contexts, which makes it difficult to draw causal links between a specific initiative and a specific result. Evidence from experimental studies and evaluations indicates that:

- pan-industry commitments appear highly effective
- measuring business food waste drives behaviour change
- apps, training, toolkits and challenges are effective
- timely messages to diners can reduce plate waste
- nudge interventions prompt diners to waste less food and to take leftovers home
- more efficacy data is needed for food labelling campaigns and food redistribution platforms.

Pan-industry commitments appear highly effective

There is robust evidence that pan-industry commitments effectively reduce food waste. The UK's Courtauld Commitment found that, across 140 participating businesses in 2021, there was a year-on-year average reduction in food waste of 17 per cent (WRAP, nd). This equates to a saving of 250,000 tonnes of food waste. The earlier commitment (Courtauld Commitment 2025) also drove a 0.8 per cent reduction in absolute greenhouse gas emissions levels across

[1] https://www.thelocal.dk/20190226/danish-organisation-aims-to-reduce-food-waste-with-new-best-before-system/

the UK's food and drink system, between 2015 and 2019 (ibid). In Norway, the Negotiated Agreement on Food Waste Reduction contributed to a 14 per cent nationwide reduction in food waste between 2010 and 2015, and a further 12 per cent reduction between 2015 and 2019 (Matvett, nd). More specifically, the Norway Cut Food Waste programme found participants reduced waste by 15 per cent, the equivalent of 390 tonnes of food waste with 1,400 tonnes of associated CO_2 emissions (European Commission, 2021). There is also evidence in favour of the US programmes described earlier, both the Food Loss and Waste 2030 Champions project (USDA and USEPA, 2021) and the US Food Recovery Challenge (Chen and Chen, 2018; United States Environmental Protection Agency, 2022).

Commitment devices are likely to drive behavioural change because they raise the visibility of an issue, and because people and organisations seek to follow through with public commitments in order to maintain social standing (Dolan et al, 2010). These programmes also measure food waste (a valuable activity in itself), and they can serve to build capability, for instance, via the sharing of best practice. In the context of the Norway Cut Food Waste programme, researchers noted: "The capability across the different participating organisations was mixed, thus the mechanism of capability building by sharing best practices … became very successful" (Ostfold, circa 2020).

The presence of awards may have contributed to the success of the US Food Recovery Challenge – as award programmes raise awareness of an issue, and winning an award can instil pride and increase intrinsic motivation in a way that monetary awards may not (eg Frey, 1994). However, there appears to be little evidence on the efficacy of sustainability awards for driving behavioural change.

Measuring business food waste drives behaviour change

As with households, the process of measuring food waste helps to enable and drive behavioural change within businesses. As Professor Miranda Mirosa (2019) explained in her report to New Zealand's Parliamentary Environmental Committee, "Being conscious of where in the foodservice industry wasteful practices are happening and having strong data to support this is essential to inform behaviour and operational changes" (Mirosa, 2019, p.38).

In their analysis of 735 catering units, Eriksson et al (2019) found that simply measuring food waste led 61 per cent of organisations to minimise their waste. Measurement was most useful when repeated over time (ibid) – perhaps because this allows businesses to track their food waste reduction, and build momentum and buy-in. In a similar vein, the WasteMaster app, which visualises food waste in production systems, has supported food service organisations to reduce their food waste by 30–50 per cent (described in Mattila, Mesiranta and Heikkinen, 2020).

Measurement of food waste is likely effective in this context because it serves as a feedback loop. Organisations begin to understand their food waste volumes and where that waste is generated, which can drive learning and change. As Thaler and Ganser (2015) note, "Psychologists tell us that in order to learn from experience, two ingredients are necessary: frequent practice and immediate feedback".

Apps, training, toolkits and challenges are effective

Apps, training, toolkits that build capability, and time-bound or ongoing challenges are all effective strategies for reducing business food waste, though the evidence base for challenges is lighter than for the other approaches.

Apps

Data is available for specific apps. Leanpath is associated with a 50 per cent or greater reduction in food waste, in adopter organisations (Leanpath, 2022), and the Winnow app has saved 36 million meals per year and prevented 61,000 tonnes of CO_2 emissions (Winnow Solutions, nd).

