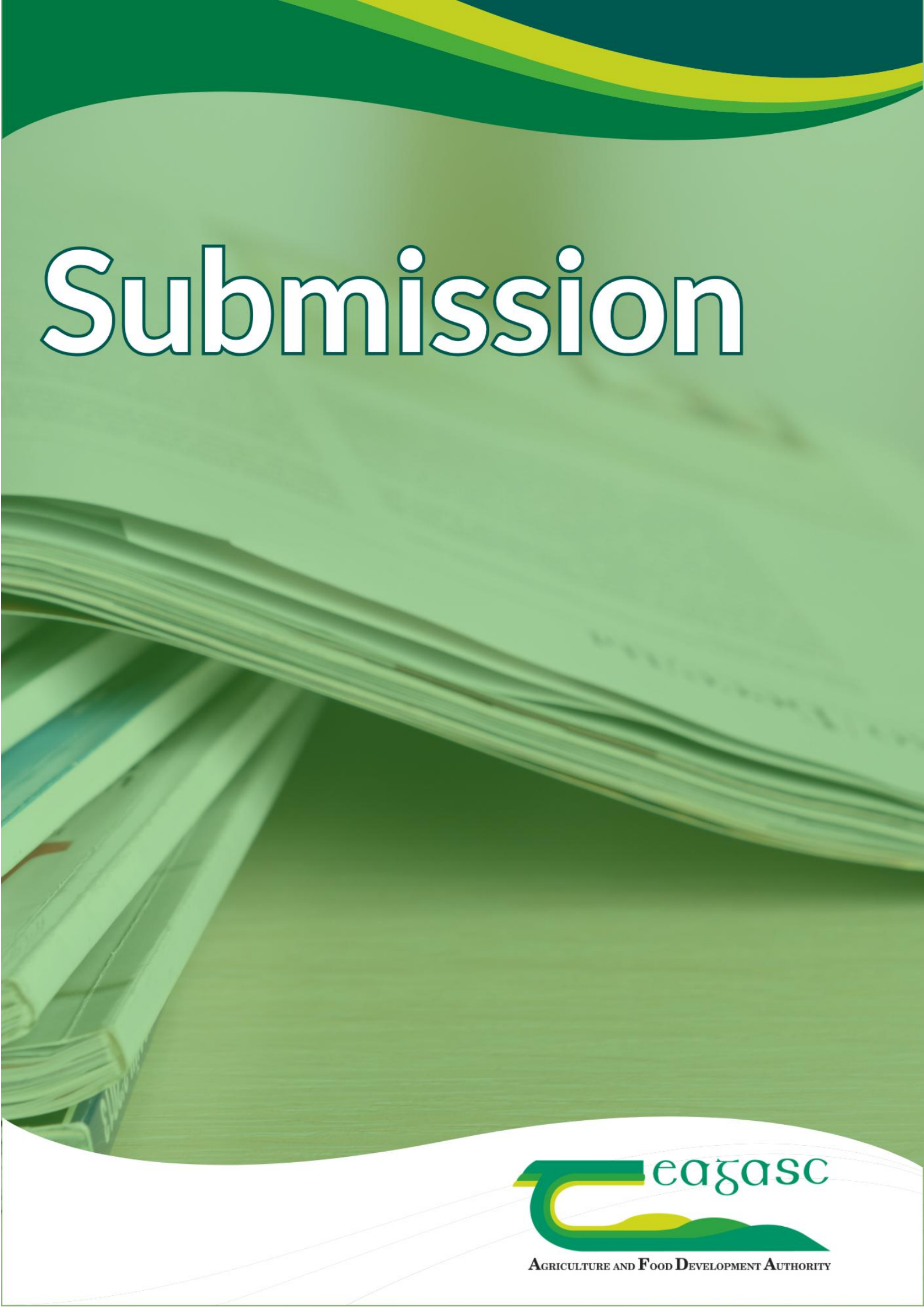
Submission



Teagasc

Agriculture and Food Development Authority

Teagasc Submission in Response to Department of Climate, Energy and the Environment (DCEE) Public Consultation on the National Food Waste Prevention Roadmap 2026-2028

28th August 2026

Preamble

Teagasc welcomes the opportunity to contribute to the public consultation on the National Food Waste Prevention Roadmap 2026-2028. We have reviewed the draft roadmap document and provide some comments and suggestions to not only help Ireland to meet EU legal obligations to reduce food waste by 2030, but to also achieve a more sustainable food system, delivering for primary producers, industry, retailers and consumers.

