

**WR1403: Business Waste Prevention
Evidence Review
L2m4-8 – Other Business Support**



A report for
Defra

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Context of Project WR1403

Waste prevention is at the top of the waste hierarchy. A major priority of the coalition government is to move towards a zero waste economy, and an important element of this will be to encourage and increase waste prevention. This review aims to map and collate the available evidence on business waste prevention. It will help inform the preparation of England's National Waste Prevention Programme as required under the revised EU Waste Framework Directive (2008).

The focus is on aspects of waste prevention that are influenced directly or indirectly by businesses - it complements a previous evidence review, WR1204, which focused on household waste prevention. The definition of the term 'waste prevention' used here is that in the revised Waste Framework Directive:

'Prevention' means measures taken before a substance, material or product has become waste, that reduce:

- a) the quantity of waste, including through the re-use of products or the extension of the life span of products;*
- a) the adverse impacts of the generated waste on the environment and human health; or*
- b) the content of harmful substances in materials and products.*

Recycling activities or their promotion are outside the scope of this review.

Context of this Module

This module is one of a number of Level 2 modules that contain analyses of Approaches, Interventions, Sector Issues and other aspects of the review. This module deals specifically with the aspect of waste prevention using the Intervention mechanism of Business Support other than Waste Minimisation Clubs.

A full map of the modular reporting structure can be found within **L1m2: Report Index**.

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Glossary

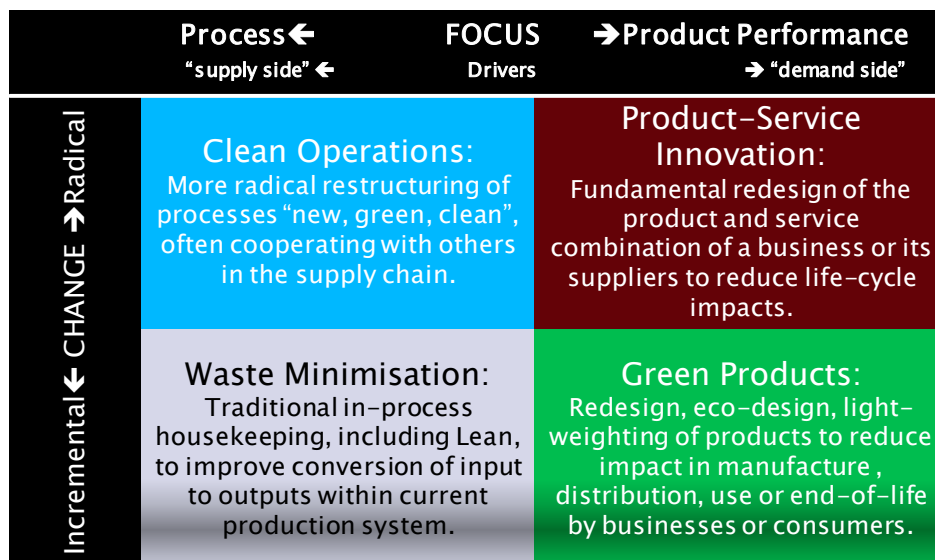
BOGOF	buy one, get one free	NGO	non-governmental organisation
BREW	Business Resource Efficiency and Waste	NISP	National Industrial Symbiosis Programme
CC	Courtauld Commitment	OSM	off-site manufacture
CRR	Centre for Remanufacturing and Reuse	RDA	Regional Development Agency
DTI	(former) Department for Trade and Industry	RTP	returnable transit packaging
EEF	Engineering Employers Federation	SME	small/medium enterprise (EU definition)
ICT	information and communication technology	TSB	Technology Strategy Board
NHS	National Health Service	WRAP	Waste & Resources Action Programme
MTP	Market Transformation Programme		

Units Conventional SI units and prefixes used throughout: {k, kilo, 1,000} {M, mega, 1,000,000} {G, giga, 10⁹} {kg, kilogramme, unit mass} {t, metric tonne, 1,000 kg}

Language used in this report

This report has used a framework for evaluating both the actions a business takes to prevent waste (the Approaches), and the mechanisms that have catalysed the actions (the Interventions). The detailed description of Approaches and Interventions may be found within the respective modules **L2m2: Approaches** and **L2m4-0: Interventions Introduction**, but a brief reference outline to the Approaches is given here:

Positioning of approaches in response to business drivers including waste



Source: Oakdene Hollins/Brook Lyndhurst

1 Other Business Support and How it Addresses Waste Prevention

A significant number of programmes and initiatives are currently running aimed at improving the environmental performance of businesses. Such business support comes in many forms including:

- the provision of help-lines for advice
- creation and dissemination of guidelines and other tools for self-analysis
- the auditing of facilities and practices
- technical assistance in implementation
- organisation of networks and application for finance.

Even though the instruments and tools applied may differ, all these business support initiatives share some elements:

- ambition to achieve a win-win situation for business and the environment
- involvement of public bodies or trade associations
- supply driven i.e. promoted by those offering support
- voluntary participation as opposed to mandatory involvement.

In the context of this survey, business support contracted without government intervention is most likely to consist of private consultancies engaged by a company at the latter's own expense. Evidence for this is extremely limited; not perhaps because of its rarity, but because there is little incentive to publicise it.

A fundamental assumption of business support is the belief in the existence of 'win-win' situations for business and the environment. It has been shown in the past that many environmental improvement measures have been good financial investments for the participating businesses. However, businesses do not adopt such measures at the expected rate due to actual or perceived barriers (1). These barriers include lack of information and knowledge, fear of risks despite obvious benefits, and scepticism of anything labelled as 'green'. Consequently, many business support programmes set out to overcome these barriers by engaging with businesses and providing guidance on such 'win-win' opportunities.

Additionally, principles of best practice may not yet have been proven and businesses consider it too risky to engage in these. In such cases business support is aimed at driving innovation by providing funding for demonstration projects to prove new technologies and to provide case studies with details on costs and pay-back times (2).

The measures taken by business are not only expected to profit them, but also to provide societal benefits by improving the environment. These beneficial externalities are one of the reasons public bodies (i.e. local / national / international authorities) set up, fund or run such business support. Such improvements are also believed to increase the general competitiveness of the regional or national economy, thus giving a further impetus for public funding. A special case is business support as an accompanying measure to help industry to adapt to new environmental regulations or taxations. A typical example is the initial ring-fencing of the Landfill Tax. Part of the revenue of this tax was used to fund business support to help companies counter the increase in disposal costs by reducing the amount of waste being generated and being sent to landfill (3).

Business support is typically a **supply-driven** phenomenon; it is seldom instigated, financed and organised by the business world itself. Even though members of the business community or trade associations often demand business support (for example (3)), the average company rarely seems interested in getting involved (4). Most business support programmes report difficulties achieving sufficient

participation by companies and tend to invest heavily in marketing and advertising campaigns. Most feel unable to charge for their services for fear of dissuading participation (4; 5; 6); a concern which may or may not be justified.

Finally, all business support organisations work on the principle of **voluntary participation**. Support may be offered to all businesses, but it is always in the power of the individual business owners to decide whether to accept it.

Business support fits in well with the theoretical principles of environmental economics. Policy measures applied to a heterogeneous group of firms tend to be most effective if they offer the affected party as much flexibility as possible. While a sound regulatory framework is needed to establish discharge and emission limits, other instruments are required to encourage companies to shift from end-of-pipe treatment methods to cleaner production, waste minimisation and sustainable development strategies (6). Business support is an example of one instrument providing this encouragement to industry.

Business support organisations involved in waste prevention activities can be characterised by the bodies funding them, their objectives, their target companies, the level of intervention and the applied tools (Table 1).

Table 1: Characterisation of business support organisations involved in waste prevention

Funding body:	Target companies:
<ul style="list-style-type: none"> ● government ● industry/trade association ● NGO ● other businesses 	<ul style="list-style-type: none"> ● national / regional / local ● sector specific ● SMEs ● supply chains
Objectives:	Approach:
<ul style="list-style-type: none"> ● waste prevention ● waste minimisation ● waste exchange ● resource efficiency ● pollution prevention 	<ul style="list-style-type: none"> ● Waste Minimisation ● Clean Operations ● Green Products ● Product Service Innovation
Tools applied	
<ul style="list-style-type: none"> ● creating networks, enabling peer-peer learning (e.g. waste minimisation clubs) ● matchmaking, waste brokering among businesses (e.g. part of waste minimisation clubs, NISP) ● auditing / gap analysis (e.g. food waste audits, energy audits by the Carbon Trust) ● training / education / seminars / workshops ● collecting and publishing guidance documents, best practices (closely linked to training) ● providing information/remote advice (e.g. helplines) ● direct support for projects ● financial advice 	

Source: Oakdene Hollins/Brook Lyndhurst

Waste prevention support programmes typically intervene at one or two levels of the waste hierarchy and use a combination of different tools bespoke to their objectives and boundary conditions.

