

**WR1403: Business Waste Prevention
Evidence Review
L1m1 – Review Overview Report**

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RESEARCH & CONSULTING

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Resource Recovery Forum

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Contents

1	Background and Objectives of the Project	1
1.1	Background	1
1.2	Research Aim and Objectives	1
1.3	Exclusions from the Scope of Waste Prevention	2
1.4	Context of this Module	3
2	Analytical Framework	4
2.1	Sectors	5
2.2	Behaviours	6
2.3	Interventions	6
2.4	Approaches	6
3	Evidence Review Statistics	9
4	Findings: Overview	12
4.1	General Observations	12
4.2	Caveats	12
4.3	Presentation of Findings	13
5	Findings: Behaviours and Attitudes	14
6	Findings: Interventions	17
6.1	Standards	17
6.2	Labelling	18
6.3	Procurement	20
6.4	Commitments	22
6.5	Communications	24
6.6	Incentives	26
6.7	Business Support – Waste Minimisation Clubs	27
6.8	Business Support – Other	29
7	Findings: Sectors	32
7.1	Construction and Demolition	32
7.2	Food and Drink	34
7.3	Hospitality	36
7.4	Retail	37
7.5	Automotive	39
7.6	Office-Based Services	42
8	Findings: Approaches	45
9	Findings: Hazard Reduction	48
10	Findings: Metrics	50
11	Cross-cutting Themes	52

11.1	Self-Motivated Initiatives	52
11.2	Reuse and Material Use Efficiency	53
11.3	Summary of Key Findings: SMEs	55
12	Bibliography	56

Glossary

BREW	Business Resource Efficiency and Waste (programme)	PRN	Packaging Recovery Note system of ‘producer pays’
C&I	commercial and industrial	PSI	product/service innovation
CD&E	construction, demolition and excavation	R&D	research and development
CSR	corporate social responsibility	REACH	Registration, Evaluation, Authorisation & restriction of Chemicals
EEF	Engineering Employers’ Federation	RTP	Returnable Transit Packaging
EMS	environmental management system	SBU	Strategic Business Unit; division of a large company
EPEAT	Electronic Product Environmental Assessment Tool	SCP	Sustainable Consumption and Production
FDF	Food & Drink Federation	SIC	Standard Industrial Classification
ICT	information and communications technology	SME	small to medium enterprise; EU definition 11-250 employees
LE	Large enterprise; EU definition >250 employees	TSB	Technology Strategy Board
MGPC	Mayor’s (of London) Green Procurement Code	VSE	very small enterprise (also Micro-E); EU definition <10 employees
MUE	material use efficiency	WEEE	waste electronic and electrical equipment
NGO	non-governmental organisation	WFD	EU Waste Framework Directive (2008)
NISP	National Industrial Symbiosis Programme	WRAP	Waste & Resources Action Programme
OECD	Organisation for Economic Co-operation & Development	WREP	Waste and Resources Evidence Programme
OSM	off-site manufacture		

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

Acknowledgements

We gratefully acknowledge the contribution of the many people from across the UK and abroad consulted during this exercise, including our own colleagues not formally part of the delivery team.

In particular we pay tribute to the review panel for their time, insights and criticisms which have improved the robustness of this work.

Finally we thank our Defra sponsoring team and Steering Group for their faith in us and their high level of engagement against a background of competing priorities.

1 Background and Objectives of the Project

1.1 Background

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. Conceived by policy personnel working in the Waste and Green Economy Programmes as well as drawing on relevant expertise from across wider UK Government, this review of the available evidence on business waste prevention will help inform the preparation of England's National Waste Prevention Programme as required under the revised EU Waste Framework Directive (2008).

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;
- b) the adverse impacts of the generated waste on the environment and human health; or
- c) the content of harmful substances in materials and products.

Project WR1204, published in October 2009 reviewed the available evidence on household waste prevention. The purpose of the present research project WR1403 is to map and collate the available evidence on business waste prevention, in order to help inform future policy development. The two reviews are complementary, so that when they are put together, they cover all aspects of both business and household waste prevention. To take an example, improvements in product design to extend its lifespan, or to reduce the adverse impacts when it eventually becomes waste, or to reduce the content within it of harmful substances, are within scope.

This project is not primarily concerned with recycling and recovery operations by businesses or consumers. Where these activities are discussed it is in a comparative sense to the core topics of waste prevention outlined above.

1.2 Research Aim and Objectives

The main aim of this project is to map the existing evidence base related to business waste prevention. In addition, this is a scoping study to help determine future evidence needs by examining what already exists and identifying priority gaps that need to be filled by subsequent studies. The mapping includes:

- UK evidence and international evidence that is relevant to waste prevention in England
- recent and more historical work – so that evidence gathered in the 1990s or even earlier is not lost and
- evidence presented in peer reviewed papers, in the grey literature and in industry data.

Work funded by *inter alia* Defra, other Government Departments, the Research Councils, TSB, WRAP, WRAP's Business Resource Efficiency programme (formerly Envirowise), WRAP's Industrial Symbiosis programme (formerly NISP), Carbon Trust, Manufacturing Advisory Service, regional development agencies and local authorities is included, as is that of their various predecessor bodies and programmes.

1.3 Exclusions from the Scope of Waste Prevention

This review has followed closely the Waste Framework Directive (WFD) definition as described above. The focus of the Directive is very much on the avoidance of waste, and the spirit is to motivate a genuine behavioural change by businesses in this respect. We are aware, however, that – to date – waste prevention has embraced a wider range of activities, broadly classed as waste exchange, which might fall outside the strict definition of the Directive.

In our analysis we acknowledge that there is a grey area of waste prevention. We have therefore defined activities and intents that are clearly in scope, out of scope and in this grey area. The following tables (Table 1, Table 2) summarise our broad interpretation of the WFD for the purposes of this work.