This submission was prepared by Ciara McDonagh, Maeve Henchion, and Shay Hannon, with contributions from Angelo Galatolo, Declan Bolton, Dermot Callaghan, Kaye Burgess, Michael Gaffney, and Siobhan Jordan. (The ordering of authors and contributors is alphabetical and does not reflect the contributions made). It brings together a wide range of expertise across Teagasc's research programme, including the Food Programme and the Rural Economy and Development Programme as well as industry engagement and research commercialisation expertise.

The response was prepared to respond to questions that were asked in the consultation. This document starts at Question 3 as question 1 and 2 related to the name and contact details of the person making the submission and the name of the organisation involved.

Question 3: Do you think the approach as outlined in the draft Roadmap will be effective in helping to deliver the reductions necessary to meet Ireland's food waste reduction targets under the revised Waste Framework Directive, and Ireland's commitment to achieve the UN SDG 12.3?

The approach outlined in the draft Roadmap is comprehensive and, if implemented, should deliver significant improvements towards Ireland's obligations under the revised Waste Framework Directive, and Ireland's commitment to achieve the UN SDG 12.3. A small number of targeted refinements (expanded below) would increase the likelihood of reaching the targets and help convert measurement and awareness into sustained, scalable action across the supply chain.

- Reference to circular economy and bioeconomy approaches are welcome. It would be useful to explicitly connect food-waste reduction and valorisation actions to greenhouse gas (GHG) mitigation, resource efficiency and bioeconomy job/market opportunities so research, investment and policy incentives target climate, circular and bioeconomy objectives.

- Improvements in food waste measurement, data capture, and reporting across the supply chain as indicated will be impactful. Opportunities to publish food waste statistics at commodity level could also be useful. The potential of digital tools and data sharing approaches (e.g. demand forecasting, dynamic pricing) that are practical for SMEs and larger companies could be further highlighted. (Care is needed however to ensure that sensors and monitoring technologies do not contribute to waste if they are poorly calibrated, overly conservative, or generate false positives that lead to unnecessary product rejection).

- In the context of research and innovation, it would be useful to:

    - prioritise applied, supply-chain-wide research that supports Ireland's 2030 food waste reduction target.
    - support innovation in shelf-life extension, packaging, and product reformulation e.g. using shelf-life estimates based on the real-world conditions in domestic fridges and tools to improve supply-demand matching between farmers or growers and retailers.
    - focus applied research on interventions that directly support the 2030 reduction target (shelf-life assessment and extension, cold chain modelling, packaging innovation, reformulation).
    - in the context of unavoidable waste, valorisation of food by-products and side-streams into higher-value ingredients, animal feed, bio-based materials and fermentation substrates should be emphasised.

- Awareness raising is required across all actors. However, it is not sufficient to effect change. It needs to be supported by specific training pathways for primary producers, processors, retailers, food service, and social economy entities, and a structured approach, with such training delivered through existing channels (Environmental Protection Agency (EPA), Teagasc, Enterprise Ireland and Bord Bia networks). Trust building initiatives are essential at consumer level.

- The Food Waste Charter provides an important platform that can be leveraged further, e.g. it could be a single-entry point that automatically links SMEs to mentoring, diagnostics and funding.

- Opportunities for alternative marketing models could also be supported. The EU funded *ROSETTA* project identified and profiled a comprehensive portfolio of eleven alternative marketing models, including value-added product transformation, innovative packaging & custom portion sizes, mobile applications and advanced logistics & inventory technologies.
- Support for applied pilots in real supply-chain settings, including farms, food manufacturers, retailers, food service operators, and public sector operated catering facilities (e.g. hospitals, schools, canteens) is likely to be beneficial to progress beyond awareness to building trust.
- A careful, proportionate approach to reporting and legal obligations needs to be maintained.
    - Continue to strengthen voluntary measurement and reporting while exercising caution on universal mandatory reporting—if mandated, it should be narrowly targeted, proportionate and phased to avoid imposing disproportionate burdens on primary producers and small processors.
    - For the Directive's donation agreement requirement, adopt a phased implementation prioritising large retailers, manufacturers and distribution centres, while ensuring redistribution capacity is scaled in parallel.