2 The Nature of the Evidence

The academic and grey literature on business support for waste prevention is vast; given time constraints a detailed analysis on all sources was not feasible. Just as no individual source was able to cover the whole breadth of issues around business support, each type of source had its own advantages and limitations (Table 2).

Table 2: Types of sources used

Type of source	Advantages	Limitations
Case studies	Specific examples of what actually worked. Good availability – large number of case studies exist.	Very specific, difficult to generalize. Data missing as often generated for marketing purposes, not for scientific evaluation.
Evaluation reports	Comprehensive review of a given support initiative, often including both successes and difficulties encountered.	Difficult to insulate the waste prevention aspect, as initiatives often include recycling, energy or water efficiency.
Academic papers	Comprehensive review, adding information about behavioural aspects.	Only few studies available.

Source: Oakdene Hollins

Two biases were expected and found during the literature review:

- Under-reporting of failed interventions; reports usually focus on successful cases and initiatives (7).
- Most sources concern business support initiatives with public funding. This was to be expected as the use of public money often requires publicly available reports to justify spending. Conversely, organisations would see little benefit in publicising the outcomes of internally-driven initiatives requiring business support.

Therefore, the lack of evidence of business support by private organisations, as well as the small number of failed examples, should not be seen as evidence for their absence. However, they point to an important limitation of this study and a possible focus for further research.

Problems were encountered in disentangling the aspects of waste prevention from the broader aspirations typical of business support programmes. Often, reported results were presented as high level benefits including savings from diversion from landfill, as well as energy or water reduction measures (7). Examinations of corporate and individual behaviour issues were few and far between.

Additionally, some waste prevention programmes were initiated to help businesses cope with new legislation and/or taxation (e.g. Landfill Tax). Even though these programmes have achieved impressive results in helping business to divert from landfill and to prevent waste, the underlying change in legislations / taxation was arguably the main contributing factor (e.g. (8)).

Finally, we would exercise caution in the further manipulation of data presented the tables; the benefits should not simply be summed as different reports may cover the same projects. In addition, sufficient detail to guarantee correct identification of waste prevention aspects was often lacking in the sources reviewed.

Much evidence is available from English and Devolved Agency sources but this review has also drawn on experiences in Canada, Finland, Australia, Germany, France and pan-EU initiatives.

3 Evidence of Waste Prevention

3.1 Introduction

Many environmental and waste programmes have supported businesses in the UK; elements of waste prevention are often included. Typical examples are given in Table 3.

Table 3: Examples of business support programmes

Programme	Comments	Benefits	Cost	Saving: Cost	ID Ref
Aylesbury Vale Industrial Waste Reduction Project	Initial cost were £58,400, but companies contributed voluntarily £30,000 at the end of the projects	£127k /y	£28.4k	4.5 : 1	(5)
Don Rother Dearn Project	Not only material waste, but also energy and water 'waste'	£565k	£200k	2.8 : 1	(9)
Courtauld Commitment	Voluntary agreement supported by WRAP food waste and packaging waste	1.2Mt of waste	-	-	(10)
Aire Calder Waste Minimisation Club	Not only material waste, but also energy and water 'waste'	£3.4m	£400k	8.4 : 1	(7)
Bedfordshire Waste Reduction in Industry	-	£339,700	£92k	3.7 : 1	(11)
The East Anglian Waste Minimisation in the Food and Drink Industry Project	annual savings of greater than 1% of turnover by implementing waste minimisation strategies achievable in the food and drink industry	£1.1m 1,370t	-	-	(12)
BREW (2005/2006)	Various sub-programmes (e.g. WRAP, Carbon Trust, Envirowise, NISP, MTP). Covers different aspects of resource efficiency.	£88.0m 120kt less haz. waste (90% by NISP) 600kt of virgin material saved	£15.0m	5.9 : 1	(13)
BREW (2006/2007)	Various sub-programmes (e.g. WRAP, Carbon Trust, Envirowise, NISP, MTP). Covers different aspects of resource efficiency.	£201m 146kt less haz. waste (90% by NISP) 3.7Mt of virgin material saved	£50.3m	4.0 : 1	(14)

Source: Collated by Oakdene Hollins/Brook Lyndhurst

Despite its status in the waste hierarchy, waste prevention has not always been prioritised in business support programmes. For instance, some have argued that early Waste & Resources Action Programme (WRAP) support favoured recycling while neglecting other options (e.g. re-use) (15). However, WRAP's current remit includes waste prevention, reuse and resource efficiency as well as recycling. Similarly, the Envision programme for SMEs in South West UK focused primarily on energy and greenhouse gas reduction and secondly on diversion from landfill. A 2010 evaluation does not mention waste prevention as being promoted by Envision (1).

In the following, the evidence for waste prevention initiated and/or supported by business support programmes is structured along the four levels of approach: waste minimisation, clean operations, green products and product/service innovation.

In general, a close connection between the set-up/funding of a business support organisation and the level of approach can be observed. Programmes aimed at the innovation of the product/service concept, for instance, need to be tailored to each case, are time intensive and costly. However, the savings per

intervention are often large (16). On the other hand, programmes trying to reap low-hanging fruits by fostering waste minimisation and some typical cleaner operations options achieve only smaller savings on a per case basis, but cost significantly less per case and are able to reach more businesses with a given budget.

3.2 *Waste Minimisation*

Waste minimisation, in this review, is understood as: measures to reduce the amount of waste produced by small changes in procedures, settings and installations. Such measures - accompanied with raising awareness and providing training for employees - are often able to reduce the amount of generated waste significantly for companies who have not previously considered waste as an issue (e.g. 50% reduction of waste from paints in an SME (17)). On-site recycling of waste is also generally considered as waste minimisation, as it usually requires no fundamental changes to the basic processes. These measures have the advantage of being mostly simple and requiring little if any investment. They often allow a 'broad brush' approach by business support, i.e. promotion of standard measures across different sectors.

However, even though waste minimisation changes how a process is being operated, it does not question the ability of the process itself (i.e. clean operations), nor whether the product could not be altered to avoid such waste generating processes altogether (i.e. green products), nor whether the same value could be delivered to the customer in a fundamentally different way (i.e. product/service innovation). As a consequence, waste minimisation efforts may be able to reduce the amount of a given waste, but will not be able to prevent a waste stream completely. This is especially an issue for hazardous waste, where a mere reduction of certain hazardous components may be insufficient. Please refer to module **L2m6: Hazard Reduction** for more information.

Despite its shortcomings, waste minimisation permits the harvest of so-called 'low hanging fruit' and is thus perceived as a good first step to engage business managers and employees alike.

The main tools used by business support organisations are:

- waste audits
- helplines
- guidelines.

These tools are comparatively low cost in line with the expected low benefits per intervention, yet are applicable to a large number of companies within the funding restraints of the business support organisation.

Typical examples of waste minimisation actions fostered by business support organisations are given in Table 4, with case studies in the Boxes which follow.

Table 4: Evidence of waste minimisation supported by business support

Category	Description	Outcomes	ID Ref
Food & Drink			
Better Staff Training	Envirowise: Fisher Foods solved problem of excessive trimming of raw materials by improved training of staff, combined with photographs of best practice and supervision	cost savings of £100k/yr; scheme cost £30k	(18)
Monitoring & audits	WRAP funded 81 flagship food and drink manufacturing sites complete on-site waste and packaging audits	n/a	(19)
Process modifications	Envirowise: Baked bean manufacturer improved maintenance and process modifications	£86k/yr savings achieved	(20)
	Envirowise: Waste prevention in soup producing company -	£100k/yr savings achieved through procedural changes and reduced raw material rejection	(20)
Unspecified	East Anglian Waste Minimisation in the Food and Drink Industry Project – 15 companies	£1.1m/yr in total resource efficiency savings from investment of £726k; raw materials use and solid waste production reduced by 1,370 t/yr	(21)
	ENWORKS: North West Waste Minimisation Project – 112 food and drink companies	£37,941/yr per business (average)	(22)
	Envirowise: Waste minimisation in baking company	£56.7k/yr savings achieved with further £14.3k/yr identified	(20)
	Envirowise: Waste minimisation in brewing company	£300k/yr savings identified	(20)
	Envirowise: Waste minimisation in distilling company	£1.2m/yr savings identified	(20)
	Envirowise: Waste minimisation in various processed foods companies	£618k/yr savings	(20)
Reuse of surplus food by charities	FareShare: Nestlé redirected 600,000 surplus meals to charities	Reduction of surplus food to landfill from 100% in 2005 to < 5% in 2006; food waste reduced by 388 t/yr	(23)
	FareShare: Total diversion of surplus food from UK retailers, manufacturers and hospitality companies as a whole through FareShare	3kt of food waste saved in 2009/10	^a
Reduce packaging	Unnamed hotels, Deux-Sèvres department, France: eliminated individual portions of jams and soaps	n/a	(24)
	New Zealand backpackers hostel: measures recommended by consultant included saving plastic bottles by encouraging guests to drink filtered tap water	n/a	(25)
Product reuse	New Zealand backpackers hostel: measures implemented include paper reuse, double-sided paper printing, refilling printer toner cartridges	n/a	(25)
	Envirowise: Fairmont St Andrews hotel and golf resort, Scotland: waste prevention activities included preventative maintenance, re-use or mending of furniture, textiles and equipment; re-use of uniforms, removal of unnecessary labelling and packaging, and take-back schemes	n/a	(26)
	Envirowise: Unnamed fish and chip shop, UK: reduces waste cooking oil by careful control of frying temperature, filtering, and daily topping up of oil	£3k/yr savings	(27)

