Introduction

Becoming more resource efficient by preventing and reducing waste in the supply chain not only produces carbon savings, but also financial savings. The six case studies in this pack represent real examples of how businesses have achieved, solely or in collaboration with others, waste reductions and saved money.

These case studies highlight WRAP’s work with Courtauld signatories and other companies to prevent waste at UK sites in the food and drink manufacturing sector between 2012 and 2013.

WRAP’s support has helped organisations identify the amount of waste created and determine root causes of generation. Sustainable solutions were then developed and implemented by the businesses to reduce their waste.

The core principle behind the projects was the employment of a methodical ‘problem solving’ approach, applying LEAN or 6-Sigma manufacturing principles and similar continuous improvement tools and techniques at each stage in the process.

Collectively these projects reduce over 3,900 tonnes of waste in the food and drink supply chain on an annual basis.
Waste Prevention Case Studies

The team deployed a structured approach to waste prevention which involved diagnosis, implementation, execution and sustainment of the results following a Plan-Do-Check-Act method (Figure 1).

**Actions taken to prevent waste**

Arla formed an intervention team that started the process by looking at waste at a very high level. The team created a mass balance for the site to understand all inputs and outputs from both financial and environmental points of view. This is also regarded as a System Boundary Map which is essentially a mass and energy balance for the whole factory.

Their analysis showed that there was around 24,000 tonnes of (liquid and solid) waste generated at Stourton dairy consisting of circa 23,000 metric tonnes of sludge and liquid waste and around 700 tonnes of solid waste, based on 2012 figures. This high level overview helped the team focus on the most significant waste streams.

The dairy company has implemented remedial solutions that will reduce waste by 2,600 tonnes per annum at their Stourton creamery.

**Figure 1. Plan, Do, Check, Act method**

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**KEY**

- **Project Management**
- **Diagnosis**
- **Implement**

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**Introduction**

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Case studies
The team adopted a ‘learning by doing’ approach and drew upon the (incumbents’) local knowledge as much as possible.

From the System Boundary Map (Figure 2), the intervention team began to explore the key hotspots along the end to end process.

The team members identified the key hotspots, where most physical wastes accrue, by populating a ‘Big Picture Map’. Having carried out this analysis, the team could then easily focus on the most significant issues which are shown in red or amber in Figure 3 – the hotspots.

The team members assembled in groups and selected key hotspots in each group.

The team facilitator mentored each team through an A3 problem-solving journey (Figure 4 provided overleaf). The facilitator did not suggest any solutions, rather created a journey for the A3 owners to find their own solutions.

Figure 3. Big Picture Map

The team facilitator mentored each team through an A3 problem-solving journey (Figure 4 provided overleaf). The facilitator did not suggest any solutions, rather created a journey for the A3 owners to find their own solutions.
The A3 owners analysed the situation and came up with a thorough understanding of the root causes of the waste problems. This forms the left-hand side of the A3.

Then the A3 owners suggested suitable countermeasures and applied those solutions following the Plan-Do-Check-Act cycle, eliminating countermeasures which proved unworthy during the ‘Check’ phase.

This eventually led the team to find out what are the best available countermeasures to eliminate the physical waste at source. This forms the right-hand side of the A3.

The teams carried out detail cost benefit analysis as part of their A3 problem solving approaches and created a business case for implementation and execution of the appropriate countermeasures. The intervention team embarked upon 5 different A3 projects with significant benefits.

**Key lessons**

The level of participation and engagement of the ARLA team was very high, despite great demand from day job and busy schedule of production to keep. The team members have begun to use the thinking and the techniques for waste prevention in their own areas.

Targets are integrated into the daily operations meetings to ensure continuity of actions. Each A3 has got a mentor/sponsor who is usually the direct manager to the A3 owner. The whole site is engaged in this new way of thinking and several workshops have been held to train staff and to inform them about approaches and progress. Team members are increasingly aware of the need to use analytical thinking to assess the situation (current state) as well as deployment of quantification tools for improvement (future state).