These refinements build on the Roadmap's strengths - measurement, collaboration and targeted sector actions - while ensuring research, technology, training and funding are directed toward practical, evidence-based prevention and valorisation that deliver both statutory targets and broader climate and circular bioeconomy benefits.

Question 4: In your opinion, which actions included in the draft Roadmap will be the most effective in reducing food waste? Are there any other actions that should be considered?

There are several complementary actions in the Roadmap that are likely to have a great impact on reducing food waste, by addressing its underlying causes across the food supply chain. Continued strengthening of food waste measurement and reporting will enable government and businesses to identify where waste occurs, monitor progress and implement targeted prevention measures. Expanding the EPA's Food Waste Charter will further support action by encouraging businesses to measure, reduce and report food waste, while promoting collaboration and the sharing of best practice. Sustained behavioural change and awareness programmes will also be critical, particularly at consumer level, given that households remain the largest source of food waste. In parallel, the Roadmap prioritises reducing waste in the hospitality, retail and manufacturing sectors through sector-specific guidance, improved food waste segregation and greater collaboration to address supply chain inefficiencies. Strengthening surplus food donation and redistribution will ensure that edible surplus food is redirected for human consumption where prevention is not possible, in line with the food use hierarchy.

Additional or strengthened actions that could be considered include:

- Further developing the Food Waste Charter into a target-based national voluntary agreement, similar to the UK's WRAP *Courtauld Commitment* and the Netherlands' *Samen Tegen Voedselverspilling*, where businesses commit to measurable food waste reduction targets and share best practice.
- Greater emphasis could also be placed on supporting the adoption of digital technologies, including AI-enabled demand forecasting, inventory management and dynamic pricing of short-

dated food, particularly in the retail and hospitality sectors where these approaches have proven effective.

- Green Public Procurement could go further by requiring food waste prevention measures in publicly funded catering, such as the mandatory measurement of food waste; redistribution of safe surplus food; menu planning standards and rewarding suppliers with certified food waste reduction programmes. As proposed in the *ROSETTA* project policy recommendations, rules could be revised to accept suboptimal foods, e.g. accept fruit and vegetables that do not meet stringent aesthetic retailer specifications but remain safe and suitable for meal preparation.

Question 5: What are the most effective awareness-raising measures and behavioural change interventions that could be considered to support efforts to reduce food waste?

Awareness and education remain necessary but insufficient tools for reducing food waste. International evidence and recent Irish stakeholder workshops *(ROSETTA*, 2026) show consumer education scores highly for perceived effectiveness, yet academic research emphasises two key psychological preconditions for behaviour change: awareness of consequences and ascription of responsibility. Unless people both understand the economic, environmental and social harms of wasting food and recognise their personal and collective responsibility to act, simple awareness campaigns are unlikely to produce durable behaviour change. This means campaigns must do more than raise visibility - they must build capability (awareness, knowledge and practical skills), opportunity (access to infrastructure and services) and motivation (social norms and incentives) so that people can and will actually adopt new practices.

Campaign design should therefore combine repeated, practical messaging with context-changing interventions and careful communications strategy. Proven approaches such as WRAP's *Love Food Hate Waste* illustrate the value of sustained, segmented messages, along with free tools (meal planners, storage guidance, recipes). Results from *ROSETTA* pilots in retail outlets in Spain and Greece indicate that combining sustainability and health messages with price discounts generated substantially higher absolute sales of suboptimal products than the price-only control. School-based capacity building (e.g. building on *Food Dudes*-style programmes) can shift norms early and create household spillovers. At the same time, Teagasc's consumer survey, carried out under the EU funded *ROSETTA* project, in collaboration with UCC and the Copenhagen Business School, highlights an important communication caveat for novel products and channels: consumer responses to upcycled foods depend strongly on product cues and the timing of disclosure. Labelling and certification to build trust must be combined with tested messaging strategies (and possibly alternative terminology from "upcycled food"). Digital nudges and apps trialled in *ROSETTA* (including examples from real-world retailers and food processors in Greece and Denmark) show further potential to deliver personalised, timely prompts, along with price discounts and messaging around health and sustainability, that translate awareness into action.