Training and toolkits

Evaluations of the training and toolkits were all positive. Businesses found the 'Your Business is food' toolkit (from the New South Wales Environment Protection Authority) useful and were grateful for the support (Instinct and Reason, 2016). The programme was most impactful for food businesses with 30 per cent or more food waste in their general rubbish bins (ibid). The Smart Kitchen Initiative in the United States – Cal Dining, which operates the dining hall for residents at the University of California, saw a 19 per cent reduction in food waste (Mugica and Rose, 2019). This is the equivalent of 27 tonnes of food waste a year, with an associated USD$98,000 reduction in food costs (ibid).

Challenges

Results were available for Denver's Food Waste Restaurant Challenge (2022), but not for the Worldchefs Food Waste Challenge (2021). The Denver data showed that the rate of diversion of food waste from landfill was around 18 per cent at the start of the pilot. This figure rose to around 70 per cent once restaurants engaged with the challenge by preventing food waste and introducing composting (City and County of Denver, 2022; Hoover, 2020). Providing hospitality staff with training increased the potential for diversion to around 85 per cent or 90 per cent of waste (ibid) – a very strong result.

Timely messages to diners can reduce plate waste

Although information alone does not tend to reduce household food waste, it appears that timely messaging can encourage diners to reduce their food waste. For instance, Whitehair, Shanklin and Brannon (2013) found that simple messages in a university canteen led to a 15 per cent reduction in food waste.

Messages may become even more effective when paired with behavioural insights such as emotive messaging and social norms.

In terms of emotive messaging, Wang et al (2022) compared the efficacy of three interventions in staff cafeterias within a hotel chain in Macau, China. The control condition provided diners with feedback on the quantity of food waste generated over time. The first treatment arm included feedback and a pro-environmental message. The second treatment arm included feedback and an environmental message and emotive input (for instance a 'smiling food bowl' or a 'concerned planet'). Researchers found the feedback and pro-environmental message to

be moderately effective, but the greatest results were seen when the emotive cues were introduced (ibid).

Regarding norms, Manomaivibool, Chart-asa and Unroj (2016) sought to raise awareness of food waste on a university campus, via informative messages and prompts in the dining area. Students were also encouraged to share their support for the waste reduction strategies on social media, to increase the visibility of the campaign and help to create a social norm. In before-and-after analysis, the proportion of student diners who finished all of their food almost doubled, as a result of the campaign (ibid).

Nudge interventions prompt diners to waste less food and to take leftovers home

Nudge interventions appear to be effective in reducing plate waste from diners. Most initiatives focus on reducing the volume of food that is served to customers, or that customers serve themselves. In one widely cited study, Kallbekken and Sælen (2013) sought to reduce food waste in hostel restaurants by reducing the size of plates at the buffet, and by encouraging guests to visit the buffet multiple times - rather than overloading their plate. Both interventions reduced plate waste by around 20 per cent, achieving statistical significance, and both interventions were low-cost, easy to implement, and had no negative impact on customer satisfaction (ibid).

In a university canteen setting, Freedman and Brochado (2010) investigated whether serving students a reduced portion size would reduce calorific intake and plate waste. Results were positive, with a decrease in portion size leading to significant reductions in food consumed per diner and plate waste ($p<0.05$). Mirosa (2019) also points to international case studies that advocate for the removal of dining trays in all-you-can eat buffets, and for greater clarity about whether a main comes with sides.

Providing diners with a doggy bag by default also appears to be a very promising strategy for reducing food waste. Scotland's 'Good to go' campaign saw diner plate waste fall by an average of 42 per cent during the trial, and there was some evidence that the campaign led restaurants to redesign their menus (Exodus Research Ltd and Techview Consultancy, 2014). The intervention raised awareness of food waste as an issue and was popular with both customers and staff (Mirosa, 2019).

