White paper

On the table

Scaling AI-led food waste and surplus visibility, reduction and redistribution

March 2026

Bristol · COMPANY SHOP GROUP · FareShare fighting hunger, tackling food waste · FUTUREPLUS · Google Cloud · Howard Tenens · Nestlé · sustainable ventures · zest

Testimonials

“Food and drink manufacturers continue to make good progress in reducing food waste – since 2007, we’ve reduced waste from manufacturing by over a third. But taking this progress to the next level requires better data, stronger collaboration and new innovation. Zest’s AI technology is a fantastic example of this – it’s helping manufacturers to reduce waste further by giving businesses greater visibility of where waste is occurring on factory lines so they can address it, including by ensuring that edible waste is rapidly redistributed. Zest’s technology is supporting our industry to build a fairer, more sustainable and more productive food system, and the Food & Drink Federation is proud to champion that mission with Zest.”

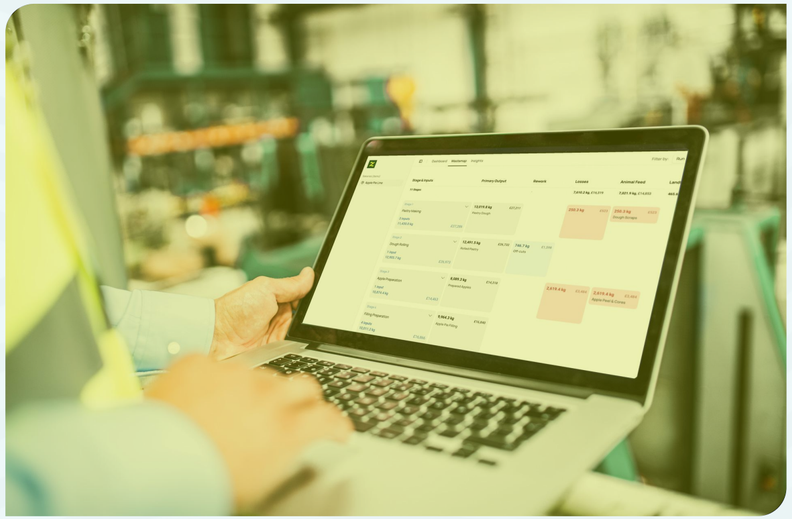
Karen Betts OBE, Chief Executive, Food & Drink Federation

“The Coronation Food Project, Inspired by His Majesty King Charles III, was launched with a primary objective of rescuing more surplus food from the manufacturing sector. We have seen dozens of leading food retailers and manufacturers contribute their industry expertise and surplus capacity to develop innovative solutions to help achieve this goal. We recognise that technological advancement in AI has a huge role to play in identifying and rescuing surplus food. At Coronation Food Project, we're encouraged to see the efforts of projects like Bridge AI to provide advancements in this area.”

Pooja Shah, Project Manager, Coronation Food Project

"This is a novel example of using innovative technology to tackle food waste and enable more redistribution of surplus food. It offers useful insights for a study that ReLondon is working on with Nottingham Business School, where we’re looking at using AI to visualise food surplus availability in London and better coordinate its distribution".

Wayne Hubbard, Chief Executive Officer, ReLondon



Acknowledgements

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Project consortium

Bristol Superlight is the UK-based manufacturer of the world's first digital commercial vehicle (OV-1), leveraging aerospace design principles to rethink truck design and transform the logistics industry. OV-1 has been proven to deliver 73% operating cost savings vs legacy truck transport.

Company Shop Group is the UK's leading redistributor of surplus products, taking perfectly good products that are destined for waste and redistributing them to members at discounted prices, delivering positive impact for businesses, people and planet.

FareShare and The Felix Project recently merged to form the UK's largest food redistribution charity. The organisation rescues high quality edible surplus food from across the food industry and gets it to over 8,000 organisations across the UK. This paper refers to the charity as FareShare, as the project was mainly carried out before the merger.

FuturePlus is a sustainability management and ESG reporting platform. By combining data-driven insights with expert consultancy, FuturePlus is applying its framework to track and report impact for this project.

Google Cloud accelerates transformation with Google's leading, AI-powered Cloud technology.

Howard Tenens owns and manages approximately 4.7 million sq ft of warehousing across the UK, a third of which is occupied by its logistics division. The company operates a national fleet of 537 assets and has grown to be one of the UK's largest independent logistics companies.

Nestlé is a global food and beverage company whose purpose is to *"unlock the power of food and beverage to enhance quality of life for people today and for generations to come."* It operates across categories such as coffee, pet care, nutrition, health, food and snacks.

Sustainable Ventures is a leading growth partner for climate tech startups through investment, expert services, collaborative workspaces and a thriving peer community. SV connects founders into its ecosystem to bridge the gap between commercialisation and innovation.

Zest is the AI-powered intelligence layer for food manufacturing. Turning siloed data into real-time action, enabling manufacturers to eliminate operational waste, de-risk production and automate surplus redistribution. With Zest, efficiency drives impact.

Funding

This white paper is an output of an Innovate UK match-funded grant project under BridgeAI, which aims to help businesses in high growth potential sectors harness the power of AI and unlock its full potential.

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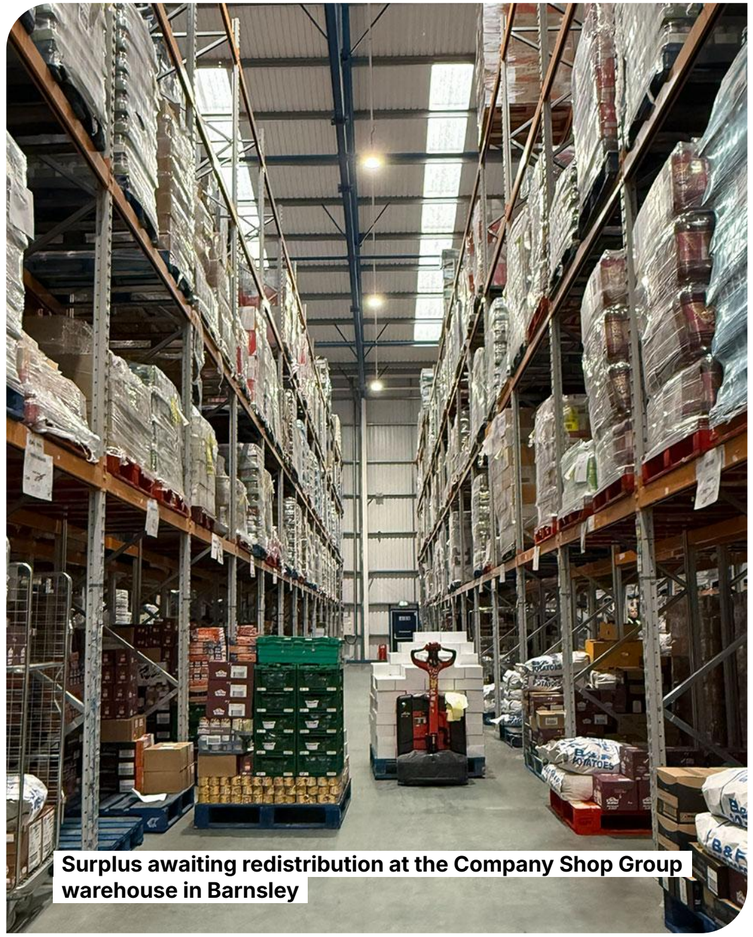


Surplus awaiting redistribution at the Company Shop Group warehouse in Barnsley

Executive summary

The food waste and surplus challenge

As a food manufacturer, it is challenging to piece together a single picture of the causes and impacts of food waste to the business due to fragmented and disparate datasets. It makes it difficult for management teams to take action. Business as usual prevails because why change something that seemingly works fine. As one interviewee put it, *"a shoulder shrugging tolerance to food waste is inbuilt in the system"*. But change is needed. In 2021, just under 2.1 million tonnes of food waste and surplus was generated by food manufacturers in the UK. Only 42,000 tonnes of this was redistributed to people, while half of the food waste generated that year - valued at £850 million - was still edible. With 11% of people in the UK living in food insecure households in 2023/24, the paradox of food waste and food insecurity needs resolving, fast.

In this white paper

Food waste and surplus is a systemic challenge that requires innovative technologies and partnerships to address it. This white paper sets out an AI-led model to scale food waste and surplus visibility, reduction and redistribution to people with a focus on ambient goods. The proposed model is based on 16 months of insights collated as part of an Innovate UK match-funded demonstrator project with nine partners: Bristol Superlight, Company Shop Group, FareShare, FuturePlus, Google Cloud, Howard Tenens, Nestlé UK&I, Sustainable Ventures and Zest.

"It's the most effective project I've seen in the industry on food waste recently, and the Food & Drink Federation is very supportive of it. Zest has a very unique offering."

Natalie Verner, Senior Sustainability Policy Executive, Food & Drink Federation

Project overview

The demonstrator project involved the collaborative development of Zest's solutions with industry partners. Eight of the 16 months involved piloting Zest's AI-led solutions in a live business environment, covering:

Real-time visibility
What, where and how much food waste and surplus is generated on one Nestlé production line by using AI to consolidate multiple datasets into one granular picture.

Prevention insights
Recommended actions to prevent food waste and surplus on that same Nestlé production line including reduction measures and opportunities to redistribute the edible parts.

Optimised redistribution
Matching unavoidable edible food surplus supply from four Nestlé sites with food demand from Company Shop Group and FareShare, using AI optimised algorithms.

Impacts achieved on the pilots

The impact on one particular Nestlé production line that piloted Zest's real-time visibility and prevention insights solutions, included:

- visibility of 4.8 tonnes of edible surplus, previously unreported
- new rework potential identified with another Nestlé production line
- diverting 100% of the surplus that was previously sent to animal feed for human consumption
- loss mitigation by a 15-fold increase in revenue from surplus sales to a commercial redistributor over a former foodstuff processor

From piloting Zest's optimised redistribution platform with Nestlé, Company Shop Group and FareShare:

- 197.1 tonnes of finished packaged goods surplus was donated by Nestlé to Company Shop Group and FareShare - equivalent to 469,189 meals. If these goods had not reached surplus status, their retail value would have been over £1 million
- 4.8 tonnes of work in progress surplus - equivalent to 11,340 meals - was sold by Nestlé to Company Shop Group. The financial benefits were distributed through Nestlé's "everyone wins" approach between the factory and charity partners
- the surplus food donations has supported an estimated 94,133 people across 787 charities and community groups

How Zest's AI-led solutions have benefitted partners

In relation to prevention measures, the detail, accuracy and predictability of food surplus generation provided by Zest has supported Nestlé in tightening internal governance to keep surplus higher up the food and drink material hierarchy. This includes clarifying standard operating procedures and reinforcing site communications. For redistribution, the combination of automated data sharing of finished packaged goods surplus supply with Zest and the use of Zest's optimised redistribution solution has given Nestlé stakeholders a shared line of sight to donation activity via a single platform, improving transparency and enabling quicker coordination. For Company Shop Group and FareShare, the speed and accuracy in which Zest's solutions map food surplus generation on production lines compared to manual waste walks has prompted a rethink of their food sourcing operational model. If less time can be spent sourcing food surplus, more time can be spent on other operations like repacking.

On the table: Scaling AI-led food waste and surplus visibility, reduction and redistribution

The proposed model for scaling

Imagine if what was achieved on the pilots was scaled across the UK. More food manufacturers would be equipped to make data-driven decisions on food waste and surplus prevention initiatives that not only commercially benefit them, but consumers too. For manufacturers, research shows a 14:1 return on investment on food waste reduction initiatives. For consumers, it would drive down consumer food prices since the cost of food waste management is currently embedded in the price of food. For edible food surplus that is unavoidable, a platform with all surplus food supply and demand would allow surplus to be redistributed more efficiently by considering demand profiles and transport distances. Less time would be spent negotiating food surplus transactions so organisations can focus on their core operations. The proposed model in this white paper puts on the table how AI-led food waste and surplus visibility, reduction and redistribution could work at scale for ambient goods.

What it takes to scale

The good news is that the underlying technologies adopted by the model already exist. The right processes and partnerships now need to be put in place to fully operationalise it. For this, there must be a step change in how food manufacturers, wholesale distributors, retailers, hospitality and food service companies, logistics companies, commercial redistributors, charitable redistributors and food upcyclers operate - individually and together. From the pilots, stakeholder engagement and market research, seven key lines of thought emerged that inform the proposed model.

Seven insights informing the proposed model for scaling

01	**Digitising food waste and surplus data is the foundation for better business decisions**	AI-led real-time visibility is superior to manual waste walks in speed, accuracy, consistency, predictability and ability to incentivise change within manufacturing
02	**Overlooking the value of human connection will lead to failure**	Successful technological, process and partnership changes consider the emotional, relational and physical experience of the stakeholders involved
03	**Market dynamics will keep evolving as goals between reduction and redistribution change**	The key is to be flexible as redistribution goals, implementation capacity and partnerships change for different food waste and surplus streams
04	**Brand protection can be maintained through trusted partnerships and Chain-of-Trust technology**	Food safety, quality and food manufacturer brand protection measures are already in place by redistributors and logistics companies for their own brand protection
05	**A redistribution marketplace is not the solution, it is part of the solution**	A marketplace would improve surplus visibility and efficient matchmaking but not data accuracy or a reduction first approach
06	**Logistics cost efficiencies come from engaging the right transport solution for the task**	Using the right sized vehicle or shared logistics systems alongside good negotiating skills, helps to reduce costs
07	**Piloting early-stage innovation in a real-time business environment is game changing for startups and corporates alike**	Testing the scope, feasibility and benefits of innovative solutions with other organisations helps to de-risk full scale implementation

Nestlé surplus cereal enjoyed by volunteers at The Felix Project's East London depot

Next steps

Through the pilots, the project consortium has demonstrated that AI-led food waste and surplus visibility, reduction and redistribution can be achieved today. Let's scale it together. What do next steps look like for the industry?

Face and embrace the data

Nestlé are using food waste and surplus data insights from Zest to make operational changes, prepare for further production line engagement and develop partnership models that align with the organisation's financial, environmental and social goals. Nestlé's curiosity in the data has allowed them to make better business decisions. Effecting change in food manufacturing is not easy, particularly when it comes to food waste and surplus. This is because its profit and loss implications are so widely distributed, which makes it difficult to create agency over the challenges and solutions. The starting point is having data granular enough to make business decisions from. One case examined as part of this project compared the use of Zest's real-time visibility solution with manual waste walks on a production line of a food manufacturer outside the project consortium. It highlighted a 50% time saving in food waste and surplus mapping on the production line as well as a 410% increase in the quantity of surplus identified by adopting Zest's solutions compared to manual waste walks. While this is only one case, it forms part of a growing body of evidence that gaining visibility of food waste and surplus generation is absolutely critical for taking action against it. The first step is for food manufacturer's to understand to what extent their organisation has total visibility of food waste and surplus generation.

Reach a consensus on a redistribution platform

Feedback on Zest's redistribution platform during the pilots was extremely positive. Nestlé see how beneficial it could be for their surplus management across the organisation, while Company Shop Group and FareShare see how it could transform their food sourcing operations. However, there needs to be a critical mass of food surplus supply and demand organisations using the platform to unlock the full efficiency benefit of it. The industry needs to reach a consensus on whether the industry as a whole moves forward with a single surplus redistribution platform, or not, as the case may be.

Engage with innovation

The collaboration between startups, corporates and charities in this project consortium demonstrated how Sustainable Ventures can de-risk piloting climate tech innovation in live business environments. Collaborative technology development can only lead to better outcomes, especially in relation to artificial intelligence, where pilots like this help to bring its use case to life. Collaborative technology development is also an opportunity to understand how innovative solutions can be tailored to suit sector or organisational needs. Engage with Sustainable Ventures for support with reaching out to the climate tech innovation ecosystem.

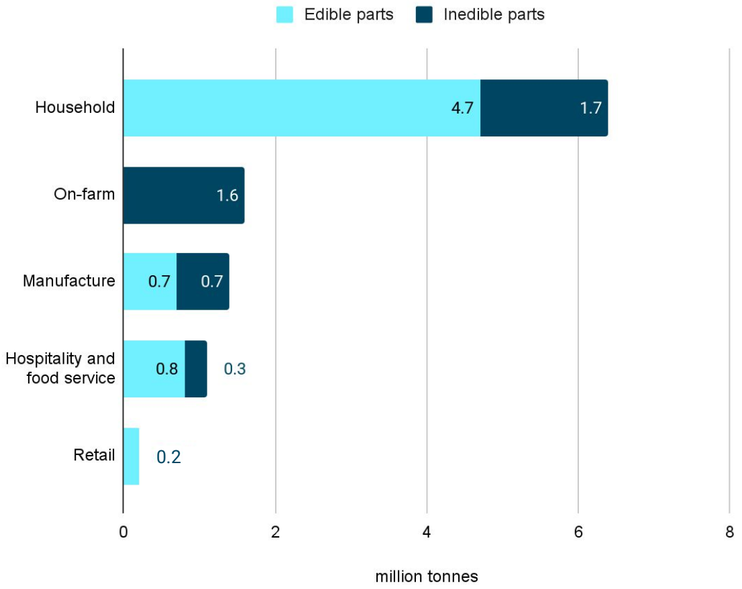
The food waste and surplus challenge

Food waste and food insecurity: the paradox

We all know - or should know - the shocking statistics on global food waste. In 2022, 1.05 billion tonnes of food waste was generated across the globe[1], which represents about 33-40% of global food production[2,3]. The economic, environmental and social impacts of this are widespread. Managing food waste costs the global economy US$1 trillion every year.[1] Food waste generates 8-10% of global greenhouse gas (GHG) emissions as well as contributing to the depletion of land use, biodiversity and water resources.[1] Meanwhile, 783 million people across the globe are affected by hunger[1], with malnutrition estimated to cost the global economy US$3.5 trillion each year[4]. The Global Food Security Index's affordability score fell by 4% between 2019 and 2022 as shocks like the covid-19 pandemic and the war on Ukraine led to rising food costs[5]; the impacts continue to be felt today. The coexistence of food waste and food insecurity is a paradox that needs resolving urgently.

The scale of the challenge in the UK

The UK generated 10.7 million tonnes of food waste in 2021. The majority of this was generated by households (60%) followed by on-farm (15%), manufacturing (13%), hospitality and food service (10%), and then retail (2%) as shown in Figure 1. This food waste is generated alongside 7.5 million people in the UK - equivalent to 11% of the population - living in food insecure households.[6] With half of the waste generated deemed edible and valued at £21.8 billion using 2021 prices (noting these figures exclude on-farm quantities)[7], preventing edible food from becoming food waste is a priority. This can be delivered through reduction measures or managing it as food surplus where redistribution to people is considered before sending it for animal feed or biomaterial processing.



// **Figure 1. Food waste generation by sector in the UK, 2021**[7]

"We need to make sure that we're keeping all nutrients in use at their highest value in the human food system rather than cascading down the waste hierarchy."

Beth Mander, Food Programme Lead, Ellen MacArthur Foundation

Policy

Drivers for food waste and surplus visibility, reduction and redistribution in the UK

The UK government is currently steering the food system towards a sustainable model. A primary driver is the UK Food Strategy's commitment to healthier and more affordable food, good growth, and sustainable and resilient supply.[8]

The Department for Environment, Food & Rural Affairs' Food and Drink Waste Hierarchy (often referred to as the Food and Drink Material Hierarchy) mandates a clear priority system that emphasises preventing waste and surplus at source. This is followed by redistributing edible food surplus to people in need before sending it to animal feed or biomaterials processing. Waste treatment and disposal options are considered the last resort.[9]

Keeping materials in use, albeit, in other economic sectors is promoted in the Department for Energy Security and Net Zero's latest report on industrial symbiosis. Information dissemination is identified as a key enabler of industrial symbiosis. *"Technology that increases the ability of firms to identify potential by-product materials to either send or receive, as well as potential partners to trade with, will increase the potential for industrial symbiosis. Stakeholders have noted that AI applications capable of learning from synergies and able to identify new synergies will increase the opportunities for industrial symbiosis and reduce the costs".*[10]

These agendas will be reinforced by 10 Downing Street's 'National Endeavour to End Food Waste' initiative with working groups on data and AI, household food waste and surplus redistribution. In addition, the agri-food roadmap within the upcoming Circular Economy Growth Plan for the UK will include the direction of travel on food waste and surplus redistribution.