Table 1: Description of activities in waste prevention (WP) deemed to be in scope

In Scope

Process modifications, in-process waste minimisation, product/process redesign (including co-operative and contractual action with others in the supply chain) are valid and transparent approaches to WP resulting in lower generation of waste in manufacture, whole/multi-life use or disposal of products. The important point here is that there is a deliberate intent and capability to prevent the arising of the wastes (compare this to demolition where there is no flexibility, for example, to alter the volume arising).

The above are mentioned as valid actions in the WFD.

Examples include:

- **all in-process waste minimisations, in-house solvent recovery (and dedicated toll recovery operations) etc.**
- **closed loop or dedicated supply-chain actions to minimise net waste impact along the supply chain – could involve product or process redesign, change in transfer specs between companies, or creating incentives for user behavioural change.**

Certain classes of WP involve closed loop reuse or remanufacture, involving co-operative action by the end user to close the loop (these are often examples of Product/Service Innovation). Attribution of benefits in waste prevention is shared between the actors.

The above is mentioned as valid action in the WFD.

Reuse or continued use of products (such as drums, IBCs, working office equipment) where these have clearly not reached end of life and do not need preparation for reuse are also included.

There are cases where a business has over-purchased or otherwise not used perfectly saleable product. If this material has been sold on or used in its intended form rather than going to waste, this is a class of WP. Opportunistic 'off-loading' e.g. to charities is out of scope.

Examples include:

- **excess paint, steel beams or timber in construction being sold on.**

Table 2: Description of activities in waste prevention (WP) deemed to be out of scope

Out of Scope

Businesses may be taking steps in dealing with a waste problem associated with residues – although there may be little they can do about the generation of such residues – and instituting further processing steps to recover useful fractions. According to the WFD these are examples of RECOVERY post waste.

Examples include:

- **the reclamation of demolition residues for hardcore substitution off-site**
- **composting of food wastes to create a saleable product**
- **sending residues for general recovery operations.**

Certain classes of waste exchange rely on diversion to by-products with no attempt to mitigate the volume of such wastes. This is grey territory which we will exclude from our core considerations of WP, but may be covered in our sections on cross-cutting themes of **L3m2: Reuse & Material Use Efficiency**.

Examples include:

- **off-cuts and production excess not fit for original purpose sent elsewhere (such as foam off-cuts, sold or not)**
- **casting sands from metal fabrication diverted into construction materials.**

1.4 Context of this Module

This module is the **L1m1: Review Overview Report** which provides some scope and context to the evidence review and a full statement of the findings of the research together with some additional themes that have been abstracted. Those requiring a briefer summary of the work should refer to **L1m0: Executive Summary**; those requiring substantial detail, including references and bibliographic data should refer to the relevant **L2** modules, an index to which may be found in module **L1m2: Report Index**, reproduced in Figure 1 below:

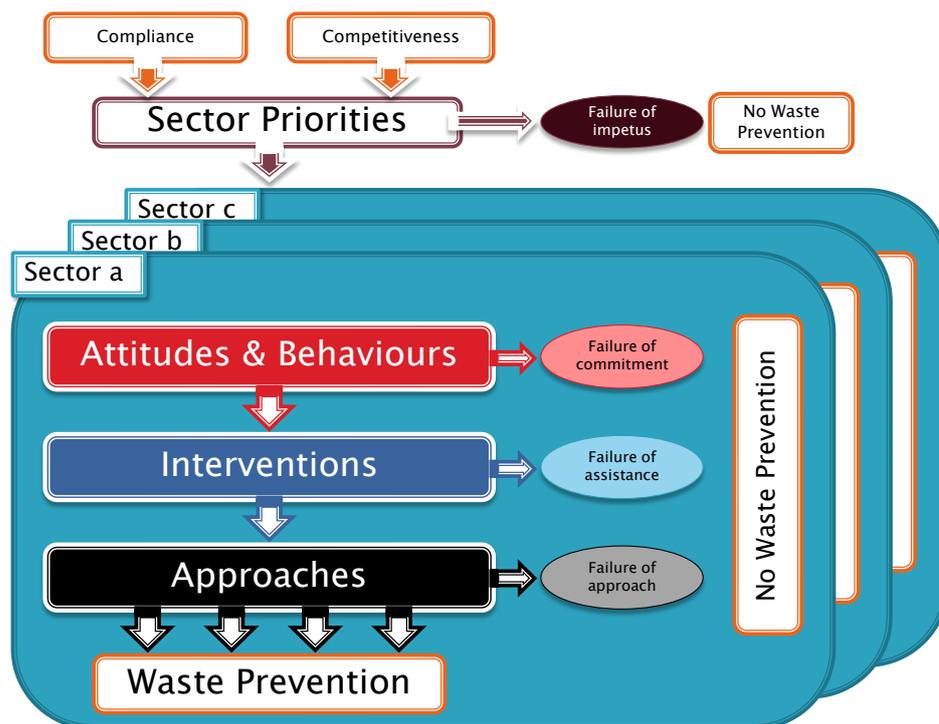
Figure 1: Document map of L1m2: Report Index

