WR1403: Business Waste Prevention Evidence Review

L2m4-3 – Procurement and Supply Chain

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 Procurement.

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

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Contents

Glossary

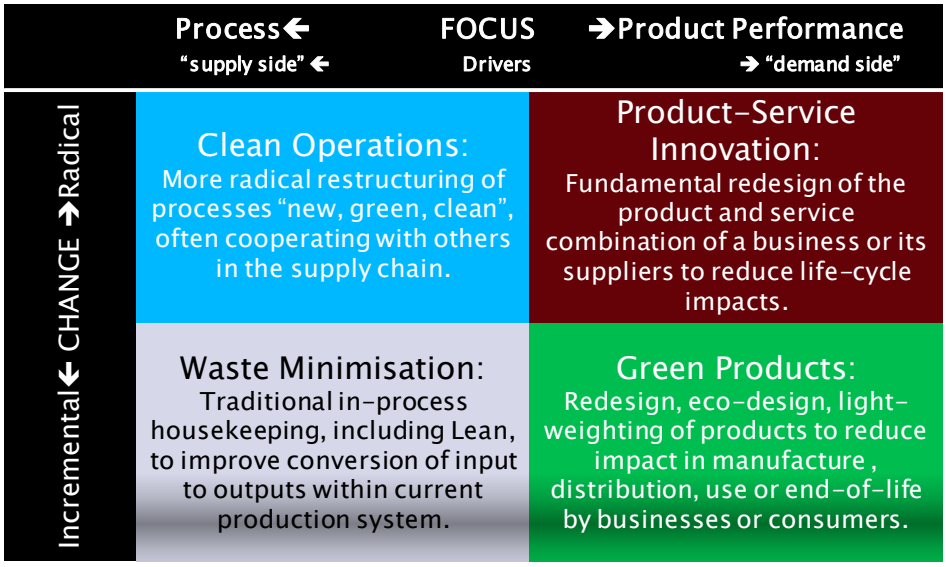
bre	Formerly known as Buildings Research Establishment	LOCOG	London Organising Committee of the Olympic and Paralympic Games
BREEAM	bre Environmental Assessment Method	NGO	non-Governmental organisation
BS	British Standard	NHS	National Health Service
BSI	British Standards Institution	NISP	National Industrial Symbiosis Programme
CC	Courtauld Commitment	OSM	Off-Site Manufacturing
CCC	construction consolidation centre	PAS	Publicly Available Specification
CIRIA	Construction Industry Research and Information Association	PVC	poly vinyl chloride
CRC	Carbon Reduction Commitment	RDC	refrigerated display cabinet
CRR	Centre for Remanufacturing and Reuse	REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
CSR	Corporate Social Responsibility	RTP	returnable transit packaging
ECVM	European Council of Vinyl Manufacturers	SCM	supply chain management
EEF	Engineering Employers' Federation	SDRN	Sustainable Development Research Network
EMAS	Eco-Management and Audit Scheme	SME	small/medium-sized enterprise (EU definition)
EMS	Environmental Management System	SOGE	Sustainable Operations on the Government Estate
GDP	Gross Domestic Product	tCO_2e	tonnes of carbon dioxide equivalent (emissions)
ICT	Information and Communication Technologies	TSB	Technology Strategy Board
ISO	International Organisation for Standardisation	VCM	vinyl chloride monomer
		WRAP	Waste & Resources Action Programme

Units Conventional SI units and prefixes used throughout: {k, kilo, 1000} {M, mega, 1,000,000} {G, giga, 10^9} {kg, kilogramme, unit mass} {t, metric tonne, 1000 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 How Procurement Addresses Waste Prevention

The UK's Sustainable Procurement Task Force, established in 2006 with Defra and HM Treasury funding, defined 'sustainable procurement' as:

> *"A process whereby organisations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organisation, but also to society and the economy, whilst minimising damage to the environment."* (1)[a]

An organisation's procurement decisions can prevent waste in two distinct ways depending on whether procurement is used primarily as:

- A tool for **internal change**: an organisation chooses to buy, or switch to (2 p. 25), an existing product or service which results in less waste being produced, normally within its own operations. Examples include procuring: reduced, reusable or returnable packaging; remanufactured products; a service instead of a product (or leasing) (3 p. 41); or services in a closed loop. Alternatively, the organisation may decide to go without the product or service altogether, again preventing waste (2 p. 25);

or

- A driver of **external change**: an organisation collaborates with, or influences, an existing supplier to change the latter's processes or products so as to reduce waste. The waste reduction normally occurs in the supplier's operation, or elsewhere in the supply chain. Crucially, the supplier's behaviour has been changed. A cascading effect along an entire supply chain can result (4 p. 13).

While both forms of procurement prevent waste in the supply chain, the evidence reviewed here indicates that its use as a driver of external change offers the greatest potential – especially when one or more large organisations in the same sector implement a common purchasing strategy. By contrast, simply switching to a different less wasteful product or service without attempting to change the behaviour of an existing supplier is likely to have less impact.

Successful business and procurement: what lessons for sustainable public procurement can be drawn from successful businesses? was published in December 2010 by the UK's Sustainable Development Research Network (SDRN). A key recommendation from this extensive review of academic and grey literature is that government should use its considerable procurement spending power[b] to stimulate the development of markets and supply chains for sustainable products and services (5 p. 7). This is something which has in fact long been recognised; indeed, sustainable procurement was first developed in the public sector and procurement strategies continue to be promoted by regional, national and supranational[c] governance bodies. For example, the European Commission has a target that, by 2010, half of all public tendering procedures should be 'green' (5 p. 11). Similarly, the UK's Sustainable Operations on the Government Estate (SOGE) Requirements has a target to "reduce waste arisings on 04/05 figures 5% by 2010 and 25% by 2020" (6). It is noteworthy that many of the examples of sustainable procurement in the construction sector discussed later involve public sector clients such as the NHS.

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[a] Sustainable Procurement should consider the environmental, social and economic consequences of: Design; non-renewable material use; manufacture and production methods; logistics; service delivery; use; operation; maintenance; reuse; recycling options; disposal; and suppliers' capabilities to address these consequences throughout the supply chain.

[b] The UK Government spends around £220bn annually on routine products and services (104)

[c] Public procurement was a theme of the 'Sustainable Development Implementation Plan' which emerged from the Johannesburg World Summit of 2002 (101). In 2008, the European Union 'launched action plans on sustainable consumption and production and on sustainable industrial policy' which *inter alia* sought to 'promote voluntary measures to increase the potential benefits of Green Public Procurement by enhancing green spending by public authorities' (103 p. 5)

Sustainable procurement is though starting to be adopted by many private enterprises, particularly large ones, as a lever for change (2 p. 4). Section 4.1 identifies some factors which might be motivating this trend.

Here are just three recent examples published on the website of Action Sustainability, a UK NGO promoting sustainable supply chains[a]; it is important to note however that waste prevention is not an explicit objective:

- The **construction** firm Willmott Dixon launched a new Sustainable Supply Chain Strategy in 2009 whose aims include providing "leadership within the industry", "winning more competitive business, and in turn suppliers, from high quality clients", and driving "innovation" and sharing "best practice".

- In 2004 the **food and drink** company Allied Domecq plc "began a programme to embed [its] Ethical Trading Policy into the Supply Chain" as part of the organization's Corporate Social Responsibility (CSR) programme. The programme was awarded "Best in Class ratings on the two procurement sections of the Dow Jones sustainability index".

- Delivering "sustainability through the supply chain" is integral to the **retailer** Marks & Spencer's "Plan A" launched in 2007. Prioritised objectives "enable buyers to provide clear requirements to suppliers and to make decisions based on the suppliers' prioritised contribution to Plan A, not to support general green claims that often amount to nothing".

In conversation Action Sustainability offer numerous other examples of sustainability efforts being engineered through procurement, such as life-cycle information demanded by Skanska of its suppliers, with similar initiatives from utilities companies.

[a] http://www.actionsustainability.com/

2 The Nature of the Evidence

A considerable body of evidence, particularly in the academic literature, has been published on procurement. However little of the material reviewed for this project isolates waste prevention *per se* from the wider suite of outcomes of sustainable procurement. Moreover, assessing the impacts of sustainable procurement is, by its nature, problematic given that changes may occur anywhere in the supply chain; it may often be difficult to prove that a particular outcome was a direct result of the action of a purchasing organisation.

The evidence reviewed is largely drawn from case studies so tends to be anecdotal in flavour. Moreover, it is dominated by examples from the construction, retail and food and drink sectors, partly due to the scope of WR1403, but also because these particular sectors have been targeted by delivery bodies such as WRAP and Envirowise. It is important therefore to recognise that procurement may be preventing significant quantities of waste in other industries, but that these initiatives have simply received less publicity. Of course, an additional consideration which applies to all the modules in WR1403 is the fact that evidence published by delivery bodies is likely to be biased towards 'good news stories'. Lessons drawn from procurement strategies which have not achieved their desired outcome would be of equal value.

As noted in Section 1, sustainable procurement has received substantial attention in the public sector, and an overt commitment from the UK Government form the mid-2000s, so there are numerous examples across government departments such as the NHS and Ministry of Defence. (This bias to public sector may be accentuated due to examination of private sector CSR materials being beyond the scope of the review.) The SOGE Requirements may have driven waste prevention in government offices. However, these activities were also beyond the scope of WR1403 – except where they cross over into the six private sectors, for example procurement practices in large construction projects such as hospitals, schools and transport infrastructure. A high-profile example from outside the target sectors (but which is, nevertheless, helpful) is from the Ministry of Justice:

- In 2009, the Ministry of Justice asked suppliers to develop a new design of mattress. The new design has a wipe-clean cover extending the product's lifespan, and incorporates filler material which can be ground up after use and recycled as carpet underlay, playground surfaces, insulation or energy generation. With nearly 84,000 inmates, HM Prison Service was previously disposing of 40,000 mattresses and pillows per annum. Annual savings from the new design are projected to be £1.2 million (7).

Given the scope and time constraints of this project, some potentially interesting areas were not investigated. One of these is the impact of legal instruments such as the UK's Carbon Reduction Commitment (CRC) on supply chains. Now called the CRC Energy Efficiency Scheme, this climate change and energy saving scheme was launched in April 2010 and is administered by the Environment Agency, the Scottish Environment Protection Agency and the Chief Inspector (Northern Ireland Environment Agency). Aimed at large public and private sector organisations, responsible for around 10% of the UK's emissions, the mandatory scheme is "designed to raise awareness in large organisations, especially at senior level, and encourage changes in behaviour and infrastructure" (8). While the focus is on energy efficiency, waste prevention innovations in the supply chain may indirectly assist organisations in fulfilling their obligations. Given that the Scheme is new, it is unsurprising that no direct evidence was found in the present mapping exercise.

Other avenues of enquiry marginal to the scope of this work include:

- The **Marrakech Process**: this global process to embed the principles of sustainable consumption and production was launched at the 2002 World Summit on Sustainable Development held in

Johannesburg. It would be useful to assess the extent to which this has targeted and achieved waste prevention in supply chain chains.[a]

- Defra's **Centre of Expertise in Influencing Behaviours** was recently established and could offer useful insights into the motivations, barriers and enablers of sustainable procurement behaviour.

- The UK's **Chartered Institute of Purchasing and Supply** may hold valuable evidence on the role of procurement in effecting waste prevention in business.