The focus is on doing the right things rather than doing the wrong things better.
Actions taken to prevent waste

Malt waste
By modifying their malt process, Carlsberg UK are diverting 260 tonnes of waste from energy recovery, and saving £50,000 per year.

Incoming grain for brewing, known as malt, is checked for quality prior to use. The filtering and de-stoning process rejects malt along with stones and other impurities detected. Approximately 260 tonnes of reject malt was being sent to Energy Recovery at a cost of £85,540 per annum including disposal. Examination of the reject malt found that the reject product contained 95% product and only 5% impurities.

A number of options were carefully considered to address this issue, and the following strategies were implemented:

- the rejection system was modified so that less malt was lost to waste each time stones were detected; and
- as an alternative outlet to energy recovery, the rejected malt is sold into the animal feed market.

By implementing these solutions, Carlsberg UK not only reduced malt waste, but they will receive a small income from the rejected malt being sold into the animal feed market.
**Hop extract waste**

Isohops and tetrahops are expensive flavour ingredients used in the production of beers. These were being delivered in 25 litre drums, but to reduce handling and packaging waste, the packaging was changed to 1000 kg liquid intermediate bulk containers (IBCs). The IBCs were connected to an automatic dosing system and changed when empty.

Nevertheless, on average a residue of 7% of product remained when IBCs were removed from the dosing system. The approximate cost of hop extract was £62 per kg and the cost of waste extract amounted to £169,000 per annum.

**Figure 6. Example of hop extract residue that is now being collected for use instead of being wasted**

To reduce the substantial hop extract being wasted, a stainless steel ramp was constructed to enable the hop extract to drain towards the tap outlet. Operators were also trained in the correct procedures for discharge. The ramp cost £300, with a fifteen-fold payback from the first IBC emptied. The ramp installation saved the company money, as excess hop waste being sent to energy recovery was significantly reduced.

**Key lessons**

As a result of waste initiatives taken, reductions have been achieved in malt and hop extract waste. It is estimated that Carlsberg UK will save £206,000 and divert 263 tonnes of waste from energy recovery per annum from these immediate changes.

**Other opportunities**

During Carlsberg UK’s waste prevention review supported by WRAP, a total of eleven potential waste prevention opportunities, equalling 960 tonnes per year, were identified. The savings were equivalent to 538 tonnes CO$_2$ eq, or £512,200 per annum. The production process was reviewed from incoming ingredients to beer production, filling, packaging and storage identifying the main inputs and outputs. Apart from the finished product, all other outputs were waste. These included waste ingredients, packaging from ingredients and product packaging components, and product and packaging waste during production.

Of the eleven opportunities identified, the two waste prevention initiatives highlighted above were carried out immediately due to their ease of implementation.

"In recent years we’ve worked hard to become industry leaders in improving environmental impact, reducing our use of raw materials, energy, water and packaging and minimising waste wherever we find it. We’ve reached out to partners across our value chain to work together on sustainability projects that will help improve our environmental impact across the lifecycle of our products."

Matt Winterburn, Head of SH&E and CSR, Carlsberg UK
Waste Prevention Case Studies

Actions taken to prevent waste
The Greencore Group implemented 8 waste initiatives at their sandwich manufacturing factory, Manton Wood.

A description of these and the associated cost savings are highlighted below. Each initiative is categorised by product material.

1. **Bread** – targeted reduction of waste at source, among other things, realising savings of over 600 tonnes per year;

2. **Tomato ends** – implemented new process whereby tomato ends are used as diced tomatoes, reducing tonnage by 97.9 every year;

3. **Buckets used for egg mayo** – changed process so buckets for egg mayo are no longer used; instead, mayo is delivered in bags and mixed with eggs on site. This has resulted in savings of 64.7 tonnes of plastic;

4. **Sandwiches** – over-produced sandwiches have been diverted from waste (as these are now being collected and sent for redistribution for human consumption), leading to savings of 40 tonnes per annum;

5. **Cleaning chemicals** – eliminated cleaning liquid used by optimising methods and equipment, achieving savings of 34 tonnes per year;

6. **Cutter loss and belt-end waste** – zoomed in on cutter loss and replaced cutters with ones that create less vibration and waste. Savings of 24 tonnes have been achieved;

7. **Ham ends** – sent ham ends back for re-usage by supplier, saving 13.1 tonnes every year; and

8. **Sausages** – developed methods to re-use sausage ends in stuffing, saving 7.8 tonnes every year; and replaced cutters with more modern ones which contribute to savings of 5.4 tonnes per year.