WR1403: Business Waste Prevention Evidence Review Report Index	Level 1	Level 2	Level 3	Level 4
	Executive Reports	Full Report	Cross-Cutting Theme	Technical Annexe
Description				
Executive Summary	L1m0			
Review Overview Report	L1m1			
Document Map	L1m2			
Full report modules comprising...				
Introduction (Report Framework)		L2m1		
Approaches		L2m2		
Behaviours		L2m3		
Interventions Introduction		L2m4-0		
Standards		L2m4-1		
Labelling		L2m4-2		
Procurement & Supply Chain		L2m4-3		
Commitments & Voluntary Agreements		L2m4-4		
Communications		L2m4-5		
Incentives		L2m4-6		
Business Support - Waste Minimisation Clubs		L2m4-7		
Business Support - Other Business Support		L2m4-8		
Sectors Introduction		L2m5-0		
Construction & Demolition		L2m5-1		
Food & Drink		L2m5-2		
Hospitality		L2m5-3		
Retail		L2m5-4		
Automotive		L2m5-5		
Office-Based Services		L2m5-6		
Hazard Reduction		L2m6		
Metrics		L2m7		
Self-Motivated Activities			L3m1	
Reuse & Material Use Efficiency			L3m2	
SME Segmentation			Within L2m3	
Review Database				L4m1
Case Studies				L4m2
Historic Materials & Marginal Themes				L4m3
Critical Review				L4m4

2 Analytical Framework

Defra’s specification for the objectives and scope of this report outlined the basic issues that needed investigation. To provide a structure for the research and the reports we developed a framework for analysing and discussing important aspects of the evidence. Figure 2 outlines the chain of ‘events’, starting with basic drivers of compliance and competitiveness, that leads businesses in a sector to engage in waste prevention – or not. Not participating in waste prevention also offers learning and was included in the scope of the project.

Figure 2: Chain of events leading to waste prevention



Source: Oakdene Hollins/Brook Lyndhurst

The remit of the project required one dimension of the analysis to be by **sector**. Figure 2 illustrates that competing demands of regulation and ‘the competitive environment’ will shape sector priorities. Waste Prevention will figure higher or lower in its importance to a business, but the decision to do anything about it will be governed by the **attitudes and behaviours** within a business; depending on the barriers to action, there is likely to be an **intervention** to catalyse the change; if internal drivers are strong enough, this may be taken without any outside assistance, but the bulk of the available evidence deals with publicly funded agencies who provided some assistance. The assistance can enable a business to make a change, which is broadly characterised by one of four **approaches**.

This evidence review has been constructed from the perspective of these four basic aspects. The thread which runs through every aspect is that of approaches, that is, the description of what action has actually been taken. Although these aspects are briefly introduced below in the order in which they appear on the diagram, we have chosen to report them in a different order in the subsequent sections: Behaviours are fundamental and provide context for other differences that occur, including segmentation, notably by differences between small and large enterprises, and appear first; Interventions appear next as they are a logical unit of analysis for policy makers; Sectors follow, summarising specific approaches adopted; and

finally we present Approaches, which provide a somewhat more abstract dimension to framing the weight of activity and a logical pause at the end of the core review.

The four basic aspects were supplemented by a number of additional themes including the measurement of benefits, hazard reduction measures and other cross-cutting themes, such as self-motivation actions and reuse and material use efficiency.

The core sections are briefly introduced below, and expanded further within their respective modules.

2.1 Sectors

This review has concentrated on the learning available from six sectors, two of which (construction and demolition and food and drink) were mandated by Defra. Amongst others, the following general criteria were used as a guide to selecting candidate sectors:

- **Absolute size of the waste stream** – The current waste position can provide guidance for where attention may be focussed in future.
- **State of learning** – The current waste position may not be a good indicator of impacts where resource measures have already been effectively implemented.
- **Supply chain position** – Drivers and barriers will vary according to how basic, how near the consumer or relative strength within the supply chain of the relevant agents.
- **Transferable learning** – Could the lessons derived be reasonably applicable or applied to businesses in similar environments? This might also include a sector rich in SMEs to better reflect the general structure of the economy.

With these in mind, the following four sectors were chosen to supplement the first two:

- **Retail** – This is an important sector both from the volume of activity and the high profile within the consumer's eye; in the case of large retailers, there is clear evidence of their power to force change back up the supply chain through Lean initiatives and purchasing power. It is also amenable to voluntary approaches to change, and shows the power of labelling, such as Ecolabel and energy rating (plus a plethora of international initiatives such as EPEAT, Nordic Swan, etc). Retail cuts across a number of materials and product manufacturing supply chains, representing the point of delivery of these to the purchaser or user. It is an important target of study because of the often considerable power that is wielded at this point.
- **Hospitality** – Hospitality is, like retail, the point of delivery of a number of services, including some delivered from the food and drink sector. However, it is wider than this, representing not only restaurant services, but also business and corporate catering, event management, hotels and others. Hospitality and retail have been identified by WRAP and its agents as important targets for change, resulting in significant numbers of waste management initiatives and prototype procurement standards.
- **Automotive** – This is a large sector with an intense focus on in-process efficiency driven by cost. Many prevention measures have been implemented including platform design, lean manufacturing and chemical waste management. The large automotive brands are relatively close to consumers, but also wield considerable power over the behaviour of the supply chain. This sector is likely to be rich in successful case studies of varying and quantified waste prevention approaches.
- **Office-Based Services** – This sector contains a high proportion of the SMEs in the UK economy and is representative of the knowledge-based and other 'back office' functions prevalent in service economies. It therefore provides an element of benchmarking for the progress of waste prevention practices in this area.

2.2 *Behaviours*

Behaviours can be expressed at a number of levels from individual to corporate. For example, the four approaches described above each imply a different focus for behaviour, and the relevant attitudes and barriers to action. The review has explored other aspects – including the impact of company size – where supporting evidence could be found. Behaviours are examined on a particular framework and have been discussed using the four dimensions of:

- **Attitudes** - What is the mind-set of the business or user under consideration? What are their beliefs and backgrounds that shape their behaviours, especially receptiveness to change?
- **Barriers** - What are the institutions and systems that prevent considering taking action? These could be internal or external to the company, physical or managerial, perhaps as a result of attitudes.
- **Motivators** - What are the key forces or triggers for taking action?
- **Enablers** - What systems, processes or assistance catalyse waste prevention action?