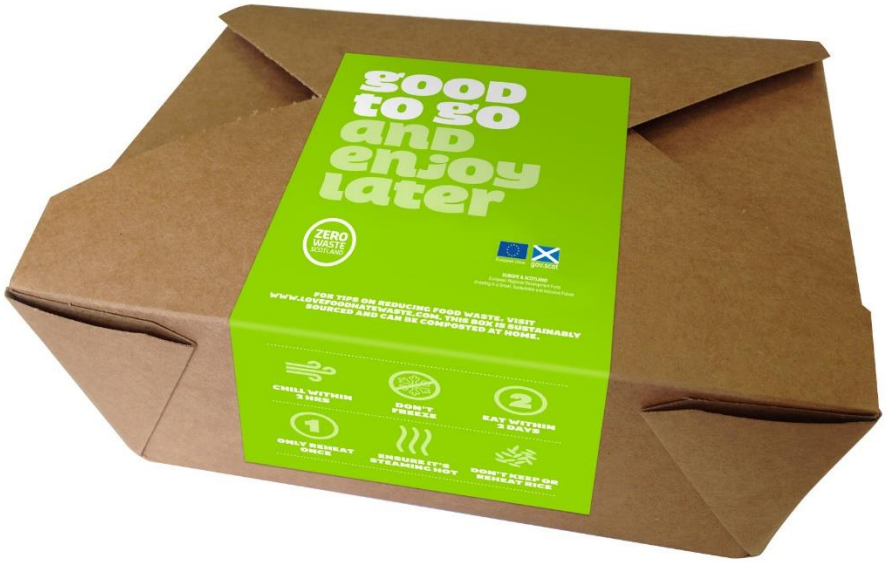
More efficacy data is needed for food labelling campaigns and food redistribution platforms

It is too soon to tell whether educating consumers about best-before labels will lead to a reduction in food waste, as many of these campaigns were introduced recently. Norway appears to be the first country to introduce additional date labelling (eg, 'best before, often good after'), in 2018. Following its introduction, seven out of ten surveyed customers said they felt more confident using their senses to determine whether a food was edible (Matvett, circa 2019). In the New Zealand context, Mirosa (2020) confirms that "Consumers can often waste food that is fit for consumption through a lack of knowledge of what these labels signify" (p.34), and she recommends a review of food labels, to address this confusion and to ensure food labels support both food safety and a reduction in food waste (ibid).

Food distribution organisations are succeeding in diverting food waste from landfill. Food distribution platforms have not yet been widely evaluated (Frey et al, 2017); however, results

are available for specific platforms. For instance, the Olio app has prevented 77,288 meals from being wasted (Frey et al, 2017), and in 2018, the ResQ Club helped to redistribute approximately 700,000 prepared meals, which equated to around 1,750,000 kilograms of CO_2 emissions (cited in Mattila, Mesiranta and Heikkinen, 2020).

Figure 4: Scotland's good to go containers



Part 3:

Encouraging participation in improved kerbside organic collections

Target behaviours

When it comes to encouraging participation in kerbside organic collections, households will ideally separate their organic waste, put it in the right bin, and put this bin out for collection. These behaviours help to divert organic waste from landfill and prevent contamination across the waste streams.

Behaviour-change initiatives

Establishment of services

It is an obvious point, but households cannot participate in kerbside organic collections if those services do not exist. As such, regulators or waste companies need to invest in building collections infrastructure, and operating a convenient collection service that households can engage in.

Information sharing and community engagement campaigns

Once kerbside collections are in place, households can be prompted to participate via information sharing initiatives and community engagement campaigns.

Information sharing tends to be passive – for instance, providing households with an information leaflet about the collection service and how to use it, and sharing information about the impacts of food waste on the environment or the household budget (eg, Bernstad, 2014; Shaw, Smith and Williams, 2018).

Community engagement campaigns tend to be more interactive. Community members may be involved in designing the communications, and key messages may be tailored to different target audiences. Information may be shared via door-to-door messengers recruited from community groups, and there may be mechanisms for ongoing engagement, enabling service providers or councils to share updates, and members of the public to ask questions.

Tools, prompts and nudges

A range of tools, prompts and nudges have been trialled to encourage household participation in organic collections – including the:

- provision of equipment
- use of timely prompts such as bin stickers

- use of norms messaging
- disincentives.

Providing equipment refers to providing households with a small benchtop bin or caddy for their organic waste, a larger storage bin, and potentially bin liners. These tools are designed to make it easier for households to participate in collections.

Timely prompts, such as bin stickers on the food recycling bin or the refuse bin, are designed to remind people to sort their waste (eg, Dai et al, 2015; Shearer et al, 2017). For instance, a UK-based research team added a bin sticker to the lid of household rubbish bins, which stated, "No food waste please: Remember to use your food recycling caddy" (Shearer et al, 2017).