The waste initiatives were developed as a result of the application of LEAN and other techniques, such as the Green Impact Matrix shown below. Read on to find out more about these methods.

![Figure 7. Green Impact Matrix highlighting the hotspots in purple and orange](image-url)
Creating and analysing a System Boundary Map
To understand all inputs and outputs from both financial and environmental points of view, a System Boundary Map was developed (see Figure 8). This is essentially a mass-energy balance for the whole factory.

The analysis showed that 7,542 tonnes of waste were generated. This high level overview helped the team focus on the most significant waste streams, and waste reduction opportunities, such as preventing waste at source.

Identifying hotspots using a Green Impact Matrix
The intervention team utilised the System Boundary Map to explore the key hotspots throughout the process and created a Green Impact Matrix. This highlighted where waste was generated and helped the team focus on the most significant issues which led to waste generation.

Applying LEAN technique to identify the root causes of waste
At this stage the WRAP-funded project facilitator familiarised the team with the A3 problem solving approach, which is a well-recognised LEAN technique. In fact the A3 method is more than just a tool; it is an approach through which the organisation learns how to learn.

The team members assembled in groups and were assigned key hotspots. They then utilised the A3 problem solving approach, analysed the collated information and developed a thorough understanding of the root causes of why the waste was occurring. This formed the left-hand side of the A3. Subsequently, the intervention teams suggested countermeasures and applied those solutions following the Plan-Do-Check-Act cycle, eliminating those countermeasures which proved unworthy during back : forward
the ‘Check’ phase. This led the team to establish what the best available countermeasures were to eliminate the generation of waste at source. This formed the right-hand side of the A3 sheet. The teams created a detailed cost benefit analysis as part of their A3 problem solving approaches and created a business case for suitable countermeasures.

Key lessons
They implemented changes that are projected to save nearly 950 tonnes of waste annually – the equivalent to 680 Mini Cooper cars. A structured approach to waste prevention was taken during the planning stage and throughout the project, following a Plan-Do-Check-Act philosophy (see Figure 9). Engaging people was vital during all phases of the project and contributed greatly to the overall success.

Other opportunities
The Greencore Group will continue to investigate other waste reduction opportunities, and place an emphasis on learning problem solving and scientific management rather than focusing on immediate benefits. Team members will continue to be encouraged to use analytical thinking to assess the situation (current state), and quantification tools for improvement (future state).

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Figure 9. Example of table used to structurally plan the project
Actions taken to prevent waste
Both the Midlands Co-operative and Fyffes worked in partnership to prevent banana waste between factory in-gate and till.

Introducing small 12kg banana boxes in convenience stores
The partnership identified that introducing small 12kg banana boxes in 8 convenience stores would reduce waste by 90% and CO\textsubscript{2}eq emissions by 56 tonnes every year. This solution was created as it was identified from the project that 18kg boxes were too large for convenience stores.

Bagging up loose bananas to reduce-to-clear
A process for stores to bag up loose bananas and put them up for sale as reduce-to-clear items, thereby reducing wastage, was trialled in 6 stores.

During the trials, stores completed data capture sheets to record banana waste. Employees were required to record data on different types of bananas (e.g. loose, small, value, and organic bananas) for three weeks, identifying the following criteria:

- amount wasted by weight/count;
- amount reduced by count;
- reason for banana wastage; and
- total value of product.

Waste Prevention Case Studies

Midlands Co-operative
The co-operative

Retailer and fruit company identify opportunities to reduce banana waste by over 80 tonnes per year

The smaller boxes minimised stock carry over at the end of the day's trading and had the added benefit of maintaining product quality for the consumer. More frequent replenishment meant the fruit was fresher and less marked or bruised, which resulted in additional sales. Consumers benefited from a better quality product and less food was wasted in store.