2.3 *Interventions*

Some businesses adopt waste prevention measures voluntarily or at least because of their own assessment of the economic and legislative pressures upon them. This work does consider those companies where evidence has been found, but largely focuses on businesses that required some incentive, assistance or catalysing agent to make changes happen. Such assistance can take a wide variety of forms ranging from the simple provision of self-help information and tools, direct promotion of opportunities, business support in many guises including consultancy, waste minimisation clubs and materials exchanges, grants for R&D or capital goods, procurement strategies, standards and labelling, and the use of pricing mechanisms such as landfill tax or PRNs.

Apart from the purely voluntary motivation, we identified the following classes of intervention and which form the basis of our analysis:

- Standards
- Labelling
- Procurement
- Commitments & Voluntary Agreements
- Communication
- Incentives
- Business Support through waste minimisation clubs
- Business Support by other means.

The last category embraces a mixture of approaches including consultancy, helpline support, case studies, guidance documents and on-line self-help.

2.4 *Approaches*

In considering the categorisation and review of reports, a number of approaches to waste prevention became apparent and as presented in Figure 3. Of course, in reality, these four approaches all exist together and therefore some organisations are taking more than one approach to some degree. (For this reason, the evidence reviews of the sectors also include the category 'Mixed Approaches' which describes some more complex, blended approaches by businesses.)

It is important to note that the approaches we describe are also applied by businesses to tackle other 'resource' priorities, environmental or otherwise; they have not been invented simply for this work. In

fact, they are compatible with a framework proposed independently by Tukker.^a In summary, the approaches, interpreted in the waste prevention context, are:

- **Waste Minimisation** – A concentration on good housekeeping and material efficiency, usually without radical changes to processes and systems.

To maintain breadth in the search, other familiar and related terms and initiatives are relevant such as: ‘waste prevention’, ‘resource efficiency’, ‘zero waste’, ‘halve waste’, ‘Lean Manufacturing/production’.

- **Clean Operations** – Adoption of new systems, chemistry and engineering to transform the production steps into a lower impact system, possibly involving the way businesses co-operate with suppliers or customers.

Common related terms – ‘cleaner operations’, ‘clean production’, ‘clean processing’, ‘zero emissions manufacturing’, ‘green chemistry’.

- **Green Products** – Stepping back to a wider view of the product, trading its impacts in different part of its life cycle to minimise overall environmental damage.

Common related terms – ‘greener products’, ‘eco-design’, ‘design for environment’, ‘low impact design’.

- **Product/Service Innovation** – Considering supply of a product, or use of the product in a new way; perhaps leased, delivered as a service, given extended life, or returned for reuse or remanufacture. Requires co-operation between user and manufacturer to ensure supply and return is effective.

Common related terms – ‘product/service systems’, ‘servicisation’, ‘servitization’, ‘product life extension’, ‘take-back’, ‘closed loop manufacture’, ‘remanufacture’, ‘reuse’, ‘business model innovation’, ‘dematerialisation’, ‘revalorisation’, ‘impact management’.

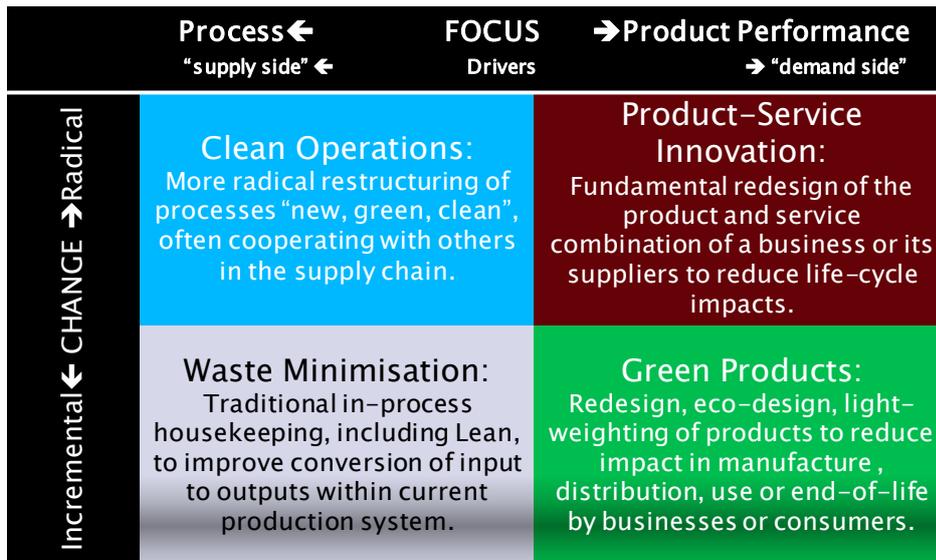
These four approaches have been positioned within the matrix of Figure 3 aligned along two dimensions of Focus and Change.

- **FOCUS** broadly partitions the approaches into those that concentrate on processes, that is, the mechanics and efficiency of transforming materials from inputs to outputs; and those that are product or performance related, that is, the use of products in service. An equivalent view is that process is “supply side” driven, whilst product/performance is “demand side” driven.
- **CHANGE** broadly characterises the complexity and nature of the actions taken between incremental changes that work within established production systems or customer engagement models; to radical changes that transform either the manufacturing process or the basis of delivering service to the user.

These are rich themes that are characterised in greater detail within the Approaches section and the dedicated Approaches module.