^a FareShare personal communication, January 2011

Category	Description	Outcomes	ID Ref
	Envirowise: Unnamed Chinese restaurant, UK: changed cooking practices to save oil	Oil use reduced by 30 - 50%, £6k/yr saved	(27)
Construction			
Best practice	A WRAP tool (NetWaste) produced an estimate of the value of the unused or damaged materials disposed of as waste of an office building construction site	nearly 2% of the total construction value	(28)
	Envirowise: Greenwich Millennium Village implemented general best practices including tool box talks, reuse of off-cuts and ensuring materials are appropriately stored	Reduction from 50m ³ per house to 24m ³ of waste	(29)
	WRAP: Benefit of reducing waste across 10 case studies. Savings could be made by contractors being more careful onsite with reduction in wastages. Some of this is proposed though implementation of a site waste management plan	0.57% savings on the value of construction	(30)
	WRAP: Used a suite of waste prevention measures include a focus on reuse of materials on site, tool box talks, better on-site storage of materials, electronic record keeping (instead of paper copies in the site office), pre-fabrication, the use of an exact cutting schedule to reduce factory offcuts, just in time delivery of materials, use of WRAP's Designing out Waste Tool, and the NetWaste Tool	£57k	(31)
N/A	WRAP: Halving Waste to Landfill project worked on an industry level to sign up construction firms and large clients of construction companies (such as supermarkets) to a commitment to half construction waste to landfill. After one year, the scheme had attracted 200 signatories	None given	(32)
On site reuse	Envirowise: St Andrews waste water treatment development noted that large quantities of concrete waste were generated and specifications were improved to enable the material to be re-used as backfill for structures	20kt	(29)
	Envirowise: Wessex Water operations centre: Excavation materials were re-used to build sections of the site boundary wall and also used as general backfill for structures	5,000 m ³	(29)
	NISP aided Scott Wilson Ltd as they undertook a risk assessment of a brownfield development site for Derbyshire County Council. It was found that contaminated material could be reused as part of the site redevelopment	10,750 tonnes £1.29m	(33)
	WRAP: Application of 3-stage process to design-out waste for a construction project (school project Birmingham). Significant savings were identified by using recycled aggregate as filler for a playing field	7.2kt	(34)
	WRAP: HSBC Case study on the implementation of Site Waste Management Plans, two examples were given reusing I-beams and concrete.	£3k	(35)
	WRAP: Local authority/RDA involved in building of a hospital achieved 99% waste diversion from landfill by segregation and recycling (both on site and through 3rd parties)	£38k	(36)
	WRAP's Halving Waste to Landfill project: A decision to refurbish an ASDA store, rather than demolish and completely rebuild it, was taken. The floor slab and additional foundations from older buildings discovered during the work were sent to a local facility for crushing, which was fed back into the new floor slab.		(32)
Packaging	DTI Technology: Carillion is testing a 500-litre bulk paint containers (supplied by ICI), which should significantly reduce packaging waste	96% (compared to standard containers)	(37)

Category	Description	Outcomes	ID Ref
	NISP: A strategy was developed with Peterborough Environment City Trust to reduce waste produced during the redevelopment of a historic city centre. Measures included: green procurement (e.g. construction materials supplied with less packaging) and less wasteful building approaches (e.g. shallower pits were dug reducing waste arisings and the requirement for more virgin materials)	3.2kt	(38)
Modifying procedures	Small consultancy firm The Oxford Group implemented a number of resource efficiency initiatives including double sided printing	£40k overall. Not possible to disaggregate from other actions	(39)
	Falkirk Council set all printers to double-sided printing	-	(40)
	Cidon introduced double sided printing and reuse of paper in fax machines	£25/y savings	(41)
Stationery rationalisation and reuse	Falkirk Council introduced 'stationery amnesty' days to encourage reuse of stationery as part of a wider programme to encourage resource efficiency	67% of waste diverted from landfill. Not possible to say what impact stationery amnesty had	(40)
Automotive			
Reduced raw materials wastage	Alloy Bodies used a waste survey to identify waste management cost savings which led to improved raw materials handling	>£24k /y savings	(42)
Retail			
Donation	Waitrose donating surplus food to FareShare, which is being rolled out following a successful trial	Not reported	(23)
Donation	Marks & Spencer has donated usable food to charity	1.2kt	(43)
Pack sizes/ Promotions	A number of retailers have reviewing their product promotions on short shelf-life products	Not reported	(23)
	Tesco moving from "buy one get one free" (BOGOF) to "BOGOF later"	Not reported	(23)
Storage	The Co-operative, Sainsbury's and Waitrose provide storage instructions on packaging to help customers reduce their food waste	Not reported	(44)

Sources: Collated by Oakdene Hollins/Brook Lyndhurst

Box 1: Envision

The Envision project, a £3.82m project financed by European Union structural funds, the South West Regional Development Agency and Devon County Council ran between 2005 and 2009. The aim was to improve resource efficiency, increase productivity and competitiveness and reduce CO₂ emissions from small and medium-sized enterprises in South West England. Information, guidance and up to two hours of free advice was offered to 2,206 businesses, of which 766 received more intensive support. The latter consisted of 3 to 10 days of on-site consultancy support.

Business Benefits

- Estimates range from £18m to £24m for the total savings to date through resource efficiencies (water, energy and waste) achieved by businesses as part of Envision. Ultimately, businesses are expected to benefit by between £65m and £105m.
- 78% of businesses receiving intensive support agreed that Envision helped them achieve savings, new market opportunities or staff cultural change. The most popular actions taken were reducing energy use and reducing the volume of waste going to landfill.

Drivers

- SMEs with a strong customer focus such as hotels and restaurants especially welcomed advice on how to implement environmental management systems as these were thought to attract customers and reduce the costs of resources.
- Envision focused on energy, greenhouse gas reduction and landfill diversion; waste prevention did not seem to be important to the organisers.

Key Elements for Success

- The use of mentors to engage businesses worked well at local level, but a lack of a region-wide marketing strategy limited Envision's overall effectiveness.
- The use of case studies was beneficial although critics were concerned that they might have been used more effectively to demonstrate the business case for resource efficiency.
- Businesses made a financial contribution towards the support which may have meant they were more likely to value the intervention.

Box 2: Oregon packaging waste prevention pilot project: Norm Thompson Outfitters

Headquartered in Oregon, USA, Norm Thompson Outfitters is a catalogue and web retailer of clothing, outdoor products and other goods. Annual revenues were approximately \$200 million in 2004. Norm Thompson was a key partner in a 2002-5 pilot project operated by the Oregon Department of Environmental Quality (DEQ) to reduce the use and waste of packaging materials by businesses in the State. The project was funded by the regional government of the Portland metropolitan area and the US Environmental Protection Agency. Norm Thompson committed to cut by 25% both packaging waste generation and the use of virgin packaging material as against 2001 levels and, through better packaging efficiency and increased use of recycled content material, reduce the amount of virgin packaging material used by 25% from 2001 levels. Key measures taken by Norm Thompson included switching in 2003 to reusable plastic shipping bags for soft goods order fulfilment. The change required the company to relax an internal standard that had previously prohibited the use of plastic bags rather than corrugated cartons for shipping higher cost products. Norm Thompson also asked vendors to reduce excessive packaging associated with “Save Your Back” bags, a day bag designed to reduce muscle strain and fatigue. Prior to the change up to 60 bin bags full of wadded-up paper might need to be disposed of in a single day at one distribution centre.