// Table 1. RAG matrix indicating why manufacturing is a priority for innovation in food waste and surplus

Key
🔴 Low priority sector
🟠 Medium priority sector
🟢 High priority sector

Factor	Retail	Manufacturing	Hospitality and food services
Food waste generation (tonnes)[11]	🔴 200,000	🟢 1,400,000	🟠 1,100,000
Edible food surplus (tonnes)[11]	🔴 234,000	🟠 706,000	🟢 800,000
Wastage rate (%)[11]	🔴 0.44 (proportion of food handled)	🟠 3.8 (proportion of food handled)	🟢 18 (proportion of food purchased)
Impact of food waste cost reduction on COGS	🟠 3-6% reduction[12]	🟢 5-10% reduction[12]	🔴 2% reduction[13]
Impact of food waste cost reduction on food insecurity	🟢 Food waste cost savings may in part pass on to consumers in the form of lower prices[14]	🟢 Lower water and waste bills will likely result in lower prices for consumers so[15]	🔴 This sector is dependent on consumer disposable income so will likely have limited contribution
Market penetration required at scale	🟢 87,000 grocery stores although four supermarkets represent 66% of the market[16]	🟠 12,195 food and drink manufacturers[17] of which 98% are SMEs. Only 3.7% of companies generate over £50 million in turnover[18]	🔴 176,685 businesses in the accommodation and food services sector of which 99.6% are SMEs[19]
Technology investment focus areas	🟠 Automation, smart shelves and refrigeration, data analytics, energy management, checkout-free stores, in-store apps[20]	🟢 Automation, data capture, process optimisation, quality control, supply chain optimisation[21,22]	🔴 Automation, personalised guest experience, guest communication, security, safety[23]

Focusing on manufacturing food waste and surplus

In line with food waste generation data, the majority of research, innovation and funding to date has gone into tackling food waste at the household and on-farm level. This includes:

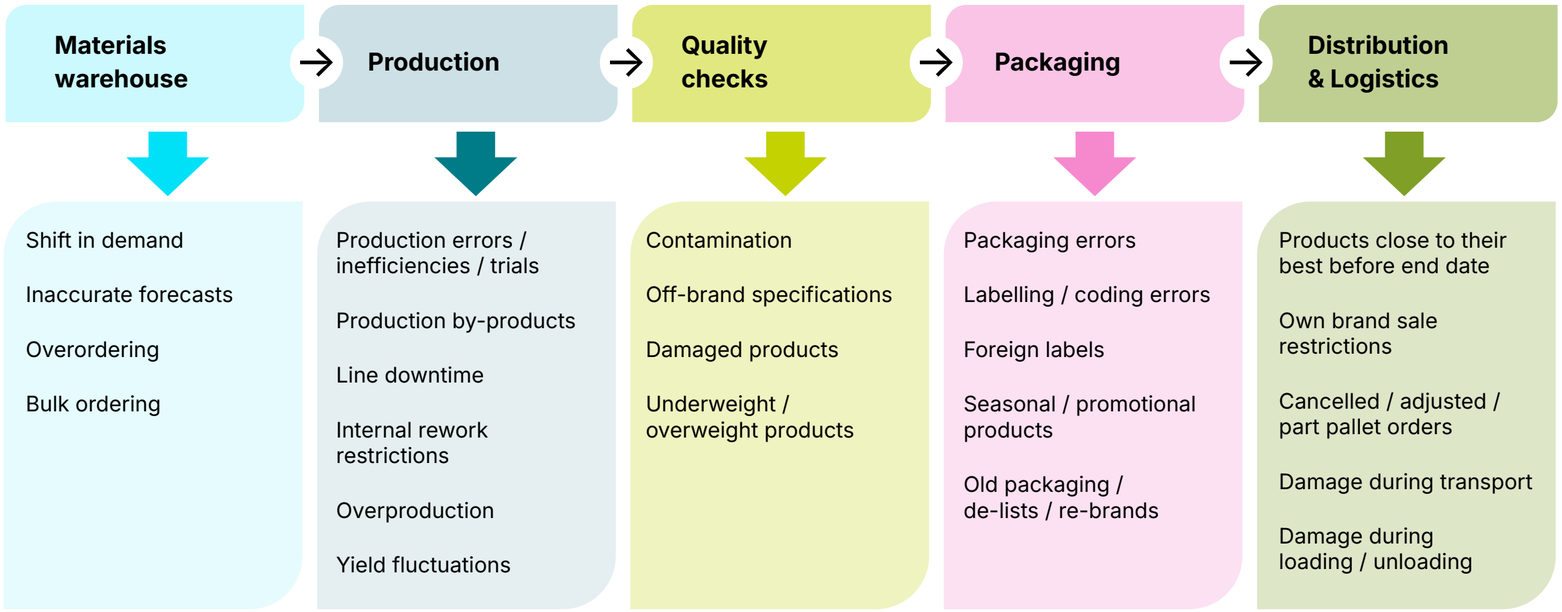
- WRAP's Love Food Hate Waste campaign
- Zero Waste Scotland's bite-size food waste course and upcoming household intervention plan for food waste reduction
- local authority initiatives such as Bristol's Slim My Waste – Feed My Face campaign and Oxfordshire's Replenish Oxfordshire project
- several projects funded under the Farming Innovation Programme delivered by Innovate UK and the Department for Environment Food and Rural Affairs (Defra) such as the SCARE project
- Defra's Food Waste Fund
- Defra's Tackling Food Surplus at the Farm Gate scheme
- WWF's Roadmap to Tracking and Reducing Food Surplus and Waste on UK Farms

Out of the three remaining food sectors from Figure 1, the manufacturing sector is a priority for innovation as the sector with the greatest potential to gain from it. It has the highest waste generation and is therefore in need of more targeted solutions, it could benefit the most financially in terms of reduction in cost of goods sold (COGS), it could pass on cost reductions to the consumers unlike other sectors and has technology investment areas that align with tackling food waste more than other sectors. This is highlighted in the RAG matrix in Table 1.

Causes of food waste and surplus generation in manufacturing

The food manufacturing industry handles almost 37 million tonnes of food, yet generates 1.4 million tonnes of food waste annually.[11] How does this food waste come to be? The causes cited by interviewed stakeholders are summarised in Figure 2. Many of these are also the cause of food surplus. It is difficult to make a distinction between the causes of food waste and food surplus as what could be treated as food surplus is often treated as food waste. This may be in cases where it is easier and cheaper to discard of food surplus as food waste, or where food surplus management options are not identified or pursued. Food waste and surplus can take the form of ingredients, residues (co-products, by-products or waste), work in progress and finished packaged goods. But why do these food waste and surplus streams continue to be generated? It is costed into the system.

// Figure 2. Causes of food waste and surplus across manufacturing stages



"Most of our surplus comes from the amount where we've finished one ingredient and you've got elements of the other ingredients left over. There are also seasonal fluctuations that affect the yield so you'll end up getting a slightly different yield from the ingredient, which will impact on the recipe balance."

Simon Ellmore, Chief Manufacturing Officer, Cook

"We have a proportion of wastage from issues with batch production that need to be disposed of before they get packaged. The second largest stream is related to customer shelf-life date requirements, with delays caused by delivery or ordering issues. Additional wastage can occur with physical loading issues during logistics. Ideally we would not waste anything at all but with batch manufacturing there will always be a percentage lost."

Christian Phipps, Environment & Sustainability Manager, Hovis

Part misalignment with the hierarchy

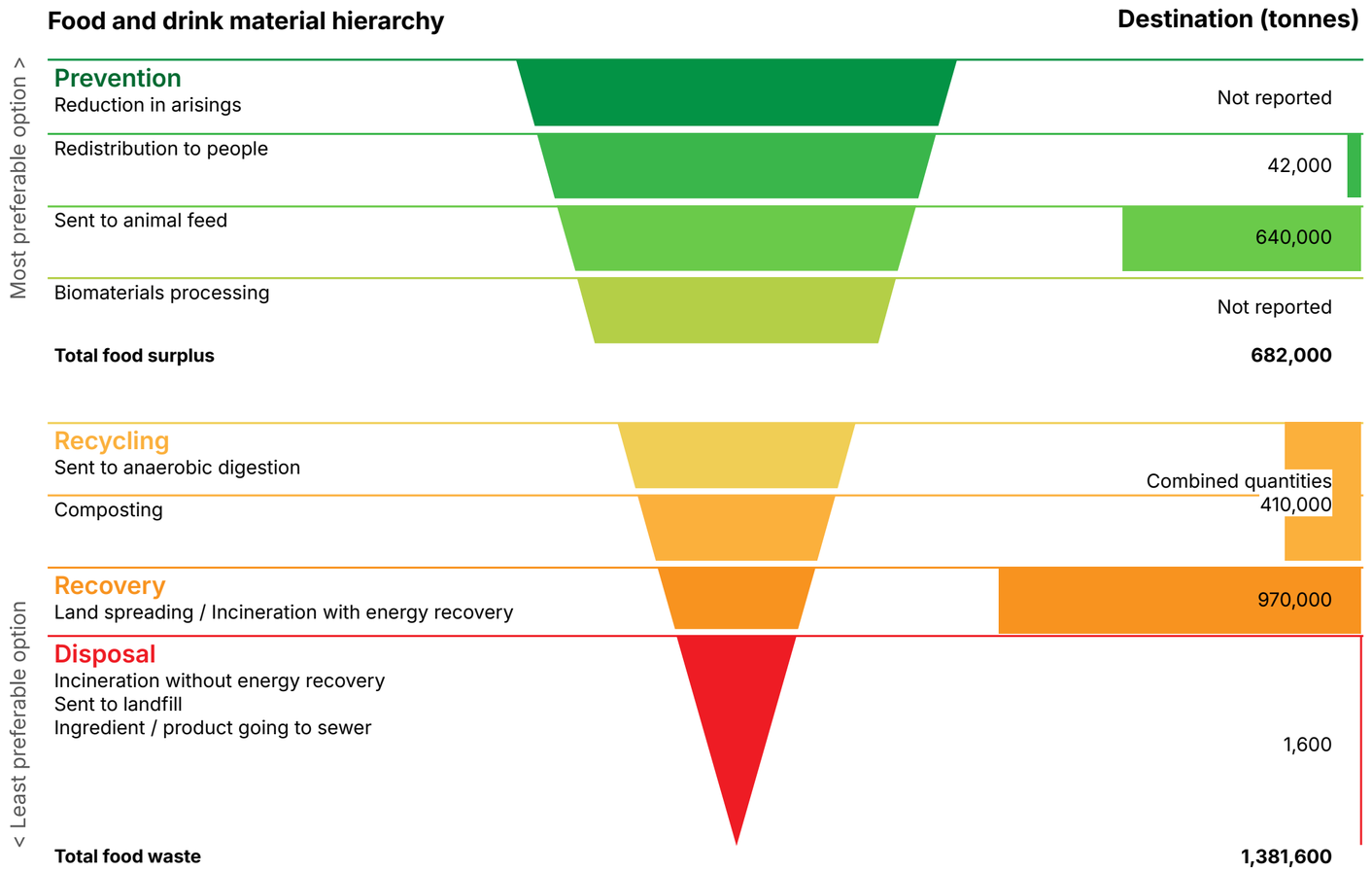
Data from WRAP shows some positive trends. Food waste arisings from manufacturing reduced by around 521,000 tonnes between 2007 and and 2021. In 2021, just under 2.1 million tonnes of food waste and surplus was generated by food manufacturers in the UK. About 680,000 tonnes of food surplus was generated (noting this excludes quantities sent for biomaterials processing), while 1.4 million tonnes of food waste was generated.[7] With respect to food surplus destinations, 6% was redistributed to people while 94% was sent to animal feed.[7] In terms of food waste management, about 30% was sent for anaerobic digestion or composting, 70% was incinerated or sent for land spreading, and 0.1% was landfilled.[7] There is evidently some misalignment with the food and drink material hierarchy as indicated in Figure 3.

In 2016, WRAP developed a scenario for food waste and surplus in manufacturing for the year 2025.[24] The scenario projected that 1.4 million tonnes of food waste would be generated. As this quantity was generated in 2021 and if reduction trends have continued, the manufacturing sector may well have generated much less than that projected for 2025. However, the scenario also projected that the ratio of surplus sent to animal feed versus redistributed to people would be 7:1. This is much less than the 15:1 ratio achieved in 2021, suggesting a need for strategic shifts across manufacturing organisations.

"The food and drink material hierarchy is there for a reason. We need to find the right balance between preventing food waste in the first place, and then getting healthy and appropriate food to where it's needed through redistribution."

Will Nicholson, Global Food Waste Programme Lead, WRAP

// Figure 3. The food and drink material hierarchy (left-middle). Food waste and surplus destinations from manufacturing, 2021 (right)[7]



Ease of operations takes precedence

Food waste and surplus reduction and redistribution to people should be prioritised, but in reality, bulk collection for animal feed or anaerobic digestion is operationally easier on the factory floor. Everything goes in one container. The contractor collects it on a periodic basis and provides data on the quantities collected and destination. While sending food surplus to animal feed is typically a revenue source for food manufacturers, sending food waste to anaerobic digestion can be a revenue source or a cost depending on several factors. This includes how desired the waste feedstock is by the receiving anaerobic digestion facility, transport costs and depackaging service provisions. Changing current operational processes is easier said than done. It requires many things to align:

01 Data accuracy and real-time monitoring

02 Cross-functional accountability

03 Investment into infrastructure

04 Allocation of space

05 Changes to standard operating procedures (SOPs) and protocols

06 A culture of resource stewardship

07 Changes to information systems

08 Supply chain and demand integration

This can be particularly challenging when data to support a solution is limited (information barrier), agency to solve the problem is lacking (behavioural barrier) and the former foodstuff processor or waste contractor has integrated infrastructure on the production line (physical barrier).

The rise of redistribution

The food manufacturing industry has increased food surplus redistribution to people from 23,000 tonnes in 2018 to 54,000 tonnes in 2023[25], with most going for charitable redistribution and some going for commercial redistribution. As redistribution has grown over the years, WRAP has created a Surplus Food Redistribution Resource Hub. It provides guidance on redistribution practices and a list of organisations working within redistribution in the UK, among other things. The Food & Drink Federation are also in the process of developing a Surplus Hub on their website.

The changing landscape

The rise of redistribution has, to some extent, created a fight for surplus amongst redistribution organisations. As a result, food surplus redistribution initiatives have historically been independent of each other.[26] This is changing. The recent merger of FareShare and The Felix Project hopes to "unlock more food, more funding, and more influence" by streamlining operations and reducing duplication.[27] More collaborative efforts are unfolding such as between Company Shop Group and Sweet Dreams to upcycle more confectionery ingredients into new products. There is also a drive for redistribution organisations to identify food surplus earlier in the supply chain as the quantity of food surplus from retailers, which is currently the largest source of surplus food, could shrink in the future. Retailers are increasingly adopting AI solutions to make stock management more efficient such as solutions from Orderly, Retail Insight and Neurolabs. Equally interesting to note is the acquisition of organisations operating higher up the food and drink material hierarchy by former foodstuff processors and waste management companies to support their clients deliver their ESG goals. Examples include Biffa acquiring Company Shop Group and SugaRich acquiring Sweet Dreams.

Case study

WRAP UK Food and Drink Pact

The UK Food & Drink Pact, (formerly the Courtauld Commitment), brings together businesses from across the food and drink supply chain who are committed to three key targets by 2030:

01 To deliver against UN SDG 12.3: a 50% per capita reduction in food waste

02 To deliver a 50% absolute reduction in GHG emissions associated with food and drink

03 An overall target that 50% of fresh food is sourced from areas with sustainable water management

Over 175 organisations are committed to working towards the 2030 targets by participating in collective action through initiatives such as:

- Net- Zero Transition Plan - aiming to reduce GHG emissions associated with food and drink by 50% in collaboration with IGD and EY
- Food Waste Reduction Roadmap - aiming to halve food waste per capita by 2030
- Water Roadmap - a structured pathway to ensure 50% of fresh food is sourced from areas with sustainable water management
- Water Collective Action Projects - achieving sustainable water management in the 20 most at-risk UK and global sourcing areas, improving water security at a catchment scale

WRAP's progress within the Pact proves that collaboration works: food waste is falling, water stewardship is scaling and GHG emissions are starting to decline. But the race to 2030 is far from over. Over the next four years, WRAP aspires to get as close as possible to their targets.

Limited application of AI in food waste and surplus

During stakeholder interviews conducted as part of this demonstrator project, only one AI-led solution to tackle food waste kept being mentioned: Winnow. A market scan uncovered some more commercial examples as shown in Figure 4.

// Figure 4. Landscape of AI solutions tackling food waste

The lack of innovative solutions for tackling food waste within food manufacturing was why Zest was established, with AI identified as a key enabler by them. To date, the application of AI in food manufacturing has been limited to optimising supply chains, inventory management, quality control, safety compliance and personalised consumer engagement.[28]

Optimising supply chain and inventory management definitely support waste reduction but its not the sole focus. In a Food Standards Agency Survey conducted in 2023, 65% of respondents stated that the main hurdle for technology adoption in the food sector is selecting the right technology that is fit for purpose.[29]

Incoming: the BridgeAI demonstrator project

The limited use of AI within food manufacturing to tackle food waste and surplus is largely down to the lack of digitised data. Zest has been looking to address this since 2022. When an Innovate UK call for demonstrator projects under the BridgeAI programme was put out, Zest and Sustainable Ventures convened a project consortium that would:

01 Understand existing processes within each partner organisation that would need to change to improve food waste and surplus visibility, reduction and redistribution

02 Design new collaborative processes that would support piloting Zest's solutions

03 Conducts pilots to inform and test Zest's solutions

04 Allow Zest to build out their solutions with direct user feedback from the pilots

05 Support Sustainable Ventures in developing a model to scale the pilot's operations across the UK

The focus of the project was on ambient food waste and surplus since Nestlé was the manufacturing partner. Further details on the demonstrator project is provided over the next three pages.

In this white paper

This first section has provided context on the food waste and surplus challenge with a focus on food manufacturing. The second section details key insights from the pilots, stakeholder engagement and market research that have supported the development of an AI-led model to scale food waste and surplus visibility, reduction and redistribution across the UK. The third section sets out the model for scaling and a cost benefit framework for different stakeholders. The fourth section covers stakeholder actions to accelerate the uptake of the model.

Out of scope of this white paper

The food waste and surplus challenge is a systemic one. There are many things that need coordinated changes to fully change the system including policy frameworks, organisation business models, product design, packaging design and materials, ingredient sourcing, technology adoption and education, to name a few. The items scoped out but considered important to acknowledge in the context of this white paper is provided in Appendix 1.

"Zest is trying to change the system and bring more circularity into mid-stream food surplus and waste. It is important that innovation like this is allowed to evolve and flourish if we are to accelerate our collective impact on food waste prevention."

Will Nicholson, Global Food Waste Programme Lead, WRAP

Case study

BridgeAI demonstrator project: piloting solutions for AI-led food waste and surplus visibility, reduction and redistribution

Project overview

This nine partner consortium project closed the gap between innovation and implementation in AI-led food waste and surplus visibility, reduction and redistribution. Over 16 months, partners designed, tested and iterated an end-to-end process using innovative solutions from Zest and Bristol Superlight. A summary of the project's impact metrics is provided overleaf. The complete set of project impact metrics is available in Appendix 2a.

Zest's role

Zest's real-time visibility and prevention insights solutions for the food manufacturing sector were developed in close collaboration with Nestlé, who adopted them on one of their production lines. It demonstrated how Zest's solutions provide food manufacturers with visibility into the causation, scale and impact of food waste and surplus generation. For Zest's optimised redistribution solution, food surplus supply and demand side dynamics were worked through with Nestlé, Company Shop Group and FareShare. Deliveries of food surplus allocated by Zest between Nestlé and FareShare were coordinated by Zest with Howard Tenens. Company Shop Group provided their own logistics.

Bristol Superlight's role

Initially, the plan was for Howard Tenens to use Bristol Superlight's zero-emissions capable vehicle, OV-1, for the deliveries that also monitor, analyse and share payload bay data along the supply chain to enable a Chain-of-Trust from collection to delivery. However, due to programme conflicts, the OV-1 test vehicle was unavailable for the pilot. As a result, Howard Tenens made use of their own fleet. Howard Tenens and Bristol Superlight used the project to explore the role of the logistics sector in scaling cost effective and efficient surplus food redistribution.

Key milestones

Dec 2024
Project begins with organisation and consortium goals agreed

Jan - Jun 2025
Pilot preparation begins with analysing existing processes and collaboratively designing new processes. Zest begin mapping Nestlé's data systems and building data ingestion pipelines

Jul 2025
First prevention insights on Nestlé production line provided by Zest. Redistribution pilots begin

Aug 2025
Nestlé begin selling work in progress surplus from their production line to Company Shop Group rather than sending to animal feed. Zest begins trials with other large food manufacturers to apply their technology across a range of industries including ready meals, snacks, sushi and cereals

Oct 2025
Redistribution pilots test collecting surplus from one Nestlé site and delivering that surplus to two FareShare sites

Dec 2025
Company Shop Group onboarded for a commercial redistribution perspective. Industry roundtable held to discuss project insights and proposed scaling model

Jan 2026
Zest begin rework material flow modelling for Nestlé. Zest optimised redistribution solution tested on pilots. Single largest surplus delivery by Howard Tenens to FareShare (16.2 tonnes)

Feb 2026
Pallet Network tested for lower cost logistics option on pilots

Enabling innovation in a live business environment

As a climate technology accelerator, Sustainable Ventures played a key convening role throughout the project. Three actions helped maintain consortium collaboration from start to finish.

01 ***Alignment to the vision***
Having and holding a shared vision was essential for anchoring the project. A week before the first delivery, there was a risk of no surplus and no vehicle being available. Using the project vision and objectives, Sustainable Ventures convened the consortium to troubleshoot and ensure the pilots could start on time.