Behaviour change at other points in the chain is also important but communication to underpin this needs to be framed to align with actor priorities in terms of production efficiency enhancements or cost reductions rather than waste prevention alone. For producers and processors, framing measures as production-efficiency and cost-reduction improvements is likely to resonate strongly and providing targeted technical support for on-farm and in-factory loss reduction are likely to be more effective. An interesting finding from a feasibility study on block chain and digital passport technologies in

cereal supply chains in Poland for traceability purposes found that adoption is driven primarily by compliance requirements and operational integration, rather than the prospect of providing consumers with a transparency story. Thus, for retailers and producers who consider investments in supply chain technology, the business case should be built around operational reliability and regulatory compliance, not around consumer-facing storytelling. ROSETTA's pilots and Teagasc's research and innovation supports together demonstrate that combining evidence-based behavioural design with practical business language and technical support increases uptake among non-consumer actors.

Linking awareness raising and behavioural change programmes with monitoring and evaluation of interventions would also be beneficial. Building on the success of the EPA's food waste standard food waste measurement protocol tool, interventions could be evaluated with clear KPIs (kg food saved, tonnes diverted to different waste prevention channels, GHG avoided, and cost-benefit) to identify what works and for whom. This information would enable the most effective interventions to be adapted and expanded, with appropriate policy supported if needed, with clear links to climate, circular and bioeconomy outcomes.

Question 6: Are there other measures that should be considered to address inefficiencies in the functioning of the food supply chain and to support cooperation amongst all actors with the aim of reducing food waste?

Building on the existing EPA Food Waste Charter, the Food Waste Charter Action Group and the annual EPA Forum on Food Waste, consideration should be given to further leveraging these established platforms to strengthen cooperation across the food supply chain and address inefficiencies that contribute to food waste. Existing initiatives provide a strong foundation for stakeholder engagement and knowledge sharing on food waste prevention. There may be opportunities to build on these structures by facilitating greater collaboration between primary producers, processors, manufacturers, retailers, hospitality businesses, food redistribution organisations, researchers and public bodies to identify supply chain challenges and develop practical, collaborative approaches to preventing food waste.

In particular, consideration could be given to supporting greater collaboration between supply chain actors to improve demand forecasting, production planning and communication. Encouraging voluntary arrangements to share demand forecasts, provide earlier notice of significant changes to orders and strengthen collaborative planning could help businesses better align production with actual demand, reducing overproduction and avoidable surplus food. Improved communication between buyers and suppliers, including the timely sharing of anticipated seasonal demand, could also support more informed production decisions and help prevent food waste arising throughout the supply chain. In the context of a dairy supply chain in Denmark, the *ROSETTA* project found that better information flow along the chain reduced overproduction relative to baseline by 84.6% for yoghurt and 78.7% for crème fraiche during the pilot period.

Building on the collaborative framework established through the Food Waste Charter, opportunities could also be explored to support voluntary cross-sector collaborative arrangements between Charter members and other stakeholders to address shared supply chain challenges relevant to food waste prevention. Such collaboration could promote shared food waste prevention objectives, coordinated actions and the exchange of practical experience across different sectors of the food supply chain, strengthening collective responsibility for reducing food waste while complementing the existing food waste measurement and reporting commitments of Charter members. Evidence

from *ROSETTA* highlights the importance of cross-sectoral collaboration through its finding that sales and donation can form a complementary system, with redistribution being a stable planned pathway that operates alongside a pricing intervention from the outset; dynamic price discounting (with communications) aims to maximise market-based recovery and redistribution takes the products that the market does not. In this context, donation is not a fallback but a core mechanism alongside pricing, that catches what the market does not take, particularly for highly perishable categories.

As food waste measurement and reporting become more widely adopted, consideration could also be given to using aggregated sector-level data, based on the EPA's existing food waste measurement methodology, to support voluntary benchmarking and continuous improvement across participating sectors. Sharing anonymised sector-level performance information could enable businesses to better understand their performance relative to others in their sector, identify opportunities for improvement and encourage the wider adoption of effective food waste prevention measures, while maintaining the confidentiality of individual business data. Highlighting the business impacts of food waste prevention (e.g. in terms of operational efficiency, profitability) in this context will enhance the effectiveness of such an initiative.