^a Tukker, A. Chapter 1 pp13, Footnote 1 in Tukker, A., Tischner, U. (2006) ‘New Business for Old Europe’, Greenleaf, Sheffield: quoting Simons et al. (2001) ‘The Fourth Generation: New Strategies Call for New Eco-Indicators’, Environmental Quality Management, Winter 2001:51 : “In general, ones sees in environmental policy a downstream shift in focus through the production–consumption chain. The first-generation environmental policies focused on remediation and emission reduction via end-of-pipe technologies. The second generation paid more attention to inherent cleaner production. The third generation included an attention to products. And the fourth generation takes final user needs as a starting point, looking at how production-consumption systems can be organised so that these needs can be fulfilled with the least environmental impact”

Figure 3: Positioning of approaches in response to business drivers including waste

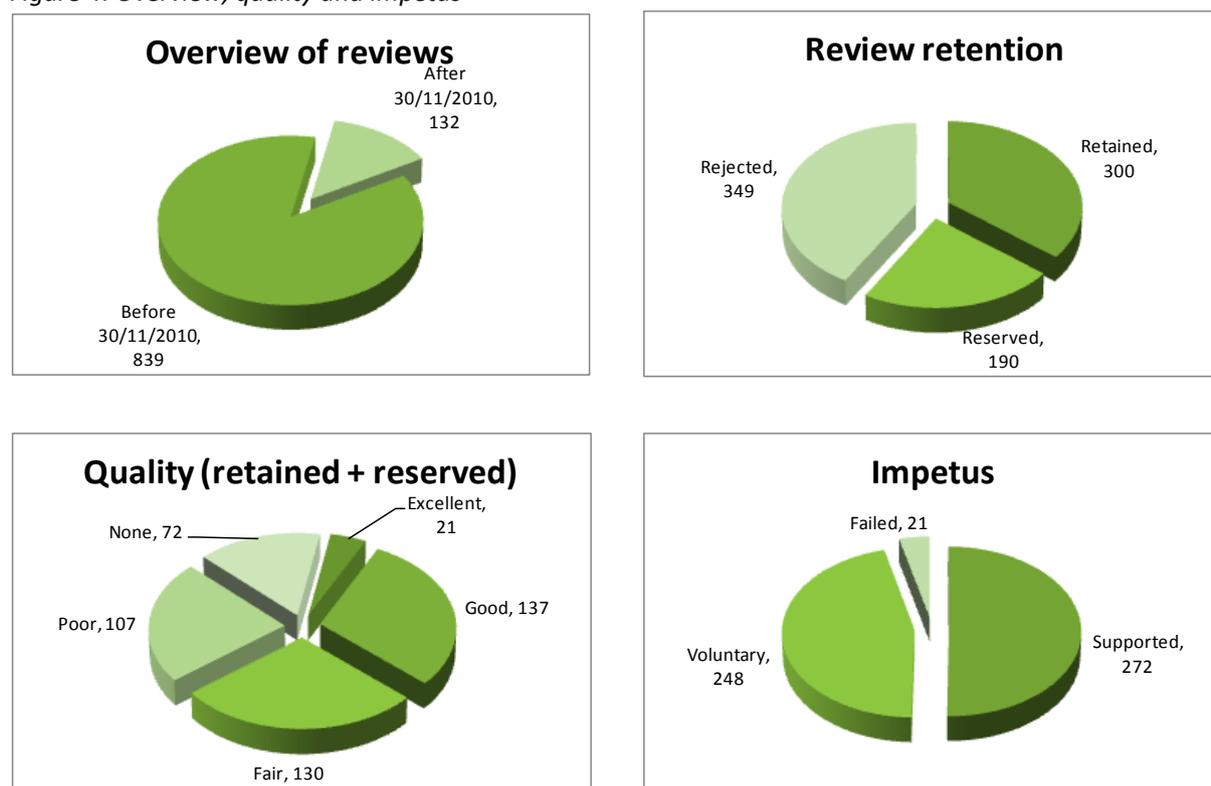


Source: Oakdene Hollins/Brook Lyndhurst

3 Evidence Review Statistics

This section provides a brief overview of the evidence review database through some rudimentary statistics. Except for the first chart of Figure 4, these are based on reports analysed by the end of November 2010. As indicated in the first chart, further reports were added later where highly relevant, but the overall messages of the charts are not materially affected.