02 ***Understanding the "what's in it for me?"***
Sustainable Ventures invited all partners to share their expected collaboration outcomes and deviations from this such as the type of surplus available and loading / unloading challenges. This built trust and allowed for rapid problem solving.

03 ***Translating perspectives and priorities***
Consortium partners naturally had different perspectives. Sustainable Ventures played a translational role to keep alignment and maintain pace. For example, Sustainable Ventures created a pilot data capture log to be the single source of truth for partners.

"Sustainable Ventures saw this project as a fantastic opportunity to support Zest and Bristol Superlight - two incredible startups in our ecosystem - in the scaled deployment of their solutions by de-risking the collaboration process."

Emily Barrett, Strategic Growth Director, Sustainable Ventures

Case study

BridgeAI demonstrator project: the measurable impacts

// Visibility and prevention pilot on one Nestlé production line

Animal feed diverted to human consumption — **100%**

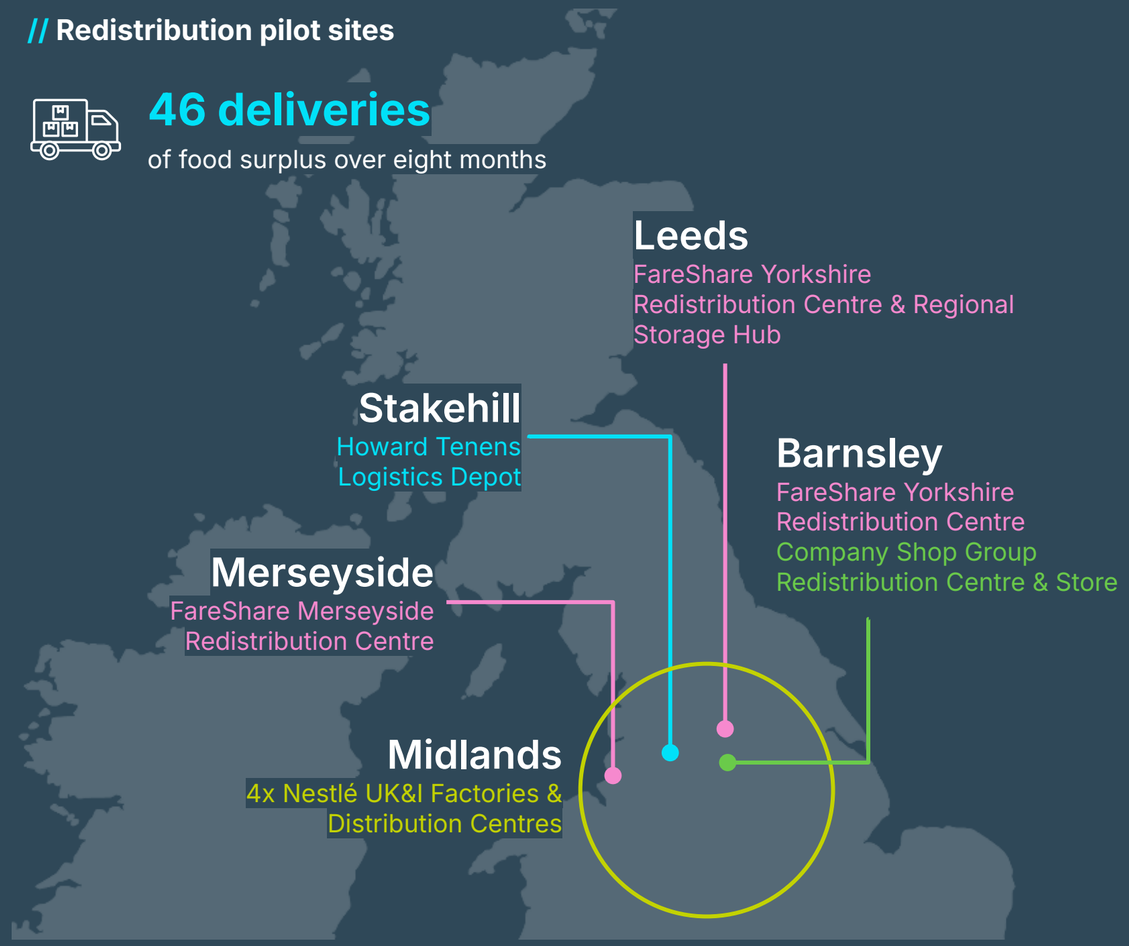
Increase in revenue from food surplus — **15x**

// Production engagement plans by Nestlé following the pilots

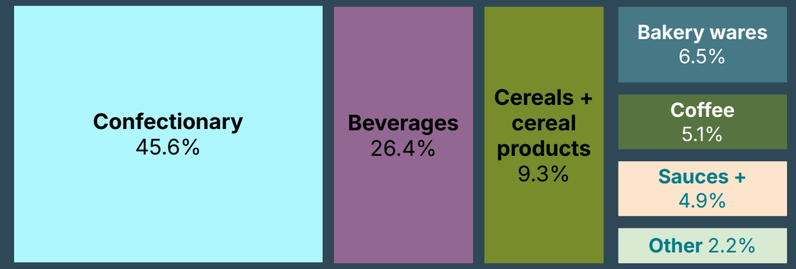
- Roll-out of updated SOPs
- Regular factory comms and visual impact displays on the positive impact delivered
- Recognition for colleagues and sites who have helped drive redistribution improvements

// Redistribution pilot sites

46 deliveries
of food surplus over eight months



// Food redistributed



// Redistribution impacts

201.8
tonnes of food surplus received by Company Shop Group and FareShare

480,529
meals equivalent of food surplus received

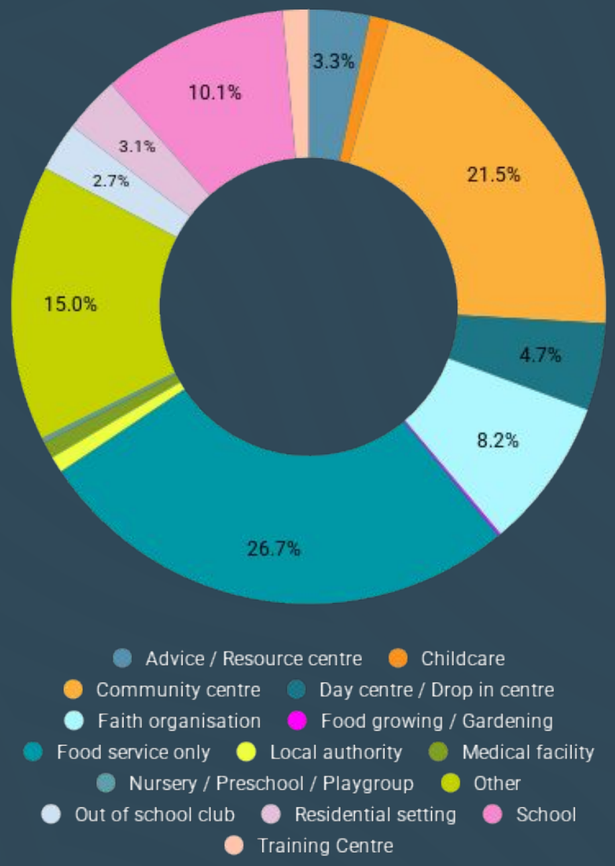
~94,133
people supported through 787 charities and organisations

>£1 million
is the retail value of the goods, had they not reached surplus status

Case study

BridgeAI demonstrator project: food surplus beneficiaries

// Figure 5. Types of charities and organisations supported by the food surplus redistributed under this demonstrator project



How FareShare supports St Paul's Community Pantry

St Paul's Community Pantry in Sheffield is one of over 270 charities receiving weekly deliveries via FareShare Yorkshire's redistribution centre. They received products including breakfast cereals, chocolate and drinks as a result of the project. This organisation gives access to food surplus to help provide a helping hand in the Norton Lees and Meersbrook communities. They host a 'Hope Hub', which provides free teas, coffee, toast and cakes alongside advice from a 'cost of living worker'. They also have a 'jobs coach' on hand, run parent forums and offer support from family workers. In addition to this, St Paul's Community Pantry gives out food to homeless individuals, provides emergency parcels to those in need, provides food parcels to school pupils, and hosts a community lunch every Friday.

"We'd be lost if we didn't have FareShare; the food really diversifies the offerings in our area and helps families maintain a balanced diet. During the winter, we give out food packs to the elderly with things like coffee, hot chocolate, soup and also warming breakfast cereals. Recently, we made sure to give them some really nice porridge that came through from FareShare that had a bit of golden syrup in it. Often you'd go to an elderly person's house and discover that they're too frightened to put the heating on and they don't have enough food, because of the cost of living crisis."

Tina Sampson-Smith, Manager, St Paul's Community Pantry

St Paul's Community Pantry in Sheffield

Deriving insights to inform the proposed model

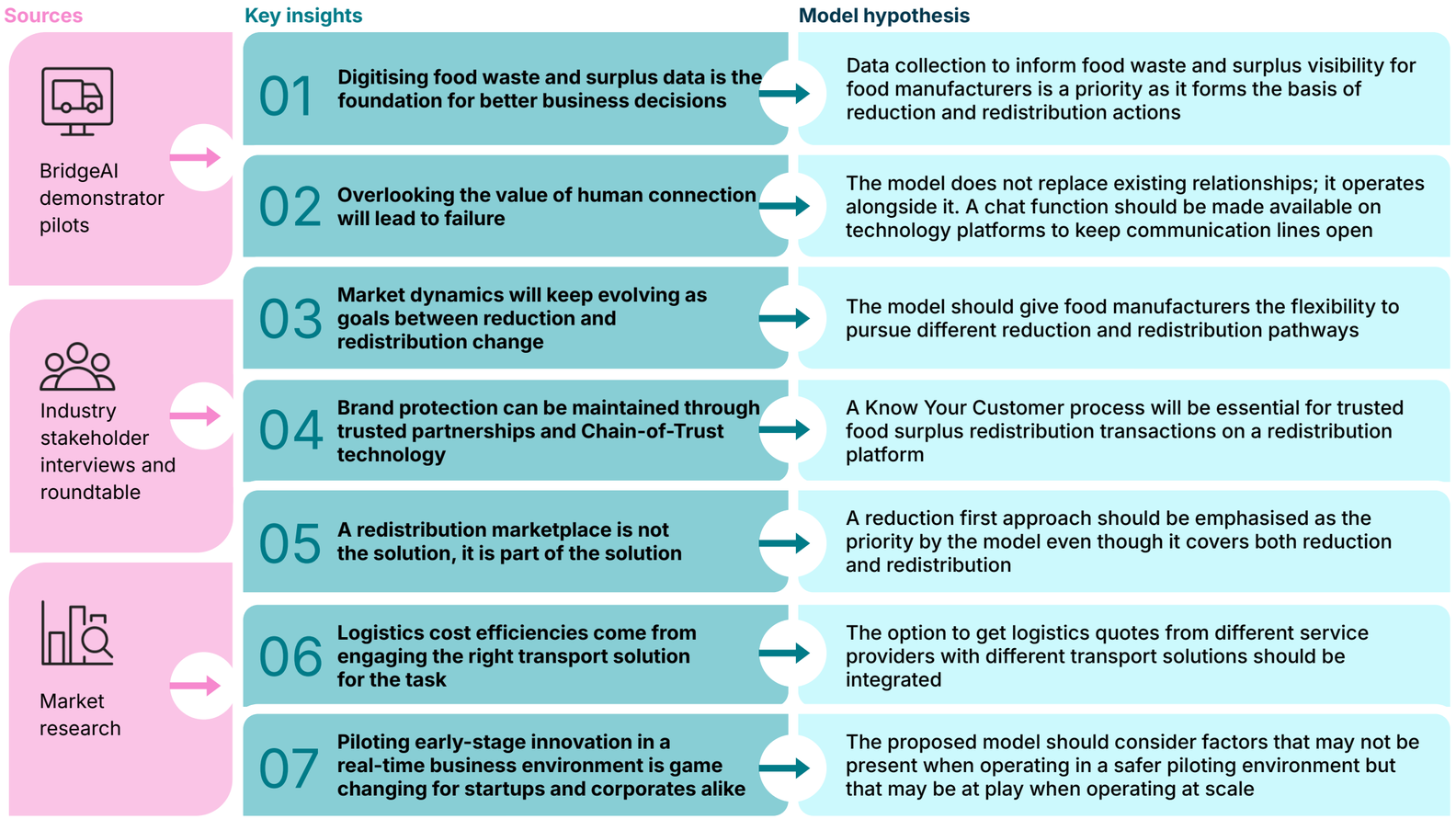
Insights development process

Insights to inform the proposed model for scaling AI-led food waste and surplus visibility, reduction and redistribution were derived by identifying trends and signals from:

- eight months of visibility, reduction and redistribution pilots with consortium partners
- 25 stakeholder interviews on the barriers, opportunities and enablers of food waste and surplus visibility, reduction and redistribution
- one roundtable attended by 43 industry stakeholders to discuss the proposed model for scaling, scaling challenges and potential solutions to address these challenges
- 16 months of desk-based market research

From this, seven key insights emerged. These are summarised in Figure 6 together with how each insight was considered in the proposed model development process. Further detail on each insight is provided in this section. The proposed model is provided in the next section. A list of all the stakeholders engaged as part of this demonstrator project is provided in Appendix 3.

// Figure 6. A summary of the key insights and how they were considered when developing the proposed model



Insight 01

Digitising food waste and surplus data is the foundation for better business decisions

There is no AI without reliable data

The global market size of AI in food and beverages was valued at US$ 8.45 billion in 2023 with a compound annual growth rate (CAGR) of 39.1% between 2024 and 2030.[28] This growth will not be achieved without high quality, digitised data that AI models can learn, function and provide value from. In the context of food waste and surplus, identifying the right manufacturing data, accessing it and digitising it is key to be able to unlock the power of AI. Sometimes the challenge is trying to find the right person with access to the data contained in siloed line equipment software or paper records. Other times, the challenge is the sheer amount of data and finding the right person that has time to decode it, as was the case on the pilots. There are organisations like TrendMiner and BRAINR that are looking to digitise and connect data across a manufacturing organisation to enhance data analytics but they do not specifically focus on food waste and surplus data analytics like Zest does.

"Food manufacturers hold vast amounts of complex data from multiple, often inconsistent, sources. These silos make it almost impossible to gain clear visibility of food waste and surplus, let alone act on it. Our AI-powered algorithms bring this fragmented data together, revealing interdependencies that show not just where waste is occurring, but why. That insight enables action to improve resource efficiency or capture surplus safely for redistribution."

Dini McGrath, Founder, Zest

Zest's real-time visibility solution

The absence of detailed data on the quantity, timings and reasons for food waste and surplus generation makes it difficult to take action against it.[30] Zest's real-time visibility solution changes this by bringing together different datasets into one granular picture of food waste and surplus generation across a production line. These datasets cover historical production data, stock levels and demand plans. They are typically found in:

- Enterprise Resource Planning (ERP) systems
- Manufacturing Execution Systems (MES)
- Former foodstuff processor and waste contractor data
- Screen data from the production line captured untracked and then converted into structured data using computer vision

AI

The real-time visibility aspect depends on how data sharing has been set up with the food manufacturer. There may be a lag of 5-10 minutes where it is truer to say 'near' real-time visibility. The data is then combined with other data sets and normalised with the use of natural language processing to be transformed into a digital waste map by Zest.

This solution combined with Zest's machine learning driven prevention technology solution fosters proactive decision-making on food waste and surplus management.

Production line data capture with cameras

Visualisation of a digital waste map developed by Zest using sample data

Data standardisation

As part of the demonstrator project, Sustainable Ventures and Zest co-designed the onboarding process for the real-time visibility solution. It is designed to be as flexible as possible since not all food manufacturers speak exactly the same language. They may also use different data structures and different systems (SAP/Infor or Oracle being large ERP providers). In these cases, there is a need to standardise the data into Zest's schema.

Zest's data pipelines convert non-standard data structures and internal terminology into a standardised master schema. This reduces onboarding time and human error. It also removes the bottleneck of asking food manufacturers to clean their data before working with Zest. In addition to this, since Zest's solutions are targeted, they do not require food manufacturers to undergo an entire digital transformation process across their organisation.

A case study comparison

Over the course of the demonstrator project, Zest piloted their real-time visibility solution with several other food manufacturers. This included one ambient products food manufacturer that has also been conducting manual waste walks on one of their production lines. A comparison of the process and outcomes between these manual waste walks with Zest's real-time visibility solution on the same production line indicates Zest's solution advantage in speed, accuracy, consistency and ability to incentivise change. This is set out in Table 2.

// Table 2. A comparison of manual waste walks with Zest's real-time visibility solution on one line of an ambient products manufacturer

Methodology for identifying food surplus	Manual waste walk	Zest AI-led real-time visibility solution
Time taken to map food waste and surplus	1 month to create an initial data set on food waste and surplus generation including an initial manual review of available data, 1 day site visit and post site visit analysis	2 weeks to create a digital waste map, which can be shared directly with key stakeholders
Data accuracy	3 tonnes of food surplus identified	12.3 tonnes of food surplus identified
Data constancy	One off snapshot of food surplus generation data based on the production taking place on the day of the manual waste walks	Able to provide continuous food surplus generation data that self learns to improve predictability
Food waste and surplus generation predictability	Based off historic waste walk	Able to see what is happening now and in the near future to help plan better
Ability to incentivise change	The data can drive change but it is scrutinised a lot more as it is regarded as a snapshot in time rather than a trend	Able to see what food waste and surplus is being generated, where on the production line it is being generated and why, to inform clear actions that drive change

The demand data play

Zest's optimised redistribution solution turns a manual, complex decision into an instant recommendation.

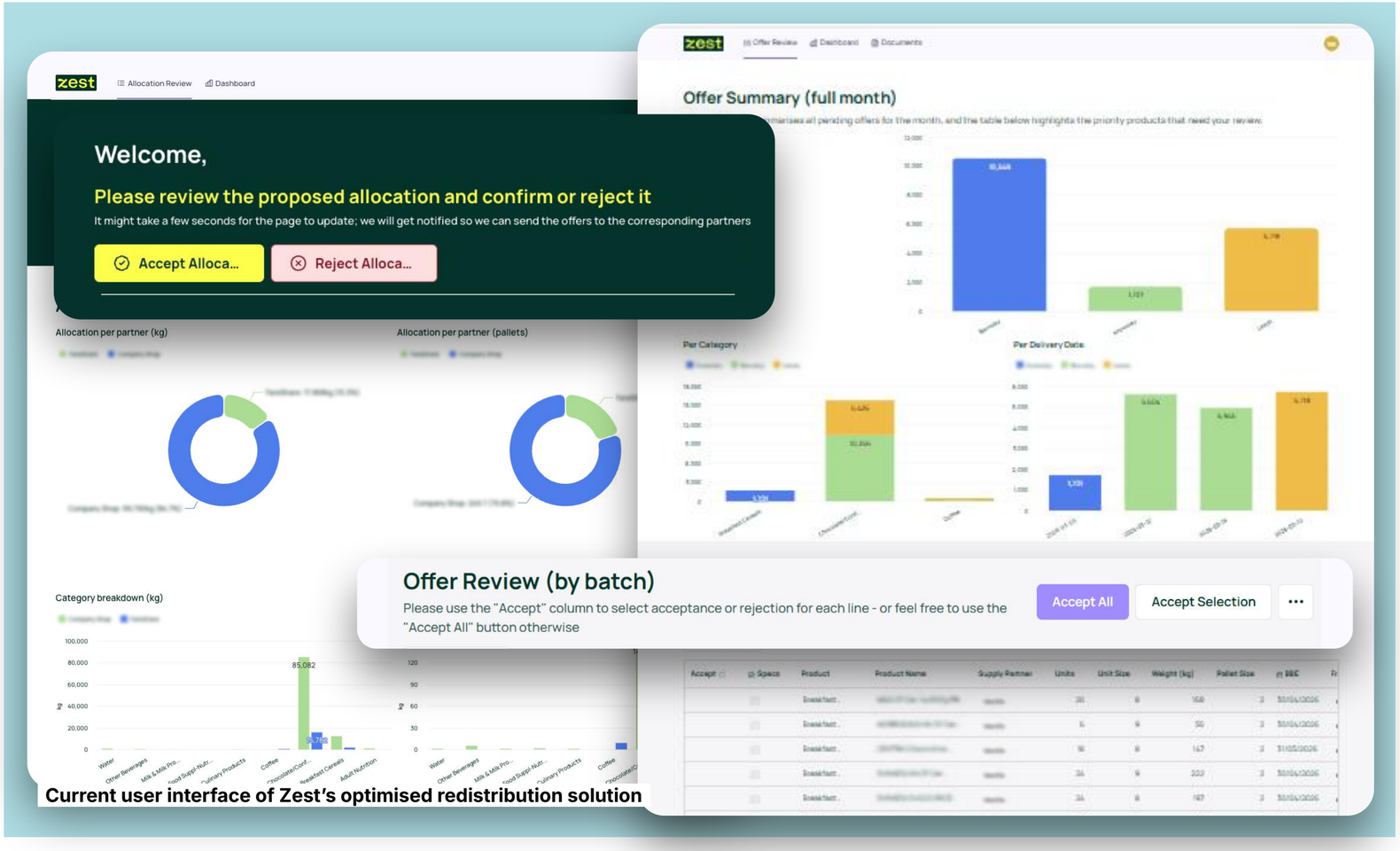
AI

Zest uses a configurable algorithm to solve complex resource allocation problems. It takes known food surplus supply and matches it to surplus demand, driven by maximising objectives such as quantity allocated and constrained by factors such as freshness, item sizes and price.