Consideration could also be given to supporting collaborative approaches that improve the identification and utilisation of surplus food throughout the supply chain, including the use of digital tools and platforms to facilitate the exchange of surplus food between primary producers, businesses, manufacturers and food redistribution organisations, where appropriate. Encouraging the development of secondary markets for edible surplus food and products that do not meet commercial/retail specifications, but remain suitable for human consumption, could further maximise the value of food resources, reduce avoidable food waste and strengthen the efficiency and resilience of the food supply chain. The *ROSETTA* project proposed innovative retail formats and digital platforms, community food hubs or cooperatives, public procurement (with adjustments to green public procurement policies), as well as quotas for use of suboptimal products, incentives and redistribution as a set of opportunities in this context.

Question 7: How should food waste prevention related training and skills development, and access to funding opportunities be supported, in particular for small and medium-sized enterprises and social economy entities?

Sectoral and representative bodies (for example those already engaged through the Food Waste Charter), Local Enterprise Offices, Enterprise Ireland, Bord Bia and applied research performing organisations such as Teagasc all have established relationships with different parts of the food chain, and coordinating a single, clearly signposted pathway across these bodies by linking Charter sign-up to a specific next step, whether that is a mentoring session, a technical diagnostic, or a training module, would convert measurement into action more effectively than awareness arising alone.

The current training landscape could be expanded and better coordinated so that tailored food waste prevention training, skills development and funding access are delivered through channels that SMEs and social-economy entities already use, coupled with hands-on technical assistance. The EPA Food Waste Charter should act as the gateway; once a company begins measuring waste it should be automatically signposted to mentoring, diagnostics and funding opportunities. Funding could be allocated through DAFM, DCEE, Enterprise Ireland, etc. to commission and manage training and

support for delivery partners such as Teagasc and Bord Bia, with the EPA coordinating outreach and organising practical training events. Technical assistance, applied site visits on food-loss, shelf-life and packaging improvements could be publicly funded through grants or targeted schemes and aligned with existing Enterprise Ireland supports, ensuring support reaches businesses through familiar networks rather than relying on them to seek it out. Aligning Origin Green and the Food Waste Charter and providing resources to organisations such as Teagasc to deliver this SME focused training at scale would create a consolidated support and signposting network. For food businesses requiring more intensive technical support, there should also be a clear referral pathway from the Charter into collaborative R&D, pilot validation and specialist infrastructure available through Teagasc, the proposed Teagasc-led, Enterprise-Ireland funded, National Food and Drink Technology Centre and other national research providers.

Internationally, the UK's WRAP has taken a similar approach with its '*Guardians of Grub*' campaign for the hospitality and food service sector, combining a simple "Target, Measure, Act" framework with a free structured online course; participating businesses that completed the associated audit process saw average food waste reductions in the range of 23–38%. A comparable low-cost, structured training pathway, tailored separately for primary producers, processors, retail and food service, could be developed here, building on the Food Waste Charter's existing membership base.

On funding, smaller businesses generally need proportionate support rather than large competitive grants designed with bigger companies in mind; technical assistance to diagnose where waste is arising, staged or voucher-based funding for training and process change, and targeted capital support for waste reducing equipment where a clear business case exists. Social economy entities involved in food donation and redistribution have distinct needs and will require annual core funding. These should be kept clearly separate from industry innovation funding streams, since the barriers facing a social economy entity are fundamentally different from those facing a food business.

Question 8: The revised Waste Framework Directive requires Member States to take measures to ensure that economic operators identified as having a significant role in the prevention and generation of food waste propose food donation agreements to food banks and other redistribution organisations.

How should this be implemented in an Irish context? Please consider the following:

The criteria for identifying the economic operators that will be subject to this requirement (for example, facility size, amount of surplus food generated, annual revenue).

Regardless of sector, the criteria used to identify economic operators should be objective, proportionate and straightforward to administer. In determining whether an operator has a significant role in the prevention and generation of food waste, Ireland should consider the scale of the operation, the likelihood that it generates edible surplus food suitable for redistribution, and its

operational capacity to facilitate food donation safely and effectively. Consideration should also be given to proportionality, ensuring that obligations do not place an undue burden on SMEs, and to geographic feasibility, recognising that access to food banks and other redistribution organisations may vary across regions. Specific criteria could include:

1. Food manufacturers: annual turnover; annual food production (tonnes); production volume by product category; number of employees; reported food waste.

2. Wholesalers: annual food throughput/distribution; number of distribution centres, warehouse storage capacity; refrigerated storage capacity, reported food waste.

3. Retailers: retail floor area, annual food sales, number of outlets, distribution centre capacity (where applicable), reported food waste.