Business Benefits

- The increased use of shipping bags at distribution centres alone prevented some 370 tonnes of packaging waste per annum, equivalent to annual savings of \$680,000. The reduced packing in the “Save Your Back” bags cut costs by a further \$2,900 a year.
- A total of \$77,400 invested in the Oregon project yielded an overall saving of more than 493 tonnes of waste or some \$994,000 per annum.
- Intangible benefits included the value of educating both Norm Thompson employees and also DEQ and contractor staff on packaging evaluation and environmental considerations.

Drivers

- Norm Thompson’s commitment to environmental improvement and sustainability was identified as a motivating factor. Its mission statement is: “[We] will be a leader in developing business practices that sustain, restore and move in harmony with the natural environment.”
- DEQ established the Oregon pilot in response to waste prevention goals adopted by the Oregon Legislature in 2001 couple with the fact that packaging comprised 20–25% of the State’s waste arisings.

Key Elements for Success

- DEQ provided crucial support in helping Norm Thompson to identify waste prevention in its own operations and to evaluate environmental marketing claims made by suppliers of packaging materials.
- The fact that certain suppliers were using excessive packing only came to light because of Norm Thompson’s culture of open communication among employees, something fostered by the Oregon pilot. The suppliers were then asked to reduce this packaging.
- Norm Thompson is a large company so could achieve significant change by influencing suppliers
- DEQ, Norm Thompson and other project partners developed a life cycle inventory analysis which helped businesses trade off probable environmental impacts of different packaging options. This tool improved decision-making.
- Although Norm Thompson had already implemented several packaging efficiency measures prior to 2002, the partnership approach embodied in the Oregon pilot created a forum for discussion of this topic.

3.3 Clean Operations

Whereas, waste minimisation only leads to a reduction of a given waste stream, advances in process effectiveness offer the prospect of eliminating certain waste streams altogether. This approach is especially valuable when trying to prevent hazardous waste by completely avoiding hazardous components. Besides allowing more significant reductions of waste, clean operation measures often have additional benefits regarding health and safety and polluting emissions (e.g. (17)). See the module **L2m6: Hazard Reduction**.

Changes in clean operations are most effective if applied not to a single company but to a supply chain or a larger industrial site.

However, corresponding to the higher rewards, costs of implementing clean production measures are generally higher. The main approaches identified were:

- substitution of technology
- reusable packaging
- substitution of raw materials.

Substitution of technology

Substitution of technology involves the replacement of existing waste generating processes with other fundamentally different processes. A typical example from the construction sector is a report assessing the benefits of replacing the traditional brick and block method of building by the Advanced Panel System involving offsite prefabrication. The fundamental shift from moving a significant amount of construction from the building site to the controlled environment of a factor allows the use of significantly better technology and a 27% reduction in waste (45).

This example highlights an important aspect of clean operation measures: As the employed technologies are typically new, businesses are naturally reluctant to take a risk in employing them. A major role of business support is therefore to promote new technologies by either disseminating information on successful new technologies, or supporting demonstration and pilot projects to prove their benefits.

Reusable packaging

Reusable packaging can be considered either as part of green products or as clean operations. Here we consider reusable packaging as a form of clean operations if it is driven by a pull from the customer asking suppliers to use returnable packaging for deliveries. Such initiatives involve the co-operation of two businesses along the supply chain, and require either that the benefits and costs of the new scheme are shared between both companies, or that the customer can impose the new scheme on its suppliers due to its market power.

Substitution of raw materials

Substitution of raw materials is used not so much to reduce the amount of waste as to avoid generation of hazardous waste by eliminating hazardous ingredients or processing aids. An example from the automotive sector is a report describing how a small tank-cleaning company was supported in replacing a hazardous cleaning agent (methylene chloride) by a non-hazardous one (baking soda). Thus the company was able to reduce its generation of hazardous waste by 55 tonnes per year (46). Please refer to module **L2m6: Hazard Reduction** for more information.

Typical examples of waste minimisation actions fostered by business support organisations are given in Table 5, with case studies in the Boxes which follow.

Table 5: Evidence of clean operations supported by business support

Category	Description	Outcomes	Ref ID
Food & Drink			
Bulk Supply of Raw Materials	Envirowise: Pasta King negotiated with its supplier to buy tomato sauce in 195kg steel drums	£33k saved in first year from reduced sauce wastage	(47)
	Envirowise: The baker Ginsters switched to the use of bulk re-usable containers 1t capacity for margarine	n/a	(48)
New Technology	Envirowise: Cambridgeshire vegetable producer G's Marketing Ltd installed a multi-head weighing machine for more accurate product weighing	£110k/yr savings for £100k investment	(18)
	Envirowise: Norwich-based Broadland Wineries installed shrink-wrap machines.	£7.7k/yr in material and labour cost savings with approx. 2 yr payback period	(49)
	Envirowise: Organic dairy Yeo Valley installed a machine that pre-stretches pallet-wrap up to 3 times its original length	24 t/yr savings in pallet-wrap; 1 yr payback period	(50)
	NISP: Unnamed food manufacturer in NW England installed a new water fluming system	400t vegetable waste eliminated; £88k/yr saved; 6.84 tCO ₂ /yr saved	(51)
Returnable Transit Packaging	EU LIFE: 'CPR system' in Italy wherein producers switched to reusable plastic transit boxes for fruit and vegetables	Over 3m boxes in circulation by 2002, unspecified waste reduction	(52); (53)
	WRAP: Frozen food manufacturer apetito replaced corrugated cardboard boxes with reusable plastic transit crates	1.2m/yr cartons saved; 112t/yr cardboard and 230t/yr CO ₂ saved (£630k investment)	(44)
	EU LIFE: Swedish 'Eurocrate' system - single-trip wooden packaging for food and drink products replaced with reusable plastic pallets and crates	28kt/yr wooden packaging waste saved; lorry transports reduced by 260,000 km/yr; 180 tCO ₂ /yr; energy consumption reduced by 52million KWh/yr; volume of damaged goods reduced by 20%; transportation costs reduced by 25%	(52); (53)
Hospitality			
Bulk supply of raw materials	Envirowise: Deans Place Hotel, East Sussex: switched to refillable bulk toiletry dispensers	£1,550/yr saved	(54)
	Envirowise: Strattons Hotel, Norfolk: switched to refillable bulk toiletry dispensers	164 kg/yr waste saved; £1,921/yr saved	(55)
	Envirowise: Unnamed hotel: switched to refillable bulk toiletry dispensers	£5,250/yr saved	(56)
Flexible menu selection	NHS: The 'cook chill' process for serving patient food	n/a	(57)
Construction			
Off-site manufacturing	WRAP: B&Q head office project identified process savings totalling 47 tonnes and £4,770 by ordering pre-fabricated building components such as stairs and toilets	47 tonnes £4,770	(30)
	WRAP: Workshop that examined designing out waste from building a leisure centre. Pre-insulation for ducting, precasting concrete stairs and reducing brick packaging	251 tonnes £33,000	(58)
	WRAP: Workshop run involving the architects planning a	617 tonnes	(59)

Category	Description	Outcomes	Ref ID
	college redevelopment project in Middlesex. The design team used WRAP's 3-step 'Designing out Waste' process. Pre-engineered classroom construction, precast concrete columns, sustainable drainage system were proposed	£45,000	
	WRAP: Particularly successful examples of OSM for pre-installed services (water, wiring, power etc.) for installation in corridor ceiling-space	Not provided	(60)
	WRAP: Examining a housing association projects, a comparison between traditional building and off-site manufacture show that there is a reduction in waste for similar building costs (materials are more expensive but labour costs are significantly reduced)	25% reduction	(45)
	WRAP: As part of the design-out waste in construction projects, during the design of new sheltered housing, potential saving in prefabricated bathroom pods were identified	55 tonnes	(61)
	WRAP: As part of the design-out waste in construction projects, during the design of new court buildings, potential saving by using two smaller diameter piles	680 tonnes	(62)
	Envirowise: Large-scale office block examined off-site fabrication of glass curtain walling, suspended ceilings, raised floors, and boiler room and roof plant pipework Reduction of packaging waste by specifying suppliers who engaged with this activity. As a result, glazing cassettes were delivered in re-usable metal containers and light fittings in bulk packaging rather than individual boxes, there was no additional cost to the project	15% (off-site) 40% (packaging)	(29)
Office-based services			
Furniture reuse/ remanufacture	Perth and Kinross Council partnered with Ogilvie Ross to remanufacture existing furniture for its office retrofit	73% of cost savings compared to new furniture	(63)
	Scott Wilson Consultancy group partnered with Baptist Church to reuse office furniture	£1940 for church in reduced costs; no impact data for Scott Wilson	(64)
ICT & consumables	Falkirk Council replaced traditional printers, scanners and faxes with multi-functional devices	-	(40)
	Cidon invested in a new intranet system and moved to an electronic purchasing and invoicing system	-	(41)
Packaging	Danwood Group office supplies worked with customers to reduce packaging	£9.3k savings for Danwood	(65)
Automotive			
Reusable packaging	Introducing reusable packaging for its carpets (Toyota)	3kt/y packaging waste	(66)
Substitution of hazardous materials	switching from cleaning with methylene chloride to blasting with baking soda (Trimac Transportation)	55t/y hazardous waste	(46)
	Manufacturing: Canadian Enviroclub: SME substituted its polishing agent glass shot for steel shot to reduce not only hazardous waste (132t/y) but also less dust being produced (health & emissions) (17)	reduce hazardous waste (132t/y) & less dust being produced (health & emissions)	(17)
New technology	Investing in a new innovative foundry process (Tital, D)	8kg/item waste of milling tools	(67)
	Installation of oil bypass filters to reduce frequency of oil changes in commercial transport fleets	80% reduction of engine oil use	(68) (69)

