

Upcycling food waste

With the food and beverage industry under mounting pressure to cut upstream food waste, upcycling is an interesting prospect. In this whitepaper we consider how to make it viable and effective.



The reduction of food waste is a complex, but urgent, issue.

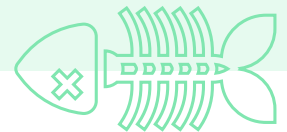
According to the Food and Agriculture Organization of the UN (FAO), a third of food produced globally each year - 1.3 billion tonnes - is wasted or lost¹. If current trends continue unchecked, by 2030 66 tonnes of food will be lost or thrown away per second².

As food waste increases, conversely there is a growing number of mouths to feed. In 2050 it's predicted that the world population will reach 9.6 billion. Unless changes are made, there's risk of a global food gap: production will be insufficient to meet the calorific needs of humanity.

The World Resources Institute (WRI) identifies reduction of food loss and waste as a top priority in its suggested measures for a sustainable food future*. It suggests a 25 percent improvement would reduce the food gap by 12 percent³.

Room for improvement

Waste and Resources Action Programme (WRAP) has estimated total volumes of avoidable food waste across sub-sectors of the UK food and beverage manufacturing industry (Figure 1)⁴. Dairy production came out top, accounting for almost a quarter (23 percent) of total avoidable food waste in the UK. This was followed by meat, poultry and fish which accounted for 18 percent. Ambient products were also in the top three, generating 15 percent of avoidable waste.



For the first time we have estimates for how much avoidable food and drink waste occurs by manufacturing sub-sector
(tonnes of avoidable food waste)
(% of the total manufacturing avoidable food waste)

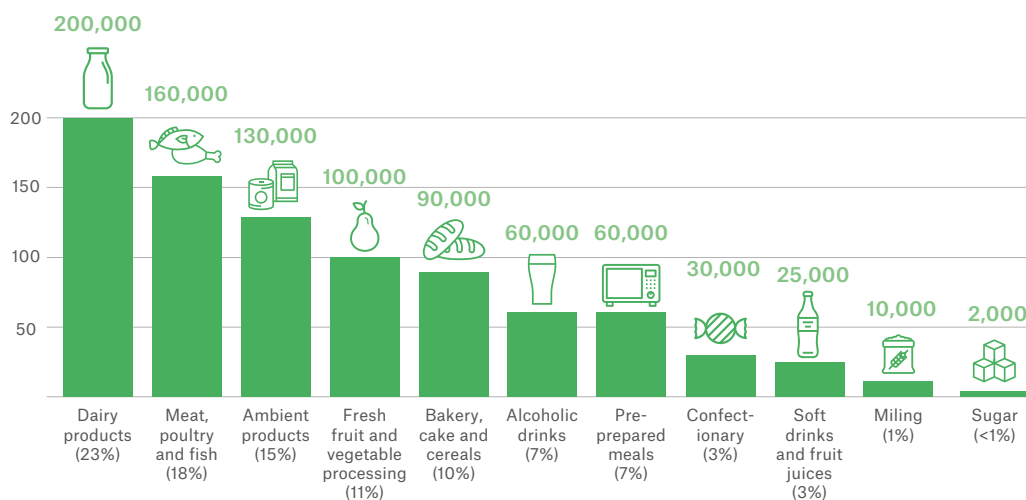


Figure 1: WRAP's estimation of avoidable food waste in UK food and beverage manufacture.

*The FAO define food loss as corresponding to losses in the supply chain and food waste as corresponding to losses due to retailers, food service providers or consumers. In this article we are using food waste as a shorthand for both food loss and food waste.

The industry response: an opportunity for innovation

Food and beverage manufacturers are under pressure to lead the fight against waste in the sector. As well as addressing internal processes and procedures, organisations like WRAP encourage them to support consumers in making better choices and developing less wasteful behaviours. Furthermore, they are expected to scrutinise and support supply chains, identifying where loss happens, and ensuring positive progress is made.

This is having an impact on the commitments outlined in food and beverage organisations' sustainability or Corporate Social Responsibility (CSR) programmes. Many include specific, measurable targets surrounding the reduction of food waste in addition to other factors such as plastic packaging.