Figure 4: Overview, quality and impetus

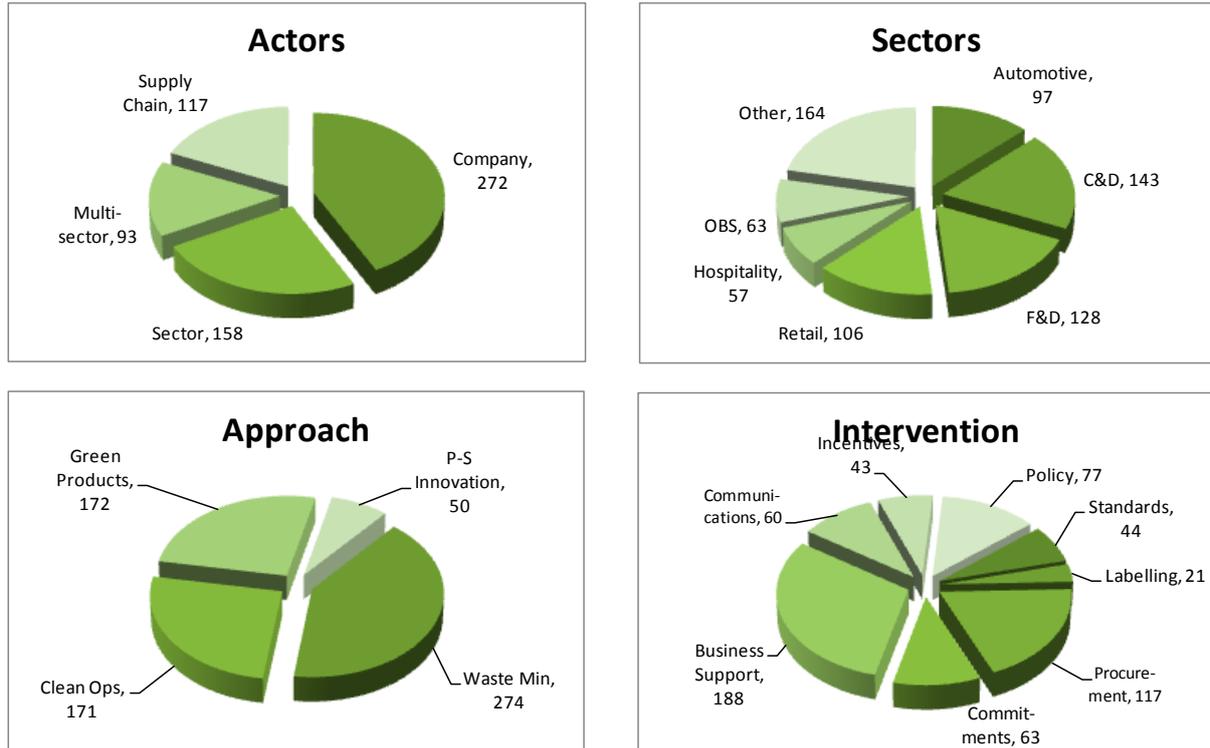


Source: Oakdene Hollins/Brook Lyndhurst

The charts of Figure 4 show the following:

- The total number of reports and documents reviewed and abstracted both in the primary review period up to end November 2010 and from that point until end February 2011.
- The number of reports:
 - Retained as being in scope, relevant and of useful quality
 - Reserved as being relevant, but not retained because insufficiently evidenced or a repetition of better sources. (These may have been selectively used to augment first draft materials once retained sources had been considered.)
 - Rejected for being out of scope or quality.
- Of the reports retained and reserved, the distribution of reports by quality assessment (ranging from 'Excellent' for well researched, methodologically robust and pertinent; 'Good', 'Fair', 'Poor'; and 'None' for materials providing background or contextual information rather than evidence).
- Of the initiatives examined in the retained and reserved reports, whether the waste prevention actions were purely voluntary, catalysed with outside support (Interventions) or, indeed, failed.

Figure 5: Actors, sectors, approaches and interventions



Source: Oakdene Hollins/Brook Lyndhurst

The charts of Figure 5 show the following:

- **Actors:** What was the centre of gravity of the action?
 - Company – actions by companies on their own e.g. own product redesign.
 - Sector – concerted action by a group of companies within one sector e.g. Courtauld commitment.
 - Cross-Sector – concerned with actions by a group of companies spanning sectors e.g. Halve Waste to Landfill commitment.
 - Supply-chain – concerned with actions by two or more companies in supply chains e.g. Some of TSB’s Zero Emissions Enterprise R&D projects.
 - Some combinations can appear together e.g. Supply-chain + Sector, but Company actions are always alone.
- **Sectors:** The number of reports found for each sector. The availability of evidence is clearly heavily weighted to much-supported sectors such as construction and demolition, and food and drink.
- **Approach:** Categorisation of waste prevention actions according to our framework. The weight of documents is heavily biased to waste minimisation within businesses. Product Service Innovation much less apparent. Green Product initiatives are dominated by a limited number of light-weighting and packaging ventures.
- **Interventions:** Categorisation of the support mechanisms used to catalyse action. Business Support and Procurement mechanisms are well represented, Standards and Labelling least seen. This clearly reflects the emphasis of public support over the last decade.

Figure 6: Company size and geography



Source: Oakdene Hollins/Brook Lyndhurst

The charts of Figure 6 show the following:

- **Segmentation** - Predominantly, the split of reports by reference to Large Enterprises, Small-Medium Enterprises and Very Small Enterprises; other differentiating characteristics were noted but thinly evidenced. Although SMEs are well referenced in the reports, differentiation of their features from those of Large Enterprises is rarely drawn out in reports that we located.
- **Geography** - The prime focus of research was the UK, but around one third of the reports were actually sourced from outside the UK including USA, Germany, France, Australia, New Zealand, Canada and Finland as well as OECD and pan-European communities.

4 Findings: Overview

4.1 General Observations

Across all areas, this review has been largely based on case studies and examples generated by agencies charged by Government with assisting businesses to prevent waste.

When we say ‘prevent waste’ we actually mean ‘to achieve a range of benefits variously branded as resource efficiency, waste minimisation, process efficiency, waste exchange, recycling, reuse and other terms’. These terms can describe genuine facets of waste reduction, but are also used interchangeably, which adds to confusion of interpretation. What is clear is that most literature does not either address or separately describe waste prevention activities in a way that allows a comprehensive and unambiguous assessment of practices.

For one, behavioural issues – attitudes, motivators, barriers and enablers – are largely absent; reports concentrate on headline benefits without a context for the decisions made, changes to be managed, assistance required or approaches taken. Materials generally report bare outcomes rather than being a means of engaging businesses who might replicate the successes by drawing parallels with their own circumstances. The absence of reports of failures is important in this respect since failures can identify genuine weak links in the process of recognising the value of waste through to embedding changes to practices, technologies, products and business models that have enduring benefits.

The reporting of case studies could benefit from standardisation of approach in the same way that tendering and purchasing proformas and business plans are expected by Government, for example.

Measurement of waste prevention is both critical in making the business case for the expenditure, and also extremely challenging – how do you measure waste that you do not generate? Issues of language and definition are important here, but there are other complications due to the generally increasingly diverse basket of measures required by agencies. Both these aspects are described in the section on caveats below.

It is also clear that businesses are subject to a range of legislative and commercial pressures of which waste prevention is only one component. This means that waste prevention might legitimately be de-prioritized by businesses whilst still achieving net environmental benefit by tackling other resource efficiency measures, such as through energy or water.

4.2 Caveats

In compiling this review, we wish to draw attention to its various limitations imposed by time; these impact on the amount of material that could be sourced and reviewed, the scope of the aspects covered, and the degree to which one-off, near-scope issues could be referenced.