[a] Although waste prevention may be implicit rather than explicit, the training and other activities that have followed the work of this Task Force (particularly internationally) include clear guidance on the opportunities to 're-think need' to prevent waste. It should be noted that, in recent months, this training has been rolled out in a programme sponsored by Defra. WRAP, as Defra's delivery body, has administered Sustainable Public Procurement (SPP) training through a National Sustainable Public Procurement Training Programme to local government in England, and through pilots to the health sector and the further and higher education sector. The training programme does discuss waste prevention as part of SPP. It also discusses the role of public procurement in stimulating waste prevention throughout the supply chain.

3 Evidence of Waste Prevention

3.1 Waste Minimisation

Procurement has been used to drive waste minimisation in the supply chain by requiring and/or assisting suppliers to:

- reduce packaging
- sign waste minimisation clauses, especially in the construction sector (9)
- adopt environmental management systems (EMSs).

The bulk of examples come from the construction sector – often on large public projects for the public sector clients:

- During the redevelopment of Peterborough's historic city centre, Osborne Civil Engineering worked with suppliers to deliver materials without packaging (10).

- Waste minimisation clauses were introduced by Kier Nuttall during the construction of the Channel Tunnel Rail Link. True waste prevention measures included the use of on-site crushers "to create recycled aggregates that could be used on-site" saving "the costs of transporting some 130,000 tonnes of material on and off site, saving some £260,000 in landfill taxes. Around 8,000 vehicle movements were also avoided …" (9).

- During the construction of the Jubilee Gardens Primary Care Centre in Ealing, Wilmott Dixon required subcontractors to price their work to include material costs. The latter were thus incentivised to minimise wastage. Overall, on-site wastage amounted to 28.8m^3 per £100,000 of project spend, substantially under Wilmott Dixon's target of 45m^3 per £100,000 (11).

- Materials over-ordering during the construction of Wessex Water's new operations centre near Bath was discouraged by trade contracts that were fixed price and set out targets for material quantities. Wessex Water covered the cost of materials up to these targets, but any excess material cost due to wastage of materials was paid for by the trade contractor (12 p. 12). During the project the construction manager Mace set out an environmental construction plan for contractors that included guidance on procurement, partnerships with waste contractors, materials handling and storage, on-site waste segregation, re-use of site reclaimed materials and measurement. An estimated 70% of site waste was diverted from landfill, although how much waste was prevented is unknown (13 p. 2). Nevertheless, this serves as a good example of a supply chain working well together.

- In 2009, prior to the building of a new health centre in Scotland, the client (NHS Greater Glasgow and Clyde) set the main contractor (Graham Construction) good practice "waste targets for the project and reviewed the contract wording to incorporate WRAP's model procurement requirements on waste and recycled content". These included a commitment to "reduce waste generation and report the tonnes of waste generated per £100k construction value". A net saving of £77,800 from both waste prevention and recycling activities such as on-site segregation was predicted for the project (14 p. 1).

Some evidence from the construction sector suggests, however, that the foregoing examples of good practice in procurement may be exceptions to the rule. Ownership of Waste, a 2009 study by the Building Research Establishment (bre), revealed that regardless of the procurement process ('traditional',

'PFI' or 'design and build') and the requirement to achieve 'BREEAM Very Good' certification[a], contractors in practice had little or no incentive to minimise waste (15).

Some examples of procurement driving waste minimisation are seen in other sectors:

- The Danwood Group is an independent supplier of office solutions such as printing, faxing and copying. As part of the Envirowise-funded Supply Chain Partnership Forum and as a supplier to Forum host organisation Manchester United Football Club, Danwood was visited by an independent Envirowise advisor. They estimated that eliminating or reducing plastic and cardboard packaging Danwood could save more than £9,300 (16).

- Norm Thompson Outfitters in Oregon, USA was "successful at engaging its suppliers to reduce packaging" (17 p. 15). Influencing vendors to "reduce underpacking of 'Save Your Back' bags [designed to reduce muscle strain]" resulted in annual savings of US$2,900 (17 p. 12).

- By working with a toy supplier to reduce packaging on 255 products, US retailer Wal-Mart saved "$2.4 million a year in shipping costs, as well as 3,800 trees and 1,000 barrels of oil" (18 p. 6).

- In New Zealand, major retailer The Warehouse "actively encourages waste elimination through its supply chain". For example, packaging associated with men's shirts was reduced saving "around 4 tonnes of waste plastic per year" (19 p. 20).

- One area which has received some attention is the adoption of environmental management systems and other standards as a result of procurement pressure. A 2008 survey found that almost three-quarters of UK manufacturers now have an EMS in place (20). Purchaser power is frequently cited as a significant, if not overriding, explanation for the adoption of standards by suppliers (e.g. (4 p. 37) (2 p. 25)). This may, however, depend on the particular industrial sector, form of accreditation or size of supplier company. For example, ISO 14001 is widespread in the German automotive industry because suppliers need to demonstrate their accreditation, but an alternative standard (EMAS) is rarely required or adopted, perhaps as its validity is restricted to Europe (21 p. 23). Please refer to report module **L2m4-1: Standards** for more evidence of waste prevention through the adoption of standards by businesses.

- Procurement pressure has also driven the donation of surplus food to charitable organisations.[b] FareShare is a national charity working with leading UK retailers, food manufacturers and hospitality businesses to redistribute food. It reports that many manufacturers were prompted to participate by their food retailer customers who wrote to suppliers encouraging them to work with FareShare and to authorise the redistribution of their own-brand products to FareShare. Overall, the tonnages diverted through FareShare are still relatively small at around 3,000 tonnes in 2009-10, although this equates to some 6.7 million meals.[c]

The following Boxes give details of the Danwood/MUFC, Norm Thompson and FareShare examples, and Table 1 summarises evidence for waste minimisation driven by procurement.

[a] BREEAM (bre Environmental Assessment Method) is the leading and most widely used environmental assessment method for buildings. It sets the standard for best practice in sustainable design and has become the de facto measure used to describe a building's environmental performance' (105)

[b] This is a rather different form of waste minimisation, but is nevertheless regarded as waste prevention rather than landfill diversion because the product is used for its intended purpose (i.e. human consumption).

[c] Fare Share's Marketing & Communications Manager, personal communication, January 2011

Box 1: Manchester United & Danwood

In 2005 Manchester United Football Club (MUFC) asked Danwood, its main supplier of office printing equipment and document management solutions, to help reduce its waste impacts. Danwood conducted a thorough print audit across the Manchester United campus and discovered that two-thirds of its customer's 150 printers and photocopiers could be removed through the deployment of multifunctional products able to scan, email, fax, photocopy and duplex print. Danwood's business model was based on a fixed price per print backed up with a single quarterly invoice. Danwood also provided the club with a used toner cartridge recycling service.

Business Benefits

- MUFC saw a 15% year on year cost saving despite an increase in printing activity.
- Much of the benefit came in the form of energy efficiency savings, but waste was also prevented through a significant reduction in the number of appliances which needed to be disposed of.

Drivers

- As a high-profile business, MUFC first developed a CSR policy in 1989, and its work with Danwood is just one of many efforts to mitigate its environmental impacts.
- The football club's philosophy of being "the best, both off and on the field" was applied to its environmental performance.

Key Elements for Success

- MUFC's membership of Envirowise's Supply Chain Partnership Forum added impetus to the initiative. The objective of the Forum, which operated from 2002 to 2007, was to drive down waste in supply chains by engaging with leading British brands. Other members included Boots, CenterParcs and Halfords.
- As part of the Supply Chain Partnership Forum Envirowise provided free consultancy support to Danwood. The delivery body estimated that as well as streamlining MUFC's printing operations, Danwood itself could save more than £9,300 per annum by eliminating or reducing plastic and cardboard packaging.
- A close working relationship between MUFC and Danwood is important.

Sources:
http://www.danwood.co.uk/documents/3020%20manchester%20united%20case%20study[1].pdf

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 the 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 was invested in the Oregon project yielding an overall saving of more than 493 tonnes 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.

Box 3: Surplus food redistribution by FareShare

FareShare is a national charity redistributing surplus arisings from the UK's food industry to homeless hostels, breakfast clubs, women's refuges and other good causes. The charity works with many big names including Sainsbury's, Nestlé, Sodexo and Brakes and operates 15 depots including two in London. The most recent was opened in Llandudno, North Wales. In 2009-10, FareShare estimates that around 3,000 tonnes of surplus - the equivalent of 6.7 million meals - was redistributed. 29,000 people a day benefited from FareShare food. This is food that would otherwise have been disposed of, often to landfill. Food and drink manufacturers accounted for 61% of the food redistributed in 2009-10, while 31% came from retailers and 8% from the hospitality sector.

Business Benefits

- Assuming it can be done efficiently and safely, redistributing surpluses to charity not only helps vulnerable people but saves food businesses significant disposal costs; however, not producing the waste in the first place would, theoretically, save companies far more money.
- The PR value of giving food to charity rather than dumping it is likely to be considerable.
- Preventing food waste also reduces greenhouse gas emissions.

Drivers

- The CSR agenda is an important motivator; many participating businesses publicise their involvement with FareShare in their CSR reports.
- For some businesses, procurement pressure may have driven participation. According to FareShare, many food and drink manufacturers got involved after being encouraged to do so by their retailer customers. The manufacturers' own trade body, the Food & Drink Federation, is also a strong supporter of the scheme, with 17 members now collaborating with FareShare.

Key Elements for Success

- Timing is key. The surplus food often has a short shelf-life so partnerships are most successful when FareShare is integrated into a company's business processes, all levels of the company are aware, and surplus food is identified as early on as possible.
- FareShare focuses its efforts on handling food from further up the supply chain as surpluses available at store level are small compared to those available at warehouse or manufacturer level. However, the charity does collect from a limited number of stores, for example, when stores are conveniently located on the way back from a delivery to a Community Member.
- FareShare has enjoyed the support of the UK Government. For example, a past Secretary of State wrote to retailers encouraging them to work with the charity. FareShare has also been referenced in the former Labour administration's food strategy 'food2030' and is promoted by WRAP.

Table 1: Summary of waste minimisation evidence

Category	Supported	Description	Outcomes	Ref ID
Supplier packaging reduction	Envirowise	Potential waste savings found at Danwood Group, a supplier of office solutions to Manchester United Football Club, after visit from Envirowise advisor	£9,300/yr savings (projected only)	(16)
	Oregon Department of Environmental Quality	Norm Thompson Outfitters, USA engaged suppliers to reduce underpacking of "Save Your Back" bags	$2,900/yr savings	(17)
	No	US retailer Wal-Mart worked with toy supplier to reduce packaging on 255 products	$2.4m/yr in shipping costs saved; "3,800 trees and 1,000 barrels of oil" saved/yr	(18)
	No	New Zealand retailer The Warehouse reduced packaging associated with men's shirts	4 t/yr plastic saved	(19)
	No	Osborne Civil Engineering worked with suppliers to deliver materials without packaging during Peterborough redevelopment	n/a	(10)
Waste minimisation clauses	No	Kier Nuttall introduced waste minimisation clauses in supplier contracts during Channel Tunnel Rail Link construction. Waste aggregate reused on site.	130 kt/yr material saved; savings of £260,000 in landfill taxes; 8,000 vehicle movements avoided	(9)
	No	Wessex Water required trade contractors to pay for any excess materials – preventing over-ordering	n/a	(12)
	No	Wilmott Dixon required subcontractors to price their work to include material costs incentivising waste minimisation during construction of Jubilee Gardens Primary Care Centre in Ealing	On-site wastage was 28.8 m^3 per £100k of project spend, (under target of 45m^3 per £100k)	(11)
	WRAP	Graham Construction incorporated WRAP's model wording into contract to reduce waste and report arisings per £100k project spend prior to construction of health centre in Scotland	total saving of £77.8k (Projected)	(14)
EMS	No	ISO14001 is widespread in the German automotive industry because suppliers need to demonstrate their accreditation	n/a	(21)
Reuse of surplus food by charities	FareShare scheme	Food manufacturers encouraged by retailer customers to participate in the FareShare scheme donating surplus food to charity.	3kt of food waste saved in 2009-10	[a]

Source: Collated by Oakdene Hollins/Brook Lyndhurst

[a] Fare Share's Marketing & Communications Manager, personal communication, January 2011

3.2 Clean Operations

Procurement is used to drive clean operations in the supply chain by requiring and/or assisting suppliers to:

- supply goods in reusable and/or returnable primary/transit packaging (RTP)[a]
- supply goods in bulk packaging
- use plot-lot ordering of materials
- adopt off-site manufacturing (OSM) techniques
- invest in less-wasteful new technologies.