There is a clear, ethical need to address this issue. However, there are also commercial benefits: food waste is a hidden cost that harms profitability and inflates consumer prices.

Food waste reduction initiatives

Many food and beverage organisations have corporate, category or brand-level targets on waste reduction.

Kraft Heinz – One of Kraft Heinz' aims is to achieve a 15% reduction in solid waste sent to landfill. The organisation focuses on growing and manufacturing in its efforts to reduce waste, for instance using precision watering to minimise irrigation waste.

Unilever – With a dedicated programme focused on the reduction of food waste, Unilever has made significant progress, but acknowledges that there is still more to be done. One initiative involves using the leftover liquid from an open can of chickpeas. The gloopy liquid called 'aquafaba' is the 'secret sauce' in New York-based condiment firm, Sir Kensington's, vegan mayonnaise. The liquid can be whipped into white peaks in the same way as egg whites and has been a hit with the vegan community as an egg substitute.⁶

Nestle – Work is underway to halve food waste by 2030. Part of this involves working with smallholders to reduce food waste and loss at the local level in the supply chain.⁷

Food and beverage leaders, as well as third-party organisations, have a window of opportunity. Applying new techniques and technologies to reduce upstream food waste could earn competitive differentiation. Dovetailing with this is the opportunity to develop new consumer product offerings which valorise waste streams.

Waste upcycling

Upcycling is one of several strategies that can be implemented to address the food waste challenge. In waste upcycling waste streams are converted into new consumer products or ingredients for human consumption.

The US based company ReGrained is one such example of a waste stream being upcycled into a new product. Sourcing grain left after the beer brewing process through a network of breweries, the company produces a range of SuperGrain+® bars and puffs.

Waste upcycling isn't restricted to B2C offerings however. Food ingredients are also possible as demonstrated by the Dutch company PeelPioneers which takes orange peel and converts it into ingredients such as dietary fibre, antioxidants and orange oil.

To date, the majority of initiatives in this space have been adopted by start-ups and smaller players. However, the approach is starting to gain attention from larger manufacturers.

The upcycling concept is certainly not new. Marmite, the popular UK spread, has been produced from spent brewer's yeast since 1902. However, a convergence of factors – food waste reduction targets and consumer demand for ethical and sustainable products – make it an exciting space for contemporary innovation.

Any corporate sustainability strategy needs to be financially viable. So, initiatives where food waste can be commercialised as an upcycled product are likely to gain traction. They represent a way for manufacturers to monetise waste that they previously paid to dispose of.

Reducing waste and cutting costs while establishing a new product or ingredient creates a win-win-win situation.

Nestle's 2019 announcement about a chocolate formulation replacing refined sugar with cocoa pulp is a case in point. A significant proportion of the soft, sweet pulp surrounding beans in the cocoa fruit is traditionally wasted in chocolate production. However, Nestle's new recipe has the potential to reduce its cocoa fruit waste while boosting the natural appeal of its products.⁸

In general, upcycling food waste is more likely to work from an economic perspective if it is handled internally where it is produced. Nevertheless, there are circumstances where it pays to source and convert food waste, or to collaborate with a third party to unlock upcycling opportunities.



Are partnerships the key to upcycling?

Delivering a successful upcycled product demands a wide range of skills and technical capabilities. At a practical level, waste stream conversion can call for specialist technology and facilities. Similarly, deriving value from the process could require an extended product ecosystem.

A partnership approach can be hugely beneficial here. This can manifest itself in various ways, from raw materials sourcing and technology link-ups to joint brand initiatives and investment.

Brand collaboration

A high profile example of brands working together to upcycle food waste is the initiative fostered by Kellogg's and Seven Bro7hers Brewing Co. (see Figure 2)⁹.

The two organisations teamed up to create limited edition beers using 'less than perfect' cereals that did not meet Kellogg's strict quality control measures. Judging by the reviews on Seven Bro7hers' website, consumer reception was positive, in terms of the beer itself and the fact that it was upcycled:

"This is my fave beer from Seven Brothers. Not only do we have a lovely refreshing and hoppy beer but I had the added frisson of helping to reduce food waste."