"The 12kg Banana Box initiative represents a genuine win-win scenario – better for the supplier, better for the retailer, better for the consumer, better for the environment."
Jon Tugwell, Environment Manager, Fyffes

Figure 10. The original 18 kg boxes alongside the new 12 kg boxes
Key lessons
The waste prevention solutions identified that banana waste can be reduced by 83.7 tonnes per year – which would represent a 50% reduction in the rate of waste as a proportion of sales – and save 270 tonnes of CO\textsubscript{2}eq per year (equivalent to the annual carbon footprint for two convenience stores).

Working collaboratively has delivered benefits to both Midlands Co-operative and Fyffes, including:

- breakthroughs achieved by working across functions and basing actions on trial results and other evidence;
- transferable learnings for all those involved; and
- opportunities for employee development by learning new skills.

![Figure 11. Example of reduce-to-clear bananas](image)

Other opportunities
The waste prevention work has accelerated plans to install banana hammock displays to reduce bruising from overfilling and optimise the banana display. As well as specifying hammocks for all new stores and store refits, a plan is now being evaluated to install hammocks in stores not currently scheduled for refit.

To improve in-store practices the team used posters (see Figure 12) and trialled an intensive visit and coaching regime. However, this proved to be ineffective. Therefore the approach has been modified to engage several good and poor stores locally to rapidly share, understand and drive best practice. The team is confident that significant reductions in waste and CO\textsubscript{2}eq savings can be made from fully engaging stores in improving banana care.

The partnership have committed to focus on improving banana care standards in store. They plan to do this via Midlands Co-operative’s new ‘Store Manager Buddy System’, whereby the managers of the best banana waste prevention performing stores will ‘buddy up’ with the managers of the worst performing stores to share best practice.

Fyffes will then coach the ‘Store Manager Buddy’ teams regarding in-store banana care. All stores will receive a banana care kit developed by Fyffes.

![Figure 12. Posters to improve in-store practices](image)
Waste Prevention Case Studies

Figure 13. Reject carton cages to segregate carton losses during trial

Tea brand reduces over 100 tonnes of carton waste and saves in excess of £100k every year as a result of waste initiatives

Actions taken to prevent waste
The Typhoo team was made aware of high levels of carton and foil waste on lines following a waste prevention review conducted by WRAP at their Wirral site. It was identified that each time the cartoner stopped, the line would stop and this would also cause waste at the foil wrapping station, creating waste teabags.

Carton losses were estimated at 114 tonnes per year. This was equivalent to losses of in excess of £100k per annum. Measures were therefore developed to monitor and reduce the amount of carton waste generated by lines.

A monitoring trial was undertaken, which looked at the following: carton age, board quality (including carton weight) and physical appearance, time in warehouse, warehouse temperature and humidity, and acclimatisation time in factory before use. The trial also focussed on line speed, and the number of reject cartons at each stage of the process (i.e. start-up and changeovers).

Due to the results of the monitoring trial, the following measures were implemented:

- the number of carton suppliers were reduced to decrease the number of carton specifications and ensure consistent performance;
- inventory control was improved to reduce proportion of aged carton stock, as old carton stock does not perform well on carton erection equipment, leading to carton and teabag waste;
- care temperature and humidity control of cartons upon arrival were improved. Care is now taken to ensure incoming pallets of cartons are not left outside; and
- storage conditions of cartons were improved, with better control of temperature and humidity. Sensors were fitted to measure relative humidity.
**Key lessons**

Based on data from the trials, Typhoo Tea expects to achieve a significant reduction in carton losses, from 4.5% to 0.21%.

It is estimated that this will reduce over 100 tonnes of carton waste per annum, saving the company over £100k per year.

The waste prevention review highlighted that the main sources of waste generation are caused from incoming packaging and waste from Typhoo packaging operations. Therefore, Typhoo focused on packaging performance on the line and packaging materials for their waste reduction strategies.

These efforts proved to be successful as significant waste was reduced and financial savings were made.

"We found the Waste Prevention Review and subsequent support from WRAP extremely beneficial in identifying our wasted resource use which is a key priority for Typhoo. WRAP helped us identify where we could reduce waste and implement action plans to deal with it."