Returnable Transit Packaging (RTP) & bulk packaging
RTP includes reusable pallets; plastic or metal crates and stillages; and reusable layer pads. These all avoid the wastage inherent in from single-trip packaging. Bulk packaging may take the form of drums, intermediate bulk containers (IBCs), removable hoppers and other production-ready packaging, and road-tanker deliveries (22 pp. 19-20). All these modes of delivery require less packaging per unit product, and also result in less wastage of the product itself in remnants within an emptied container. Research from the food and drink sector shows that up to 5% of raw materials can be left in supply containers after dispensing (23). Sometimes, purchasers may require that packaging is changed to recycled material, material with a high recycled content, or material which can be more easily recycled. Such interventions are not forms of waste prevention as defined in WR1403.

The adoption of bulk packaging and RTP is notable in the retail supply chain:

- For example, a 2005 study of the food and drink sector in the East of England found that in two cases, "retailers' packaging waste management schemes assisted waste minimisation for the food producers and along the supply chain". Initiatives included the introduction of "reusable containers to transfer finished product from the factories to the retailers" (24 p. 22). The study found that "customer pressure - i.e. from food retailers" was among the major drivers of waste minimisation practice in the food and drink suppliers (24 p. 17). The study also found that "greater involvement of suppliers in resolving packaging issues" was among "important factors in ensuring that the barriers to waste minimisation are reduced for the food and drink industry" (24 p. 25).

Many other examples are listed in Table 2. It is important to recognise that when a procurer requires goods to be supplied in returnable or bulk packaging this often entails a new packaging design. Thus, many of the examples classed here under the heading clean operations could equally well be viewed as forms of green products as discussed in Section 3.3.

Plot-lot ordering
In the construction sector, waste prevention centres on reducing wastage of products themselves rather than packaging. Traditionally, sub-contractors arrange with suppliers for deliveries to sites on an *ad hoc* basis. Such fragmentation causes over-ordering and wastage, problems exacerbated when space is limited. One solution is the introduction of 'plot-lot' ordering systems in which only those materials required for a specific task are available at any one time. Less material stored on-site reduces the risk of damage or weather spoilage. In addition, construction workers are encouraged to use available material more sparingly (25). Research from 2006 shows that contractors adopting plot-lot ordering generated 8% plasterboard waste against and an average 12 % wastage rate (26 p. 24).

[a] The adoption of towards reusable packaging is most commonly seen with secondary and tertiary transit packaging where there is a reasonable chance that packaging can be returned to suppliers for reuse. By contrast, reusable systems for primary packaging are now rare, even long-established ones such as glass milk bottles, because supply chains have lengthened and return-rates have dropped (102).

A 2004 survey on waste minimisation practices in the construction sector which found that "supplier flexibility" in providing smaller quantities of materials and to project specifications in the construction sector "reduced the needs for on-site storage and the opportunities for damage to occur on-site … [and] was integral to waste minimisation". However, the research also revealed that "supply chain alliances with suppliers/recycling companies" while reducing the amounts sent to landfill "do not necessarily reduce the volume of waste [generated in the first place]" (27 p. 24).

The construction logistics company Wilson James is a well-known pioneer of this approach to materials supply. Wilson James requires all suppliers to plan ahead and book into a Construction Consolidation Centre (CCC) to secure a specific delivery slot. Materials for construction projects are consolidated into 'work packs' and distributed more intelligently on a 'just-in-time' basis with significantly less wastage (28). During the refurbishment of a major client's (Unilever) head office, Wilson James established individual contractor supply chains which provided "a robust just-in-time materials delivery schedule" reducing the risk of waste (29 p. 43). Wilson James's CCC approach was also used by Skanska during the redevelopment of the London hospitals discussed above; a primary aim was to reduce vehicle movements (and hence carbon emissions) during work in a restricted site in central London (30).

Off-Site Manufacturing

Also seen in the construction sector, is a move towards ordering of materials which have been pre-assembled, a process known as off-site manufacture (OSM). Instead of carrying each material category to site separately, complete pre-assembled modules are brought to site reducing both transport intensity and material stockholding on site (30). In evidence to the 2007-8 Session of the House of Lords Science and Technology Committee on Waste Reduction, building contractor Laing O'Rourke reported that OSM "could reduce the amount of waste often produced on-site by over-ordering, damage during transportation, lack of co-ordination with suppliers or damage by the weather". Substantial savings could be achieved "by adopting principles of standardisation in design or by engaging with the supply chain to ensure that standard manufactured components can be adjusted to suit a specific design" (31 p. 32).

Other examples of OSM:

- During the redevelopment of two hospitals in London by main contractor Skanska, services such as water, wiring and power were pre-installed in corridor ceiling-space, generated no on-site waste and cut installation time (30).
- LOCOG procured construction materials and products in pre-assembled forms so as to prevent waste during the development of the London 2012 Olympic site. In addition, its procurement strategy prescribes particular construction and fixing methods to facilitate disassembly (32).
- For some of the on-going refitting of its stores, retailer Sainsbury's has adopted OSM. Its suppliers RG Group and Fit Out (UK) Ltd now fabricate 'backwalls' (partition panels with mounted images and graphics) off site "reducing construction waste by up to 40%, as well as reducing construction cost, the duration of departmental closures and disruption to the trading store". Wastage through a consolidation centre approach is also further reduced by an average of 16.25% through "improved design, material procurement, storage and manufacturing" (33).

Box 4: Off-site manufacture in supermarket refits

Off-site manufacture (OSM) is a technique increasingly seen in the construction sector where materials are supplied to the site as pre-assembled modules. OSM can lower transport intensity and material stockholding on site compared with the traditional method whereby each material category is ordered separately. Having fewer orders and less material stored on site also reduces wastes arising from building materials being damaged in transit or storage. Pre-fabrication within a controlled manufacturing environment rather than on a building site also delivers efficiencies in labour, time and materials. Working with suppliers RG Group and Fit Out (UK) Ltd, the retailer Sainsbury's recently combined OSM and a Consolidation Centre approach for the refitting of some of its stores. Backwalls are partition panels with mounted images and graphics and are an important marketing element in refits. Materials for these are now consolidated at off-site workshops where the backwalls are fabricated before being delivered to, and fitted at, the stores. The small amount of waste and packaging that does arise is 100% reused or recycled.

Business Benefits

- Construction waste was directly reduced by up to 40% which meant substantial cost savings.
- The OSM approach limited the duration of departmental closures which minimised disruption to trading during store refits.
- The consolidation approach optimises the efficiency of distribution vehicles and avoids the problems of congestion in the supermarket car parks.

Drivers

- Clearly, the shop refitters were driven by their powerful customer to adopt OSM techniques. Sainsbury's itself was motivated by the opportunity to cut costs and reduce disruption to trading.

Key Elements for Success

- Substantial savings could be achieved by adopting principles of standardisation in design or by engaging with the supply chain to ensure that standard manufactured components can be adjusted to suit a specific design.
- Sainsbury's achieves even greater efficiencies by combining OSM which a consolidation centre approach see Wilson James case study. wherein materials and modules are stored and delivered on a just-in-time basis. In addition to the 40% reduction in construction waste, a further 16.25% in material savings are realised through improved design, material procurement, storage and manufacturing.

New technologies

A clean operations approach to waste prevention often requires investment in new technologies and equipment. Pressure from a procurer can drive this investment:

- Apollo Motor Group repairs damage to vehicles insured by Aviva. When the insurer asked its supplier to reduce claims costs, Apollo switched to a new, less wasteful, technology. The innovations enable damaged panels and bumpers to be repaired rather than having to be replaced. Waste was reduced by 42%. New forms of waste arising could more easily be diverted from landfill. Annual waste management costs were reduced by about £77,000 enabling Aviva to hold its prices with no increase for inflation (34).

Table 2 summarises evidence for clean operations approaches driven by procurement pressure. Many of the interventions were documented, if not supported, by Envirowise and WRAP.

Table 2: Summary of clean operations evidence

Category	Supported	Description	Outcomes	Ref ID
RTP & Bulk Packaging	Envirowise	Retailer Halfords asked Autoglym (chemicals supplier) to switch to bulk transit packaging	£30k/yr savings	(16)
	Forum for the Future	Constructor Carillion asked ICI (paint supplier) to switch to bulk transit packaging	Waste reduction of 96% (projected)	(35)
	Envirowise	Baker Ginsters asked various suppliers to switch to bulk transit packaging	30% reduction in cardboard per tonne of product in 2006 vs. 2003	(36)
	No	Food manufacturer Pasta King asked tomato sauce supplier to switch to bulk transit packaging	Savings of 59 t/yr steel; 37 t/yr sauce; £33.1k/yr from reduced sauce wastage	(37)
	No	Furniture-maker Herman Miller, Inc (USA) asked moulded-plastic seat vendors to switch to re-usable (and recyclable) packaging	$200k/yr savings; 27 t/yr packaging saved; 40% in productivity in transport and storage	(38; 39)
	No	Unidentified retailers asked various food and drink manufacturers in the East of England to switch to RTP	n/a	(24)
	No	Automotive manufacturer Ford (UK) asked various suppliers to switch to RTP	Savings of 23 kt/yr cardboard; £100k/yr	(40)
	No	Book-printer Arcata Graphics (USA) asked various suppliers to switch to RTP	$200k/yr	(39)
	WRAP	Skanska asked its lighting contractor to switch to RTP during construction at Bart's Hospital, London	Packaging waste 'virtually eliminated for that material category'	(30)
	Envirowise	Drinks manufacturer Allied Distillers asked container supplier United Glass to switch to RTP	£26.1k/yr savings	(41)
	WRAP & CC	Burton's Biscuits asked various suppliers to switch to RTP and to eliminate some packaging	£10k/yr savings (identified)	(42)
	No	Xerox (USA) asked various suppliers to switch to RTP	$1.5m/yr savings	(40)
	No	Retailer Boots asked sandwich suppliers to switch to RTP	Savings of 200 t/yr plastic, 270 t/yr cardboard; £125k/yr	(43; 38)
	No	Retailer Boots asked bottle suppliers to switch to RTP	Savings of 13t cardboard; 2.5t plastic; £20k/yr	(44)
	No	Retailer Debenhams asked various suppliers to switch to RTP	n/a	(43)
	No	Retailer Delhaize (Belgium) asked fruit, meat, fish & vegetable suppliers to switch to RTP or reduced transit packaging.	n/a	(31)
	WRAP	Retailer Argos asked suppliers to switch to a bespoke reusable plastic bag for deliveries of sofas (N.B. Similar schemes now evidenced for other retailers such as Furniture Village)	17 tonnes of cardboard and plastic packaging saved during a trial	(45)
	Envirowise	Retailer Halfords asked a supplier Summit Accessories to switch to RTP	£25k/yr savings	(16)
	No	An unspecified retailer customer asked apetito (frozen food company) to switch to RTP	Savings of 112 t/yr cardboard; 230 t CO_2 /yr	(46)
	No	Retailer Tesco worked with various suppliers to switch to RTP	Savings of 46 kt/yr cardboard	(43)