"What a great concept, bought it expecting a one off novelty beer but was really good and will be ordering more."

"I loved this beer and can't wait to try more of your beers. I love the upcycle but the fact it tastes so good as well is even better."

This collaboration illustrates the potential for different sub-sectors to jointly tackle food waste with outcomes that generate commercial benefits and positive brand recognition.



Figure 2: Kellogg's and Seven Bro7hers collaborated to create three limited edition beers from waste generated in the manufacture of popular cereals.

Technology Partnerships

Technical collaboration can also deliver excellent outcomes.

Take the upcycled ingredient specialist, Renewal Mill¹⁰. Its equipment is placed in the facilities of plant-based milk companies where it harvests by-products, such as okara (soybean pulp).

These leftover solids are dried and milled without using any synthetic processing techniques or unnatural fortification. The end-product is a nutritious gluten-free flour suitable for cooking and baking. Figure 3 outlines the process.

Renewal Mill also processes oat and almond pulp and has successfully experimented with carrot and vanilla bean pulp. Its goal is to craft the 'upcycled ingredient platform of tomorrow' applying its proven process to the many billion tonnes of food by-products generated each year.

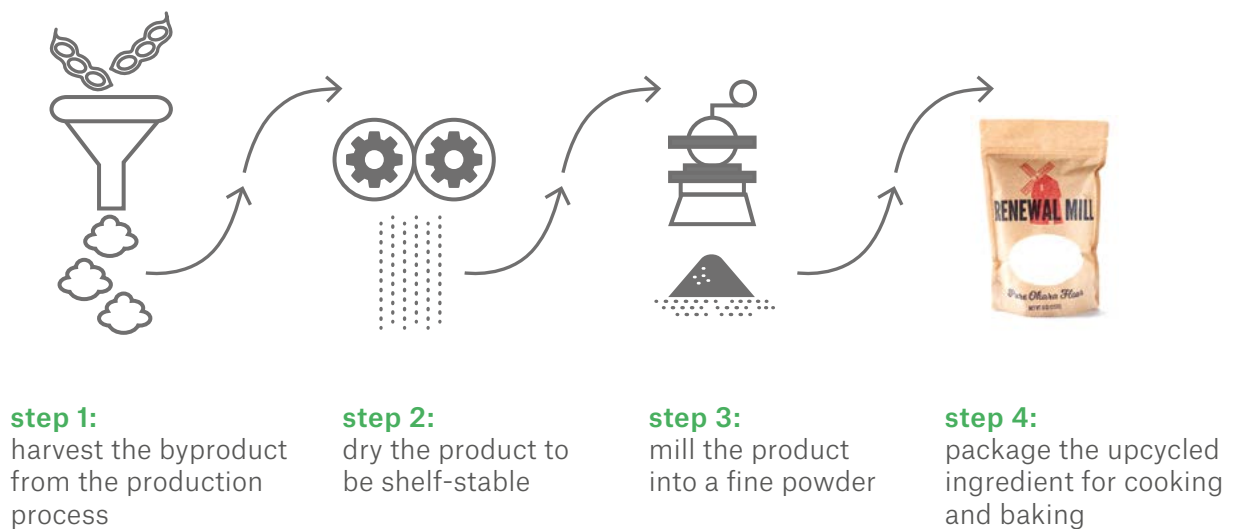


Figure 3: An overview of how Renewal Mill manufactures flour from by-products of plant-based milk manufacture.

Fostering productive partnerships

There are three core factors to evaluate when considering food waste upcycling: the supply chain, the consumer and sustainability. Taking a systematic approach helps identify which strategies are most viable, and where partnerships might prove most beneficial.

Supply chain considerations

Identify the origin of the waste stream – is it internally produced or externally sourced?

Assess availability – are large volumes produced in a few locations? Or is it generated at low volumes across many sites (increasing costs and environmental impact due to transportation)?

Verify technical procedures – what is the concentration of the desired component, and how much processing is required to obtain it? Will it be a simple drying process or a more sophisticated multistep extraction?

Establish costs – how expensive will it be to create an upcycled product or ingredient for human consumption? Could better value be achieved via alternative end uses such as animal feed or biogas production?