4. Contract caterers: number of meals prepared per day and per year; number of kitchens/catering sites operated; contracts value; reported food waste.

5. Logistics platforms: annual food volume transported or stored; refrigerated warehouse capacity; role in managing rejected or returned food; ownership/control of surplus food.

The operators' existing participation in food waste reporting may also be a key criterion for consideration.

- **Whether a phased approach should be introduced and, if so, how this should be applied?**

A phased implementation approach could prioritise sectors that generate the largest volumes of surplus food, consistent with the Directive's emphasis on proportionality. This would allow businesses and redistribution organisations time to develop the necessary partnerships, systems and operational capacity before the obligation is extended more widely.

Implementation could begin with large retailers and distribution centres, followed by large manufacturers and wholesalers, and then large contract caterers, reflecting their respective potential to generate and redistribute edible surplus food. Subject to experience and available redistribution capacity, the obligation could subsequently be extended to medium-sized operators where appropriate.

Question 9: Should mandatory and proportionate food waste reporting requirements be introduced for certain food businesses? If so, which food businesses should be considered for such reporting?

Logistics and supply chain management theory and Teagasc's sectoral experience indicate that actions at one point in the chain can shift benefits and cost up and down the chain. Hence, we advise caution in relation to mandatory reporting: actions by actors that are relatively more powerful than others could shift waste and costs along the chain, without reducing total food waste. Furthermore, given the structure of the agrifood sector in Ireland, the cost burden is likely to fall most heavily on primary producers and small processors, whereas the largest levers for prevention may sit at retail, foodservice and consumer stages. As a result, mandatory reporting could divert scarce resources from prevention activity where it is most effective, resulting in perverse outcomes and undue and unfair burdens. In addition, introducing a mandatory element may undermine the "collaborate, innovate and share" approach set out in the Roadmap.

Nonetheless, we strongly support the proposed improvements in food waste measurement, data capture, and voluntary reporting across the supply chain. The potential of digital tools and data sharing approaches that are practical for SMEs and larger companies could be further explored.

If mandatory reporting is introduced, it must be proportionate and targeted rather than a universal requirement. It should be narrowly targeted at actors with the greatest control over flows and the largest potential to reduce avoidable waste. Stakeholder consultation and co-design approaches, along with carefully designed and evaluated pilots would be essential before scale-up could be considered.

Question 10: What date marking measures could be considered to support food waste prevention at a consumer level?

The draft Roadmap identifies date marking as a priority under Action 38. This is a cross-sector issue: it affects consumer behaviour directly, but the dates are set by manufacturers & processors across the sector, so measures need to work for producers, manufacturers, processors, retailers & consumers.

A use-by (UB) date is a food safety marker & foods carrying it, e.g. fresh meat, ready-to-eat salads, dairy products, should not be eaten after that date even if they look or smell fine, since harmful bacteria may be present without any visible or detectable sign. Improving UB dates is rarely solely a labelling decision as it typically requires underlying research & development to extend product safety & shelf life, rather than simply changing what appears on the pack. This need is sharpened by further pressures on industry: consumers are increasingly critical of the visual appearance of food & will scrutinise & reject items that show any sign of cosmetic defect well before the product is actually unsafe or of reduced quality, while retailers separately require a viable minimum shelf life on receipt of stock to allow for transport, distribution & adequate shelf-holding time before sale. Any extension of UB dates therefore has to satisfy food safety science, retain acceptable visual & sensory quality for the extended period, & still leave enough shelf life at the point of retail receipt to be commercially usable. This is a more demanding target than simply proving a product remains microbiologically safe. Without this underlying technical work across all three requirements, a business cannot safely or commercially extend a UB date even where there is a clear consumer & waste-reduction case for doing so. Consumer expectations with regards to use by dates also need to be considered.

A best-before (BB) date relates to quality rather than safety: food remains safe to eat after this date provided it has been stored correctly & the packaging is undamaged, though taste, texture or freshness may decline. Continued & expanded public information reinforcing this distinction building on "Look-Smell-Taste" remains essential, alongside clear on-pack storage guidance & support for ensuring the wider distribution chain manages stock & product dates responsibly.