Category	Supported	Description	Outcomes	Ref ID
	No	Retailer Waterstone's worked with Securicor Omega Express (distribution company) & Macmillan Distribution Ltd (publisher) to switch to RTP	Savings of 15 t/yr cardboard; 95% reduction in paper in-fill; £7k/yr;	(43)
	No	Automotive manufacturer Toyota (USA) asked various suppliers to switch to RTP and bulk packing of materials	Savings of 3 kt/yr wood & cardboard; $3.5m/yr	(47)
	No	During the redevelopment of a BP office and lab at Sunbury, Surrey by Carillion, suppliers of 'glazing cassettes' were required to switch to RTP while and 'luminaries' were delivered in bulk packaging rather than individual boxes	40% packaging waste saved	(12)
	No	Retailer Marks & Spencer asked various suppliers to switch to RTP and bulk transit packaging	78% reduction in packaging waste	(43)
Plot-Lot Ordering	Envirowise	Unspecified contractors adopted plot-lot ordering of plasterboard	Plasterboard waste reduced to 8% vs. an average 12 % wastage rate	(26)
	No	Wilson James's Construction Consolidation Centre approach during refurbishment of Unilever's head office	n/a	(29)
	No	Wilson James's Construction Consolidation Centre approach used by Skanska during redevelopment of London hospitals	vehicle movements and CO_2 emissions reduced	(30)
	No	Retailer Sainsbury's has also adopted a consolidation centre approach to store refits	Waste reduced by an average of 16.25%	(33)
OSM	No	Construction company Laing O'Rourke uses OSM for unspecified projects	n/a	(31)
	No	During the redevelopment of two hospitals in London by main contractor Skanska, services such as water, wiring and power were pre-installed in corridor ceiling-space	no on-site waste was generated; installation time cut	(30)
	LOCOG	LOCOG required that contractors procured construction materials and products in pre-assembled forms during London 2012 development	n/a	(32)
	No	Retailer Sainsbury's has adopted OSM for store refits by suppliers RG Group and Fit Out (UK) Ltd	40% reduction in waste; reduction in financial cost, disruption to trading	(33)
New Technology	No	With pressure from Aviva insurance, Apollo Motor Group switched to new automotive repair technology	Waste reduced by 42%; savings £77k/yr	(34)

Source: Collated by Oakdene Hollins/Brook Lyndhurst

The following Boxes give more details of the Xerox and Marks & Spencer examples outlined in Table 2.

Box 5: Waste prevention by Xerox

Founded in 1906 and today employing 130,000 people in 160 countries with a $22 billion turnover, Xerox is one of the world's largest suppliers of business technology. The company is tackling waste prevention on several fronts. Green Products approaches include the development of a new toner requiring less toner mass per page which results in reduced toner waste. For certain printers, Xerox has also invented 'ColorQube' a solid ink colour technology eliminating the need for cartridges or other consumable items. In addition, Xerox is a pioneer of Product-Service Innovations such as leasing equipment and consumables enabling its reuse or remanufacture rather than disposal at end-of-life. The company operates numerous 'take back' schemes.

Business Benefits

- Xerox's new solid ink cartridges generate 90% less toner waste than conventional counterparts.
- In the US, Xerox's cartridge return programme for mid- and high-volume machines enabled 65% of eligible cartridges to be returned for remanufacturing. In 2009 more than 2.2 million cartridges and toner containers were returned. Reuse of leftover toner in cartridges saves Xerox several million dollars in raw material costs each year.
- Using its considerable procurement power, Xerox can effect significant change in the supply chain. For example, when Xerox (USA) asked suppliers to switch to returnable transit packaging this led to annual savings of $1.5m.

Drivers

- Although many of Xerox's initiatives appear voluntary, new regulations in territories where it does business serve as additional motivators. For example, it is working to comply with the EU's Waste Electrical and Electronic Equipment Directive and participates in countries' individual collection and recycling programs.

Key Elements for Success

- In parts of the world where Xerox exercises direct control over the end-of-life management of equipment, return rates are high. For instance, 95% of equipment sold through direct channels in the US is returned to Xerox.
- Xerox maximizes the end-of-life potential of products and components by considering reuse in the design process. Machines are designed for easy disassembly and contain fewer and more durable parts. Up to 70-90% of machine components can be reused in remanufactured equipment.
- Xerox works hard to challenge negative consumer perceptions of the quality of equipment made with reused or recycled components.

Sources
http://www.xerox.com/corporate-citizenship-2010/sustainability/waste-prevention.html

Box 6: Waste prevention by Marks and Spencer

"To reduce non-glass product packaging by 25% by 2012", and "to send zero waste to landfill by the start of 2012" are just two of the aims in Plan A, Marks & Spencer's high profile sustainability strategy launched in January 2007. The Plan sets out 100 commitments on climate change, waste reduction, raw materials, ethical trading and customers' health to be achieved by 2012. A further 80 commitments to be fulfilled by 2015 were recently added. M&S wants to be known as "the world's most sustainable major retailer". Examples of specific waste prevention include asking suppliers to switch to returnable and bulk transit packaging, using lighter and reduced primary packaging, and the phasing out of PVC from packaging and products. Food waste has also been challenged, particularly by improving stock planning through more accurate demand forecasting systems; in addition M&S has donated 1,200 tonnes of usable surplus food to charity.

Business Benefits

- A 78% reduction in packaging waste was achieved by the switching to returnable and bulk transit packaging solutions. For instance, M&S worked with its supplier Tibbett & Britten Group to use transit packaging for groups of products rather than to individually pack them.
- As well as helping the environment, Plan A has helped M&S's bottom line. In 2010, the retailer reported that Plan A had generated £50m of additional profit by acting as a "unique selling point", enabling it to differentiate itself from its competitors.

Drivers

- M&S's CSR agenda is clearly a motivating factor, and seems itself to driven by changing consumer attitudes; the company states that "we understand that our customers still want to buy beautiful looking gifts, just with less packaging and we are making it easy for them to do this".
- Although Plan A is a voluntary initiative, M&S had previously been engaged with Envirowise's Supply Chain Partnerships scheme which encouraged retailers to work with supply chains to improve environmental performance and maximise profit margins. Some of the Plan A actions are also compatible with WRAP's Courtauld Commitment Phases 1 and 2, to which M&S is a signatory.

Key Elements for Success

- Marks & Spencer's has used its considerable power in the supply chain to help it achieve its goals on waste prevention. Rather than simply accepting suppliers' 'green claims' at face value, M&S's buyers choose suppliers, and provide clear requirements to them, based on their contribution to Plan A.
- Flexibility has been important. For instance, in 2008-9 M&S relaxed its food pricing rules in UK stores to lower the cost of items approaching sell-by dates; this led to a 20% reduction in food waste.

Sources
http://corporate.marksandspencer.com/documents/publications/2010/how_we_do_business_report_2010

3.3 Green Products

Procurement is used to promote green products in the supply chain by requiring and/or assisting suppliers to:

- concentrate the product so as to require less packaging per unit
- lightweighting primary or transit packaging
- redesign packaging to improve packing efficiency
- offer re-sized product portions to reduce wastage
- reduce hazardous content or wastes associated with manufacture.

To these should be added **RTP or bulk packaging** innovations where new designs have been required, as discussed in Section 3.2.

Many of these techniques have been evidenced as a result of Phase 1 (2005-10) of the WRAP-supported Courtauld Commitment and are thus widely seen in the retail and food and drink sectors. The modules **L2m5-2: Food & Drink Sector**, **L2m5-3: Retail Sector**, and **L2m4-4: Commitments** discuss the approaches in further detail and give numerous examples arising out of the Courtauld Commitment as well as other supported and unsupported supply chain initiatives. Some of these have been reproduced in Table 3 which includes two further examples:

- The retailer Sainsbury's worked with a supplier to redesign the packaging of its own-brand garlic bread saving of 160 tonnes per year of packaging (43 p. 18)
- Ford Europe worked with suppliers to develop a vegetable oil-based lubricant which significantly reduced the waste generated by metal-cutting machinery in the production of engines (48 p. 138).

Table 3: Summary of green products evidence

Category	Supported	Description	Outcomes	Ref ID
Concentrated Product	WRAP/CC	Princes & Tesco: designed a double-strength squash drink to reduce packaging	470 t/yr plastic saved	(49)
Light-weighting (Both primary & transit packaging)	No	Drinks company Diageo: lightweighted bottles and used thinner shipping canisters	97 t/yr glass and paper annual saved	(50)
	No	Procter and Gamble reduced the weight of one of its product plastic bottles by 30%.	1,250 t/yr plastic saved; 750 t/yr cardboard saved	(19)
	TSB	Valueform and Reading University undertook a research project to produce a more resource efficient packaging material based on waste vegetable matter	n/a	[a]
Light-weighting (Primary packaging only)	WRAP/CC	Britvic: J_20 Soft drink packaging reduction	4,000 t/yr glass saved	(42)
	WRAP/CC	Britvic: Robinsons soft drink packaging reduction	1,670 t/yr plastic saved	(42)
	WRAP/CC	Burtons: Cookies	32% reduction in plastic	(42)
	WRAP/CC	Cadbury: Easter Eggs packaging reduction	Medium egg range: 220 t/yr plastic saved; 250 t/yr carton board saved; 90 t/yr less transit & display packaging; Large egg range: 108 t/yr plastic saved, 65 t/yr carton board saved; 44 t/yr corrugated cardboard saved	(42)
	WRAP/CC	Coca-Cola: Soft drink can packaging reduction	15,000 t/yr aluminium saved (projected across EU)	(42)
	WRAP/CC	Coca-Cola: Soft-drinks bottle packaging reduction	3,500 t/yr glass saved	(42)

Category	Supported	Description	Outcomes	Ref ID
	WRAP	ContainerLite project(2005-6)	7,781 t glass saved (during trial period); 36,500 t saved (within 12 months of project end)	(51)
	No	Drinks company Diageo: lightweighted cans	187 t/yr aluminium saved	(50)
	No	Drinks company Diageo: redesigned a returnable beer bottle for Africa	3 kt/yr glass saved	(50)
	WRAP	Duchy Originals: Biscuits box reduced	9 t/yr carton board saved	(52)
	WRAP	GlassRite: Beer, Cider & Spirits (2007-8)	32,300 t/yr glass saved	(51) (53) (54)
	WRAP	GlassRite: Food, Soft Drinks & Ready-to-Drinks (2006-8)	21,415 t/yr glass saved; 14,447 tCO_2 /yr	(55)
	WRAP	GlassRite: Wine (2006-8)	11,397 t/yr glass saved; 11,400 tCO_2/yr saved	(56) (57)
	WRAP/CC	Greencore: Bottled water packaging reduction	110 t/yr plastic saved	(42)
	WRAP/CC	Greencore: Yorkshire puddings packaging reduction	115 t/yr plastic saved	(42)
	WRAP/CC	Heinz: Ketchup plastic packaging reduction	340 t/yr plastic saved	(42)
	WRAP	Heinz: thickness of Easy Open' can ends reduced by 10%. Some cost savings due to more efficient packing of lighter cans	1.400 kt/yr steel saved; £404k/yr savings (45)	(58)
	WRAP/CC	Innocent: Kids smoothie packaging reduction	90 t/yr paper saved	(42)
	WRAP	Kane Salads: Salad bags with thinner film	10-15% material savings	(52)
	No	Kraft Foods: Change from an aluminium foil wrapper with paper envelope to plastic flow pack for chocolate bars	6.3 kt/yr aluminium and paper saved globally	(59)
	WRAP/CC	Mars: Celebrations chocolates packaging	720 t/yr unspecified packaging material saved	(42)
	WRAP/CC	Mars: Easter Eggs packaging reduction	Medium eggs: 200 t/yr cardboard saved; plastic insert weight reduced by 35%	(42)
	WRAP/CC	Mars: Uncle Ben's sauce bottles packaging reduction	450 t/yr glass saved	(42)
	No	Miller Brewing Company, North Carolina, USA: lightweighted its glass bottles by 1 oz and the size of aluminium can lids from 2.375" to 2.25"	1.36 kt/yr aluminium and 1kt/yr glass saved	(60)
	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	(42)
	WRAP/CC	Müller: Dairy yoghurt pots plastic packaging reduction	1.8kt less unspecified packaging material (2009 vs. 2006)	(42)
	WRAP/CC	Nestlé: Easter eggs packaging reduction	784 t/yr various packaging materials saved	(42)
	WRAP/CC	Nestlé: Quality Street chocolates tin packaging reduction	237 t/yr steel saved	(42)
	No	Packaging design changes, in France, resulting in a 23% weight reduction of Choco BN biscuit packages and 50% weight reduction of "Carte Noire" coffee filter sachets.	n/a	(19)
	WRAP/CC	Premier Foods: Bread packaging reduction	1,200t plastic total saving (2005-8)	(42)