Shah Khan, Group Technical and Ethical Manager
Typhoo Tea

**Other opportunities**

The WRAP waste prevention review also identified that waste management on site was good, and a number of good practices were already in place to prevent waste for example:

- corrugated board boxes used to import empty tea caddies were relabelled and reused to distribute filled caddies;
- reels of filter paper are as large as possible to reduce the number of reel changeovers, increasing line efficiency and minimising the amount of filter material left on the reel;
- considerable efforts are made to recycle all waste materials leaving site, achieving zero waste to landfill in 2012; and
- Typhoo’s Eco Refill pack, saving 92% of packaging. See details here.
Retailer and food manufacturer work together to reduce bagged salad waste

Waitrose and Wingland Foods worked in partnership to tackle wastage by creating smaller packages of bagged salad types for certain convenience stores. The results of a trial showed that, on average, the salad wasted was cut by almost a third – rising to an 80% reduction in wastage in some instances.

**Actions taken to prevent waste**

It was identified that the rates of sale at convenience stores versus larger branches were significantly variable, especially once seasonality was considered. Both businesses studied the waste that was being generated from bagged salads in convenience stores over a 4-week period.

Waitrose and Wingland Foods were not happy with the levels of bagged salad in convenience shops having to be sent to anaerobic digestion – this action goes down as wastage for the company, so steps were taken to address it.

There was clearly a need to have more than one format of case count that could apply to the rates of sale of individual branches or branch groups.

The partnership identified products that it believed would drive a reduction in overall wastage if case counts were reduced to 8x for the following products: Classic salad 14x185g, Caesar salad 12x250g, Essentials Crunchy salad 10x200g, and Essentials Iceberg salad 10x300g.

They investigated how products could come in two different case counts and determined that a new product would need to be developed for smaller case counts with its own unique EAN number and packaging artwork.

A short-term solution was preferred, so a trial was conducted and the four products were changed for the total estate rather than just convenience. The performance of these lines were measured and waste savings were recorded.

During the trial, salad waste was cut by 80% in some instances. On average, waste from bagged salad was reduced by approximately one-third.

The performance of classic salad did not improve to the levels of the other products and a commercial decision was made to remove this from the convenience range.

**Key lessons**

The initial changes were relatively easy and quick to implement. However, scaling up the operation would not necessarily be the best course of action as not all bagged salad lines demonstrate high wastage levels in convenience branches. For example, smaller case counts on lines that do not have high wastage levels could damage sales opportunities and lead to poor availability. Commercial considerations would therefore need to be met.

**Other opportunities**

To roll out dual case count formats as part of future category plans, the
partnership will need to consider the critical path for product launch and the artwork process.

As part of the future bagged leaf category plan, the businesses are including the opportunity to duplicate products in varying case count formats. It is expected that two case count formats will be reasonably practical, and it is not envisaged that more than two formats are needed.

A trend was identified during the trial. During the Christmas and New Year’s period, as well as during the extreme weather in early February, the convenience wastage of bagged salad rose disproportionally to the wastage for the category across the whole estate.

Areas to explore in the future are:

- the impact on products such as bagged salad in convenience branches when large numbers of people are on holidays from work, e.g. Christmas, Easter, summer holidays; and
- the change to buying trends during extreme weather and whether further changes such as this could be made for convenience branches in certain categories (e.g. Food to Go).

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1IFCO SYSTEMS’ core competence is the efficient management of a worldwide rental pool of over 175 million RPCs (returnable plastic containers) used to transport fruit and vegetables.

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Working in partnership proved an effective way of identifying problems and introducing solutions that can reduce wastes that impact on both our businesses.”

Alan Williams, Supply Chain Development Manager
These case studies are part of a series of WRAP resources on waste prevention.

For more information, visit [www.wrap.org.uk/waste-prevention](http://www.wrap.org.uk/waste-prevention)

You can access:

- waste prevention background data;
- W.A.S.T.E. problem-solving discipline;
- guidance on reducing waste; and
- tip sheets.

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