BB dates are typically set based on the sensory characteristics of a food product as perceived by the human senses, including appearance (colour, texture), aroma, taste, and mouthfeel. Rather than being determined by a safety threshold, a BB date usually marks the point at which a product is expected to begin losing these desirable sensory qualities (e.g. bread starts to firm & dry out, fruit juice begins to lose its fresh flavour). Because these thresholds are based on quality expectations rather than any safety risk, they are inherently more open to adjustment through evidence-based shelf-life work than use-by dates are. This is precisely where there is much scope for organisations such as Teagasc to support companies & retailers of shelf-stable products in basing BB dates on robust shelf-life evidence rather than conservative defaults. Many smaller Irish food businesses set

dates cautiously in the absence of in-house shelf-life or sensory panel data. Practical support for shelf-life studies including structured sensory (organoleptic) evaluation alongside microbiological & physicochemical testing delivered through bodies such as Teagasc working directly with industry, would help address this & could sit naturally within the technical assistance measures proposed under Actions 30–31. BB conventions need to be reassessed specifically for fruit and vegetables (F&V). Natural variability in shelf life makes fixed dates a poor fit for some categories of F&V & a significant driver of avoidable waste.

Consideration should also be given to removing BB dates from very shelf-stable, low-risk products & to piloting more dynamic, condition-based date marking (such as time-temperature indicators) for perishable products where cold-chain integrity is a more relevant factor than a fixed date. There is a clear precedent for retailer-led action on inappropriate date marking. Marks & Spencer has removed best-before dates from over 300 fresh fruit and vegetable products (around 85% of its produce range), replacing them with an internal staff-facing code and encouraging customers to judge freshness themselves. This is in line with WRAP/FSA guidance that a UB date should only be applied where required for food safety. M&S's sustainability reporting shows a 46% reduction in food waste against target because of such measures. This is a useful, evidenced example of the kind of category-by-category review assessing which products need a safety-based use-by date versus a quality-based best-before date, or no date at all and that Irish retailers and manufacturers could be encouraged to undertake as part of the feasibility work under Action 38.

Question 11: The FoodCloud Food Circle Project Reports published alongside the draft Roadmap make policy recommendations to support food donation and redistribution.

In your view which recommendations listed in the reports (also included in Appendix 2 in the draft Roadmap) should be considered as priority actions for implementation?

As indicated above, food donation and redistribution can form part of a complementary system. It needs to be carefully planned so that it is not a default option, and it is likely to vary significantly by category.

Question 12: Research and innovation are important for the development of new methods and technologies to reduce food waste.

What would you see as being a priority area for research as part of implementation of the next Roadmap? Are there any types of technology that should be examined as a potential solution to reduce food waste in a specific area within the food supply chain?

Research and innovation should follow the food use and waste hierarchy: prevention of avoidable waste is the first priority, supported by robust measurement, shelf-life science, processing, packaging, forecasting and behavioural interventions then where waste is unavoidable, research

should focus on retaining the highest possible value through food/feed use and higher-value bio-based valorisation. Priority research should deliver standardised measurement and predictive shelf-life methodologies that combine temperature-history data and spoilage kinetics to enable dynamic expiry, smarter stock rotation and consumer-facing freshness indicators. Integrating these models with sensors, traceability and AI forecasting will improve supply-demand matching, allow at-risk batches to be redirected before loss and optimise cold-chain logistics. Applied R&D on mild and non-thermal processing (high pressure processing, pulsed electric fields, ultrasound-assisted and other emerging methods), water-activity control and related preservation approaches should be prioritised to extend safe shelf life while supporting clean-label reformulation. The growing "clean label" demand removes many traditional preservatives and increases pressure on shelf life; targeted research into natural antimicrobial and antioxidant systems and processing techniques that maintain safety and quality without reliance on chemical preservatives or additives is needed so industry can meet clean-label expectations without increasing waste. Packaging research should focus on active and intelligent systems and real-time freshness indicators, designed in line with the EU Packaging and Packaging Waste Regulation, to replace fixed calendar dates with product-state information for retailers and consumers. Digital tools and AI-driven forecasting, linked into packaging and shelf-life models, can reduce overstocking and improve forecast accuracy between growers, consolidators and retailers. Operational losses from temperature abuse, labelling errors and packaging faults remain significant and under-recognised drivers of waste across processing, distribution and retail; these require coordinated training and adopting best practice approaches so that procedural improvements are adopted broadly.