Category	Supported	Description	Outcomes	Ref ID
	WRAP	Radnor Hills: Plastic bottle packaging thinner	3.4kt PET savings (projected)	(52)
	WRAP/CC	Robert Wiseman Dairies: Milk packaging reduction	340 t/yr plastic saved	(42)
	No	Sainsbury's supplier redesigned packaging of garlic bread	160 t/yr packaging saved	(43)
	WRAP	Sheepdrove Organic Farm: Meat box packaging reduced	7 t/yr cardboard saved	(52)
	No	The replacement in the 1990s of "Clorox" glass sauce and dressing bottles in the USA with plastic and lightweighting by 15% resulting in an increase in market share.	n/a	(19)
	WRAP/CC	United Biscuits: Jacob's Biscuits for Cheese. Plastic cartons replaced with cardboard of a lighter weight	4,000 t/yr plastic saved	(42)
	WRAP/CC	Weetabix: Cereals packaging reduction	103 t/yr cardboard saved	(42)
	WRAP	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)	(61)
	WRAP/CC	Young's Seafood: Admiral's fish pies packaging reduction	242 t/yr cardboard saved	(42)
	WRAP/CC	Young's Seafood: Chilled raw fish packaging reduction	80 t/yr mixed packaging material saved	(42)
Light-weighting (Transit packaging only)	Envirowise	A pet food company redesigned transit trays using less cardboard	£100k/yr saved	(38)
	No	Drinks company Diageo: removed dividers from cases of bottles	740 t/yr cardboard saved	(50)
	WRAP/CC	Northern Foods: 'Goodfellas' pizza box redesigned– primary packaging made 4% heavier enabling reduction in transit packaging and improved stacking	4 kt/yr cardboard saved overall; number of pizzas damaged in transit cut by 75%; more efficient pallet stacking reduced transport miles by 1m/yr	(62)
	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	(63)
	No	Riverford Organic Vegetables, which runs a vegetable box home delivery scheme, redesigned its packaging to use less material and to use pallets more efficiently, reducing emissions and costs	n/a	(64).
	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	(65)
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	(42)
Portion Re-sizing	WRAP/CC	Warburtons: designed a new mid-sized loaf to reduce food waste	n/a	(42)
Misc	No	Ford Europe worked with suppliers to develop a vegetable oil-based lubricant to reduce metal-cutting waste	n/a	(48)

Source: Collated by Oakdene Hollins/Brook Lyndhurst

3.4 Product/Service Innovation

Procurement can drive Product/Service Innovation in the supply chain by choosing:

- remanufactured products
- leasing as a purchasing strategy.

Remanufactured products

When a procurer purchases a remanufactured product, this has the effect of preventing waste elsewhere in the supply chain, and is perhaps the best known example of procurement driving product/service innovation. Remanufacturing is a process for reusing products, where the form and function of a device or its sub-components are retained to the fullest extent (66). A familiar example is the remanufactured printer toner cartridge (67 pp. 56, 61), but the concept applies to many other goods and services ranging from truck engines and vending machines to office furniture and carpet tiles.[a]

A 2009 life-cycle analysis study found that a decision by a retailer to buy a remanufactured rather than new refrigerated display cabinet (RDC) saves 2.1 tCO_2e. If priority were given to the purchase of remanufactured RDCs where feasible, some 123,000 tCO_2e could be saved annually in the UK (66). Similarly, purchasing remanufactured toner cartridges presently saves 11,600 tCO_2e annually in this country (68 p. 5).

In 2009, the Centre for Remanufacturing and Reuse (CRR) valued UK remanufacturing and reuse activities (which includes refurbishment) in 16 industry sectors[b] at almost £2.4 billion, saving more than 10 million tCO_2e (69 p. 19). Activities are most evident in the ink and toner cartridge, automotive, pumps and compressors, and off-road equipment sectors (69 p. 20).

Table 4 provides estimates of values of selected remanufactured or reused products, and savings achieved, within the supply chains of 'in-scope' sectors.

Table 4: Value of, and savings from, remanufacturing and reuse of selected products in the UK

Product	Sector/Supply Chain	Value of activities (£m)	Material savings (kt)	Carbon savings ($ktCO_2e$)
Various (excluding Tyre Retreading)	Automotive	408	27.2	48.1
Tyre Retreading (Remould & Reuse)	Automotive	40	70	267
General Catering Equipment	Catering/Food & Drink	21	2.5	4.5
Refrigerated Display Cabinets	Catering/Food & Drink	40	4.8	8.5
Vending Machines	Catering/Food & Drink	16.58	2.0	3.5
Reclaimed Products*	Construction*	63	2,600	800
ICT Equipment	Office-based services	192	11.5	20
Ink & Toner Cartridges	Office-based services	435	2.5	6.3
Office Furniture	Office-based services	37.4	10	15.2

Source: (69)

**'True' remanufacturing as defined in this report does not occur in the construction sector - most demolition companies cannot reclaim complete usable systems - but the market for reclaimed materials is considerable*

[a] More information is available on the website of the Centre for Remanufacturing and Reuse (http://www.remanufacturing.org.uk)

[b] The 16 sectors assessed were: Aerospace; Automotive; Catering and Food Industry; Construction; ICT Equipment; Industrial Tooling; Ink and Toner Cartridges; Lifting and Handling Equipment; Medical, Precision and Optical Equipment; Off-Road Equipment; Office Furniture; Pumps and Compressors; Rail Industry; Textiles; Tyre Retreading; and, White Goods.

Leasing

The preparations for the London 2012 Olympic Games have driven Product/Service Innovation by suppliers. LOCOG has the objective of sending 'zero waste to landfill' and *Towards a one planet 2012,* its sustainability plan published in 2009 (32), identifies "leasing as the favoured procurement solution for venues with temporary elements" among a suite of measures ensuring waste is minimised during the de-commissioning of "temporary venues and other structures".

LOCOG aims to "rely on more temporary elements than any other Games"[a] including:

- seating
- buildings/structures (tented/modular)
- surfaces, flooring
- fencing, crowd control
- partitioning
- furniture, fittings and equipment
- signage
- tensile fabrics
- ducting, pipework, cabling
- fabric applications – wraps, banners, flags, drapes
- name badges, folders, etc.

Allied with this is LOCOG's development of a *Temporary Materials Method and Toolkit* with the following objectives[b]:

- zero waste to landfill; maximising opportunities at the top end of the waste hierarchy (i.e. reduce, reuse and recycle)
- minimising embodied carbon
- promoting human and ecological health.

Unsurprisingly, given that London 2012 is a future event, no quantitative evidence is yet available of waste being prevented through these initiatives.

Alternatives

On the whole, however, the case for the benefits of leasing and indeed of numerous product/service innovations (PSIs) has not been clearly defined. The EU SUSPRONET 'New Business for Old Europe' (70) programme supported research in this area, which identified that transformational benefits were most likely when radical reorganisation of the service (and system supplying it – physical and informational) was enabled. Highly product-focused PSIs had benefits limited to around 30% of life-cycle impact, and leasing perhaps 50% (p366). This implies that a deep relationship must be engineered between procurers and suppliers in order to specify, engineer and commit to risky new systems or supply. The role of government in this is not known.

Table 5 summarises evidence for product/service innovation driven by procurement. Box 7 gives more information on the LOCOG example.

[a] From unpublished minutes of LOCOG Temporary Materials Forum held in February 2009

[b] Personal communication between Oakdene Hollins and LOCOG

Table 5: Summary of product/service innovation evidence

Category	Supported	Description	Outcomes	Ref ID
Leasing	No	Leasing of temporary elements in the London 2012 Olympic Games	n/a	[a]
Purchasing remanufactured goods	No	Various examples of remanufactured goods as discussed.	270kt/yr materials saved	(71)

Source: Collated by Oakdene Hollins/Brook Lyndhurst

Box 7: London 2012 Olympic Games development

Waste prevention has been evident in the preparations for the London 2012 Olympic and Paralympic Games. While landfill diversion is a priority - LOCOG, the organising committee, has the objective of sending 'zero waste to landfill' – several measures have been taken to reduce the waste arising in the first place. For instance, LOCOG favours the leasing of temporary venues and other elements to limit the volume of material needing to be disposed of after the Games. These include seating, tented and modular buildings, flooring, fencing, furniture, signage, tensile fabrics, cabling and pipework. Where new permanent developments are needed, off-site manufacturing has been adopted with construction materials and products for bridges and structural frames procured in pre-assembled form. Particular construction and fixing methods are also prescribed by LOCOG to facilitate disassembly and maximise the options for reuse or recycling. Finally, LOCOG's Sustainable Sourcing Code required that, where practicable, all packaging and products could be reused, recycled or recovered and certain hazardous materials (e.g. PVC with heavy metal additives) avoided. Suppliers and licensees were also expected to calculate the carbon impact of their products and services.

Business Benefits

- Quantitative evidence is not yet available on the amount of waste that LOCOG has avoided through these initiatives and the financial costs saved, but the figures are likely to be impressive.

Drivers

- Although LOCOG had already pledged to divert 90% of construction refuse from landfill, its ambition was further boosted by WRAP's Halving Waste to Landfill commitment which it signed up to in 2009. LOCOG wanted to demonstrate it was part a much bigger government initiative and to show leadership

Key Elements for Success

- LOCOG clearly set out its intentions in *Towards a one planet 2012*, the sustainability plan it published in 2009.
- Given the scale of the Olympic development, the organisers were in a strong position to put pressure on a range of suppliers to prevent waste in their activities. LOCOG saw its Sustainable Sourcing Code and Materials Policy as an opportunity to inspire change and catalyse industry innovation.
- LOCOG helped develop a new standard: BS 8901 Sustainability Management Systems for Events – which in turn guides preparations for the Games.

[a] From unpublished minutes of LOCOG Temporary Materials Forum held in February 2009

3.5 Mixed Approaches

Some evidence is available of procurement driving mixed approaches to waste prevention in the supply chain. In all cases, external business support was present.