Category	Description	Outcomes	Ref ID
Retail			
Reusable packaging	Alameda County (US): Use of returnable transit packaging	18kt	(70)
	Argos: Trial on reusable sofa bags	Potential of 1,560 t/yr if rolled out	(71)
	B&Q: Reusable plastic Carrierpacs	1,100 t/yr, £300k/yr	(72)
	Boots: Developed reusable plastic transit system	470 t/yr, £125k/yr	(43) (73)
	Debenhams: Introduced of re-usable plastic boxes and roll cages to transport stock from its suppliers to its warehouses and department stores	Not reported	(43)
	Halfords: Supplier purchased more in bulk resulting in fewer intermediate containers	£30k /yr	(65)
	Halfords: Supplier introduced reusable cardboard boxes	£25k /yr	(65)
	Marks & Spencer: Transit packaging used for groups of products, reusable plastic boxes replacing outer packaging	Not reported	(43)
	Sainsbury's: Introduced chilled products supplied in reusable plastic crates and tracked using smart tags	Not reported	(43)
	Spar: Increased use of RTP from 44% to 51% in Austria	3.5kt in 2004	(70)
	Svenska Retursystem: Introducing reusable crates in two regions in Sweden	12,475t over two years	(70)
	Tesco: Introduced plastic returnable crates with a supplier	46kt/yr	(43)
	Waterstone's: Partnership between distributor, publisher and retailer to design a custom-built re-usable tote box	15 t/yr, £7k/yr	(43) (73)

Sources: Collated by Oakdene Hollins/Brook Lyndhurst

Box 3: Achmea Parts Service and the RESPECT project

Damaged and end-of-life vehicles generate significant quantities of waste metal, plastic, rubber and glass of which a large proportion is hazardous shredder material sent to landfill. Through its LIFE Programme, the European Union in 2000 supported an innovative approach in the Netherlands to reusing automotive parts. At the time, all hire vehicles in the country were repaired with new parts with no system for managing the flow of used parts. Achmea Parts Service created a network of car dismantlers, body shops, car fleet managers and insurance companies. It promoted large scale re-use of used car parts through a new “green insurance scheme” with lower premiums than regular policies: essentially, clients with the green policy have their car repaired with used parts. Achmea demonstrated that the system would be economically, ecologically and technically viable and that 80% of all car damage could be repaired with used parts without compromising quality standards.

Business Benefits

- Achmea succeeded realised the large-scale re-use of second hand car components leading to a win-win situation, with significant environmental and economic benefits. By early 2002, some 75,000 green policies had been sold with 6,000 repairs performed with used parts. Emissions from painting were halved as used parts require fewer or no additional paint layers while some 60 tonnes of material were saved in 2001 alone.
- However, the scheme suffers from the fact that parts suitable for newer vehicles – which represent the bulk of the lease market – are rarer. Therefore the green policy tends to be offered to customers with cars older than 3 years.

Drivers

- The cost and regulations associated with disposal of end-of-life vehicles in Europe was a key driver for some elements of the supply chain, while other parties benefited from reduced vehicle repair bills or insurance premiums.

Key Elements for Success

- Funding from the EU LIFE Programme was important at the outset.
- All parties involved in the project put much effort into the project’s implementation. They demonstrated the viability of the concept of green repairing, created the required procedures and quality assurances, and worked hard at improving the professionalism of the dismantling industry. They also undertook wide scale dissemination activities.
- The information technology system developed for the project makes for effective and efficient communication between all parties in the scheme.

Box 4: Waste reduction by apetito

Based in Wiltshire, apetito provides frozen food and catering solutions to care homes, local authorities and hospitals, and offers a frozen meal delivery service to the public via its Wiltshire Farm Foods franchise and a private hot meal delivery service through local authorities via apetito Services. In 2009, the company invested £630,000 in a new reusable plastic transit crate system to replace the single-trip corrugated cardboard boxes previously used supply hospital and care home clients with multi-portion and twin-portion meals. The new crates work well with apetito's existing processes and are easy to fill up, handle, transport, store and wash. They also proved surprisingly robust, better protecting apetito's products and expected to last for up to five years. Following advice from WRAP, apetito also eliminated "low-sales-volume products" from its inventory to further reduce waste and started directing 3,000 tonnes of food waste to an anaerobic digestion plant in Devon.

Business Benefits

- Switching to the new crates enabled apetito to avoid the costs associated with procuring and disposing of around 1,200,000 cartons a year, saving some 112 tonnes of carton board and 230 tonnes of greenhouse gas emissions. Although apetito has not published the financial savings realised from this measure, the company "is confident that the investment will pay back financially in the longer-term".
- With the new plastic crates, customers are left with less waste to deal with and can more quickly access the contents than was the case with the cardboard boxes.
- Each crate can contain several meals with different recipes, whereas in the previous carton system, each case would contain identical meals. Individual products can now be ordered and are packed on the day of delivery offering flexibility to customers who need to serve varied or special menus.

Drivers

- Although apetito was keen to reduce the transit packaging waste, some pressure also came from its customers.
- apetito was motivated in part by its being a signatory to the Courtauld Commitment, a voluntary agreement hosted by WRAP aimed at reducing food waste and associated packaging.

Key Elements for Success

- One-to-one assistance in the form of a waste prevention review undertaken by WRAP helped apetito achieve its goals. The review was one a series of visits to members of the Food and Drink Federation in support of the trade association's "Five-Fold Environmental Ambition" and the Courtauld Commitment.
- Registration to ISO 14001 in 2009 helps apetito in achieving its environmental objectives.

Sources

<http://www.apetito.co.uk>

<http://www.caterersearch.com/Articles/2010/10/14/335489/apetito-takes-the-holistic-approach.htm>

<http://www.apetito.co.uk/Documents/apetito-Sustainability-Report-2010.pdf>

<http://www.apetito.co.uk/Documents/Care%20Homes%20-%20Why%20Choose%20apetito.pdf>

3.4 Green Products

The approaches of waste minimisation and clean operations are limited by the properties specified by the final product. By changing these specifications, the impact of certain processes or substances may be reduced or avoided altogether. Lightweighting is a prominent example of the green products approach. By reducing the weight of a product the amount of material going into the product and ultimately as waste can be reduced. Furthermore, as waste during the production processes is in many cases related to the throughput of material additional reductions of production waste may be achieved. In the food and drink sector many projects have been supported by WRAP and other organisations to use light-weighted packaging (e.g. glass bottles (74) (75) and steel cans (76)).

An important issue in such projects is that changes in the feel or appearance of a product need to be accepted by the respective customers. Many of these projects therefore include collaborative elements across the supply chain. Additionally, changes in consumer products may require market studies and consumer research (e.g. (77) (78)). In the example of light-weighting food and drink packaging, two types involving retailers have been found:

- Retailers may be included in steering groups to ensure support and implementation of the trails (e.g. ContainerLite (79), GlassRite food (80), GlassRite Beer, Cider and Spirits (81)).
- Retailers may undertake trials themselves for their own-brand packaging (e.g. Tesco (82) (74), the Co-operative (77) (82), ASDA (80) (78), Iceland (83)).

Typical examples of waste minimisation actions fostered by business support organisations are given in Table 6.