This demonstrator project was admittedly the first time that FareShare had thought about demand in such detail. At first, charity level demand was considered but the onus on charities to periodically provide this data was too high. FareShare then considered historical surplus allocations at the redistribution centre level as a proxy for demand. This covered typical food categories and quantities for each FareShare redistribution centre involved in the pilot. It allowed food surplus from Nestlé to be proportionally allocated across FareShare's redistribution centres. As a result, FareShare could accept the offers of surplus with more confidence. With increased data and insight of this demand, a clearer picture can be built with which to match supply. It begs the question: if all food surplus supply and demand was on one platform, could surplus food be distributed more efficiently?

"From a supply chain perspective, how do you fairly contribute to a national ecosystem of food banks, charities and redistributors from Inverness to Truro?"

Mike Barry, Co-founder, Planeatry Alliance



Current user interface of Zest's optimised redistribution solution

Insight 02

Overlooking the value of human connection will lead to failure

Change management is essentially a human experience

About 70% of change programmes fail. This is largely due to employee resistance and lack of management support. On the contrary, change is 30% more likely to stick when people are truly invested in it.[31] Most research into tackling food waste is on the drivers and barriers of behaviour change, and less on behavioural interventions themselves. Where there are studies, they focus on household, retail and hospitality sectors.[32] All eight components of change at the factory level mentioned on page 12 have a human experience associated with it. This could be emotional, relationship-based or physical as described in Table 3.

// Table 3. Key human experiences to consider when implementing food waste and surplus initiatives in food manufacturing

Change component	Human experience
Data accuracy and real-time monitoring	• Building trust in Zest (or Zest-like) solutions through trials to overcome the perceived risk in sharing data • Understanding that food waste and surplus is not an inevitable cost of doing business but a missed opportunity to improve both the top and bottom lines[12]
Cross-functional accountability	• Designating an owner for each initiative who feels responsible to deliver on it • Engaging with procurement, R&D, supply chain, manufacturing, marketing, communications, finance and sustainability teams to align on KPIs such as food waste and surplus reduction, proportion of surplus cleared for sale or donation, and COGS recovery[12]
Investment in infrastructure	• Trust that the new infrastructure is fit for purpose and works • Embedding human-centric design into the process to make process changes easy to adopt such as visual cues by using clear surplus collection receptacles
Allocation of space	• Respecting the physical flow of the worker and not creating a bottleneck or safety hazard • Designating an owner of the space
Changes to SOPs and protocols	• Involving operational teams when writing the new SOPs so they feel empowered • Changes to operational flows to ensure full traceability with minimum complexity
A culture of resource stewardship	• Buy-in and support from senior leadership • Training and education through demonstration with both permanent and temporary staff, which consistently gets reinforced by management • Feeling proud of the social impacts achieved by redistributing perfectly good food to people through visibility of the internal (KPIs) and external (social value) impact it has made
Changes to information systems	• Feeling responsibility over traceability, liability protection and sustainability reporting
Supply chain and demand integration	• Psychological safety of creating leaner production forecasts that lead to less food waste and surplus generation • Having a relationship manager that understands the partnerships with different redistribution organisations or food upcyclers

Relationships between organisations will remain critical

The food sourcing functions of redistribution organisations and food upcyclers are founded on relationships with food manufacturers. The critical importance of this will remain even with technology in place. Why? The food manufacturer may want to sell their surplus one month to recoup COGS rather than donate it (see Insight 03). Food manufacturers may need to request specific interventions by redistribution organisations or food upcyclers for brand protection or legal reasons (see Insight 04). In all cases, the lines of communication will need to remain open. The pilots were a great example of increased engagement between Nestlé and FareShare, which supported the case to unlock new surplus food categories for FareShare during the demonstrator project.

Case study

The power of interaction across Nestlé and FareShare

FareShare and Nestlé have worked in partnership to tackle food insecurity across the UK since 2005. Over this time, Nestlé has redistributed surplus food, coffee and water through FareShare's network, contributing the equivalent of almost 10 million meals to charities and community groups. This includes after school clubs, food banks and community centres. Alongside this, Nestlé has donated pet food to support wider community needs.

In 2025 alone, Nestlé donated the equivalent of 500,000+ meals, supporting 4,206 charities and an estimated 483,000+ people, alongside more than 750 hours of staff volunteering. Nestlé was FareShare's first delivery partner, enabling surplus from its network to be redistributed to FareShare's regional centres and onwards to thousands of local organisations. Today, FareShare is Nestlé's official corporate charity partner and a key charitable redistributor of surplus food. The partnership continues to be supported by senior leadership engagement, representation at key FareShare events and summits, national campaigns and dedicated volunteer days across FareShare's depots. This senior buy in has ensured the relationship extends beyond surplus redistribution to broader collaboration and shared impact.

Most recently, the partnership has evolved further through the BridgeAI demonstrator project. The project has driven a significant increase in surplus food donations flowing from the Nestlé network into FareShare's charity network. It has also improved the quality of engagement between both organisations. This includes clearer communication, more consistent communication and creating space to revisit historic misconceptions. It has strengthened collaboration with national and site level teams. It has deepened mutual understanding of FareShare's redistribution model, regional demand and network capacity, helping surplus to be allocated more effectively to where it is needed most. The BridgeAI demonstrator project reflects the trust built over two decades and represents the next phase of this long standing partnership.

FareShare picking Nestlé surplus for a charity delivery

Insight 03

Market dynamics will keep evolving as goals between reduction and redistribution change

Preparing charity subscriptions for dispatch at the FareShare Yorkshire Redistribution Centre in Leeds

Reduction vs Redistribution

If given the choice, most food manufacturers would reduce food waste and surplus as much as reasonably practicable. It makes commercial sense. In fact, research shows a 14:1 return on investment on food waste reduction initiatives.[33] But as highlighted on page 12, ease of operations takes precedence and changing existing processes is a complex process that not everyone has the capacity to embark on. On the face of it, one would think that reducing food waste and surplus would reduce the surplus that charities like FareShare and The Felix Project, City Harvest, FoodCloud, The Bread and Butter Thing, and many others rely on. The reality is, there is a lot more food surplus being generated than is currently visible or communicated. Even with reduction measures in place, there would always be food surplus available for charities. Several stakeholders said it would be too risky for food manufacturers to build no tolerance into the quantities they produce; they would rather slightly overproduce than to pass up an order and risk losing customers.

Commercial vs Charitable redistribution

The pilots addressed commercial versus charitable redistribution head on with both Company Shop Group and FareShare involved. Both organisations have worked with Nestlé for many years. In the end, the allocation of surplus between the organisations was based on Nestlé's internal surplus strategy - donate finished packaged goods equally between the two organisations but look to sell work in progress where possible to recoup COGS. This reflects the sentiment at the industry roundtable where it was shared that food manufacturers may want to sell certain surplus and donate others. This could even change on a case by case basis. It also reflects how Company Shop Group onboard partners. The process involves agreeing how each partner wants to 'transact' with Company Shop Group through sales, donations or a combination of both. It always depends on the food manufacturer's redistribution goals.

Giving surplus value

There was much discussion during the interviews and industry roundtable on giving surplus a pound value. There is no right or wrong answer here. Market players will keep doing what they need to in line with their strategic goals. The different points raised on the topic include:

Food manufacturers start to listen when a pound sign is put next to food waste and surplus

Free food is such a powerful tool at providing wrap around charity services

So long as money is the lead, it will win

Over-commercialising surplus risks squeezing out charities

We're not paying for surplus feedstock for our upcycled products yet as we're just starting off but we hope to in the near future

Managing a pallet of fruit and veg waste at the market might cost £60. Sending my lorry to upcycle it costs £40. I already save them £20

Making surplus food free, devalues it

We donate food because it's the right thing to do. We don't want to make money from it

Social supermarkets allow low income households to continue shopping in store at large discounts

"The return on investment for businesses has got to be significant. It has to be shown to improve the manufacturer's bottom line one way or another. Otherwise, you're never going to get scalability."

Will Nicholson, Global Food Waste Programme Lead, WRAP

Who pays for logistics?

The logistics cost for Nestlé to FareShare deliveries on the pilots were match-funded between the grant and Howard Tenens. This was different from what was taking place before the pilot and could be different to what happens once this project finishes. The conclusion was that the market will decide what works best for each surplus transaction. This is the case for Globechain transactions where it is left for the item supplier (typically a corporate) and demand organisation (charity) to agree on logistics between themselves. Food manufacturers may decide to sell more surplus to cover their logistics costs. They may even provide logistics for free as part of their social impact strategy. Redistribution organisations may want to provide logistics themselves to gain control over time-sensitive, perishable and unpredictable supplies. The costs may even be split between the supply and demand side. There was also a proposal shared at the industry roundtable for logistics companies to provide reduced tariffs or cost-sharing programmes for food surplus transport as part of their social impact initiatives. Existing and proposed reduced tariffs for food surplus transport is cited in several research papers.[34,35] Logistics companies would of course need to make the business case work for offering free or reduced cost logistics.

Case study

The "everyone wins" model by Nestlé

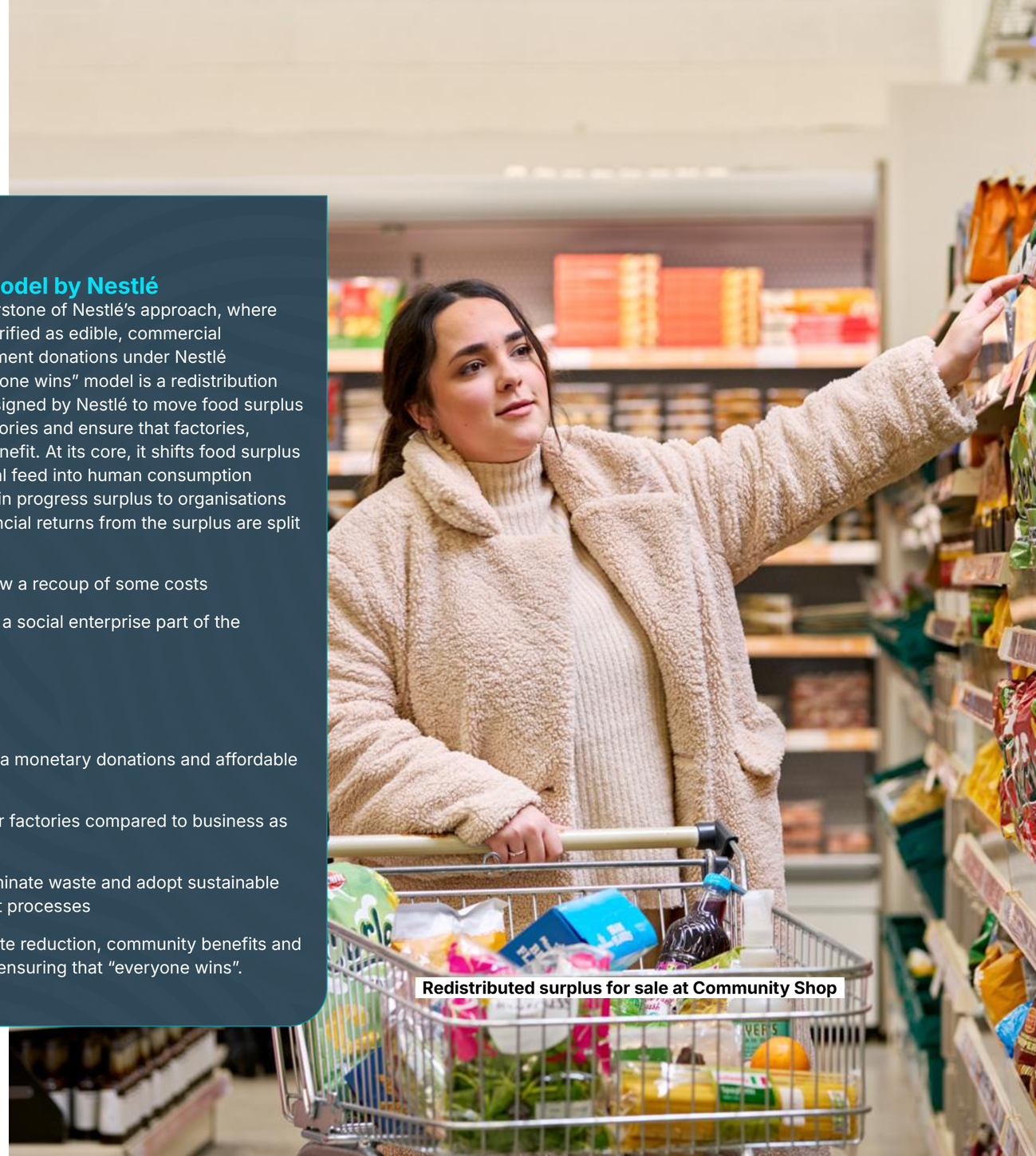
While donations remain a cornerstone of Nestlé's approach, where work in progress streams are verified as edible, commercial redistribution is seen to complement donations under Nestlé oversight and policy. The "everyone wins" model is a redistribution and value-sharing approach designed by Nestlé to move food surplus up the food chain across its factories and ensure that factories, communities and charities all benefit. At its core, it shifts food surplus from lower value uses like animal feed into human consumption channels through sales of work in progress surplus to organisations like Company Shop Group. Financial returns from the surplus are split so that all stakeholders gain:

- 50% to the factory, to allow a recoup of some costs
- 25% to Community Shop, a social enterprise part of the Company Shop Group
- 25% to charity partners

This creates:

- increased social impact via monetary donations and affordable food access
- higher financial returns for factories compared to business as usual routes
- stronger incentives to eliminate waste and adopt sustainable food surplus management processes

Overall, the model supports waste reduction, community benefits and improved return on investment, ensuring that "everyone wins".



Redistributed surplus for sale at Community Shop

Insight 04

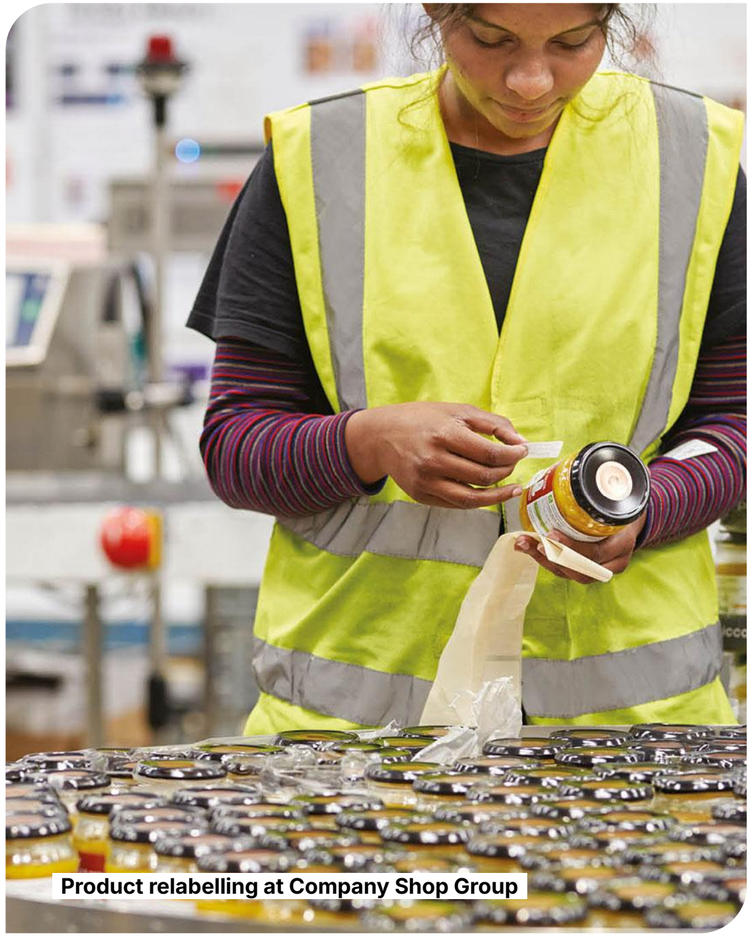
Brand protection can be maintained through trusted partnerships and Chain-of-Trust technology

Repacking and relabelling

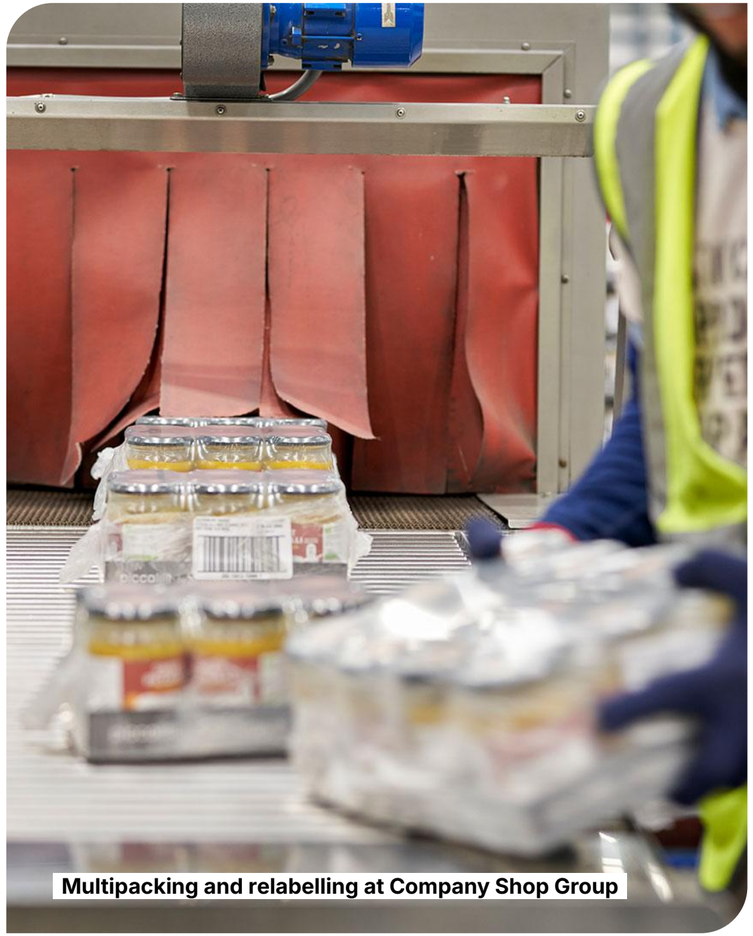
In theory, it would make most sense for food manufacturers to repack and relabel surplus food in-house into the formats required for brand approved, legal redistribution. There has been success in cases where grant funding is available for these operations such as through Defra's Food Waste Fund in 2019 and the Coronation Food Project, or where a specific budget has been allocated by food manufacturers to undertake these operations under an ESG initiative. It can also work where the surplus is put aside then ran back down the packing line when capacity exists on later shifts. This makes use of manual and technical capacity that would have otherwise been unutilised. In most cases, however, it can be commercially challenging for food manufacturers to do this as it detracts from their core business operations. So, these operations get passed onto redistribution organisations or third party service providers such as Oakland, Deka and We Can Foods. The scale and varied nature of operations by redistribution organisations observed during this demonstrator project cannot be understated; whatever the repacking and relabelling challenge, they can usually propose an intervention solution to resolve it.

"When I first started in the role 20 years ago, the food safety management system was about 35 pages long. It's now about 187 pages long. It reflects the many different situations and supplier requirements that have come our way so we've written policies and procedures to match that."

Stephen Hayes, Operational Compliance Manager, FareShare



Product relabelling at Company Shop Group



Multipacking and relabelling at Company Shop Group

Relabelled Nestlé surplus coffee by Company Shop Group

Brand protection and product liability

Brand protection for food manufacturers is all about ensuring only quality and safe to eat food surplus reaches consumers to minimise complaints per unit. At times, this means removing branding on the products altogether. All food redistributed in the UK must meet Regulation 852/2004 and 853/2004 to ensure a high level of consumer protection with regard to food safety. Existing product liability laws mean that liability for food surplus typically transfers from the supplier to the recipient once the food is accepted, provided the donor or seller acted in good faith, declared any risks and followed all relevant food safety laws when the food left their control. Redistribution organisations actively work with food manufacturer's legal teams to provide clarity and written agreements that establish a clear chain of responsibility, helping to overcome corporate risk aversion that often prevents donation or sale. WRAP have also prepared several guidance documents in collaboration with the Food Standards Agency to support redistribution. This is supplemented with evidenced-based SOPs developed by redistribution organisations to maintain food safety in new intervention situations.

Case study

Coronation Food Project: Alliance Food Sourcing

The Coronation Food Project is a major UK-wide initiative launched by His Majesty King Charles III to save surplus food at farms and factories, build large-scale Coronation Food Hubs and provide flexible funding to grassroot charities. The program has worked with 35 organisations to rescue nearly 5,000 tonnes of food - equivalent to 12.5 million meals - and raise over £20 million to expand the UK's cold storage and logistics infrastructure.