- In 2002, Envirowise established a Supply Chain Partnership Forum hosted by leading UK brands such as Boots, CenterParcs, Halfords and Manchester United with the aim of promoting resource efficiency among suppliers. Envirowise claims that by 2007, savings from reduced raw materials usage (i.e. waste prevention) within participant supply chains exceeded £3.5m with a payback of 1-2 months. Various approaches were evidenced (16 p. 18).
- Scotland-based Allied Distillers Ltd, with Envirowise support, worked with its supply chain on resource efficiency reducing overall materials use by 945 t/yr. Strategies taken by key suppliers included: reducing the weight of labels (£11,000/yr saving) (Green Products) and reducing paper and foil use (£85,000/yr saving) (Waste Minimisation). In addition, bottle supplier United Glass switched to re-usable plastic layer pads instead of cardboard layer pads (£21,600/yr saving) which is an example of clean operations approach (41).
- The WRAP-supported 2006-8 GlassRite: Wine project included a study of the environmental advantages of bulk importing of foreign wine for bottling in the UK. Typically, bulk importing enables 24,000 litres of foreign wine to be carried to the UK in each shipping container as against only 14,400 litres when the wine is bottled in the country of origin. This approach not only improves transport efficiencies but, importantly, permits the use of lighter bottles since they do not have to endure the rigours of shipping; thus, material savings can be won. In addition, lead times can be reduced further preventing wastage due to incorrect forecasting; when bottling in the country of origin the decision on what blend of wine to produce requires the use of long-term demand forecasting because of the time incurred shipping the wine. In effect, this technique combines a Clean Operations approach (bulk supply) with a Green Product (lightweighted glass bottles). A report for Defra estimates cost savings per bottle ranging from 2-13 pence depending on the country of origin (23). Bulk importation of wine has yet to be widely adopted by the industry, although the retailer Tesco has now adopted this practice for all its own-label wine.[a]

Table 6 summarises evidence for mixed approaches driven by procurement.

Table 6: Summary of mixed approaches evidence

Category	Supported	Description	Outcomes	Ref ID
Bulk supply (clean operations) & Lightweighting (green products)	WRAP	2006-8 GlassRite: Wine project: Investigation into the benefits of importing wine to the UK in bulk containers rather than in bottles.	Cost savings per bottle of 2 to 13 pence (projected)	(23)
Various	Envirowise	Envirowise's Supply Chain Partnership Forum with various leading UK brands (Boots, CenterParcs, Halfords, Manchester United FC)	Total savings of £3.5m	(16)
Lightweighting labels (green products), Reducing packaging (waste minimisation) & RTP (clean operations)	Envirowise	Allied Distillers Ltd worked with its supply chain to reduce packaging waste in various ways	945 t/yr packaging saved; £11,000/yr saved from lightweighting labels; £85,000/yr from reducing packaging; £21,600/yr from RTP	(41)

Source: Collated by Oakdene Hollins/Brook Lyndhurst

[a] Dr Peter Lee, Oakdene Hollins, Personal Communication

3.6 Hazard Reduction

Only limited evidence has been found of procurement resulting in the prevention of hazardous waste:

- LOCOG requires suppliers of PVC to the London 2012 Games to demonstrate that the material "has been manufactured in accordance with the *ECVM* [European Council of Vinyl Manufacturers] *Industry Charter* for the Production of VCM [vinyl chloride monomer] and PVC". The Charter requires that the material is made with minimal toxic impacts and its non-recycled content contains no "lead, mercury or cadmium stabilisers" (72).
- In addition, LOCOG "decided, as a matter of choice, to use reasonable endeavours to procure PVC which is produced using non-phthalate plasticisers". This is a valid example of waste prevention as the agency is with the procurer. LOCOG stresses that the stipulations are in addition to the requirement that "all chemicals used in the production of PVC must be registered or pre-registered for use under the REACH regulations with the European Chemical Agency". Additional LOCOG conditions regarding minimum recycled content and take-back schemes for the PVC are also set out, but are beyond the scope of WR1403.
- Some retailers (such as Marks & Spencer) have decided to phase out PVC altogether from packaging and products (44 p. 62).

However, we know that hazard reduction is a prime target of green product initiatives undertaken by the private sector as well as being an implicit component of various sector and product road-mapping exercises undertaken by Defra. For example, ecolabel criteria are largely aimed at this and may be used in procurement of, for example, textiles, detergents and electronic goods. (Waste prevention on the other hand is only one of several priorities competing at the production stage compared to hazard reduction, water conservation, energy use etc.)

Box 8 details the Europe-wide HazRed project.

Box 8: HazRed

Launched in 2004, the three-year HazRed project aimed to check the rise in hazardous waste generation across Europe. Funded through the EU Life Programme, the project sought to address hazardous arisings from small and medium-sized enterprises. In the UK, HazRed was co-sponsored by the Environment Agency, Scottish Environment Protection Agency, Envirowise, Waste Recycling Group and others. They tracked and targeted areas of highest hazardous waste arisings and impact across focus sectors including pharmaceuticals, printing, automotive and construction. Training workshops were run and specialist advisors sent to specific businesses. Measures taken included removal of such substances as chromium, cyanide and volatile organic compounds from protective finishes, paints, strippers, inks and cleaning fluids.

Business Benefits

- Some 1,200 tonnes of hazardous waste were diverted from landfill and savings to business totalled more than £440,000.

Drivers

- Businesses saw their involvement in HazRed as a way not only to save costs but also to ensure compliance with ever more stringent hazardous waste regulation.
- One company wanted to participate because taking action to limit environmental impact was 'a central part' of its strategy. Another pointed out that customers working towards their own sustainability targets, including the standard ISO 14001, expected suppliers to demonstrate a similar commitment.

Key Elements for Success

- The backing of the Environment Agency has been crucial to the success of HazRed. The Agency maintains an interest with schemes such as the European Pathway to Zero Waste targeting construction and other high-impact sectors.
- Recognising that larger companies are better placed to benefit from the environmental guidance and exploit advances in clean technology, the HazRed project deliberately targeted SMEs.
- Various communications tools were used to recruit companies and influence behaviour including sector champions, workshops, member communications within trade associations, regional and national press, Project Partner events, websites and newsletters.

3.7 Purchasing as a Tool for Internal Change

The examples above indicate that procurement is often used to drive waste prevention in the supply chain. Procurement can also be used purely to effect internal change – i.e. to reduce waste arising within the procurer's own operations, with no recorded impact elsewhere in the supply chain. The important distinction in these cases is that suppliers' behaviours are not changed since the procurer simply switches to a new product or service. Some examples are identified below, and many more are discussed in the other sector-based modules that are part of WR1403.

Waste Minimisation

- A Canadian hotel implemented 'a source reduction strategy targeting all hotel supplies … to control the input of materials and avoid things such as Styrofoam and excess packaging' (67 p. 51).
- Rascards, a manufacturer of plastic store cards based in the northwest of England, asked its German supplier of PVC sheets to eliminate timber cages around the product. When the request was refused, Rascard switched supplier to an Italian company which did supply the PVC without timber. Savings of 4 tonnes per annum were achieved (29 p. 29). As noted below, this is also an instance of a procurer failing to effect behaviour change in the supply chain.

Clean Operations

- Following advice from Envirowise, Deans Place Hotel in East Sussex switched from small toiletry bottles to large, pump dispensers in the public areas and guest rooms during 2008 saving an estimated £1,550/year (73).
- Strattons Hotel in Norfolk installed refillable pump dispensers for toiletries in the rooms "to minimise packaging and allow bulk purchase". This diverted 164 kg of waste from landfill per year with saving £1,921 annually. The hotel also "arranged with suppliers (e.g. a local brewery and a fruit farm) to return cardboard boxes for re-use" (74).
- A third unnamed hotel, again with Envirowise engagement, "found that miniature toiletries were disposed of still containing an average of 70% of their contents. Refillable pump dispensers were installed in the rooms to minimise packaging and waste. The cost of toiletries fell by £5,250/year" (75).

Table 7 summarises evidence for the use of procurement as a tool for internal change.

Table 7: Procurement as a tool for internal change

Category	Supported	Description	Outcomes	Ref ID
Waste Minimisation: Packaging reduction	No	A Canadian hotel implemented "a source reduction strategy targeting all hotel supplies … to control the input of materials and avoid things such as Styrofoam and excess packaging"		(67)
	No	Rascards, a manufacturer of plastic store cards, switched supplier to source PVC without timber.	4t/yr wood saved	(29)
Clean Operations: Bulk packaging	Envirowise	Deans Place Hotel in East Sussex switched to large, pump toiletries dispensers	£1,550/yr saved	(73)
	Envirowise	Strattons Hotel in Norfolk switched to large, pump toiletries dispensers	Saved 164 kg/yr waste; £1,921/yr saved	(74)
	Envirowise	Unnamed hotel switched to large, pump toiletries dispensers	£5,250/yr saved	(75)
Green Products	Ministry of Justice	Ministry of Justice procured a new design of extended lifespan mattress	£1.2m/yr savings (projected)	(7)

Source: Collated by Oakdene Hollins/Brook Lyndhurst

3.8 Examples on the Border of the Scope of Waste Prevention

One form of waste reduction through supply chain pressure lies just outside the scope of this review but is nevertheless instructive. This concerns a shift to upstream processing of raw materials adopted by some manufacturers. Preparing raw materials earlier in the supply chain has a great potential for reduction of bulk organic wastes (e.g. peelings, husks, etc.) and also for the economic transfer of wastes to recycling outlets such as animal feed, anaerobic digestion or composting (76 p. 1279). In the UK, Northern Foods[a] now requires suppliers to perform some vegetable preparation work; yield losses in vegetable preparation can be as high as 50% due to poor quality and the losses incurred in the skinning process. The approach has reduced vehicle movements between growers and food manufacturers and transport packaging. Importantly, manufacturing lead times have been lowered reducing the risk of wastage due to incorrect demand forecasting (23).

[a] In November 2010, Northern Foods announced its merger with Irish-based food company Greencore

4 Behavioural Aspects

4.1 Motivators

Despite growing evidence that consumers bear in mind environmental and particularly ethical factors when purchasing products for personal or family use (77), their behaviour in the workplace may be different. A 2006 survey on 1,000 employees across UK public and private sector organisations indicated that employees tended to behave in less 'environmentally friendly' ways in the workplace than at home. It found that despite having a clear understanding of what steps they need to adopt, employees look towards their employer to lead by example when it comes to being environmentally responsible (78). Similarly, a 2009 survey found that while 87% of respondents thought it was 'everyone's' responsibility to be resource efficient at work, a significant proportion failed to perform waste prevention tasks at work which they might do at home (79).

Evidence suggests that environmental concerns alone are unlikely to drive voluntary sustainable procurement behaviour by businesses. For example, a 2009 study found that CSR pressures were "not a major driver in encouraging remanufacture and remanufactured RDCs [refrigerated display cabinets]", in part due to the problems with quantifying the environmental benefits (66). The adoption of sustainable procurement by a company seems instead to be motivated by the following factors:

Cost

The opportunity to reduce costs and increase competitiveness seems to be a driver of waste prevention in the supply chain. For example, in evidence to the 2007-8 Session of the House of Lords Science and Technology Committee on Waste Reduction, a senior manager at Nissan revealed that the motor manufacturer 'issues green purchasing guidelines to its suppliers and asks them to "take responsibility for their own waste and recycling … [We] demand cost reductions and efficiency improvements year on year on year. We know inside our own plant that when you demand those kinds of cost reductions it makes people avoid waste …"' (31 p. 80). Cost-saving is also a reason businesses choose remanufactured products such as refrigerated display cabinets (66) toner cartridges (68 p. 5), furniture (80). Other motivations for buying remanufactured goods include "the ability to perform cost-effective energy upgrades and to enable specified customisations to enhance the retail brand" (66). The example discussed in Section 3.2 of a motor insurance company (Aviva) asking its supplier to switch to less wasteful repair techniques was motivated by a need to cut costs (34).