Norms messaging can occur at two scales. First, high-level injunctive norms which highlight what community members 'should' do, can be used at the outset of a campaign to encourage household participation in collection services. Second, descriptive norm messages can be used as a form of feedback to highlight that many or most households are already engaged with the collection service, which should prompt non-participants to engage.

Disincentives refers to some form of charge for the creation of refuse or landfill waste - which should encourage households to increase their food waste recycling. This is known as a 'pay as you throw' policy (eg, Van der Werff et al, 2019).

The evidence base - what works?

The evidence base is emerging, but fairly consistent to date. Research shows that:

- information alone does not effectively drive behaviour change
- change occurs when services are well designed, and households receive simple at-home storage systems
- there is value in working with communities on design and rollout
- after rollout - bin sticker 'prompts' are effective
- norms messaging is effective
- disincentives for waste creation can be effective.

Information alone does not effectively drive behaviour change

The evidence base suggests that providing households with information about the value of food waste recycling is insufficient to drive behaviour change. In a Swedish case study, households were either provided with information leaflets about food waste separation or provided with the equipment to support waste separation. Information alone was ineffective at increasing food waste separation or food waste volumes (Bernstad, 2014). Similarly, a UK study compared the effectiveness of two informative messages, one focused on the economic impact of food waste, one on the environmental impact, and a control condition in which households received no information. There were no statistically significant between-group differences in terms of the volume of food waste produced.

Change occurs when services are well designed and households receive simple at-home storage systems

This review focuses on supporting participation in improved kerbside collections. Although not the focus of this review, the evidence suggests that an 'improved service' would involve:

- fortnightly collection of waste
- the collection of food waste alone, rather than food and garden waste
- convenient or easy-to-use tools to support participation (Government of South Australia, 2010; Hyder, 2012; Ladele, 2020; Rawtec, 2019; VANG Household Waste, 2020; WRAP, nd).

Participation increases when households are provided with appropriate at-home storage systems. The evidence suggests households prefer to receive a ventilated benchtop caddy and compostable liners - rather than an unventilated and unlined container (Government of South Australia, 2010; Hyder, 2012; McInnes and Cavanagh, circa 2018; McDonogh, circa 2021). These initiatives consistently achieve high diversion rates. For instance, diversion of 70 per cent or higher in trials in South Australia (Hyder, 2012); 80 per cent in a trial of 'wet and dry' organics in Shoalhaven City Council (ibid). A reduction in the proportion of organic waste in refuse bins from 39–29 per cent was also found after a multi-faceted community engagement campaign in Ireland that included the provision of kitchen caddies and compostable bags (Cré et al, 2015).

Providing supermarket shoppers with compostable bags for their fruit and vegetable purchases can also make it easy to engage in food waste collections. A field experiment found consumers preferred this initiative over accessing council bags, and follow-up bin audits indicated that compostable bags had been used in the green waste collection, and that the volume of green waste per household increased, both of which are positive signs (Rawtec, 2019).

There is value in working with communities on design and rollout

The evidence suggests that the most effective interventions and communications are tailored to the nuances of the local community (VANG Household Waste, 2020; New South Wales Environment Protection Authority, 2021). For instance, researchers in the Netherlands stated,

> "A diagnosis must therefore be conducted before the right intervention(s) can be selected. The devil is in the detail" (VANG Household Waste, 2020, p.9).

Similarly, the New South Wales 'Scrap Together' campaign led to improved diversion rates across three councils, and in this campaign, "Councils were provided with the Scrap Together creative collateral and were supported by the EPA in *tailoring the template communications plan so that it reflected their individual communities and context*" (New South Wales Environment Protection Authority, 2021, p.3, emphasis added).

The evidence also suggests that it is best practice to collaborate with trusted community partners, when rolling out a new collection service. For instance, Shoalhaven City Council's trial of a 'wet and dry' organics collection achieved fantastic results, diverting 80% of waste from landfill, and much of this success was thought to be driven by the community engagement approach (Hyder, 2012). The Council consulted extensively with the community prior to rollout, partnered with community groups to support information sharing during the launch, provided updates via community groups, established a 'shop front' where citizens could ask

questions or share concerns, and made home visits to elderly citizens in the area (ibid). Another successful trial in Gippsland, Australia included the door-to-door distribution of kitchen bins and education packages by community groups (Hyder, 2012).