Born out of the Coronation Food Project, Alliance Food Sourcing is a consortium of retailers, manufacturers, hauliers and suppliers who are pooling their surplus capacity and industry expertise to develop innovative solutions to extract previously inaccessible surplus food from the manufacturing space. The consortium is convened by IGD, FareShare and The Felix Project.

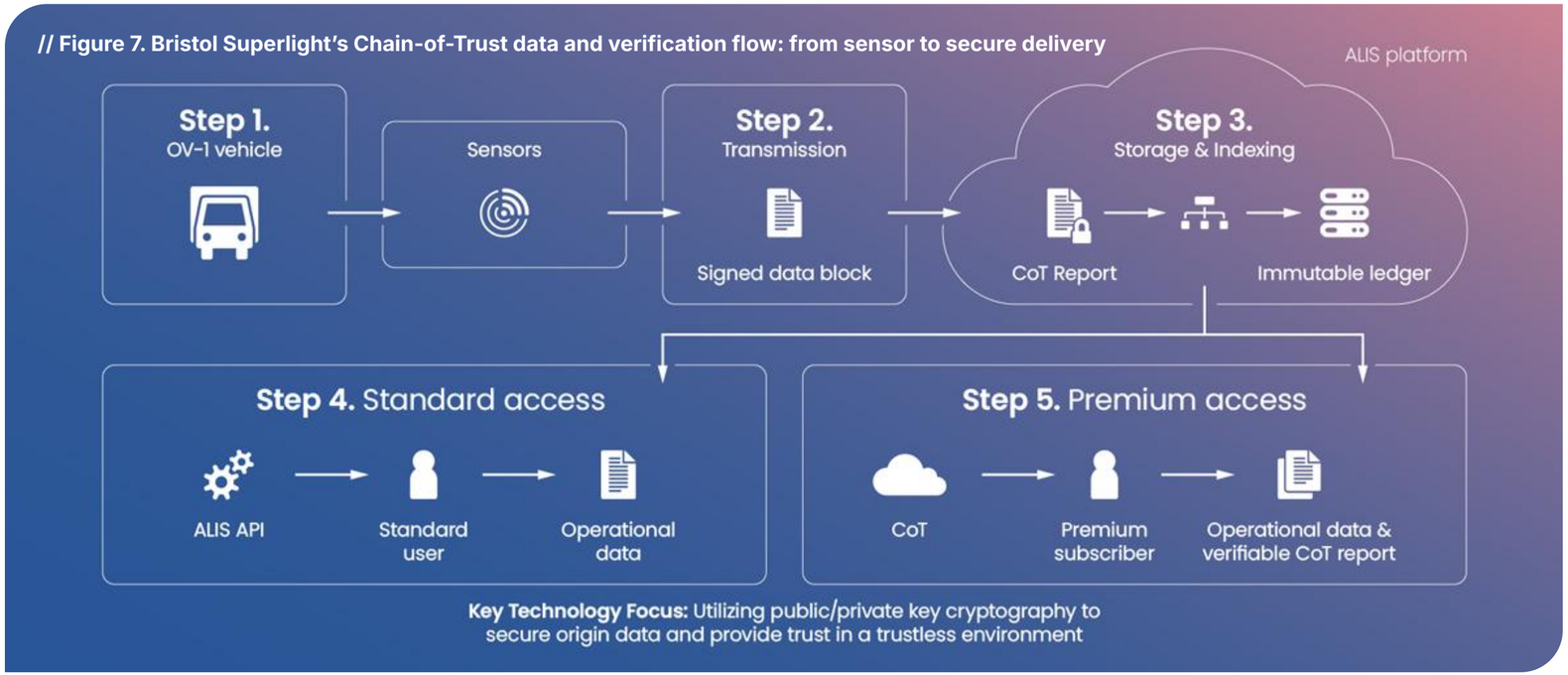
Manufacturers like 2 Sisters Food Group, Premier Foods, Charlie Bighams and Barfoots have introduced repacking processes to rescue surplus products that are either work in progress or have minor visual defects. Retailers like M&S, Tesco & Sainsbury's have worked with their partners including 2 Sisters, Greencore and Bakkavor to manufacture ready meals utilising surplus manufacturing capacity. Asda, IPL, Morrisons, Myton, Waitrose and Prima Fruit have changed grading processes to redirect more produce away from animal feed.

The ambition is for the programme to be delivering 30 million meals a year by FY 2028/29. Alongside the roll out of dozens more surplus recovery initiatives, this scale up will be supported by advancements in technology, utilisation of surplus haulage capacity and investments into processing capacity.

Creating a Chain-of-Trust in logistics

Food provenance can be provided by labels and certifications, but it can also be provided using technology. Bristol Superlight's Chain-of-Trust technology uses sensors on board their electric vehicles to track temperature, moisture and vibration within the truck, which are processed in real-time with server-grade edge compute capabilities. This, combined with cloud-based machine learning, provide real-time analytics to all stakeholders along the chain, and can also provide real-time insights to drivers to enable proactive measures to be taken to maintain the quality of the food the vehicle is transporting. This can include identifying driving profiles that exceed acceleration or braking constraints as well as thermal constraints. Similar to this, Howard Tenens has recently upgraded to a cloud-based telematics system that uses AI cameras to monitor vehicle metrics and driver behaviours. Deviations from 'normal conditions' such as harsh braking are used to share live actions with the driver and to support any future investigations.

// Figure 7. Bristol Superlight's Chain-of-Trust data and verification flow: from sensor to secure delivery



Outlook

Bristol Superlight x Zest

Bristol Superlight's soon-to-be-launched OV-1 electric 7.5-tonne commercial vehicle represents an entirely new class of logistics transportation. The vehicle is designed and manufactured with the same underlying principle as leveraging AI technologies for more efficient food surplus redistribution by Zest: *resource intelligence*.

From a volume delivery standpoint, Bristol Superlight's OV-1 represents a fundamental departure from traditional automotive engineering, replacing the "diesel box truck" with a design rooted in aerospace principles. By utilising a proprietary "space frame" chassis, software and electronics in place of mechanical components, OV-1 achieves a 50% increase in volume and 73% total cost of ownership savings versus legacy vehicles in commercial use.*

Together, OV-1 and Zest's optimised redistribution solution would optimise food surplus redistribution by considering how to allocate and transport more efficiently. Just as OV-1 rethinks the physical structure of commercial vehicles to save energy and expense per pallet delivered, Zest's optimised redistribution solution rethinks the logical structure of the supply chain to reduce food waste and feed more people.

By stripping away the inefficiencies of the past - whether they be heavy steel frames or uncoordinated supply chains - we can create a model of abundance defined by efficiency and precision, not excess.

* third party data from six months of commercial use comparison.

Insight 05

A redistribution marketplace is not the solution, it is part of the solution

Success factors behind redistribution marketplaces

Surplus redistribution marketplaces, or reuse marketplaces, epitomise the circular economy yet some fail. One case in point is Yume - an Australian digital trading platform that generated additional revenue for food manufacturers by selling surplus products and streamlined donating unsold food to relief organisations. After a decade of operations, it entered into voluntary administration after investment in the platform had put unexpected strain on Yume's operating capital.[36] The success factors behind several surplus redistribution marketplaces that are still operational today is shared in Table 4 below. The one thing that connects them all is their scale of usership, both on the supply and demand side. A comparison to Zest's optimised redistribution solution is also provided in the table.

// Table 4. A comparison of success factors behind a selection of food surplus redistribution marketplaces

Factor	Spoiler Alert	Company Shop Group	Surplus Group	Zest - Optimised Redistribution Solution
Business model	B2B software as a service	Company Shop: B2C retail Community Shop: Social enterprise	Morris & Son: B2B wholesale Approved Foods: B2C retail	B2B software as a service
Revenue source	Software subscriptions	Direct retail sales	Trading margins	Software subscriptions
No. of users	300+ manufacturing plants and distribution centres; 600+ buyers and charities	800+ retail, manufacturing and logistics partners; 251,000 members of Company Shop; 16,541 members of Community Shop	Unknown for Morris & Son; 500,000 customers of Approved Foods	12 manufacturing plants and distribution centres; 2 buyers and charities
Success factors	• Instantly pushing real-time inventory to a pre-approved buyers or charities • Integrating with ERP systems to move food before expiry for maximum residual value • Automating tax write-off documentation	• Approval from all major UK major retailers to not de-brand products • Facilities to repackage, relabel and wash products • Member-only supermarkets protect the integrity of the brands they redistribute	• Dual-channel flexibility ensures that stock will always have a home • Own fleet allows them to collect at short notice • De-brands products if retail brands prefer not appearing in discount retail	• Automated surplus data sharing between manufacturers and Zest • Accurate surplus data from real-time visibility solution • Considers changing redistribution goals of food surplus suppliers

Why redistribution marketplaces are only part of the solution

A redistribution marketplace could support greater surplus visibility across the market and more efficient supply-demand matchmaking but only if there is a critical mass of industry users on both the supply and demand side. However, it would not solve:

- the root cause of poverty, which many redistribution marketplaces are set up to support
- why food waste and surplus is generated in the first place so that reduction can be pursued ahead of redistribution in line with the food and drink material hierarchy - a main driver of why Zest's solutions cover real-time visibility and prevention insights as well as optimised redistribution
- the accuracy of the surplus data on the marketplace as highlighted in Table 2 where 3 tonnes of food surplus was identified on a production line from manual waste walks while 12.3 tonnes was identified on the same production line using Zest's real-time visibility solution
- relationship-based decisions on specific surplus allocations that a food manufacturer would like to make. Spoiler Alert, Company Shop Group, Surplus Group and even Yume are founded on extensive networks of surplus supply and demand organisations, which cannot be underestimated

Insight 06

Logistics cost efficiencies come from engaging the right transport solution for the task

Transport solutions tested on the pilots

For the pilot deliveries from Nestlé to FareShare, the plan was for Howard Tenens to use Bristol Superlight's 7.5-tonne petrol range extender electric vehicle (OV-1) to minimise the GHG emissions associated with transport on the pilots. As OV-1 was not available, Howard Tenens explored the use of a DAF 18-tonne rigid electric vehicle. It quickly emerged that charging would be required enroute but the pilot's geographic area was not served by sufficient charging infrastructure. Therefore:

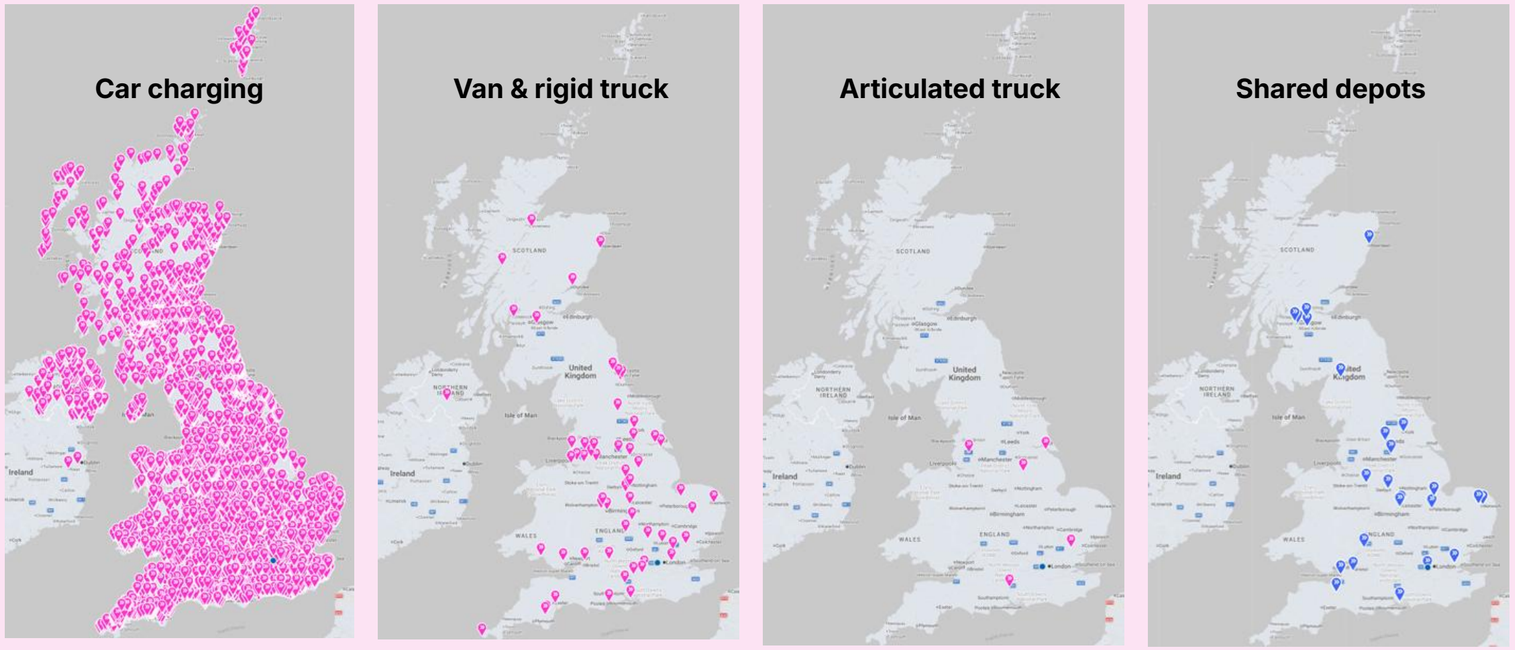
- for 3/28 deliveries, a dedicated 18-tonne rigid heavy goods vehicle (HGV) running on hydrotreated vegetable oil (HVO) was used, noting Howard Tenens vehicles are dual-fuel capable. HVO was used for the first three deliveries as it was available through bulk purchase at a lower cost per litre than diesel. Following these initial deliveries, HVO was no longer used as the price differential no longer provided a cost benefit to Howard Tenens versus diesel
- for 24/28 deliveries, a dedicated 18-tonne rigid diesel HGV was used. A dedicated vehicle ensured instant availability and weekly agility, ensuring no redistribution failed due to a lack of transport
- for 1/28 deliveries, a pallet network service that Howard Tenens is partner of - The Pallet Network - was used. This service is only available for consignments of nine pallets or fewer, and makes use of available capacity across partner vehicles already on the road to reduce both GHG emissions and costs. During this delivery, two 44-tonne articulated lorries and two 18-tonne rigid HGVs were used. All of these vehicles ran on diesel. Due to a morning specified collection at Nestlé as opposed to a standard afternoon collection offered by the service, the GHG emissions and cost benefits observed of this service was reduced

Table 5 provides a summary of the key metrics from the three transport options used on the pilots. The table also compares these with OV-1 metrics, which were estimated through simulations of all 28 journeys. For vehicle utilisation rates, the HGV-HVO was higher than the HGV-Diesel but only because one of the HGV-HVO deliveries had a high number of pallets, which increased the overall average. The vehicle utilisation rate for The Pallet Network cannot be calculated due to other unknown consignments onboard the vehicles but the very concept of pallet networks is to maximise vehicle utilisation rates. A higher vehicle utilisation rate would have been achieved by using OV-1 as it is a smaller vehicle than a 18-tonne rigid HGV. As expected, the average CO_2e emissions per tonne-km for both HGV-HVO and The Pallet Network deliveries were lower than diesel deliveries, with OV-1 estimated to be significantly lower than all three of these options (see Appendix 2b for calculations). The average costs can only be compared between HGV and The Pallet Network deliveries since OV-1 costs only cover electricity and petrol consumption rather than chargeable cost. There was a small cost reduction from using The Pallet Network compared to dedicated HGVs, which would have been greater if a morning collection was not requested.

// Table 5. A comparison of key metrics for different transport solutions considered under the BridgeAI demonstrator project pilots

Factor	18-tonne rigid HGV-HVO	18-tonne rigid HGV-Diesel	The Pallet Network	OV-1
Data type	Actual	Actual	Actual	Estimated
No. of deliveries	3	24	1	28
Total distance (km)	1,139.42	7,625.07	302.40	9,066.89
Average vehicle utilisation rate by pallet capacity (%)	56.25	48.44	n/a	64.26
Average CO_2e emissions ($kgCO_2e$ / tonne-km)	0.12	0.37	0.29	0.05
Average cost (£ / tonne-km)	Chargeable cost for both HGV-HVO and HGV-Diesel journeys: 0.61		Chargeable cost: 0.45	Energy cost only: 0.03

// Figure 8. Current electric vehicle charging infrastructure across the UK



Electric vehicles need to be the right solution for every task but current infrastructure limits this

The pilots highlighted limited electric truck charging infrastructure across the UK. Even with Nestlé providing charging facilities across the sites that food surplus was being collected from and a petrol range extender available on Bristol Superlight's OV-1, charging infrastructure would still be required enroute for longer routes. As indicated in Figure 8 provided by Paua, charging infrastructure significantly drops as the vehicle that needs charging gets bigger. The lack of electric truck charging infrastructure is a national problem that requires nationwide solutions. There are several major consortia projects underway to address this including GRIDSERVE, eFREIGHT 2030 and Milence. Charging point operators such as bp pulse, Shell Recharge and Vital EV Solutions are also integrating truck-specific bays. Until this infrastructure is available, HVO fuelled vehicles should continue to be used for longer transport distances as a lower GHG emissions option.

"Trialling and adopting electric vehicles is key to our decarbonisation strategy. We have already made significant progress in reducing our carbon emissions, with average fleet CO_2e/km reduced by 55% over the last five years by switching to renewable fuels. 29% of the electricity used in our operational sites is generated from on-site renewables, and the remainder is procured through a 100% renewable electricity contract."

Anna Rickard, Environmental Consultant, Howard Tenens

More data on logistics costs is needed

The cost of picking, sorting, storing and transporting food surplus often makes it cheaper for food manufactures to send it to animal feed or anaerobic digestion than to redistribute it to people.[35] While transport costs are often cited as a major barrier for food manufacturers wishing to redistribute their food surplus, there is limited data on this in the public domain to validate this. When delivering the Defra Food Waste Fund in 2019, FareShare reported that transport costs accounted for 21% of costs while packaging accounted for the greatest proportion of costs at 58%.[37] In this last financial year, Company Shop Group's transport cost was 2.3% of total costs. In both cases, transport is not the greatest cost contributor. However, these are only reported costs from a redistributor's perspective; some surplus supply partners provided their own logistics, whose logistics costs are not accounted for in these figures. More data is needed to develop logistics models that drive cost reductions.

Options to reduce the cost of logistics

Ultimately, reducing the cost of logistics comes down to two things:

01 Engaging the right transport solution for the task as highlighted in Figure 9

02 Negotiating the cost with third party logistics providers on a tariff or contract basis

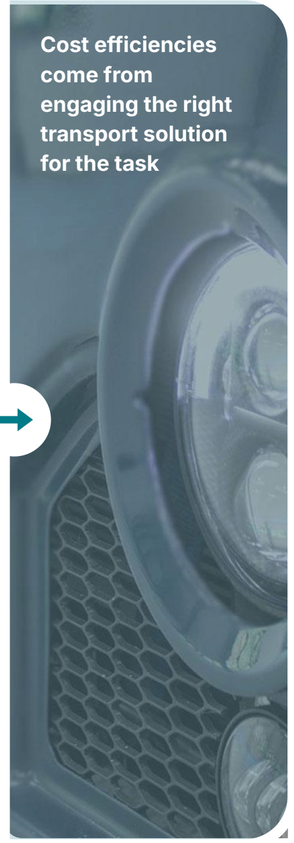
"Finding a logistics provider that can handle our volumes, in the ad hoc capacity current upcycling requires, at an affordable cost, is really difficult."

Chloë Stewart, Founder & CEO, nibs etc.

// Figure 9. Logistics challenges and solutions related to surplus food transport exposed during the BridgeAI demonstrator project

Challenge	Potential solution
Some larger manufacturing facilities and distribution centres only have dock level heights compatible with 18 tonne trucks but lower food surplus volumes do not warrant the use of such large vehicles	Using a smaller vehicle is more cost effective for smaller volumes. Manufacturers should allow the use of low load areas for vans coming to collect the surplus. It should not be fixed that the vehicle is loaded on the dock
Some food manufacturers prefer more regular collections to reduce food surplus storage space in their warehouses	Regular collections of smaller volumes can be made using smaller vehicles or the Pallet Network. The Pallet Network requires food manufacturers to meet specific loading schedules
Some redistribution organisations would rather inefficient collections of food surplus with their own fleet to avoid that surplus becoming a waste	Using a shared logistics systems is more cost effective. This may mean partnering with other redistribution organisations to design such a logistics system. It may require food manufacturers to be a bit more flexible with collection schedules
Some organisations prefer to use their own fleet or logistics companies they work closely with	The main thing is reaching an agreement between supply and demand organisations on who provides and pays for logistics. The most cost efficient solution should be considered as part of this
Regular collections are generally preferred by logistics companies to make it worthwhile for them to get involved amongst much larger, regular contracts	Food surplus generation is variable. Large vehicles should collect larger volumes. Small vehicles should collect smaller volumes. Regular collections of smaller volumes can be made using smaller vehicles, the Pallet Network or another shared logistics system

Insight



Insight 07

Piloting early-stage innovation in a real-time business environment is critical for startups and corporates alike

Why it matters

Piloting innovative technology solutions is never easy, let alone a nine partner, first-of-a-kind pilot in a real time business environment. But pilots have transformative potential and can deliver multiple benefits for all involved as set out in Table 6.