Table 6: Evidence of green products supported by business support

Category	Description	Outcomes	Ref ID
Food & Drink			
Concentrated Product	WRAP/CC: Princes & Tesco: designed a double-strength squash drink to reduce packaging	470 t/yr plastic saved	(84)
Lightweighting (Primary & transit packaging)	TSB: Valueform and Reading University undertook a research project to produce a more resource efficient packaging material based on waste vegetable matter	n/a	(85)
Lightweighting (Primary packaging)	WRAP/CC: Britvic: J20 Soft drink packaging reduction	4kt/yr glass saved	(44)
	WRAP/CC: Britvic: Robinsons soft drink packaging reduction	1,670 t/yr plastic saved	(44)
	WRAP/CC: Burtons: Cookies	32% reduction in plastic	(44)
	WRAP/CC: Cadbury: Easter eggs packaging reduction	Medium egg range: 220 t/yr plastic saved; 250 t/yr cartonboard saved; 90 t/yr less transit & display packaging. Large egg range: 10 t/yr plastic saved, 65 t/yr cartonboard saved; 44 t/yr corrugated cardboard saved	(44)
	WRAP/CC: Coca-Cola: Soft drink can packaging reduction	15kt/yr aluminium saved (projected across EU)	(44)
	WRAP/CC: Coca-Cola: Soft-drinks bottle packaging reduction	3.5kt/yr glass saved	(44)

Category	Description	Outcomes	Ref ID
	WRAP: ContainerLite project(2005-6)	7,781t glass saved (during trial period); 36.5kt saved (within 12 months of project end)	(75)
	WRAP: Duchy Originals: Biscuits box reduced	9 t/yr carton board saved	(72)
	WRAP: GlassRite: Beer, Cider & Spirits (2007-8)	32.3kt/yr glass saved	(75) (86) (81)
	WRAP: GlassRite: Food, soft drinks & ready-to-drinks (2006-8)	21,415 t/yr glass saved; 14,447 tCO ₂ /yr	(80)
	WRAP: GlassRite: Wine (2006-8)	11,397 t/yr glass saved; 11,400 tCO ₂ /yr saved	(87) (82)
	WRAP/CC: Greencore: Bottled water packaging reduction	110 t/yr plastic saved	(44)
	WRAP/CC: Greencore: Yorkshire puddings packaging reduction	115 t/yr plastic saved	(44)
	WRAP/CC: Heinz: Ketchup plastic packaging reduction	340 t/yr plastic saved	(44)
	WRAP: Heinz: thickness of Easy Open can ends reduced by 10%. Some cost savings due to more efficient packing of lighter cans	1.4kt/yr steel saved; £404k/yr savings (45).	(76)
	WRAP/CC: Innocent: Kids smoothie packaging reduction	90 t/yr paper saved	(44)
	WRAP: Kane Salads: Salad bags with thinner film	10-15% material savings	(72)
	WRAP/CC: Mars: Celebrations chocolates packaging	720 t/yr unspecified packaging material saved	(44)
	WRAP/CC: Mars: Easter eggs packaging reduction	Medium eggs: 200 t/yr cardboard saved; plastic insert weight reduced by 35%	(44)
	WRAP/CC: Mars: Uncle Ben's sauce bottles packaging reduction	450 t/yr glass saved	(44)
	WRAP/CC: Müller: Dairy Vitality yoghurt drink packaging reduction	Bottle: 167 t/yr plastic saved Shrink sleeve: 126 t/yr plastic film saved Carton sleeve: 68 t/yr cardboard saved Tray: 35 t/yr cardboard saved	(44)
	WRAP/CC: Müller: Dairy yoghurt pots plastic packaging reduction	1.8kt less unspecified packaging material (2009 vs. 2006)	(44)
	WRAP/CC: Nestlé: Easter eggs packaging reduction	784 t/yr various packaging materials saved	(44)
	WRAP/CC: Nestlé: Quality Street chocolates tin packaging reduction	237 t/yr steel saved	(44)
	WRAP/CC: Premier Foods: Bread packaging reduction	1,200 t plastic total saving (2005-8)	(44)
	WRAP: Radnor Hills: Plastic bottle packaging thinner	3.4kt PET savings (projected)	(72)
	WRAP/CC: Robert Wiseman Dairies: Milk packaging reduction	340 t/yr plastic saved	(44)
	WRAP: Sheepdrove Organic Farm: Meat box packaging reduced	7 t/yr cardboard saved	(72)
	WRAP/CC: United Biscuits: Jacob's Biscuits for Cheese. Plastic cartons replaced with cardboard of a lighter weight.	4kt/yr plastic saved	(44)
	WRAP/CC: Weetabix: Cereals packaging reduction	103 t/yr cardboard saved	(44)
	WRAP worked with Birds Eye to trial reductions in the use of cardboard in the cartons used for Birds Eye's frozen product range	54 t/yr cardboard savings (equivalent to 1.5% of one factory's total board usage)	(88)

Category	Description	Outcomes	Ref ID
	WRAP/CC: Young's Seafood: Admiral's fish pies packaging reduction	242 t/yr cardboard saved	(44)
	WRAP/CC: Young's Seafood: Chilled raw fish packaging reduction	80 t/yr mixed packaging material saved	(44)
Lightweighting (Transit packaging)	Envirowise: A pet food company redesigned transit trays using less cardboard	£100k/yr saved	(73)
	WRAP/CC: Northern Foods: 'Goodfellas' pizza box redesigned—primary packaging made 4% heavier enabling reduction in transit packaging and improved stacking	4kt/yr cardboard saved overall; number of pizzas damaged in transit cut by 75%; more efficient pallet stacking reduced transport miles by 1m/yr	(89)
	Envirowise: Norwich-based Broadland Wineries reduced film use, standardised to one type of self-erecting cardboard tray and started to re-use packaging spacers	Film: £8k/yr saving Tray: £26/yr card saving Spacers: £3.4k/yr unspecified material savings	(49)
	Envirowise: Snack manufacturer Burts Potato Chips redesigned its transit packaging in order to increase the packing density of boxes on a pallet by 147%. Thinner cardboard boxes used	Unspecified savings in handling, fuel, time and material costs	(90)
Packing efficiency	WRAP/CC: United Biscuits: Hula Hoops multipacks redesigned to allow excess air to be squeezed out enabling more efficient packing	400 t/yr cardboard saved	(44)
Portion Sizing	WRAP/CC: Warburtons: designed a new mid-sized loaf to reduce food waste	n/a	(44)
Construction			
Design for use and end of life	WRAP: 3 stage process to design-out waste for a construction project (enlargement of a school). Potential saving of about of waste during the lifetime of the build by using a wood wax coating instead of paint	1,500 kg	(91)
Design to avoid waste generation	WRAP: A secondary school project reduced external walling and design iterations which revised the building grouping, shape and layout	100 t £73k	(92)
	WRAP: Locating a new school in a corner rather than the middle of the site would mean less material had to be excavated. This saving is mainly due to a reduction in the cost of waste disposal, as less waste would be produced	8.8kt £87k	(92)
	WRAP: Construction of a medical rehabilitation centre and a swimming pool for the military. Potential saving by re-design of pool to avoid the need for a basement	2,184 tonnes	(93)
Design for use and end-of life	WRAP: A design guide and web tool was used to develop a two-storey office and warehouse headquarters. The majority of the building components are made from reclaimed and renewable resources, many will be prefabricated offsite and standard sizes are used throughout. The layout, with a central spine housing all services and support accommodation, can be easily extended or altered in future. Surrounding the buildings, there is a landscaped garden, reinstating top soil, flora and fauna excavated during construction.	(not given)	(32)
Retail			
Packaging Redesigns	ASDA: New pack for their Café Sandwich range, reducing cardboard sleeve and using a plastic film; keeps food fresh for longer	56% lighter packaging	(44)
	ASDA: Reduced headroom in plastic trays	279 t/yr	(72)

Category	Description	Outcomes	Ref ID
	ASDA: Lighter jars adopted for three product lines	278.5 t/yr	(80) (78)
	ASDA: Thinner plastic film trialled	10-15% material savings	(72)
	Boots: Packaging changed from rigid box to reusable tin with card sleeve	95% reduction in weight; 900 t	(44) (94)
	Comet: Standardised, simplified and minimised packaging use; benchmarked use of packaging materials by suppliers	Not reported	(43)
	Co-operative: Lightweighted glass bottle (broke 300g barrier)	20 t	(44) (72) (77)
	Co-operative: Lightweighted glass bottle	138 t	(44)
	Co-operative: Lightweighted glass bottle	445	(82)
	Co-operative: De-packaging from corrugate	1.8 t	(72) (83)
	Iceland: A number of trials in progress on frozen and chilled foods to reduce packaging	Not reported	(44)
	Iceland: Remove outer cardboard boxes and cling-film inner wrap	By half	(83)
	Marks & Spencer: 'Skin packs' introduced rather than trays; keeps meat fresher for 4 extra days	69% fall in weight	(44)
	Marks & Spencer: Replace plastic drum with film	90% reduction, 17.5 t	(44)
	Marks & Spencer: Thinner plastic film with improved seals	10% direct savings	(72)
	Morrisons: Reducing the thickness of its card in its 'Prepared for You' range	390 t	(44)
	Musgraves: Change from trays to plastic pouches	Over 100 t	(44)
	Sainsbury's: Flow wrap solutions, plastic optimisation	104 t	(44)
	Sainsbury's: Reductions in packaging	37% fall across the range	(44)
	Sainsbury's: Reducing void space in boxes	7.2 t	(95)
	Sainsbury's: Removed cardboard carton	160 t	(43) (73)
	Somerfield: Reduced weight whilst ensuring no negative affects to shelf life, or protection	30 t	(44)
	Tesco: Double concentrate squash reducing bottle sizes	1,592 t	(44)
	Tesco: Lightweighted glass bottle (300g)	3,500 t	(82) (74)
	Waitrose: Reduce thickness of plastic film	16 t	(44)