- **Scope** – Waste Prevention (WP) has been treated with a relatively strict adherence to the Waste Framework Directive intent. We acknowledge (as does the legislation) that there are grey areas between what is strictly in and out of scope, and we have tried to be clear about these.
- **Inference of behaviours** – There is relatively little good literature concerned with corporate and individual behaviours in business waste prevention. We have tried not to make unsupported inferences about behaviours from the outcomes reported.

- **Time constraints in sourcing** – Limited time available to complete this project means that some relevant sources may have been missed.
- **Self-selected reporting** – The evidence found may to some extent have been self-selected, due in part to the emphasis placed by agencies charged with assisting businesses on promoting positive outcomes; on the other hand, there are limited benefits to companies to reporting the payback of internal, voluntary initiatives. Where available they usually target stakeholders other than interested government agencies or other companies who might learn from them, and are seldom cast as waste prevention. In mitigation there have been a few organisations generating independent case studies and assessments, such as Earthshine.
- **Disaggregation of waste prevention** – WP is seldom reported as a stand-alone but is often included within other waste or materials activities. Separating benefits and linking them to specific actions is therefore difficult.
- **Language shifts** – The language of businesses, public sector agents, consultancies, NGOs and activities has shifted over time making it difficult to compare activities and results. In addition, searching for ‘waste prevention’ generates many hits on activities such as recycling and diversion from landfill that are often confused with the true scope of this review.
- **Metrics shifts** – In parallel with the language, the types of measures of benefit have evolved to embrace, in general, a wider range of impacts. CO₂ emissions are highly topical, but are outside the strict scope of this work. Metrics also reflect the interests of funding agencies, which have become more diverse, and these measures may well address different needs than those of the businesses. This is covered further in Section 10.

4.3 *Presentation of Findings*

The following sections aggregate findings from the major elements of the report. For each section there is a brief overview of the topic area and subsections where relevant. The evidence is then presented in three categories:

- **Learning** - The most strongly evidenced aspects of the review presenting the firmest learning and basis for policy development.
- **Insights** - More interpretive aspects which add colour, the less firmly evidenced findings and possible implications for future action.
- **Research Gaps** - Areas where the team believes that evidence is lacking and could benefit from further research. This is distinct from areas where evidence is suspected to exist, but could not be located within the scope or time of this project.

5 Findings: Behaviours and Attitudes

Attitudes, motivations and behaviours are themes which run throughout this review, both with respect to the approaches to waste prevention evident in each sector and the way in which businesses respond to different interventions. This overarching section is concerned with the evidence sources that have studied attitudes and behaviours explicitly, which most commonly relate to SMEs though a number of studies are generic.

The direct evidence on business attitudes and behaviours to waste prevention is highly fragmented and partial. Where evidence specific to waste prevention was found to be scarce, the review drew from nearby domains, such as pro-environmental behaviour and resource efficiency to provide further insight. The research team developed a three-by-four matrix of key influences on business behaviour at different levels within organisations in order to classify and provide some coherence to the evidence found. The dimensions of the matrix comprised:

- Individuals, organisation (corporate), external institutions;
- Ethos and values, roles and relationships, resources, and contextual factors.

Learning

- **The overall prevalence of business waste prevention behaviour is uncertain.** Survey data on business waste prevention behaviour gives mixed indications of prevalence. There is some evidence that awareness of and perceived importance of waste prevention or resource efficiency increases with size of business.
- **Motivations for and barriers to business waste prevention are not fully understood.** No studies were found that had used a systematic or theory-based approach to examine the behavioural drivers of waste prevention in business, including the relative importance of different drivers. We do not have a full understanding of the motivations for and barriers to business waste prevention although inferences can be made from the weight of evidence for different aspects.
- **Cost is an important influencing factor although the true costs of waste are not always transparent to businesses.** Poor conceptual understanding of waste prevention by businesses appears to be at the root of a number of the identified barriers – particularly those related to understanding of and attitudes towards costs and cost savings.

Two key aspects likely to influence business decision-making with respect to waste prevention are potential cost savings and the implementation costs of changing processes. Businesses – especially SMEs - may not be able to judge either accurately. Because businesses tend to associate ‘waste prevention’ with an ‘end-of-pipe’ issue and not with improvements in efficiency and productivity, they often fail to appreciate the full embedded costs in waste. (Waste prevention offers larger financial and CO₂ savings than diversion since it eliminates not only disposal costs, but also unnecessary raw material manufacturing, processing, shipment etc. One study in the retail sector estimated that savings of £627 per tonne from prevention compared to £70 from diversion.) In turn, this can create sceptical attitudes to the idea that they can make net financial savings through waste prevention.

The evidence base does not provide a good understanding of how considerations around cost savings and investment interact with other behavioural drivers, including social aspects such as corporate ethos and culture.

- **Regulation is a key motivator for reducing the hazardousness of waste.** The evidence suggests that reducing the risk of prosecution or penalties is an important motivator for businesses to reduce the hazardousness of waste – though none of the evidence reviewed to date concluded whether this risk avoidance behaviour takes them beyond compliance.
- **Corporate culture and leadership can drive waste prevention.** The evidence suggests that corporate culture can play a key role in facilitating or inhibiting waste prevention within businesses, especially in SMEs. The prevailing collective attitudes, values and norms embedded in structures and processes appear to be more powerful driving forces than individual attitudes, values and norms: people’s behaviour in the workplace tends to conform to the corporate culture.

Backing from business leaders can validate the decisions made by managers and the way operations are run by staff. While the evidence suggests that leadership and a positive corporate culture can motivate business waste prevention, it is not clear whether these factors act as actual motivators – driving waste prevention – or as facilitators or enablers.