Consumer considerations

Ascertain the USP - the sustainability story alone is unlikely to be enough to sell an upcycled product. What additional benefits are offered – health & wellness, natural ingredients, functionality?

Consider whether target audiences understand the concept of upcycled food waste - how should this be communicated? Some waste streams may be more acceptable to consumers than others, such as plant-based versus meat-based.

Establish the price-point – how much are consumers willing to pay for a product upcycled from food waste?

Sustainability considerations

Think carefully about claims – calculating the financial value of a valorised waste stream is relatively straightforward, but wider sustainability benefits can be harder to quantify.

Consider the sustainability trade-offs – how do factors such as waste source, processing and packaging impact waste reduction, water and carbon footprint. There is limited environmental benefit if an upcycled product reduces waste but scores poorly from a water or carbon point of view.

Look at emerging tools – there has been an uptick in methods to help food manufacturers establish the benefits of food waste reduction. FORKLIFT¹² (FOod side flow Recovery LIFe cycle Tool) is a great example. It's an EU-funded project that applies a partial lifecycle greenhouse gas impact and costing calculation to six key examples of unpreventable food processing wastes.

Investor activism

As large multinationals with big budgets turn to innovative waste reduction strategies such as upcycling, what will happen to the food and beverage start-ups that led the current trend?

Fledgling companies that address food waste benefit from a twin-turbo of margin improvement and sustainability which appeals to investors and venture capital firms. It's been reported that companies dedicated to food waste reduction unlocked \$125 million in venture capital funds in 2018¹¹.

There are opportunities for food waste innovation across the entire farm-to-fork spectrum. It can come in many guises, from technologies that improve production and distribution outcomes to home-based solutions enabling consumers to monitor and manage food more effectively. We believe upcycling has a significant role to play alongside other strategies in the fight against food waste as the industry works to secure a sustainable food future.



Consumer demand for food waste reduction

Oakland's sister company Leatherhead Food Research recently presented findings from a study¹³ which underlined growing consumer awareness of the food waste challenge. However, it also highlighted fundamental conflicts in perceptions surrounding accountability and responsibility.

For instance, there was a disconnect in the figures for individual versus collective accountability. The question "How concerned are you about the amount of food waste which you, the UK, and the globe are creating?" showed 39 percent of consumers are concerned about their own food waste, compared to 92 percent and 91 percent respectively when it comes to UK and global food waste.

The research also identified an interesting three-way split surrounding thoughts on who is responsible for addressing food waste. Of the people surveyed, 27 percent felt it was down to individuals, 24 percent thought it was an obligation for food and beverage manufacturers, and 38 percent put the onus on retailers.

Somewhat surprisingly, 76 percent of respondents said they'd be willing to accept reduced availability of certain products if it helped address food waste. However, only 15 percent said they'd be prepared to compromise on taste and quality.

Another Leatherhead survey explored how behaviours and attitudes changed when the UK entered lockdown during the Covid-19 pandemic. When asked about ethics and sustainability, 38 percent of respondents said they had taken more steps to reduce food wastage at home. In addition, 46 percent thought manufacturers should source more ingredients and products in the UK rather than transporting them for many miles, a move which could reduce supply chain waste.

Insights like these are of immense importance when considering consumer participation, co-operation and acceptance of strategies to reduce food waste.

How Oakland Innovation can help

We bring technical expertise and experience in food and beverage processing and formulation coupled with market assessment and strategic partnership capabilities. This puts us in a strong position to illuminate the path to a sustainable value proposition via innovative technical solutions such as food waste upcycling.