Company performance

Closely allied with cost-reduction is the less tangible motivator of "improved company performance". A 2009 report from the Engineering Employers' Federation (EEF) cited "an improved public image and competitive advantage via innovation…" as potential drivers. (2 p. 25) Similarly, *Successful business and procurement*, the 2010 review published by SDRN, concluded "with a moderate degree of certainty" that strategic purchasing and supply chain management (SCM) had "a positive impact on a firm's performance". The report stresses that these activities "go beyond traditional cost-reduction [and] are aligned with internal integration and a firm's business strategy, and entail buyers being aware of the strategic direction of the firm." (5 p. 7)

Regulation

The 2010 SDRN report cites regulation as "'an important aspect of encouraging sustainable SCM in firms" (5 p. 9) and recommends that more needs to be done to create a regulatory environment that encourages, enables or requires the private sector to adopt sustainable procurement practices. But evidence that regulations have motivated procurement in a way that results in waste prevention is

mixed. For example, the *Producer Responsibility Obligations (Packaging Waste) Regulations* have arguably driven considerable supply chain changes in terms of promoting lightweight, reusable, returnable or bulk packaging (43 p. 5). By contrast, a 2005 study of waste minimisation in the food and drink sector found that "UK regulations influencing pollution prevention/reduction and natural resources consumption (such as pollution/resource taxes) have done little so far to stimulate producers, suppliers, and consumers to act on their conjunctive supply chain responsibilities". The authors suggest that "pressure on suppliers to the food and drink industry should be increased, both through regulatory and voluntary approaches..." (24 p. 17).

4.2 Barriers

Barriers to sustainable procurement can be divided into two categories:

- barriers to an organisation deciding to purchase sustainably in the first place
- barriers to an organisation being able to effect change in the supply chain or to find sustainable products/services.

These will be addressed in turn.

Factors preventing an organisation deciding to purchase sustainably in the first place
A perception that procuring less wasteful products or services conflicts with value for money (2 p. 4), or that 'greener' products and services cost more is a key barrier to taking the decision to buy sustainably. Competition from cheaper and more easily available new imported goods exacerbates the problem (66).

Linked to this is short-term decision-making based on limited information about the whole-life impacts of purchases, including financial costs (66) (2 p. 4). Research on the choice of energy-using products suggests "that people tend to give less weight to future costs than is rational, in standard economic terms … [and] are likely to focus on the purchase price and pay less regard to the energy costs they will have to pay as a result of using the product in the future" (81 p. 1). Labelling, standards and other product declarations address this tendency (2 p. 4), although can themselves be confusing and sometimes omit whole-life cost implications (2 p. 4).

Other barriers are structural. For example, the complexity of procurement procedures can impede changing them to include environmental criteria (21 p. 24). A 2009 report on remanufacturing in the UK notes that "separately accountable departments for purchasing and maintenance, meant that products were often bought on the basis of price. Therefore there was a perverse incentive to opt for cheaper and perhaps poorer quality new products" (69 p. 12).

Conservatism within a sector also acts as a barrier. For instance, despite the significant savings to be won through bulk importation of wine, the technique has yet to be widely adopted in the industry. A follow-up study for Defra concluded that "[m]arket participants would probably overcome the barriers in time if at least one retail competitor insisted on their supply chain using the system more extensively" (23).

Competing criteria such as customer satisfaction and long-term commercial relationships can prevent organisations changing suppliers (21 p. 24). Legal barriers may also exist; when tendering, it may be illegal to require would-be suppliers to have accreditation to a particular environmental standard (e.g. EMAS) (21 p. 24). However, requiring suppliers to demonstrate that their products or service meet environmentally sustainable criteria in a more general sense is, of course, acceptable.

A 2008 study of SMEs in Nova Scotia, Canada found that "time and financial resources were the greatest factors limiting ESCM [environmental supply chain management] implementation" (82 p. 1569).

The 2010 SDRN report identifies "lack of knowledge of sustainable technologies, lack of project management, lack of appropriate procurement systems, lack of market, lack of political will and focus on short term profitability" as barriers to sustainable construction procurement (5 p. 8). The research also reveals that more generally procurement professionals in the private sector can be disconnected from the strategic direction of their organisation: "There is an issue around how procurement is valued within firms and as a profession, and UK practitioners were found to rate themselves particularly low" (5 p. 9).

Lack of power to effect change in the supply chain or to find sustainable products/services

The main barrier is the fact that not all purchasers have the power to source – or cause to be developed – waste-efficient products and services. While large corporations or public sector bodies wield considerable procurement influence, smaller businesses do not (17 p. 14). This explains why delivery bodies devote their efforts to changing the behaviour of leading blue chip companies (e.g. WRAP's Courtauld Commitment, Envirowise's Supply Chain Partnership Forum).

Examples of a lack of purchaser power include:

- Kingspan Insulation, having adopted BRE's Environmental and Sustainability Standard (BES) 6001: Framework Standard for Responsible Sourcing of Construction Products, found that although one larger supplier offered "nice warm words" the latter failed to change their behaviour, as Kingspan had little apparent power in the market. Kingspan solved the problem by 'changing its language', by couching it in terms that the supplier would understand: "The 'bottom line' was that if suppliers weren't willing to change, this could lose Kingspan continuity of business and therefore the suppliers would also lose out" (83 p. 9).
- During a building project in Cardiff City Centre, the contractor was sourcing too small a quantity of building material which "gave rise to few opportunities to influence suppliers to reduce packaging or take it back" (84).
- When Rascards, a manufacturer of plastic store cards based in the northwest of England, asked its German supplier of PVC sheets to eliminate timber cages around the product, the request was refused. Rascards was forced to switch supplier (29 p. 29).

Purchasers may have limited control if supply chains are lengthy and complex with products having multiple owners, or if they cross international borders (2 p. 24). The 2008 Construction Resources and Waste Roadmap notes that "[d]iscussions with industry stakeholders have identified the difficulty of achieving change with a fragmented supply chain" (85 p. 32). Similarly, a 2005 study of waste minimisation practice in the food and drink sector in the East of England found that "the packaging from imported products has become a major problem for food producers. Audited companies had to keep a number of containers from imported raw materials on-site as they were non-returnable, non-recyclable, and unacceptable for landfill" (24 p. 23).

Another barrier may be the wilful obstruction from suppliers resistant to change; a particular problem when greater visibility in the supply chain would reveal vested interests and unethical practices. For example, the construction logistics company Wilson James found that its CCC approach, which tackles the problem of over-ordering of materials, was the ''worst nightmare to some people in supply chain, as they had been able to make money from the inadequacies of the conventional approach". At the end of one construction project, over £200,000 of unused and unclaimed materials were left in Wilson James's CCC which would not normally have been visible on conventional projects[a] (28). A parallel comes from the State of Oregon, USA where several businesses participating in an initiative to reduce packaging "were provided with information from packaging suppliers or potential suppliers that was misleading or

[a] Wilson James eventually overcame this 'cultural resistance' in suppliers used to delivering materials on an ad hoc basis. The main 'stick' being the threat that "non-compliant deliveries to site would be rejected and turned away". Wilson James reports that a "good number of suppliers were not only 'won over' by the new approach, but they continue to use and pay for the Consolidation Centre for their own businesses on projects where it is not specifically required" (28).

downright inaccurate. This misinformation tended to support the status quo (no change) or the sales position of individual suppliers" (17 p. 14).

Supply chains should be viewed as more than just a flow of materials. A 2008 article on sustainable procurement in Nova Scotia, Canada, stresses the importance of information exchange between companies: "A lack of information can be a major limitation to supply chain efficiency, whereas firms might use strong informational relationships to facilitate inter-firm learning" (82 p. 1562).

Even if a procurer is powerful and a supplier is cooperative, procurement can still fail if the supplier lacks the resources to make requested changes such as investment in 'greener' technology, the appointment of an environmental manager or better training of staff. This is likely to be truer for smaller SMEs (24 p. 21). Alternatively, the procurement pressure can have unexpected consequences as was the case when Rejuvenation, an American manufacturer, and a direct marketer of period-authentic lighting and house parts asked a supplier to find an alternative to "an expanded polystyrene foam tray in a corrugated box". The supplier replaced it "with a tray made from molded pulp". This increased the recycled content and improved the recyclability of the package, but "increased overall package weight (and resulting waste generation) and likely reduced some life cycle burdens (such as total energy use) while increasing others (including some atmospheric and waterborne pollutants)" (17 p. 10).

A potential barrier to an organisation being able to procure less wasteful products or services could be that the latter are simply not available in the marketplace. No evidence for this has been found, but one should not exclude this possibility, particularly for smaller organisations who may be unable to pressurise suppliers into offering such products or services.

4.3 Enablers

Public sector leadership
As discussed in Section 1, sustainable procurement has been driven largely by the public sector. The 2008 *Construction Resources and Waste Roadmap* observes that 'Government-procured projects are an ideal opportunity for working out the best approaches and identifying barriers that need to be addressed.' (85 p. 32) The 2007-8 Session of the House of Lords Science and Technology Committee on Waste Reduction, highlights the following benefits of sustainable public procurement (31 p. 77):

- The significant spending power of Government encourages innovation and sustainability. For instance, 40% of construction in the UK is procured by Government. (86 p. 5), and across Europe public procurement accounts for 16% of GDP (87 p. vii).
- Public sector consumption "constitutes a significant proportion of total consumption".
- Markets for sustainable products and services are stimulated.
- The "process of changing behaviour across Whitehall provides invaluable lessons to policy-makers about what is involved".
- Important signals are sent "to people about public priorities, and social and cultural preferences".

As discussed above, the planning for the London 2012 Olympic Games has a strong focus on procurement aimed at driving high rates of material reuse and innovative waste prevention measures such as leasing of existing structures. LOCOG's sustainability plan includes a 'Materials Policy' as an "opportunity for sustainable procurement to inspire change, and a catalyst for industry innovation to occur" (32). Its *Sustainable Sourcing Code* requires that, where practicable, all packaging and products sourced by suppliers and licensees can "be reused, recycled or recovered" (88). More generally the *Code* expects suppliers and licensees to calculate the carbon impact of their products and services using a basic high-level analysis or a full carbon footprint based on Publicly Available Specification PAS 2050.[a]

[a] PAS 2050 is a voluntary specification developed by the British Standards Institution to assess the life cycle greenhouse gas emissions of goods and services.

Business support

Evidence suggests that support from various public sector and non-governmental bodies can facilitate the development of sustainable procurement strategies by private enterprises. For example, frozen food manufacturer apetito states the following in its '*autumn 2009 sustainability update*':

> *'Working with inspirational partners such as Forum for the Future, WRAP, NISP and Natural Step we well understand the impact the whole food chain our environmental performance … Central to this is ethical purchasing in accordance with our 'Sourcing with Integrity' procurement policy, which sets out minimum supplier standards regarding ethics, environmental impact and business continuity'* (89 p. 11).

Table 8 lists organisations which have fostered sustainable procurement in the public or private sector in recent years.