// Table 6. Benefits of piloting by stakeholder

Stakeholder	Piloting benefits
Climate tech startups	• understanding the relevance of solutions with industry partners • incorporating real-time feedback early on in the development process, when there is still some flexibility to do so • refining product and commercial models • accelerating the journey to scale
Large corporates	• defining new customer solutions • increasing competitive advantage • meeting sustainability targets • complying with regulations
Charities	• an opportunity to explore alternative routes to delivering objectives • building awareness of the charity mission with new partners • scoping the time, cost and complexity required to adopt innovations into business as usual

What it takes

The BridgeAI demonstrator project is one of 40+ innovation programmes supported by Sustainable Ventures in over a decade. Three themes continue to emerge around what it takes to successfully pilot.

01 Define the scope

As with any project, planning is essential to success. This is even more important for innovation pilots where there are many more unknowns due to the nature of what is being tested. For the BridgeAI demonstrator project, the consortium spent seven months scoping and planning the pilot before any surplus was identified. Scope expansion, for example, looking at additional Nestlé and FareShare sites was contingent on meeting a range of conditions and was done in phases.

02 Deliver as a team

Despite each organisation having individual objectives from taking part in the pilot, the delivery was done as one team. Balancing the individual needs with the core project vision increased trust and flexibility. Additionally, the pilot involved multiple stakeholders and approvals. Early into the planning process, the team identified who from each organisation needed to be informed, engaged and / or responsible. This allowed for the team to drive progress whilst bringing in stakeholders at key moments as necessary.

03 Prepare for problems

The expectation from the beginning of the pilot was that things would go wrong. Learning from problems was essential and so the team established ongoing continuous improvement sessions to discuss the unexpected and how to avoid the same problems repeating, for example, variations in surplus allocated versus what was marshalled for collection.

Beyond the pilot

When this consortium first came together, it was always with a view to take it forward beyond the pilot. Whilst the BridgeAI demonstrator project has a formal finish date, the organisations do not. The pilot has unlocked significant insights and impact that partners will be taking forward.

Commercialisation and customer growth

Both Zest and Bristol Superlight are focussing on further developing their technologies and expanding their offer to new customers.

Blueprint for change

Nestlé are committed to reducing avoidable food waste and surplus, embedding behaviour change sparked from the project and exploring how the redistribution model can be replicated across all its factories.

Climate tech and innovation

Company Shop Group will continue to explore innovative climate tech solutions and how they can complement existing redistribution models. FareShare are continuing to look at how to make more use of data-driven insights to map and access previously inaccessible surplus. Howard Tenens will continue to explore how climate tech solutions can reduce their current fleet's GHG emissions.

Ecosystem support

Sustainable Ventures will continue to expand its venture and ecosystem expertise to support more climate tech innovators and corporates to pilot and deploy solutions at scale.

Insights and platforms

FuturePlus and Google Cloud will continue to provide enabling insights and technology support to their customers to accelerate growth.

A model to scale AI-led food waste and surplus visibility, reduction and redistribution

Developing the model

The model for scaling AI-led food waste and surplus visibility, reduction and redistribution across the UK for ambient goods was developed by Sustainable Ventures. It is based on the insights shared in the previous section of this white paper, which informed hypotheses for the model. The model development process is set out in Figure 10. The final model in Figure 11 on the next page emerged after several iterations with input from consortium partners and industry stakeholders.

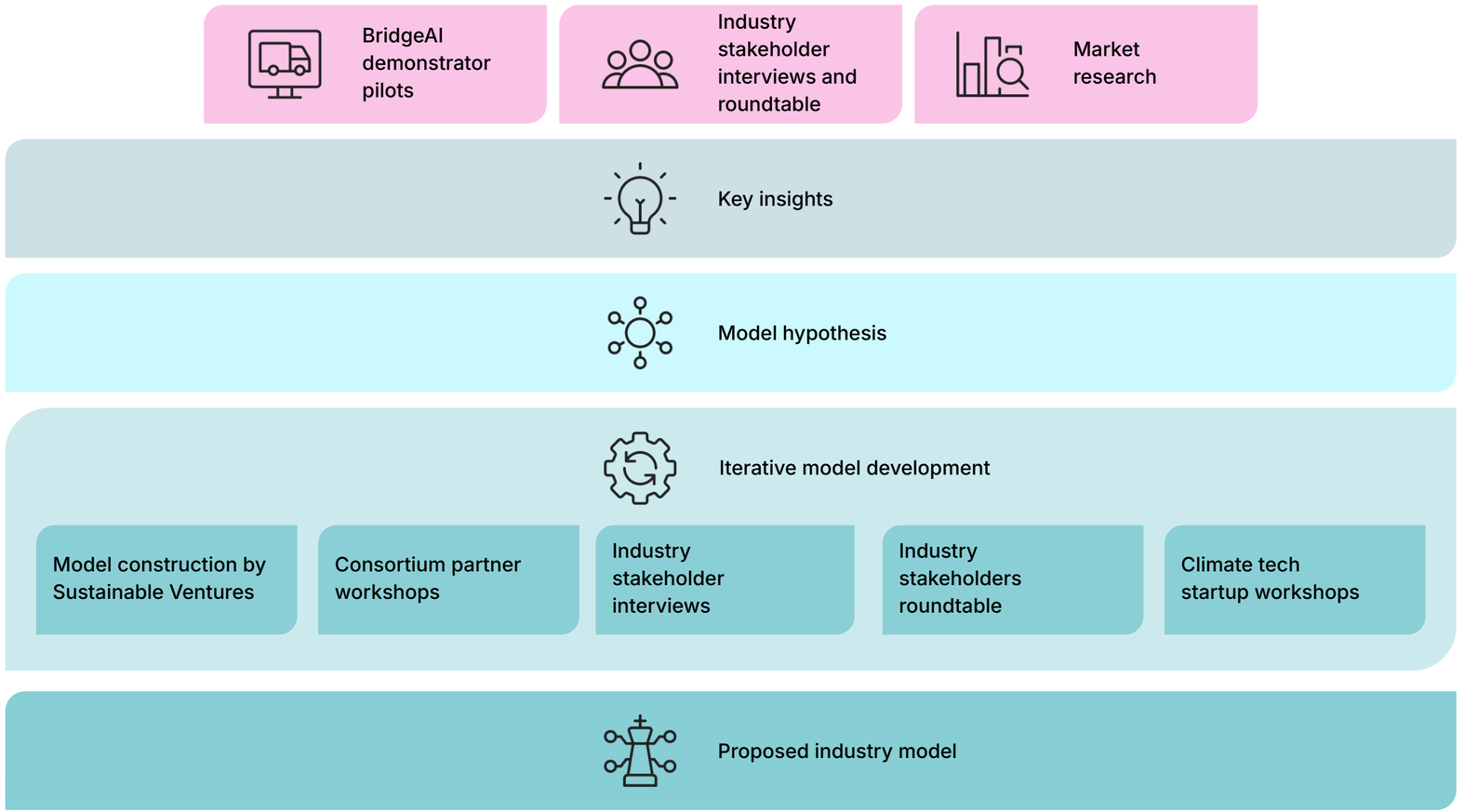
"What an amazing industry roundtable event. It was so exciting to see so many stakeholders in one room working on collaborative solutions."

Rusudan Gongladze, PhD Candidate in Food Redistribution in UK Supply Chains, Cranfield University

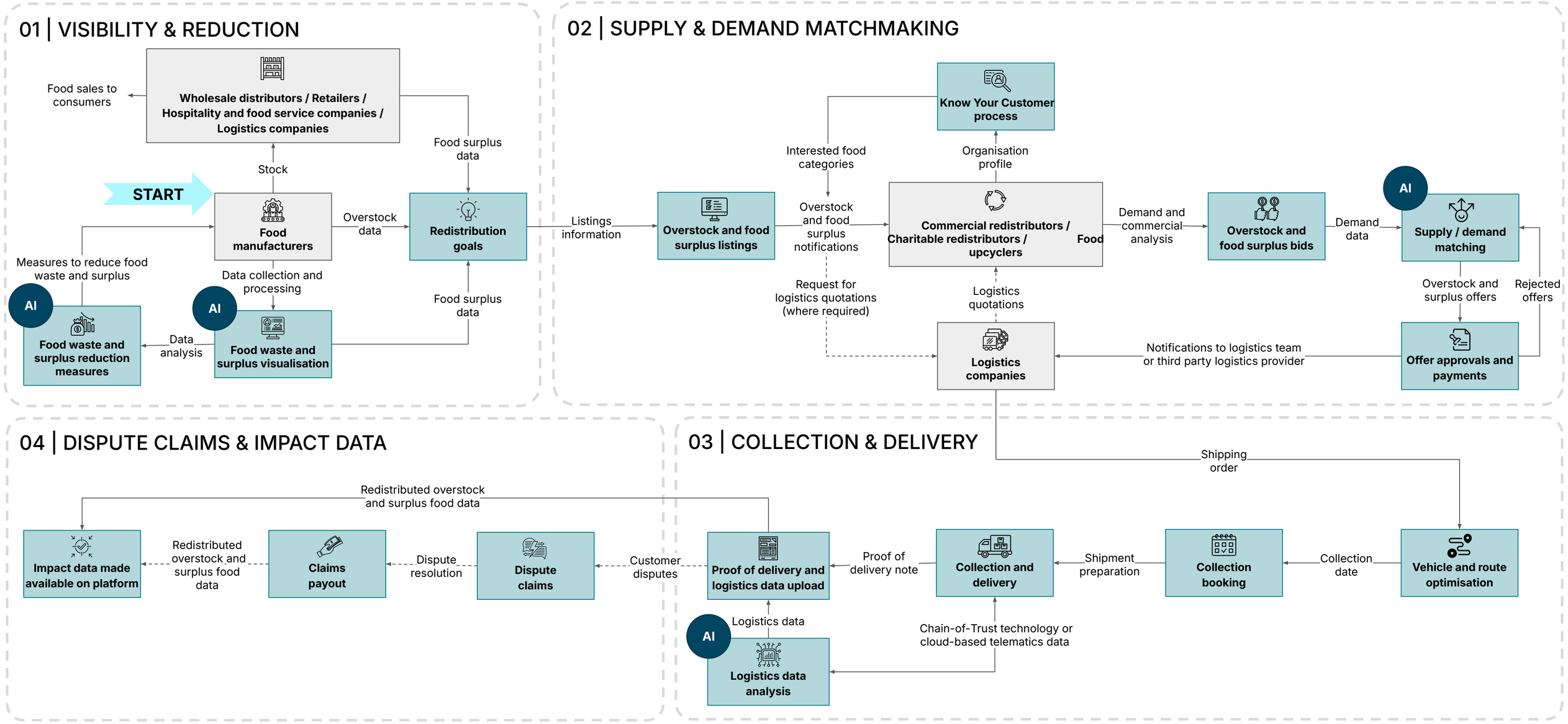
Key differences from the pilots

While the pilots, by definition, considered processes and partnerships across a discrete number of organisations, the model considers processes and partnerships at scale. It considers the different goals, situations and challenges that partners outside the project consortium hold. It takes into account other related activities not covered in the pilots that would support scaling such as using the redistribution platform for selling excess stock on. It considers intersection points with current industry processes more than the pilots as the pilots wanted to maximise testing the innovations themselves.

// Figure 10. The proposed model development process



// **Figure 11. A model to scale AI-led food waste and surplus visibility, reduction and redistribution for ambient goods**



Process phase | Stakeholder | Process stage | AI AI innovation

How the model operates

It starts with visibility

As the saying goes, you can only change what you measure. So the model begins with collecting and processing both line equipment and factory level data to identify what, where, how much and why food waste and surplus is being generated on production lines. This relies on adopting Zest's real time visibility solution or other similar solutions.

Take actions to reduce first

High impact reduction measures are then identified. Those with a clear business case are implemented by food manufacturers as a priority. The changes are successfully implemented by considering the human experience of key implementation stakeholders. This part of the model adopts Zest's prevention insights solution or other similar solutions.

Then redistribution should be pursued

As we know, there will always be some level of food surplus generated. If food surplus quantities are being consistently generated, food manufacturers should seek to design these out through reduction measures. For surplus streams that cannot be designed out (such as by-products) or will not be designed out (for commercial reasons), cost effective measures should be put in place by food manufacturers to sell or donate this surplus via a redistribution platform, such as Zest's optimised redistribution solution.

Getting a critical mass of users

Redistribution platforms only work effectively if there is a critical mass of users. This can be achieved if the food industry collectively agrees on using it. Related transactions can be moved on to the platform to grow usership. This includes selling or donating food surplus from wholesale distributors, retailers, hospitality and food service companies, and logistics companies as well as selling food manufacturers' overstock.

Listing on the redistribution platform

Food surplus from different sources in the food supply chain and overstock from the food manufacturer would then be listed on the redistribution platform for sale or donation. Whether the listing is for sale or for donation would depend on the redistribution goals of the lister for that specific surplus in that specific moment in time. Providing this flexibility is important. For example, some food manufacturers may want to fund part of their surplus repacking operations to make it fit for donation through the sale of other surplus. The redistribution goal may also be to minimise emissions, which would involve only allocating surplus to demand organisations located closest to the lister. Food manufacturers who are using a real-time visibility solution would be able to part automate the listing process by exporting surplus quantities from real-time visibility solutions onto the redistribution platform.

Requirement associated with listings

The listing may come with requirements attached to it, including but not limited to, only offering surplus to:

- existing partner organisations
- organisations that hold accounts with the listing organisation
- organisations that are British Retail Consortium Global Standards accredited

Demand organisations that have signed up to the redistribution platform would then be notified of relevant listings based on their profile, which would be created through a Know Your Customer process. An open and/or closed chat function would allow for listing clarifications between supply side and demand side organisations.

Supply and demand matchmaking

Organisations notified about the listing would then put in a bid for the overstock or surplus. This could be a quantity and price in the case of a sale or just a quantity in the case of a donation; this acts like the demand data Zest use in the matchmaking process. The bid would need to account for the logistics costs if the listing does not come with logistics provided. If notified organisations do not have access to logistics, they could look to get a quote through the redistribution platform. All bids would need to be in by a certain deadline after which an algorithm would look to match supply and demand of the overstock or surplus. Offers to select bidders would then be made for them to accept or reject. Accepted offers would then need approving by the listing organisation. A closed chat function on the redistribution platform would be used for coordination. Rejected offers would go through the matchmaking process again, unless the listing organisation said otherwise.

Time for collection and delivery

For the accepted and approved surplus offers, the logistics process would kick off. The extract process will depend on who is providing the logistics service, what vehicle is being used and any listing or demand side transport requirements. Chain-of-Trust technology or cloud-based telematics systems would be used on board logistics vehicles to maintain the quality of surplus or overstock during transport.

Finishing with dispute claims and impact data

Journey data, along with proof of delivery, would then be uploaded onto the redistribution platform to feed into a dispute claims process, where required. Once the dispute claims process is sorted (if there is one), impact data on the redistribution transaction would be made available to both supply and demand side organisations.

Testing the model

Test 01

How do Zest's solutions interface with and operationalise this model?

The proposed model builds directly on Zest's existing capabilities in real-time visibility, prevention analytics and redistribution. However, it extends beyond current functionality in certain areas and would require targeted product enhancements to fully operationalise the model. The distinction between current capability and future development is important. Some components are deployable today, while others would require further technical development and market validation to deploy in the future.

Real-time visibility

Zest's current real-time visibility solution has been developed using datasets typically available within larger food manufacturing environments, where digital infrastructure and structured data capture are more mature. Adaptations would be required for food manufacturing SMEs to accommodate:

- ➔ lower levels of data standardisation
- ➔ greater reliance on semi-structured or manual data
- ➔ variability in ERP and production tracking systems

Zest is now exploring this adaptation pathway. Expanding accessibility to SMEs is strategically important given that 98% of UK food manufacturing businesses fall into this category. Ensuring the model functions effectively in lower-data environments will be critical for scalability.

Prevention insights

Zest's prevention insights solution is built to scale. It's proprietary data engine integrates directly with manufacturer's existing factory systems to monitor the complex and moving relationships between ingredients, machinery and environment. Rather than just flagging that surplus has occurred, Zest identifies the root cause. By analysing thousands of operational variables, the system pinpoints the specific conditions, such as temperature fluctuations or line speed inconsistencies that lead to waste. Rigid, manual rule-setting (which often fails to catch unpredictable errors) is replaced with dynamic AI that learns a manufacturer's specific production patterns. This framework allows for rapid deployment across multiple facilities, ensuring a single source of truth for waste prevention.

Optimised redistribution

The redistribution component is structured as a marketplace capable of accommodating multiple supply and demand-side organisations simultaneously. The marketplace is powered with an AI driven allocation model, which delivers rigorous matching while avoiding rule-based approaches. The model's constraints are fully configurable. This enables the platform to optimise redistributed quantities over varying transaction quantities, accounting for logistical limitations and a broad spectrum of other operational requirements such as shelf life, unit sizes and cost. This flexibility ensures the solution remains both controllable and effective, regardless of the scale or complexity of the marketplace it serves.

Test 02

How would the model need to be adapted for fresh, frozen and chilled surplus?

Fresh, chilled and frozen surplus streams introduce additional operational considerations compared to ambient surplus streams. Fresh produce requires careful handling due to fragility, while chilled and frozen products depend on temperature-controlled logistics. Adopting Chain-of-Trust technology or cloud-based telematics systems to maintain food safety and food quality during transport of these surplus streams would be more important than with ambient food surplus.

Zest has successfully piloted the real-time visibility and prevention insights solutions with frozen food manufacturers, demonstrating that it can monitor and optimise for perishable production effectively. For redistribution, the architecture is already perishable-aware and multi-objective meaning fresh, chilled and frozen streams can be incorporated through small operational adjustments.

While fresh produce food processing is covered by Zest's solutions, real-time visibility and predictive insights within agriculture warrant their own, unique solutions. For example, US-based Full Harvest use AI to identify out of specification crops in real-time. They then connect farmers with food manufacturers who can use these surplus crops as ingredients for juices, soups or snacks. Full Harvest handle logistics and pricing to ensure it is cheaper for farmers to sell their surplus than to plough it back into the ground. Reliable data and coordinated logistics are fundamental to this, which the model is already designed around.

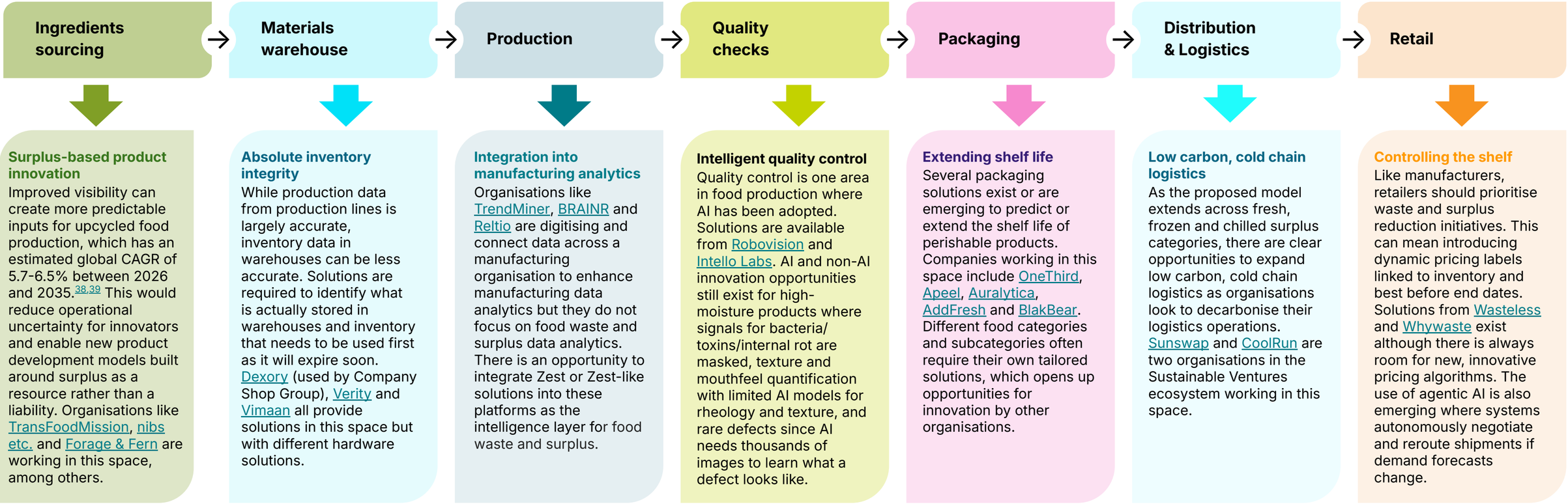
In short, the model is ready to support fresh, chilled and frozen surplus. It is validated for visibility and prevention except within agriculture, and readily extendable for scalable redistribution with minimal adjustments.