Finally, there is mixed evidence on the value of door-knocking to provide information and equipment to households. A Swedish study found the benefits of door-knocking eroded over time (Bernstad, la Cour Jansen and Aspegren, 2013), whereas Dai et al (2015) found door-knocking and information sharing to be effective. Information in this study was shared via visual aids (two A2-size posters), an information leaflet, and hand-size stickers to put on the fridge or kitchen caddy, to prompt people to create compost or pig-feed from their food waste. Pre and post-intervention data showed that households receiving the intervention captured significantly more food waste in the appropriate collection (ibid). However, these effects were recorded two weeks after the intervention and it is possible that the results would have degraded over a longer timeframe, or that the results were driven primarily by the sticker intervention, as described below, rather than the information or the door-knocking.

Bin sticker prompts are effective after rollout

Bin stickers are a surprisingly effective intervention for increasing participation in kerbside organic collections. In their large trial involving over 63,000 households in South-East England, Shearer et al (2017) found that adding a sticker prompt to the refuse bin, stating 'No food waste please: Remember to use your food recycling caddy' led households to capture 20 per cent more food waste in the organics collection. This significant result was achieved for just £0.35 per household. No changes were seen in the control condition, ie, households that did not receive a bin sticker (ibid). Similarly, studies in the Irish context found that in Buncrana, close to 600 households only received a sticker intervention on their residual bin, and no other initiatives (eg, information leaflets or a kitchen caddy). The sticker alone increased participation in collections and the tonnage of food waste collected (McDonogh, circa 2021).

Norm messages are effective

A range of researchers have advocated for the importance of social norms in driving increased participation in kerbside organic collections. In Canada, researchers found norms favouring green bin use to be one of the strongest predictors of support for green bins, along with individual concern for environmental impact, and convenience (Ladele, 2020). In the Netherlands, researchers found setting group goals and receiving feedback to be one of the most effective interventions for driving change (VANG Household Waste, 2020).

Earlier we distinguished between injunctive norm messages that focus on what community members 'should' do, and descriptive norm messages that serve as a form of feedback about what others are doing. Both forms of messaging appear to be effective.

Regarding injunctive norms, Swedish researchers developed a pamphlet that called for residents to join their neighbours in recycling their food waste, highlighting that "in a survey recently sent out to households in Hökarängen around eight out of ten residents stated that they considered recycling food waste to be '"very important'" (Linder, Lindahl and Borgström, 2018). When these prompts were shared via an information leaflet, along with images to help people identify the community food waste bins, the rate of food waste recycling lifted significantly and remained elevated throughout the follow-up period of close to two years (Linder, Lindahl and Borgström, 2018).

The data on descriptive norms is a little less clear. A US-based study found that households who were told “x per cent of households in Costa Mesa separated all of their food scraps this week”, with the percentage value randomly varying between 75% and 84%, were more likely to separate their food scraps compared with a control group. However, the effect size was relatively small. In contrast, a UK-based study activated norms at the street level rather than the household level by providing households with a postcard, indicating whether they were in a high-performing street or a low-performing street (Nomura, John and Cotterill, 2011). The message to high-performing streets was paired with a smiley face, while low-performing streets saw a sad face. Results showed that high-performing streets maintained their performance over time, and low-performing streets improved (ibid). These two studies suggest that it is good practice to activate a collective norm (street vs street, rather than household vs street), to use emotive feedback, and to draw on real-world data that people can trust.

Disincentives for waste creation can be effective

A final mechanism for improving participation in food waste collections is to increase the associated cost of throwing out waste. For instance, Van der Werff et al (2019) reviewed the impact of a ‘pay as you throw’ (PAYT) intervention that charges households based on the volume of waste created. PAYT effectively diverted food waste into the organic collection, but it did not lead to a reduction in food waste volumes. The PAYT model has been successful in both the US and Japan, leading to reduced waste volumes of 17–30 per cent, driven by increased recycling rates and the reduction of waste at the source (ibid).

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