Sources: Collated by Oakdene Hollins/Brook Lyndhurst

3.5 Product/Service Innovation

Product/Service Innovations offer the opportunity for waste prevention by considering the performance demanded by the user and reinventing the delivery of product/service combination to meet this in a lower impact manner. Not unsurprisingly, this approach is highly integrated into the operation of the business model, so it is harder to nurture as a business opportunity internally, as well as to defend externally against prevailing models. Two main forms have been identified in the literature:

- **Re-use:** Prolonging the lifetime of a product, which can be done without any modifications (re-use in the strict sense), or after refurbishment, restoration or repair, which is usually aimed at achieving a material exceeding the original specification criteria.
- **Servicization:** The product to offer is no longer a material object, but a service. This can be achieved by dematerialisation of the product (e.g. e-books) or by moving from owning to leasing / renting.

Compared with the previous approaches to waste prevention fostered by business support organisations, Product/service Innovation is rarely evidenced. This is likely due to the fact that – as noted above – it is closely entwined with normal operations so is rarely (until recently) labelled as an environmental initiatives; and by the same account is usually self-motivated and particularly difficult to promote using conventional intervention methods prevalent in this review. A few examples are nevertheless presented in Table 7.

Table 7: Evidence of product/service innovation supported by business support

Category	Description	Outcomes	Ref ID
Construction			
Closed loop reuse	WRAP: Cyril Sweett and Barclays Bank performed an analysis using design details of two projects together with information on alternative products and materials available from both mainstream and local suppliers was used to propose the reuse of materials. It was concluded that the reconditioning and reuse of furniture such as countertops could result in financial saving	£36k	(96)
	WRAP: The refurbishment of Royal Commonwealth Pool, Edinburgh reused ceiling tiles and skirting boards	52 tonnes	(97)
	WRAP: Application of 3 stage process to design-out waste for a construction project (school project Birmingham). Minor potential savings by reusing old fence	70 kg	(34)
Open loop reuse (sale)	Defra: Pre-refurbishment audit of Reading University led to the identification and reuse opportunities including slate tiles, timber doors and radiators	115 tonnes	(98)
	WRAP: A Project for Designing out Waste at a Language College. As part of the project a reclamation survey of a building scheduled to be demolished identified good reclamation opportunities including: external London stock brickwork; plain clay roofing tiles; and floorboards and floor joists	£45k	(92)
	Envirowise: Luxury housing development looked at Recovery of 50,000 roofing tiles from demolished buildings for re-use	£48,000 saved from re-use	(99)
	Envirowise & DTI: A pre-demolition audit was performed at a hospital. This work (partly funded through the DTI) provided information on the deconstruction and re-use of construction materials. The subsequent report included a reclamation valuation survey and an environmental quantification of a range of materials and products expected to generate from the demolition	Key demolition products of 24,515 m ³ . Worth between £0.5m and £7m.	(99)
Automotive			
Re-use	Implement network of repair shops to reuse used parts, including setting up of a 'green' car insurance scheme to provide incentives for customers.	180-210 tons of parts re-used per year	(100)
Retail			
Packaging	Waitrose selling organic milk in 'eco-pouch' to be used in reusable 'jug'	Pouch uses 75% less plastic than equivalent bottle	(44)
	ASDA trial of reusable <i>Eziserv</i> in-store dispensing system for fabric conditioner	Potential to save 96% of plastic packaging	(101)
Re-manufacturing	Retail - Retreading of tyres: Argos (supported by WRAP) decided to retread the tyres of its vehicle fleet.	Reduction of tyres' waste by 103t in 2008	(42)
	CRR: Redesign of Exoteq's Meos mobile handset to facilitate multiple cycles of use.	Projected:	
	CRR: Provision of life-cycle impact data to chiller cabinet company remanufacturing retail units for improved energy performance and extended life.	Projected:	
Reuse-based business models	CRR: Production of case-study-based learning materials for use by business schools et al to educate future business managers.	Unknown. Too early to measure impact.	

Sources: Collated by Oakdene Hollins/Brook Lyndhurst

4 Behavioural Aspects

4.1 Motivators

Several different motivators have been identified which encourage companies to participate in business support programmes. The most often cited motivators are:

- cost reduction
- compliance / reduction of regulatory risk
- environmental improvement
- customer / supply chain pressure.

Cost reduction

The opportunity to reduce costs is frequently cited as an important motive for businesses participating in a waste prevention initiative (e.g. (12) (102) (103) (104)). According to a survey of Welsh businesses in 2006-2007, business support regarding resource efficiency was perceived by 80% of the participants as very helpful to reduce cost (4). Some studies (e.g. (102) (104)) stress the importance of the financial bottom line for SMEs in particular.

Compliance

Secondly, the need to remain compliant and to reduce regulatory risk is a main driver of businesses to join business support projects. In the above mentioned Welsh business survey, the need to address regulatory pressure was described as “very important” by 81% of respondents (4). This is again especially true for SMEs, of which 34% have never attempted to reach full compliance with environmental legislation according to this survey. Participation in business support programmes offers a comparatively cheap way to identify issues of non-compliance and to become compliant (104). An additional, related motivation of business is to incorporate expected regulatory changes. Such businesses expect that their proactive behaviour will make it easier and sometimes cheaper to comply, once the legislation comes into force (6).

Environmental improvement

The ambition to achieve environmental improvement for its own sake is another - but less often quoted - motivating factor for businesses to endorse business support (103) (102). This factor is typically connected to a strong personal commitment by the owner or the management team of the company, and can sometimes be manifested by a company signing up to a sector-wide commitment or voluntary initiative. See module **L2m4-4: Commitments**.

Pressure

Many businesses experience not only regulatory pressure but also supply chain pressure, notably environmental expectations from their customers (102). In the food and drink industry, for example, the need to improve environmental performance to remain a supplier to large retailers is the second most important motivating factor to participate in business support activities (12). See module **L2m4-3: Procurement** for more information.

4.2 **Barriers**

The main barriers to participate in a business support programme according to the reviewed literature are:

- lack of awareness of the cost of waste and perceived limited benefits
- lack of knowledge about the available support
- cost of business support
- lack of senior management commitment and support or failure to empower responsible staff.

Costs and benefits

Many businesses are not aware of the true cost of waste (7) (3) (20). In many cases only the disposal costs are taken into account, while losses due to extra use of raw materials, embedded value of discarded semi-finished products or the cost of waste handling are ignored (11). This lack of awareness of the cost of waste is a major barrier for businesses participating in business support (103). In the Welsh business survey, respondents stated that they did not consider business support for environmental improvements as helpful to reduce costs (4). This finding is supported by a 2006 study from Canada in which SMEs cited improvements in process efficiency as the least important reason to participate in an environmental support program (104). The study authors suggest that this is due to a lack of awareness of the connection between pollution prevention and cost reduction.

Terminology seems important. In a 2009 review of waste prevention policy in Finland it is argued that the phrase 'waste prevention' is not helpful in the context of business support, as businesses do not associate a reduction in waste with an improvement in the bottom line (105). The term 'resource efficiency' is more effective because companies relate it to cost reduction. Moreover, for many SMEs waste is simply not an issue; it is considered to have no impact on the one hand, and not avoidable on the other (106).

Knowledge of support

Various studies highlight the perceived lack of knowledge about the available support for businesses. Not only were many businesses ignorant of their own support needs, they were also unaware of the range of available environmental business support available to them. In the Welsh business survey only around 20% of businesses were aware of either WRAP or Envirowise (4). In a 2006 study by the Federation of Small Businesses, only 5% of SMEs were aware of WRAP or Envirowise, only 3% of waste minimisation clubs and fewer than 1% were aware of the BREW programme (107).

However, businesses who are looking for support complain about "the cluttered landscape of agencies and support organisations" (2). In a similar fashion industrial trade associations consider the large number of support organisations as confusing (3). This may be a reason why many companies look to either their local authority or the Environment Agency to inform them of, for example, changes in environmental legislation and how they should respond, rather than to business support organisations (106). According to evidence presented to the House of Lords in 2008, 49% of UK businesses contact local authorities about environmental issues and around 25% of businesses see local authorities as the most valuable source of environmental information (3).