Test 03

What are the innovation opportunities in relation to the model?

There are several innovation opportunities for both climate tech startups and corporates in relation to the model. Examples are provided in Figure 12.

// Figure 12. Innovation opportunities related to the proposed model by food supply chain stage



Cost benefit analysis framework

Surplus collection point 1 at a Nestlé factory

Surplus collection point 2 at a Nestlé factory

A qualitative review of costs and benefits

The business case for adopting the proposed model will vary by organisation. It will depend on an organisations' goals, the exact scope of the initiative they are implementing, their implementation strategy and capacity to deliver. The tables in Appendix 4 provide a framework in which a cost benefit analysis or business case can be prepared by different stakeholders within the proposed model when looking to implement food waste and surplus visibility, reduction and redistribution initiatives. The cost and benefit categories may not always be applicable to each stakeholder, but they provide a starting point to work from. For food manufacturers in particular, the key benefits would likely be increased visibility of food waste and surplus to develop a strategy around, a reduction in the cost of goods sold, boosted staff morale from purpose-driven work and becoming a preferred supply chain partner for buyers with supply chain wide ESG goals. The key cost categories for food manufacturers would likely be physical and digital infrastructure investments to implement reduction and redistribution initiatives, and the associated staff time associated with these operational changes.

"When we can create a composite picture of waste and surplus streams, and put a value on it, it's phenomenally compelling. The business case is there. Managers say: 'I'm not having that in my factory. We're going to lean into our continuous improvement team - whose expertise is to identify a problem, identify potential causes, test some interventions, measure outcomes, and keep going around the improvement cycle'."

Alan Hayes, Strategic Advisor, Future Strategy

Key actions stakeholders can take to scale

Ready for action

To transition from pilots to an industry-wide operational model, introspective actions are required by organisations as well as coordinated action across the entire food supply chain. Based on the insights and proposed model, key actions specific stakeholders can take to accelerate this transition is provided in Figure 13 overleaf.

Additional practical steps that can be taken across the food industry to tackle food waste and surplus are available from Anthesis[40], Newton in collaboration with FareShare and The Felix Project[41], and WRAP[42].

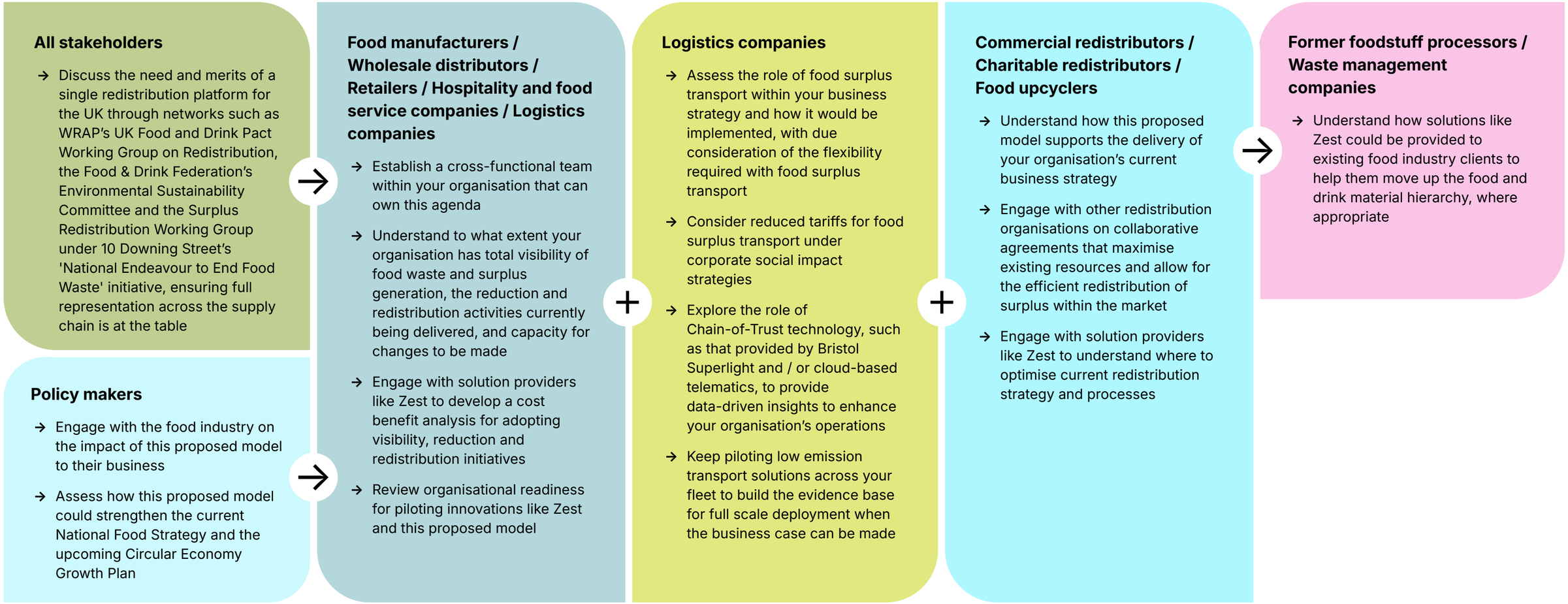
"We are enormously grateful to all the partners involved in this ground-breaking project. At a time when demand for food support is at an all-time high, it is essential to come together and explore the real-life benefits of the next generation of technology. AI is becoming increasingly important in driving business improvements across multiple industries, and we're delighted to be part of an innovative project exploring its capabilities for rescuing and redistributing surplus food. Innovative tools such as those used to quickly map surplus have the potential to transform the food redistribution sector."

Charlotte Hill, Chief Executive Officer, FareShare and The Felix Project

FareShare loading surplus for redistribution to charities

Stakeholder actions

// Figure 13. Key actions stakeholders can take to scale AI-led food waste and surplus visibility, reduction and redistribution



A call to action from the industry, to the industry

Findings from the BridgeAI demonstrator project

The paradox of food waste and food insecurity is one of the most significant systemic challenges of our time. It seems fitting to target solutions within food manufacturing as it:

- has not been the focus of innovation to date even though its technology investment areas align with reducing food waste
- is the third largest contributor of food waste in the country with half of it deemed edible and avoidable through redistribution
- could benefit financially as well as having the greatest ability to pass that financial benefit onto consumers

The nine partner BridgeAI demonstrator project piloted three AI-led solutions developed by Zest for food manufacturers and redistribution organisations. The pilots proved that the business case is not just environmental or social, but it is profoundly commercial:

- From improved visibility of edible surplus generation, Nestlé mitigated losses on one of their production lines by a 15-fold increase in revenue from surplus, with the financial benefits split between the factory and charity partners
- Internal rework opportunities were identified for Nestlé to reduce food waste generation, alongside an increase in redistribution, further reducing waste and surplus management costs
- The automated allocation of surplus by Nestlé on a single platform to Company Shop Group and FareShare resulted in time savings across all three organisations on surplus transactions

A call to action

The pilots demonstrated that AI-led food waste and surplus visibility, reduction and redistribution can be achieved today with the right technologies, processes and partnerships in place. It is now time to scale; the proposed model in this white paper provides an approach for just this. The call to action from the industry is summarised below.

Face and embrace the data

Food manufacturers need granular food waste and surplus data to make lasting operational changes. Food manufacturers should look to adopt solutions provided by organisations like Zest for real-time and predictive analytics on food waste and surplus generation to make data-driven business decisions.

Reach a consensus on a redistribution platform

Food manufacturers and redistribution organisations are looking to streamline their redistribution activities. A redistribution platform could be the answer to this. However, there needs to be a critical mass of food surplus supply and demand organisations using it to unlock its full efficiency benefit. The industry needs to reach a consensus on whether the industry as a whole moves forward with a single surplus redistribution platform, or not, as the case may be.

Engage with innovation

Clarity is needed on the use case and benefits of artificial intelligence for organisations, particularly in climate tech innovation where its environmental impacts are under more scrutiny. Getting involved in multistakeholder innovation pilots provides a space for collaborative technology development to support better outcomes at both the organisation and sector level.

Moving forward

There is immense energy to tackle food waste and food insecurity across the UK. It is now about channeling that energy into action. By moving beyond siloed manual processes towards a collaborative AI-led model, the food industry can achieve unprecedented food waste and surplus visibility, critical waste reduction and efficient redistribution at scale.

The challenge is no longer a lack of food, but a lack of visibility.

Let us bridge that gap together.

Starting now.

Appendices

On the table

Scaling AI-led food waste and surplus visibility, reduction and redistribution

Frozen berries

Appendix 1

Out of scope of the white paper

Policy drivers

The pilots have demonstrated how food waste and surplus visibility, reduction and redistribution can be achieved for ambient products in the current policy environment with the right technologies, processes and partnerships in place. Wider policy changes and their impact on this and the proposed model for scaling have not been considered in this white paper.

Defining food surplus

There is no industry standard for what should be classed as food surplus and this white paper does not look to set a standard. The classification will depend on the commercial, food safety and sustainability strategies of food manufacturers as well as the food surplus demand organisations they work with.

Retailer food specifications

Food specifications created by retailers was cited as a notable cause of food waste and surplus by several interviewees. The 'wonky food' movement has bought greater awareness on the agenda. Most solutions address the impacts rather than the root cause. For example, some supermarkets have established 'imperfect' lines with WRAP encouraging retailers to move toward 'whole crop purchasing' instead of only buying 'Class 1' produce. There are also organisations like Odd Box that have commercialised opportunities from wonky vegetables. Where possible, redistribution organisations look to repack and redistribute the products that fall out of retail specification. One solution addressing the root cause, albeit in specific cases, is when retailers temporarily relax specifications after extreme weather events, which prevent entire crops from being wasted.[43] As extreme weather events become more frequent, the food sector may see more of this. Supermarkets are also removing best before dates on fresh produce packaging.[44] The reality is that tackling the root cause is extremely complex with consumer preferences and retail specifications so intertwined.

Non-ambient food

Due to the nature of the partner organisations involved in the demonstrator project, most of the insights gained relate to ambient goods. As the model for scaling is based on the pilots, it focusses on ambient goods. The model could be adapted for fresh, frozen and chilled goods in the future.

Unintended consequences for animal feed and anaerobic digestion

Scaling food waste and surplus reduction and redistribution to people will likely reduce the quantities diverted to animal feed and anaerobic digestion. In 2021, 30 million tonnes of animal feed was bought.[45] In the same year, approximately 2.7 million tonnes came from all food sectors with 640,000 tonnes coming from food manufacturing.[7] This represents 9% and 2% of feedstock, respectively. In 2025, food waste from households and businesses together with processing waste and residues made up 33% of anaerobic digestion feedstock. This is projected to significantly reduce to 6% in 2030 and 4% in 2050.[46] Therefore, the potential consequences are not considered significant.

Environmental impact of AI

As mentioned in Sustainable Venture's *Advancing AI's Potential for Climate Innovation* report[47], AI's technological promise exists in tension with concerns around its own expanding energy footprint. While these concerns deserve due attention, the latest evidence indicates that if deployed responsibly, and targeted at the right problems, AI has the potential to deliver a strong net benefit to the climate transition.[48] Google's data centers deliver >6x more computing power per unit of electricity than they did five years ago. Google has maintained a 100% renewable energy match on a global basis every year since 2017, and are going even further by pursuing their 24/7 carbon-free energy ambition. Further detail on how the GHG emissions associated with the use of Google Cloud in this demonstrator project is provided in Appendix 2a and 2b.

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Appendix 2a

BridgeAI demonstrator project: impact data

At the outset of the project, FuturePlus facilitated an impact scoping workshop with all consortium partners to establish a shared approach to measuring intended outcomes. Using the FuturePlus impact measurement framework, indicators were developed and organised across five themes: Environment, Climate, Social, Inclusion and Economic. Data to support each indicator was collected on an ongoing basis. Key pilot impact data is presented in this appendix.

// Table A2a.1. Environmental impact data from delivering the BridgeAI demonstrator project, July 2025 - February 2026

Impact category	Measure	Result	Notes
Environment	Total food surplus received for redistribution, by food category	• Confectionary: 92.04 tonnes (45.60%) • Beverages: 53.18 tonnes (26.35%) • Cereal: 18.75 tonnes (9.29%) • Bakery wares: 13.12 tonnes (6.50%) • Coffee: 10.35 tonnes (5.13%) • Salts, spices and soups: 9.87 tonnes (4.89%) • Other: 4.53 tonnes (2.24%) • **Total: 201.82 tonnes**	Includes all finished packaged goods and work in progress goods received by Company Shop Group and FareShare over the pilot period. Figures rounded to two decimal places. Totals may not sum exactly due to rounding.
	Quantity of food surplus redirected from animal feed to human consumption	4.76 tonnes	This reflects the minimum quantity of food surplus redirected from animal feed to human consumption during the pilot, since there could have been some finished packaged goods previously being sent to animal feed but this was not able to be quantified.

Appendix 2a

// Table A2a.2. Climate impact data from delivering the BridgeAI demonstrator project, July 2025 - February 2026

Impact category	Measure	Result	Notes
Climate	Total distance travelled across all food surplus deliveries	11,226.04 km	Total distance travelled across all vehicles used for food surplus deliveries to Company Shop Group and FareShare during the pilot. Each delivery reflects a single Zest allocation (collection from a Nestlé site and delivery to a Company Shop Group or FareShare site). Where more than one vehicle was used in a delivery, each vehicle's distance is included.
	Average distance travelled per food surplus delivery	244.04 km	Average distance travelled per food surplus delivery to Company Shop Group and FareShare during the pilot. Each delivery reflects a single Zest allocation, comprising a collection from a Nestlé site and a delivery to a Company Shop Group or FareShare site. Where more than one vehicle was used in a delivery, this is still counted as one delivery.
	Average vehicle utilisation rate by pallet capacity	• HGV-HVO: 56.25% • HGV-Diesel: 44.88% • The Pallet Network: n/a • OV-1: 64.26% • Average across transport types (excluding The Pallet Network and OV-1): 45.64%	The average proportion of pallet capacity filled per vehicle (measured by number of pallet spaces occupied relative to maximum pallet capacity), across all food surplus deliveries to Company Shop Group and FareShare during the pilot period, including all vehicle types. As shown in Table 5 on page 30, HGV-HVO deliveries demonstrate a higher average utilisation rate compared to HGV-Diesel. This is driven by one of the three HGV-HVO deliveries carrying a greater number of pallets, which increased the overall average. The OV-1 figure is based on simulated runs as the vehicle was not deployed during the pilot.
	Total GHG emissions associated with transport of food surplus	11,374.13 $kgCO_2e$	Includes direct and indirect GHG emissions from all vehicles used across food surplus deliveries to Company Shop Group and FareShare during the pilot. Each delivery reflects a single Zest allocation (collection from a Nestlé site and delivery to a Company Shop Group or FareShare site). Where more than one vehicle was used for a delivery, each vehicle's emissions are included.
	Average GHG emissions associated with transport of food surplus per delivery	247.26 $kgCO_2e$	Average direct and indirect GHG emissions per food surplus delivery to Company Shop Group and FareShare during the pilot. Each delivery reflects a single Zest allocation, comprising a collection from a Nestlé site and delivery to a Company Shop Group or FareShare site. Where more than one vehicle was used for a single allocation, this is still counted as one delivery.
	Average GHG emissions associated with each transport type	• HGV-HVO: 0.12 $kgCO_2e$/tonne-km • HGV-Diesel: 0.31 $kgCO_2e$/tonne-km • The Pallet Network: 0.27 $kgCO_2e$/tonne-km • OV-1: 0.05 $kgCO_2e$/tonne-km	Average direct and indirect GHG emissions per tonne of food surplus moved per kilometre, across all deliveries to Company Shop Group and FareShare during the pilot. This metric normalises for load weight and distance, enabling comparison of carbon intensity across transport types. Lower figures indicate more emissions-efficient transport. The OV-1 figure is based on simulated runs as the vehicle was not deployed during the pilot (further information is provided in Appendix 2b).
	GHG emissions associated with the Google Cloud and Google Workspace services supporting Zest's AI-led solutions	• Location-based: 38.34 $kgCO_2e$ • Market-based: 25.59 $kgCO_2e$	Direct and indirect GHG emissions associated with the Google Cloud and Google Workspace services used to support Zest's AI-led solutions during the pilot, reported on both a location-based and market-based basis. Emissions associated with hosting Bristol Superlight's Chain-of-Trust technology on Google Cloud has been excluded from this analysis as it was not tested as part of this project (further information found in Appendix 2b).

Appendix 2a

// Table A2a.3. Social impact data from delivering the BridgeAI demonstrator project, July 2025 - February 2026

Impact category	Measure	Result	Notes
Social	Total equivalent number of meals received by Company Shop Group and FareShare	• Company Shop Group: 309,862 • FareShare: 170,667 • **Total: 480,529**	Calculated using WRAP's methodology, where one meal equivalent is 420g of food. This figure illustrates the scale of food redistributed and does not imply that this number of balanced meals could be prepared from the surplus.
	Number of charities and organisations supported with food surplus	787	Includes the unique count of charitable organisations receiving surplus food via FareShare and Community Shop (one organisation) receiving support from Company Shop Group.
	Number of people supported with food surplus (Company Shop Group)	3,743	Estimated number of people supported through food surplus redistribution via Company Shop Group, as calculated by Company Shop Group.
	Number of people supported with food surplus (FareShare)	90,390	Estimated number of people supported through food surplus redistribution via FareShare, as calculated by FareShare.

Appendix 2a

// Table A2a.4. Inclusion impact data from delivering the BridgeAI demonstrator project, July 2025 - February 2026

Impact category	Measure	Result	Notes
Inclusion	Geographic reach of food surplus redistribution	• North Yorkshire • West Yorkshire • South Yorkshire/Barnsley • Merseyside/Cheshire • Humberside/Lincolnshire • East Midlands • London • North Wales	Geographic reach was mapped across postcodes spanning seven regions of England, encompassing Company Shop Group distribution points and FareShare delivery locations.
	Community impact through Company Shop Group programmes	• Supported 692 people through hub programmes • Enabled 429 people to participate in Cook Clubs • Enabled 2,590 children to receive free meals • Supported 32 people back into work via Progress Academy • Saved members £201,304 on their shopping bills	Includes all Company Shop Group programmes and partner organisations that received food surplus or monetary support from the sale of food surplus as part of this pilot.
	Types of charitable organisations supported through food surplus redistribution (FareShare)	• Food service: 34.68% • Community centres: 18.85% • Faith-based: 9.48% • Advice/resource centres: 6.61% • Schools: 6.11% • Day/drop in centres: 4.78% • Out of school clubs: 2.52% • Residential: 2.37% • Other: 14.60%	Includes all charitable organisations that received surplus food through FareShare as part of this pilot.

Appendix 2a

// Table A2a.5. Economic impact data from delivering the BridgeAI demonstrator project, July 2025 - February 2026

Impact category	Measure	Result	Notes
Economic	AI effectiveness	Please refer to pages 18-21 for further information.	Reflects the effectiveness of Zest's AI-led solutions in data standardisation, real-time visibility of food waste and surplus, data standardisation, identifying food waste and surplus prevention measures, and optimised food surplus redistribution, as evidenced in this white paper.
	Number of successful food surplus allocations by Zest and associated deliveries	46	Reflects the number of successful food surplus journeys during the pilot as allocated by Zest, where each delivery comprises a collection from a Nestlé site and delivery to a Company Shop Group or FareShare site. In a small number of cases, a single delivery required more than one vehicle. These are still counted as one delivery as they form part of the same allocation.
	Transport costs, by transport type	Howard Tenens - chargeable cost • HGV-HVO: £0.94/tonne-km • HGV-Diesel: £0.58/tonne-km • Combined HGV-HVO & HGV-Diesel: £0.61/tonne-km • Pallet Network: £0.45/tonne-km Bristol Superlight - energy cost only • OV-1: £0.03/tonne-km	Cost per tonne-km is calculated on the basis of total load weight, inclusive of food surplus and pallet weight. Figures cover deliveries to FareShare only; Company Shop Group deliveries are excluded. All Howard Tenens deliveries were invoiced at a flat rate per delivery regardless of fuel type; variation between HGV-HVO and HGV-Diesel figures reflects differences in load size and average distance rather than fuel cost. HGV-HVO runs carried smaller, lighter loads over longer average distances, resulting in a higher average cost per tonne-km of food moved. As OV-1 was not deployed during the pilot, OV-1 costs are estimated from simulated energy (electricity and petrol) consumption only and do not reflect full operational costs. This figure should be read as an indicator of energy cost only rather than total chargeable cost. Howard Tenens and The Pallet Network figures are based on the total chargeable cost and are not broken down by cost component.
	Estimated retail value of food surplus redistributed to Company Shop Group and FareShare	>£1,000,000	The retail value shown is an estimate based on average conversion factors by food category, as applied by redistribution organisations. As these goods had already reached surplus status and would not have been available at retail, this figure does not represent savings to recipient organisations - it indicates the commercial value of the food prior to becoming surplus. Figures cover finished packaged goods only (work in progress is excluded). Company Shop Group and FareShare apply different conversion methodologies, producing different estimates of value; an exact combined figure is therefore not presented and the value is approximated as over £1 million.
	Growth of involved start-ups	The consortium's start-up partners (Bristol Superlight and Zest) have seen positive commercial developments during the project period, including team expansion, new commercial partnerships and continued commercial momentum.	A high-level, qualitative snapshot of commercial progress made by the consortium's start-up partners during the pilot period, based on information shared by Bristol Superlight and Zest.