Where waste cannot be avoided, prioritise pathways that retain highest value: food/feed uses first, then conversion to ingredients, materials and other higher-value bio-based products. Applied valorisation research should target the wide range of sectoral side streams across dairy, meat, marine, bakery and crops so that compliance obligations become economic opportunities rather than pure costs. Ireland already has a strong base of activity- projects such as CirCoVal, AimBio, ROSETTA and IMPRESS, together with industry-led initiatives, demonstrate depth of expertise across multiple sectors. In addition, the role of the National Prepared Consumer Food Centre in developing products from edible by-products and researching packaging to extend shelf life is already highlighted in the roadmap. What is missing is coordinated national pilot-scale capacity to bring these efforts together and scale innovation, particularly for SMEs.

Teagasc has carried out a feasibility study into a National Bio-Circularity Centre and recommends this national specialist facility be prioritised in the 2026–2028 Roadmap. This would provide pilot infrastructure, technical expertise and processing capability to de-risk valorisation pathways and enable producers and SMEs to trial conversion of by-products into higher-value ingredients and other uses. The proposed Enterprise Ireland funded National Food and Drink Technology Centre, to be led by Teagasc, will include a bicircular/sustainability theme so industry can access a structured route from problem identification, feasibility and pilot validation to commercial deployment. This would help convert research outputs into practical solutions and would complement rather than duplicate existing research and demonstration infrastructure.

Applied research should be co-designed with primary producers and food businesses and tested in real production and supply-chain environments so outcomes are transferable and adoption pathways are credible.

Alongside technology development, research must support systematic methodologies that enable prevention and valorisation approaches to be applied consistently across biological resources, processing systems and food sectors, improving reproducibility and facilitating collaboration between

research and industry. Research funding should be ring-fenced with two complementary strands: core science to build fundamental understanding (shelf-life science, preservation technology, by-product characterisation) and applied research funding specifically designed to help companies work directly with organisations such as Teagasc to deliver practical food waste prevention and valorisation solutions.

Question13: Do you have any other comments or feedback on the content of the draft Roadmap?

Overall Teagasc welcomes and commends this roadmap. It particularly welcomes the food systems approach, the focus on the whole supply chain, the appreciation of the differences across sectors, the recognition of a wide range of relevant stakeholders, and the integrated approach built around "collaborate, innovate and share" approach. It also welcomes the tailored approach to sub-sectors which recognises that there are different causes, and thus different solutions, in different sub-sectors.

The Roadmap would be strengthened by a clear implementation framework that assigns ownership for key actions, identifies delivery partners, and includes measurable indicators of impact. These should distinguish between food waste prevented, surplus redistributed for human consumption, unavoidable material valorised at higher value, and material directed to lower-value recovery or disposal. This would help ensure that progress is measured against the hierarchy rather than simply by reductions in disposal.

While we recognise the value and legitimacy of the Food Use and Waste Hierarchy as the foundation for the roadmap, industrial use could have a stronger emphasis in the case of unavoidable food waste. From a food-waste perspective, elevating industrial use could convert large quantities of unavoidable or contaminated food into useful outputs, capturing value that would otherwise be lost and reducing volumes sent to disposal. Scientific and technological advance such as AI-driven demand prediction, smart temperature monitoring sensors, dynamic shelf life modelling and smart packaging that tracks freshness provide real time data to prevent spoilage and optimise stock rotation. Food waste reduction increasingly relies on technologies that can convert by-products into high-value ingredients and materials. Conventional valorisation methods such as enzymatic hydrolysis, dehydration, and wet and dry extraction enable the recovery of proteins, fibres, and bioactive compounds from waste streams. Growing emphasis on green extraction technologies, including approaches that minimise solvent use, supports more sustainable recovery of valuable compounds. Emerging non-thermal technologies such as pulsed electric fields, cold plasma, and high hydrostatic pressure further enhance extraction efficiency by preserving thermolabile nutrients and improving yield. Together, these existing and novel technologies contribute to a circular economy by transforming unavoidable food waste into valuable ingredients, bioplastics, nutraceuticals, and other sustainable materials.

The new Teagasc-led, Enterprise-Ireland funded, National Food and Drink Technology Centre will support the Food Waste Prevention Roadmap via applied research, validation, and industry adoption particularly for the food processing, manufacturing, retail, food service, and wider supply-chain elements of the Roadmap underpinning this prevention approach.