Cost of support

The cost of business support was widely cited as an important barrier to participation (4) (6) (103) (108). There are four types of cost related to business support which may occur:

- **Cost of engagement** – primarily time lost while employees work with the business support organisation. This could be normally regarded as an opportunity cost, and may lead to projects being aborted in times of high demand or if projects of higher priority come along (example given in (5)).
- **Cost of advice** – out-of-pocket costs paid to the consulting organisation for their support services. For publicly-financed business support, these costs are usually low, often for free, up to a certain level. However, support from private consultants may be too high to be affordable for small companies, even though the expected benefits would typically justify it.
- **Cost of change** – costs to transform the advice and the learning into action. These could be investment costs for new equipment, or internal costs for training or redesign of processes and workflows.
- **Cost of surprise** – costs due to rectifying issues unearthed during the support project. These are often related to violations of legal requirements of which the business was not aware but which have been highlighted by the support organisation. Fear of this form of ‘collateral damage’ might be especially pronounced for SMEs, of which around a third decide not to attempt full compliance with the law (4).

Unfortunately, no evidence regarding the price elasticity of demand for business support could be identified. In general, though, such costs are particularly pronounced for SMEs which find it difficult to justify joining voluntary schemes from a financial standpoint. This barrier is closely linked to the question of whether business support should be free or should be charged. In the Welsh business survey 80% of respondents stated that they would use more environmental support if it were free (4). On the other hand, a minimum fee can also be an enabler by assuring commitment (see Section 4.3). The ‘cost of surprise’ is especially important for support from organisations linked to the government and requires confidentiality arrangements (104).

Lack of commitment

A further important barrier is lack of senior management commitment and support (6) (9) (103). A clear indication of the involvement of the managing or financial director was found to be fundamental for achieving a financial payback of a waste prevention project (11). In SMEs, senior management commitment is largely a time management issue. There are usually only few resources to spend on environmental issues, often it is the job of the director (102). In larger companies, those charged with reducing the cost of waste may not be empowered either to take action, or to benefit – in financial or social terms – from any reductions.^a Closely related to the lack of senior management commitment is a company culture that is either not concerned with environmental issues, or that is not reluctant to engage its employees openly. Often ideas proposed by business support organisations conflict with preconceptions held by employees in the companies which lead to rejection of the support (102).

Small businesses

Small business size is a barrier that is evident from the various difficulties of SMEs mentioned above. Small and medium-sized companies typically generate little waste and have limited resources to deal with it (12). As mentioned above, this leads to a pronounced lack of awareness of the cost of waste produced (106) (104), as well as difficulties in assigning management attention to these issues (102). In addition, SMEs are reported to perceive their access to business support as limited, as governmental organisations are seen to deal mainly with ‘big business’ (2). On a positive note, the scope for savings, (i.e. the need for

^a Conversation with Martin Gibson, former Director, Envirowise.

improvement), is generally less in percentage terms with SMEs than is the case with larger firms. In part this is because waste streams and resource use is often more visible in smaller operations (9).

4.3 Enablers

The enablers of successful business support are closely related to the barriers that need to be overcome, and the motivators that can be exploited. Examples of enablers reported in various studies as having been of special importance are:

- senior management commitment
- focus on financial achievements
- previous environmental engagement
- regulatory or supply chain pressure.

Management commitment

An important enabler to achieve successful business support is ensuring senior management commitment (10) (102). One business support initiative (Aylesbury Vale Waste Reduction) required participants to provide senior managers for initial meetings to ensure their commitment (5). Another way to ensure commitment by senior management is to require a fee for participation in the support programme (5) (11). Businesses who pay for the support received are, arguably, more likely to value it and will be more motivated to contribute to the programme and to endorse recommendations by the project. However, as discussed in Section 4.2, other surveys have shown that a fee for business support is a significant barrier in itself (e.g. (4)).

Financial achievement

Even though not all business owners are driven only by the urge to maximise profitability, a focus on financial savings is an important success factor in most programmes (e.g. (5) (10) (109)). Cost reduction has been cited as a major motivator for participation and consequently all evaluation reports, and especially the case studies, reviewed include an analysis of their achievements in terms of monetary measures. (See module **L2m7: Metrics**) In order to 'sell' the potential to reduce costs of operations to prospective participants business support organisations are not so much using the term 'waste prevention', as 'resource efficiency' (109).

Previous engagement

Various studies reported that those companies already advanced in their environmental performance are most receptive to further business support (e.g. (11)). This implies that business support aimed at companies that have already engaged in some forms of waste reduction will find it easier to achieve sufficient levels of participation.

Pressure

On the other hand, in order to engage companies not interested in environmental issues voluntary business support is not reported to be sufficient. Some form of pressure, e.g. via regulations or via the supply chain, seems to be a prerequisite for such companies to join support programmes (e.g. (4) (110) (111)).

5 Conclusions

5.1 Learning

- **A large number of reports have been identified, showing that business support programmes are generally effective in helping companies to prevent the generation of waste.** This is reflected not only by the reported figures in evaluation reports, but also by business surveys stating that they find business support in general as beneficial.
- **In the sectors covered by this review, waste prevention is not generally the main focus of relevant business support programmes.** Most of such programmes include prevention of waste, but focus on recycling or more generally on diversion from landfill. It could not be deduced from the literature available in this study whether this is due to the set-up of the business support organisations or programmes, or due to inherent difficulties in supporting businesses in preventing waste.^a
- **Reduction of cost is a main motivator of companies to accept offers of support.** However, evidence suggests that many companies do not recognise the true costs of waste and are thus not susceptible to joining waste minimisation programmes under current mechanisms.
- **Even though businesses demand support in environmental matters, the response to the offered support programmes is generally low.** Many business support organisations report an unwillingness of companies to fund their activities, even though they report significant cost savings achievements by the companies.
- **According to the reports submitted by business support organisations funding is essential for them to continue their work.** A service based purely on fees from participating companies is generally not seen as feasible as such fees are significant barriers to participation by prospective companies (3).

5.2 Insights

Within the food and drink, retail and construction sectors a few topics (e.g. light-weighting of packaging, recovery of demolition waste) dominate the reported examples. At the other end of the scale is the automotive sector. According to the studies reviewed, this sector seems to use less business support, and a great deal of its waste prevention activity is unsupported.

Based on the reviewed reports, voluntary support programmes alone are insufficient to transform industry practices. Business support for waste prevention is predominantly embraced by companies already engaged in environmental issues.

A 'carrot and stick' approach of offering business support to help companies adapt while using taxation to send a price signal has been considered effective by industry representatives e.g. EEF in (3). Besides regulatory pressure, the supply chain is another important source of encouragement to look for support such as has been seen from retailers towards the food industry.

Moreover, business support seems to play an important role in encouraging and helping SMEs to reach full legal compliance. While the risk of enforcement seems to be sufficient for larger companies, some

^a We note that early 'waste' programmes were certainly intended to have a more holistic approach to waste akin to recent resource efficiency concepts, but may have been derailed (for the sectors reviewed in this work) by a change of emphasis towards landfill diversion resulting in promotion of recovery methods.

small businesses, if left without support, seem not to aspire to full compliance with environmental legislation.

Regarding achievements in waste prevention, it is difficult to separate the role of business support organisations from price signals set by taxation or the need for companies to comply with new regulations. A study by the National Audit Office on the BREW Programme stated that it found it impossible to disentangle the effect of introducing the Landfill Tax from the effect of accompanying business support by the BREW Programme (8). Neither academic literature nor the reviewed reports provide an indication regarding the right balance between regulatory or supply-chain pressure on the one hand and the enabling business support on the other hand, to achieve the most effective approach to waste prevention.

5.3 **Research Gaps**

The following three gaps were identified:

- Within the scope of this review we found little evidence of the effects of business support by non-governmental organisations or of failures in business support (7). **Further research into these fields, especially regarding business support by companies along the supply-chain, might be useful to generate further insights.**
- **An evaluation of the extent to which environmental business support actually benefits the environment would be useful for policy makers.** A 2001 study of waste minimisation clubs (7) showed that financial savings make up most of the overall total benefits with non-financial benefits for society only 1-27%. This implies that environmental benefits are only an added bonus. It is not known whether the same low share of societal benefits is also true for other forms of business support.
- **A systematic evaluation of the role of private consultancies could be beneficial.** Not only in self-motivated efforts, but also in supported interventions their assistance as providers of skills and knowledge may not be recorded. A better grasp of their contribution and its relative importance may indicate other intervention options.

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