Appendix 2b

Greenhouse gas emissions considerations as part of the project

A summary of the GHG emissions that were considered for reporting as part of this project, whether it was scoped in or out and why, and the emissions calculation methodology used for those emissions scoped in is provided in the table below and overleaf.

// Table A2b.1. Summary of GHG emissions scoped out

Category	Description	Scope	Justification
Avoided emissions	Avoided emissions were defined as the GHG emissions prevented by redirecting food surplus to human consumption via OV-1 vehicles, compared to surplus following existing disposal routes via conventional vehicles - with avoided emissions potentially arising from differences in both waste treatment pathways and transport emissions	Out	At the project's outset, avoided GHG emissions were identified as a key intended impact area. Two key factors meant avoided emissions could not be robustly measured or credibly reported at this stage: 1. The majority of food surplus redistributed during the pilot was already being directed toward high-tier destinations within the food and drink material hierarchy, meaning the emissions differential between existing and pilot routes was limited. 2. Bristol Superlight's OV-1 was not available during the pilot period, meaning the intended lower emissions transport component of the project was not realised. Although simulations provide indicative insight into what GHG emissions may have been under OV-1 deployment, these remain modelled rather than realised. Avoided emissions may be more readily evidenced in contexts where surplus is demonstrably diverted from less preferred food and drink material hierarchy fates and lower emissions transport is operational. These are important considerations for scaling this model that seeks to measure and evidence associated avoided emissions.
Embedded emissions	Emissions associated with the production of food and vehicles used in this project	Out	Consistent with this project's focus on operational impacts rather than lifecycle emissions, embedded emissions associated with the food and vehicles used in this project were determined to be outside the scope of this project.

Appendix 2b

Greenhouse gas emissions considerations as part of the project

// Table A2b.2. Summary of GHG emissions scoped in

Category	Description	Scope	Justification and methodology
Transport emissions	Emissions associated with the vehicle transport of food surplus between Nestlé sites and redistribution organisation sites	In	During the pilot period, OV-1 was not operationally available. As a result, conventional diesel vehicles were used for deliveries, with hydrotreated vegetable oil (HVO) fuel and The Pallet Network each trialled across a small number of runs. Transport emissions across all delivery modes were calculated in accordance with the Greenhouse Gas Protocol, using 2025 Defra emissions factors. Transport emissions include both direct and indirect emissions associated with fuel and electricity use: • Direct emissions refer to emissions produced from the combustion of fuels during vehicle operation (e.g. tailpipe CO_2 emissions from diesel or petrol use) • Indirect emissions include upstream lifecycle emissions associated with energy production and supply, such as well-to-tank emissions from fuel extraction, refining, and distribution, as well as transmission and distribution (T&D) losses associated with electricity generation and delivery. For OV-1 simulated deliveries, a location-based electricity accounting method was applied to estimate emissions associated with electricity consumption. Emissions were calculated using Bristol Superlight's vehicle-specific modelled data, including estimated electricity (kWh) and petrol consumption for each simulated delivery. As OV-1 was not deployed during the pilot, the resulting emissions estimates represent modelled rather than realised operational emissions. In line with the Greenhouse Gas Protocol, biogenic CO_2 emissions associated with bio-based fuels (e.g. HVO) were also calculated and are available separately. Biogenic emissions arise from the combustion of carbon originating from recently living biomass rather than fossil sources. However, consistent with standard reporting practice, these emissions are not included in the emissions totals or impact metrics presented in this project.
Digital infrastructure emissions	Emissions associated with the digital infrastructure services supporting the project's AI platform	In	Zest's solutions are built on Google Cloud and also utilise Google Workspace services. Digital infrastructure emissions associated with these services were sourced directly from Google's Carbon Footprint service, using Google's GHG Protocol-aligned methodology. Bristol Superlight's Chain-of-Trust technology is also hosted on Google Cloud but was not used as part of this project and has therefore been excluded. The emissions associated with usage of Google Workspace from other partners has been deemed out of scope, and therefore has also been excluded.

Appendix 3

List of industry stakeholders engaged throughout the project

James Alasdair, Nestlé UK&I
Dr Lawrence Alger, Bristol Superlight
Rasa Akelyte-Rashid, Brunel University of London
Dave Avery, Anthesis
Steve Bacon, Bristol Superlight
Andrea Baddeley, Company Shop Group
Mike Barry, Planeatry Alliance
Zac Bartlett, Vida Vodka
Oliver Bell, WRAP
Patrick Bion, Minimal
Genevieve Boast, Thomas Franks
Joanna Boyle, Company Shop Group
Rosemary Brotchie, WRAP
Chris Brown, Nestlé UK&I
David Brown, FareShare
Emily Brown, Sustainable Ventures
Gabriel Brueckner, Zest
Emma Chapelhow, Agribot
Wellington Chiwara, Eel Rides
Joseph Chow, Company Shop Group
Olivia Christie, Sustainable Ventures
Alex Cohen, Google Cloud
Matthew Coley, Company Shop Group
Caroline Conroy, WRAP
Anna Cooper, Apetito
Tania Da Silva, Bristol Superlight
Mohamoud Dadey, ChargeShare
Alex Dalton, FareShare
Julia Dalmadi, Transfoodmission
Sam Davies, Auralytica
Sophie Davies, FuturePlus
Ben Davison, Zest
Bruno de Penanster, Ananas Anam
Steve Denison, Google Cloud
Rupert Denny, Howard Tenens
Joe Elgar, Zero Carbon Company
Simon Ellmore, Cook
Eliza England, Sustainable Ventures
Graeme English, ReLondon
Peter Evans, Howard Tenens
Federico Marchionna Faré, Zest
Peter Ferns, Forage & Fern
Marcela Flores, Tierrasphere
Paul Foreman, Nestlé UK&I
Andrew Fox, Company Shop Group
Kees Frederiks, Freelance consultant
David Godding, Outbreak Labs
Rusudan Gongladze, Cranfield University
Lily-Ann Green, Howard Tenens
Anne-Marie Greening, FareShare
Alan Hayes, Future Strategy
Stephen Hayes, FareShare
Sibylla Heckmann, Barocal
Manjot Heer, Zeti
Tom Holmes, FareShare
Charlie Hope, Google Cloud
Isabel Hope, Zero Carbon Company
Louisa Hoy, FuturePlus
Andrew Hughes, TripShift
Jeremy Hulse, Sustainable Ventures
Michael Humphrey, Newton
Philip Hunt, Sustainable Ventures
Stewart Husband, Nestlé UK&I
Adam Hussain, Apetito
Jamie Hutchinson, Cordon Technologies
Sarah Ivory, Whitbread Plc
Hans Jager, Sustainable Ventures
Chetna Jain, Bristol Superlight
Jenni Jones, Nestlé UK&I
Lijo Jose, Hubl Logistics
Emma Keller, Nestlé UK&I
Koren Knapp, Soup4em
Chris Knight, Agribot
Gee Law, FareShare
Andy Lee, Howard Tenens
Jonathan Lodge, City Farm Systems
Ben Macdonald, nodum
Aditya Maheshwari, Brunel University of London
Beth Mander, Ellen MacArthur Foundation
Jim Mann, UNDO Carbon Removal
Shirley Marshall, Liverpool 6 Community Association
Edward McKenzie, Listt
Lewis McLaren, Apetito
Lasse Melgaard, Two Raccoons / Osmose Studio
Nell Miles, Department for Environment Food and Rural Affairs
Abbie Mines, Ocado
Holly Mobley, Company Shop Group
Jaume Morapedros, La Penya
Chris Morling, FareShare
Hossein Mousavi, Bristol Superlight
Stuart Muir, Tesco
Rachel Muse, Argon & Co
Will Nicholson, WRAP
Colin Oliver, Bristol Superlight
Sophie Orpen, FareShare
Apostolos Papadopoulos, Crop Intellect
Sarah Peck, Nestlé UK&I
Joanne Phillips, Company Shop Group
Christian Phipps, Hovis
Anna Ricard, Howard Tenens
Ed Robinson, Wells & Co
Nicola Robinson, FareShare
Tina Sampson-Smith, St Paul's
Nicole Sanchez-Castillo, FareShare
Alina Sartogo, Zest
Fabian Saverimuttu, Google Cloud
Charlotte Scribbins, Company Shop Group
Rachel Shairp, ReLondon
Sheban Siddiqi, Bristol Superlight
Nathan Sivakumaran, Bristol Superlight
Alexandra Smith, FuturePlus
Michael Smith, Howard Tenens
Richard Smith, FareShare
Sönnich Sönnichsen, Nottingham Trent University
Matthew Stephenson, Sweet Dreams
Chloë Stewart, nibs etc.
Julia Stoddart, The Venture
Gary Stott, Company Shop Group
Stephanie Sung, Nestlé UK&I
Anthony Taylor, dps
Meg Taylor, Howard Tenens
Neil Taylor, Bristol Superlight
Amanda Thomas, Anthesis
Steve Thomas, Ample
Doug Thompson, Company Shop Group
Joseph Tighe, KleanDrive
Molly Todd, FuturePlus
Sophie-Claire Turner, Sustainable Ventures
Alyssia Vazquez, FareShare
Max van Mesdag, Bristol Superlight
Kasun Waduge, Bristol Superlight
Danielle Walsh, Clearly
Ravindra Wandhare, Bristol Superlight
Jacob Wells, dps
Patricia Weyts, Wallonia Investment & Trade
Bill Widdowson, Bristol Superlight
Tom Williams, FareShare
Charlie Wilson, See.Sense
Danielle Winning, Metalchemy
Anna Winter, Auralytica
Lee Wood, Company Shop Group

Appendix 4

Cost benefit analysis framework by stakeholder

// Table A4.1. Potential direct and indirect benefits related to the proposed model by stakeholder

Category	Subfactor	Food manufacturers	Wholesale distributors	Retailers	Hospitality and food service companies	Logistics companies	Commercial redistributors	Charitable redistributors	Food upcyclers
Direct benefits	Reduced waste management fees	●	●	●	●	●			
	Reduced cost of goods solds	●	●	●	●				
	Higher revenue from redistribution than animal feed or anaerobic digestion	●	●	●	●				
	Higher revenue from additional surplus transport contracts					●			
	Reduced food sourcing costs						●	●	●
Indirect benefits	Improved production efficiencies	●							●
	Increased visibility of available surplus	●					●	●	●
	Whole life carbon, water and waste reduction	●	●	●	●		●	●	●
	Reduced consumer prices	●	●	●	●				
	Increased sales / contracts from the conscious consumer / client	●	●	●	●	●			

Appendix 4

// Table A4.2. Potential intangible and competitive benefits related to the proposed model by stakeholder

Category	Subfactor	Food manufacturers	Wholesale distributors	Retailers	Hospitality and food service companies	Logistics companies	Commercial redistributors	Charitable redistributors	Food upcyclers
Intangible benefits	Boosted staff morale from purpose-driven work	●	●	●	●	●			
	Improved social license to operate	●	●	●	●	●			
	Digitalisation of the surplus food market	●	●	●	●		●	●	●
	Increased trust from Chain-of-Trust	●	●	●	●	●	●	●	●
	Narrative-driven marketing	●	●	●	●	●			●
Competitive benefits	Reduced trade prices	●							
	Reduced wholesale prices		●						
	Market leadership in sustainability	●	●	●	●	●			
	Preferred supply chain partner for organisations with related ESG goals	●	●	●	●	●			
	Speed of access to surplus food						●	●	●
	First mover advantage in the growing upcycled food category								●

Appendix 4

// Table A4.3. Potential direct and indirect costs related to the proposed model by stakeholder

Factor	Subfactor	Food manufacturers	Wholesale distributors	Retailers	Hospitality and food service companies	Logistics companies	Commercial redistributors	Charitable redistributors	Food upcyclers
Direct costs	AI-led food waste solution subscription, transaction and/or membership fees	●	●	●	●	●	●	●	●
	Reduction and redistribution infrastructure investments (physical and digital)	●	●	●	●	●	●	●	●
	Logistics costs	●	●	●	●	●	●	●	●
	API integration with redistribution platform					●			
	Chain-of-Trust technology or advanced telematics systems investments					●			
	Surplus procurement costs						●		●
	R&D to stabilise production against fluctuating surplus quantities								●
Indirect costs	Staff time for data collation	●			●				
	Managing reduced food sold in-store vs listed surplus			●					
	Staff training on redistribution protocols and platform	●	●	●	●	●	●	●	●
	Know Your Customer compliance time						●	●	●
	Food safety compliance					●	●	●	●
	Listing and approving offers	●	●	●	●	●			
	Providing logistics quotes					●			
	Bidding, accepting and rejecting offers						●	●	●
	Consolidating or marshalling surplus	●	●	●	●	●			

Appendix 4

// Table A4.4. Potential Intangible and opportunity costs related to the proposed model by stakeholder

Factor	Subfactor	Food manufacturers	Wholesale distributors	Retailers	Hospitality and food service companies	Logistics companies	Commercial redistributors	Charitable redistributors	Food upcyclers
Intangible costs	Initial friction related to change in processes	●	●	●	●	●			
	Risk of channel conflict with manufacturing partners		●	●		●			
	Risk of cannibalising full price sales if surplus sold too close to stores			●					
	Fear of food safety liability from prepared food from surplus				●				
	Pressure of tighter delivery windows for surplus					●			
	Emotional burden of losing bid or being allocated lower quantities						●	●	●
Opportunity costs	Time spent on reduction and redistribution vs core operations	●	●	●	●	●			
	Space used to store surplus vs stock	●	●	●	●	●			
	Higher revenue from animal feed or anaerobic digestion than redistribution	●	●	●	●	●			
	Potential loss of reduced food revenue in-store			●					
	Forgoing higher tariff, more regular and larger load deliveries					●			
	Building relationships through manual waste walks	●					●	●	●

Glossary

Definitions of terms used in the report

AI-related terms

Computer vision: Computer vision is a field of AI focused on enabling machines to interpret and understand visual information from the world, such as images and videos. It involves tasks like object detection, image segmentation, and facial recognition.[49]

Large language models: Large Language Models (LLMs) are a subset of large models specifically designed for natural language processing tasks. Based on architectures like transformers, these models are trained on vast amounts of text data to understand, process, and generate human-like language. Examples include GPT, BERT, and similar systems.[49]

Machine learning: Machine Learning (ML) is a subset of AI (Data-Driven AI) that uses statistical methods to enable systems to learn from data and improve performance over time.[49]

Natural language processing: Natural Language Processing (NLP) is a field of AI that focuses on enabling machines to understand, interpret, generate, and interact using human languages. It encompasses tasks such as text analysis, machine translation, speech recognition, and language generation.[49]

Optimisation: Optimisation in machine learning refers to the process of adjusting model parameters to minimize or maximise a specific objective function, such as reducing prediction error or improving accuracy. This is achieved through algorithms like gradient descent, which iteratively refine parameters to achieve the best performance.[49]

Food and drink material hierarchy

Food surplus: For the purposes of UK guidance, the term 'food surplus' describes any food and inedible parts that are sent to the following: redistribution to people (e.g. through a charity or commercial redistributor), animal feed and bio-based materials/biochemical processing (e.g. feedstock for other industrial products).[50] Food surplus is sometimes referred to as 'surplus food' or just 'surplus'.

Reduction in arisings: Reduction refers to minimising the total quantity of waste and surplus generated at source. Within food manufacturing, this could involve supply chain alignment, process optimisation and rework. Rework is food, materials and ingredients, including work in progress that has left the normal product flow and requires action to be taken on it before it is acceptable for release and is suitable for reuse within the process.[51] Rework can be undertaken on the same production line or on other production lines in a manufacturing facility. It can also be undertaken in other manufacturing facilities owned by other food manufacturers or food upcyclers that valorise food surplus into new food products.

Redistribution to people: In the context of waste prevention, only include redistributed surplus food where the food would otherwise have ended up as waste, or would have been sent to animal feed or bio-based materials/biochemical processing. This may include food redistributed by both charitable organisations (such as FareShare, Food Cycle) and commercial ones (such as Company Shop, who also operate Community Shop). Where surplus is sold, explain why this qualifies as waste prevention. Do not include food that is produced or provided expressly for donation, any food that is donated but still suitable for retail sale, or regular sale of food to secondary markets.[50]

Number of meals equivalent: This is calculated in line with WRAP who qualify that the number of meals equivalent is the "figure based on the assumption of an average meal weighing 420g (based on the average of a range of typical meal weights, using data derived from Food Portion Sizes, FSA 2008). This does not imply that this many balanced meals could be made from the food surplus but illustrates what the amount of food surplus might equate to.[25]

Sent to animal feed: Diverting food and/or inedible parts, directly or after processing, to animals.[50]

Bio-based materials/biochemical processing: This refers to destinations in which food and/or inedible parts are 'valorised' by conversion into industrial products. Examples include creating fibres for packaging material, creating bioplastics (e.g. polylactic acid), rendering into a raw material to make products such as soaps or cosmetics. If material is sent to this destination and accounted as 'surplus', rather than 'food waste', businesses should undertake due diligence with the recipient of the material to ensure that valorisation into other industrial products occurs, as intended (e.g. producing saleable products for chemicals, packaging markets, saleable biodiesel, etc.). Further guidance is available for assessing whether your material qualifies for reporting as a 'bio-based material/biochemical processing'.[50]

Food waste: For the purposes of UK guidance, the term 'Food Waste' describes any food and inedible parts sent to: anaerobic digestion / codigestion, composting / aerobic processes, incineration / controlled combustion, land application, landfill, sewer / wastewater treatment, not harvested / ploughed-in or other (including unmanaged disposal).[50] Definitions of each waste treatment and disposal option is provided on p16 of this WRAP document.

Glossary

Definitions of terms used in the white paper

Project terms

Chain-of-Trust: Chain-of-Trust is terminology used by Bristol Superlight for their proprietary technology relying on the deep embedded data sources and sensor fusion in Bristol Superlight's OV-1 vehicle. The Chain-of-Trust provides certificated results in a trustless environment for food logistics to all stakeholders in the value chain (logistics operator, food producer, food consumer, and matchmaking partners). Using multimodal data sources and secure on-vehicle machine learning capabilities, the quality of food in transit is assured to all parties.

Demonstrator project: This refers to the Innovate UK funded consortium project under the BridgeAI programme on AI-led food waste and surplus visibility, reduction and redistribution. The nine consortium partners include: Bristol Superlight, Company Shop Group, FareShare, FuturePlus, Google Cloud, Howard Tenens, Nestlé UK&I, Sustainable Ventures and Zest. The project ran between December 2024 and March 2026 with a project extension recently approved for until July 2026.

Food surplus formats: Food surplus can take different formats, including:

- ingredients - raw materials, additives, processing aids
- by-products - secondary streams generated during the main production process that were not the primary product of the production line
- work in progress - semi-finished food items that have undergone some processing but are not yet final products
- finished packaged goods - completed products that are fully processed, packaged and labeled

Sustainability terms

Environmental, social and governance: A framework used to identify, measure and report on the sustainability impacts of an organisation or project. It covers environmental, social, economic and governance dimensions. FuturePlus measures these impacts across five themes: environment, climate, social, inclusion and economic - reflecting an expanded view of environmental, social and governance.

Greenhouse gas emissions: Greenhouse gas (GHG) emissions are releases of the seven greenhouse gases covered by the GHG Protocol into the atmosphere as a result of human activities. Under the GHG Protocol Corporate Standard, these emissions are categorised as direct and indirect emissions across Scopes 1, 2, and 3, and are measured in carbon dioxide equivalents (CO_2e) to account for their varying global warming potentials.

Social impact: This refers to the measurable effects of a project or initiative on the well-being of its stakeholders and wider communities, including the reach and distribution of benefits across communities and geographies.

Abbreviations

CAGR	Compound annual growth rate
CO_2e	Carbon dioxide equivalent
COGS	Cost of goods sold
Defra	Department for Environment Food and Rural Affairs
ERP	Enterprise resource planning
ESG	Environmental, social and governance
GHG	Greenhouse gas
HGV	Heavy goods vehicle
HVO	Hydrotreated vegetable oil
LLMs	Large Language Models
MES	Manufacturing execution systems
ML	Machine Learning
NLP	Natural Language Processing
R&D	Research and development
SMEs	Small and medium-sized enterprises
SOPs	Standard operating procedures

On the table

The challenge is no longer a lack of food,
but a lack of visibility.

Let us bridge that gap together.

→ Get in touch

Bristol
COMPANY SHOP GROUP
FareShare fighting hunger, tackling food waste
FUTUREPLUS
Google Cloud
Howard Tenens
Nestlé
sustainable ventures
zest