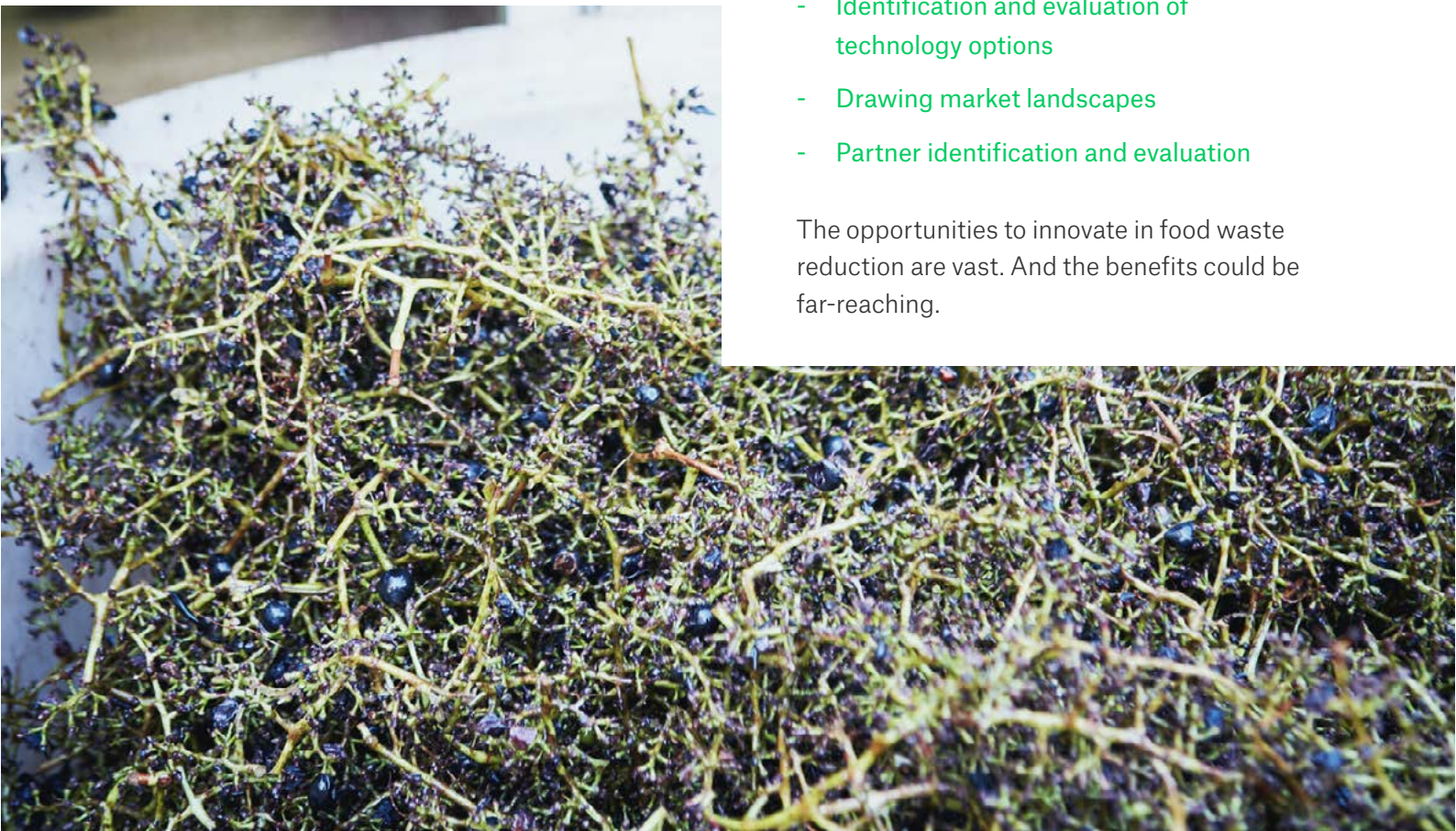
Over recent years we have applied these capabilities across several challenges in waste stream upcycling and valorisation for global food and beverage manufacturers. This has included exploring technologies that can convert food waste into valuable ingredient streams, and how biotechnology can be leveraged to transform

waste streams. We've also worked on landscaping the current upcycled snacks and beverages market to identify critical factors for product success in this space. And we identified potential waste streams for the development of an upcycled beverage product.

Oakland is well placed to provide guidance on:


- Key factors for upcycled product / ingredient development
- Identifying and sourcing waste raw materials
- Identification and evaluation of technology options
- Drawing market landscapes
- Partner identification and evaluation

The opportunities to innovate in food waste reduction are vast. And the benefits could be far-reaching.



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