Table 8: Organisations promoting sustainable procurement in the UK

Type	Organisation	Is procurement the sole objective?	Sectoral focus	Notable initiatives
Central Government	Defra	No	Public & Private	2007 Sustainable Procurement Action Plan including Quick Wins (90) Product Road Maps for food and drink, passenger transport, buildings, clothing and textiles (91) Marrakech Task Force
	National Sustainable Commissioning and Procurement Programme	Yes	Public & Private	Procurement Cupboard website: provides case studies, tools, primary documents, and other content aimed at procurement professionals (N.B. not a legal entity but run by a group of willing and knowledgeable individuals)
	The Office of Government Commerce*	No	Public only	The Centre of Expertise in Sustainable Procurement was established to spread good practice across central Government only – now part of the Cabinet Office
Delivery Body	Envirowise*	No	Public & Private	2002-7 Supply Chain Partnership Forum Guides (92) (93) and Case Studies
	WRAP	No	Public & Private (especially retail and construction)	Courtauld Commitment (Phases 1 & 2) The Construction Commitments: Halving Waste to Landfill guidance documents[a]
Regional Government	Regional Development Agencies †	No	Public & Private	The London Development Agency supported the Mayor's Green Procurement Code (in the mid 2000s)

[a] Guidance aimed at construction includes 'model wording' relating to waste reduction to be included in contract documentation (99 p. 25); and reports such as *Waste Recovery Quick Wins, Requirements and Clauses*; *Reducing waste in smaller projects*; *Achieving resource efficiency; Designing out Waste: a design team guide for buildings*.

Type	Organisation	Is procurement the sole objective?	Sectoral focus	Notable initiatives
Private/Non-Governmental Organisation	Action Sustainability[a]	Yes	Public & Private (especially construction)	In 2010 ran a sustainable procurement in construction training course, aligned to the principles recommended by BS 8903 Principles and Framework for Procuring Sustainability and the CIRIA construction guide. Supported the Strategic Supply Chain Group* bringing together senior executives and board-level representatives to consider environmental and sustainability issues in supply chains
	BRE	No	Public & Private (especially construction)	2008 British Environmental and Sustainability Standard 6001:2008 (94)

Source: Collated by Oakdene Hollins/Brook Lyndhurst
†due to be scrapped at time of writing (January 2011)

The dissemination of good practice in procurement is typically just one of a number of policy objectives for these bodies, but for a few, such as Action Sustainability, it is their sole purpose. For most of the organisations listed in Table 8, waste prevention is one of a raft of intended outcomes which also includes energy and water efficiency, biodiversity protection, and social equity. WRAP is the only significant UK-based delivery body to work on waste issues exclusively. In the domain of sustainable procurement, WRAP has been most active in the construction and retail sectors – the Courtauld Commitment and the Construction Commitments: Halving Waste to Landfill being notable initiatives which have directly or indirectly resulted in waste prevention (see below). Much of WRAP's work is, however, beyond the scope of waste prevention as defined in this mapping study because it concerns recycling and reuse of waste materials through better on-site segregation (95) (11) and the procurement of secondary materials (9), or materials with a high recycled content (4) (96).

During its existence, the delivery body Envirowise (whose role has now been subsumed within WRAP) published many case studies on sustainable procurement, and guides entitled *Cost and Environmental Benefits from Supply Chain Partnerships: Mentor Guide* (GG317) and *Supplier Guide* (GG318). The effectiveness or otherwise of these publications in preventing waste is unknown. More compelling evidence comes from the Supply Chain Partnership Forum established by Envirowise in 2002. Hosted by Boots, CenterParcs, Halfords and Manchester United and other large UK businesses, the Forum aimed to promote resource efficiency among suppliers. Envirowise claimed that by 2007, savings from reduced raw materials usage (i.e. waste prevention) within participant supply chains had exceeded £3.5m with a payback of 1-2 months (16 p. 18).

London Development Agency supported the funded London Remade to administer the Mayor's *Green Procurement Code* in the mid 2000's, although the initial emphasis was "to stimulate demand for recycled products and materials" (97 p. 1). Following a re-launch in 2007, the *Code*'s remit was widened to encompass 'the broad range of environmental considerations in procurement'. (98)

The modules **L2m4-7: Waste Minimisation Clubs** and **L2m4-8: Other Business Support** provide more information in this area.

[a] http://www.actionsustainability.com/

Standards, Environmental Management Systems (EMS) and Labelling

Understanding the whole-life impacts of products and services can be difficult. Therefore, various standards, certification schemes and labels for products and services based on social, economic and environmental criteria (4 p. 13) have been developed to assist in purchasing decisions. Waste prevention is encompassed in the following standards:

- Standards for implementing an EMS (e.g. British Standards Institution's BS 8555 and International Organisation for Standardisation's ISO 14001 (2 p. 25)
- European Community's Eco-Management and Audit Scheme (EMAS) (4 p. 62) (2 p. 25)
- BRE's British Environmental and Sustainability Standard 6001 (83 p. 2)
- Canadian Environmental Choice Programme (21 p. 85)
- Green Seal Environmental Partners (21 p. 85)
- Manuals of 'environmentally-friendly' products and services developed by local authorities (97 p. 18).

Similarly, labels such as the Japanese Eco-Mark (21 p. 85), the European Union's Ecolabel (2 p. 25) or the Canadian Environmental Choice Programme's Eco-Logo label (19 p. 31) may play an important role in procurement. 2003 research on nine retail chains in Italy accounting "for more than 80% of the retailing sector" found that "the large majority of the interviewed companies use the eco-label as an effective and useful assessment tool for their suppliers, in order to select them for their vendor-list" (21). This suggests that purchaser power can drive suppliers to work towards achieving the EU Ecolabel.

We should note that EU Ecolabel is a generic approach, but that there are many more product and sector-specific 'eco' labels in operation, often tackling different impacts. For example, in textiles, in addition to EU Ecolabel, Oekotex, GUTS and Bluesign are commonplace but have varying relevance to waste prevention.

Standards, codes and labels can also be adopted by the purchasing organisations themselves, again with the aim of facilitating the sustainable procurement process:

- As part of its EMS, an Oregon (USA) manufacturer and direct marketer of period-authentic lighting and house parts Rejuvenation "had an employee task force examining vendor packaging" (17 p. 10).
- In 2001, the London Mayor's Green Procurement Code was launched with Regional Development Agency funding, although the initial focus was on encouraging materials with high recycled content rather than waste prevention (97). The Code was re-launched in October 2007 with a new emphasis on "management and behaviour change" and a widened remit to "reflect the broad range of environmental considerations in procurement, from energy efficiency to the use of sustainable natural resources and from buying recycled content products to minimising vehicle emissions".[a]
- In summer 2010, Action Sustainability launched *BS 8903: Principles and Framework for Procuring Sustainability*, described as 'the world's first standard for sustainable procurement'[b].

The modules **L2m4-1: Standards** and **L2m4-2: Labelling** provide more information in this area.

Tools

Successful business and procurement, the 2010 SDRN report introduced above identifies several tools used in the public sector such as "supplier assessment questionnaires, life cycle assessment tools, and mathematical modelling" (5 pp. 7-8). However, few were used in the private sector and no evidence was found of waste prevention resulting from their use.

[a] http://www.greenprocurementcode.co.uk/?q=node/75
[b] http://www.actionsustainability.com/

Commitments
Voluntary sector-wide agreements have been employed to drive sustainable procurement with a waste prevention focus, the Courtauld Commitment being a high-profile example. In addition, signatories to the Halving Waste to Landfill commitment have promoted change. For example, the retailer Asda Wal-Mart 'requested that its entire supply chain sign up to WRAP's commitment.' (99 p. 14) More generic national targets and aspirations also seem important. The retailer The Warehouse was motivated to reduce waste in its supply chain as 'part of its commitment to New Zealand's aim of Zero Waste … [which it has been promoting] across the retail industry via the New Zealand Retail Association'. (19 p. 20)

The module **L2m4-4: Commitments** provides more information in this area.

5 Conclusions

5.1 Learning

- **Good evidence has been found for procurement being used as a driver of external change** (i.e. elsewhere in the supply chain), far less for procurement being used as a tool for internal change only. Having received significant promotion by the public sector, sustainable procurement and supply chain management is being adopted by a growing number of private companies, especially larger ones such as multiple retailers, automotive manufacturers and large construction contractors (especially when the client is a public body – for example in the construction of schools or hospitals). However, waste prevention in the supply chain is rarely an explicit objective.

- **In terms of approaches, a good spread of evidence was encountered for waste minimisation, clean operations and green products being driven by procurement.** Most examples came from the construction, retail and food and drink sectors and usually concerned the prevention of packaging waste; reusable or returnable transit packaging, light-weighting of primary packaging and bulk packaging was commonly seen. Rather less evidence was available on product/service innovation approaches; the procurement of remanufactured products and leasing being the only examples, although the evidence on leasing is weak within the scope of the search.

- **While public procurement has clear environmental objectives (driven by EU targets), this is not necessarily true for the private sector**. Instead, motivations are more likely to be the opportunity to reduce cost and improve company performance. The importance of legislation is less clear-cut. Assuming an organisation wishes to purchase sustainably, a lack of purchaser power is the main barrier, particularly where supply chains are complex or cross international borders. In some cases, suppliers can wilfully resist the efforts of a procurer to change their (the supplier's) behaviour.

5.2 Insights

As noted above, waste prevention is rarely an explicit objective of sustainable procurement. However, the concept's definition is not a stable one: outcomes which this work would define as waste prevention, may well have been intended but have been understood by businesses as 'waste reduction' in a more general sense.

Very little evidence was found of the impact of procurement strategies being used to drive hazardous waste reduction, although we note that hazard reduction is a key feature of the EU Ecolabel, which can be built into purchasing frameworks. It is possible that regulations such as REACH are sufficient drivers, and companies do not feel obliged to go beyond compliance with the law, although it is the belief of some, such as Action Sustainability, that businesses are increasingly influenced by CSR motives and are tackling waste prevention as an embedded component of 'low impact' production using supply chain initiatives. There are good examples in construction.

The cost of a product or service, its functionality and perceived quality are key aspects of any procurement decision (66). Potential environmental gains - including waste prevention - although important, are apparently secondary considerations from the purchaser's point of view. An opportunity exists for purchasers to be better apprised of the financial benefits of buying remanufactured and recycled goods, as well as reusing existing stocks. Fiscal instruments already favour sustainable purchasing decisions in the UK, but scope exists for further refinements. For example, the Enhanced Capital Allowance scheme encourages users to buy the most energy-efficient electrical products, but this applies only to new purchases; remanufactured products of an equal efficiency are at present ineligible (66).

Standards, labelling schemes and other forms of product and service declarations play a key role in verifying the whole-life sustainability impacts of a product (2 p. 4). Similarly, appraisal techniques such as whole-life costing and discounted cash flow can encourage purchasers to avoid short-termist decision-making (2 p. 26).

The 'greening of supply chains' where collaborative partnerships between suppliers and customers are established provide "significant opportunities to control resource flows and environmental impacts … and can identify opportunities for innovation and develop resource-efficient solutions" (2 p. 4). As a 1998 article in the journal *Supply Chain Management* points out, the crude size of a procuring organisation can be a misleading proxy for power in a trading relationship; power instead "appears to be that associated with a firm's ability to innovate and become a source of new ideas for its trading 'partner(s)' " (100 p. 92). Voluntary agreements, like Courtauld, have been successful because they promote an innovative and inclusive approach to procurement while setting time-limits on results (2 pp. 4, 26).

Finally, it is worth reiterating that procurement seems an especially potent agent for change when adopted by large private or public sector organisations which have the power to create and sustain markets for new and less wasteful products and services.

5.3 Research Gaps

Two research gaps have been identified:

- The bulk of the evidence reviewed reported actions to prevent packaging waste in the supply chain. **It would be useful to further investigate strategies which relate to preventing waste in the product itself;** portion re-sizing and product concentration in the food and drink sector and off-site manufacture and plot lot ordering in construction are both promising areas for which evidence is currently scarce.

- The preparations for the London 2012 Olympic Games have involved a considerable degree of procurement pressure aimed at driving waste prevention in the supply chain. **Assessing the success or otherwise of these efforts would be of general interest in procurement.**

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