- **Engaging SMEs in waste prevention:** A number of generalisations can be made about SMEs based on the evidence reviewed (though it needs to be borne in mind that the SME definition covers a diverse array of sectors and company sizes, and much of the literature is concerned with the smaller SMEs):
 - *Key barriers* relate to negative attitudes, awareness and understanding of waste prevention (in particular related to the ‘true’ cost of waste), lack of resources (staff capacity, skills and expertise, and access to capital), lack of external pressure and a sense of powerlessness with respect to both customers and suppliers.
 - *Key motivations* relate to positive attitudes of the owner-manager, cost saving opportunities and compliance with legislation/regulation.
 - There appears to be no ‘silver bullet’ in terms of how best to engage SMEs on waste prevention, although there is some evidence that supply-chain initiatives can be effective in addressing some of the barriers highlighted above.

Insights

Waste prevention needs to be moved up the decision-making hierarchy

Waste is to some extent seen as inevitable, but it is also associated with costs and minimised as part of ‘good housekeeping’ – though with the caveat that the true costs of waste are often poorly understood (refer to the learning point above).

The language of policy, regulation and communications plays an important role here in framing how businesses think about what they should be doing. Terminology such as ‘waste prevention’ may inadvertently focus attention on waste products; businesses then gravitate to solutions that deal with end-of-pipe waste through recycling and landfill diversion rather than by upstream changes in products and processes that can tackle these problems at source.

By contrast, the language of ‘profitability’, ‘efficiency’, ‘productivity’ and ‘wastage’ is likely to be more successful at drawing businesses’ attention to strategic decision-making than the language of ‘waste prevention’, which is technical and operational. The key challenge is not how to drive waste prevention behaviour as such, but how to encourage decision-making behaviour that drives waste prevention.

The right tools and mindsets are required for decision-making to prevent waste

While a number of case studies have been developed by business support programmes to help businesses understand the benefits and investment costs of undertaking waste prevention, these are sometimes criticised by business as being too generic. There is a need for a wide range of information and advice, which is transparent about the implementation costs as well as benefits, which is tailored for:

- Businesses in different sectors, of different sizes, with different resources and capabilities, and with respect to specific processes;
- Individuals at different levels or in different roles within individual businesses (for example, finance directors need different kinds of information from operations managers).

Waste prevention guidance tends to focus on the technical aspects, and there is a lack of complementary guidance on how to drive behaviour change. There is some evidence that businesses with a mindset that embraces action learning and continuous improvement may be more likely to utilise these human factors in a positive way, and to be more successful at developing the kinds of decision-making processes that drive waste prevention.

Recycling behaviour can create a barrier to waste prevention

There is limited evidence that existing recycling behaviour can create a barrier to waste prevention behaviour by businesses, either because the business considers it is already 'doing its bit' by recycling or because of sunk investment costs in recycling technology.

Research gaps

- **Assess the prevalence of waste prevention behaviour:** In order to determine the prevalence of waste prevention behaviour within businesses, there is a need to develop research methodologies that capture actual waste prevention behaviours. Better, clearer, survey questions are required to elicit accurate information on the prevalence of true waste prevention, as distinct from recycling or reducing waste to landfill.
- **A systematic assessment of motivations and barriers for true waste prevention:** There is a major evidence gap in relation to a systematic examination of the prevalence and relative weight of motivations and barriers for true waste prevention that is framed by theories of behaviour and socio-technical change. Such research would help improve understanding of the relative weight of human as well as technological dimensions in sparking behaviour change and creating long-lasting changes.
- **Language testing:** The evidence review highlighted a number of issues around language, suggesting that messages about efficiency and productivity may be more effective than messages about waste prevention. Language testing to identify the terminology that appeals to businesses may be worthwhile in order to develop effective calls to action on waste prevention. Research could build on the initial findings from Defra's forthcoming *Improving Communications with SMEs* (1), a draft of which was provided for this review.

6 Findings: Interventions

6.1 Standards

A standard is an agreed, repeatable way of performing an action. It is a document that contains criteria designed to be used as a rule, guideline, or definition. Standards are designed for voluntary use. However, laws and regulations may refer to certain standards, and make compliance with them compulsory.^a The range includes:

- **ISO** – formal standard created and maintained by the International Standards Organisation.
- **BS (British Standard)** – the national equivalent of an ISO standard.
- **PAS (Publicly Available Specification)** – issued by BSI in consultation with users, but taken up voluntarily. This is often seen as a taster, a precursor to a full standard, and has been employed extensively by WRAP in recycle specifications such as wood, compost and tyre crumb.
- **Sector-based standards and codes of practices** – these are by voluntary agreement within a sector and can entail some sort of qualification, audit or label. Self-assessment schemes are widespread, such as the US EPEAT scheme for environmentally sound computing equipment.
- **Community based guides and codes of conduct or practices** – these may be developed by a ‘community of interest’ to regulate activities, often for reputational reasons, or to become a *bona fide* community member. An example of this is the Furniture Reuse Network’s on-line white goods repair and recycling guides aimed at embedding sound member practices.
- **Internal company guides** – usually as an adjunct to a management system, but commonly employed in engineering applications and processes to support compliance with health, safety and good design and operating practices. However, these also extend to the softer systems of CSR and ethical trading.

Within this report, individual internal company standards have not been considered to any depth due to lack of defined boundaries and documentation on their benefits.

Standards concerned with waste management have largely focused on developing appropriate specifications for the reuse and recycling of waste or landmark work developing carbon foot-printing^b rather than on waste prevention interventions. Examples include WRAP’s efforts on developing Publicly Available Specifications, which have been successful but which focus on improving the quality of recyclates such as glass, tyres, compost, wood and plastics.^c Such activities are out of scope in the current work.

Evidence for the efficacy and scope of standards to address waste prevention is correspondingly sparse. Identified evidence almost exclusively examines diversion from landfill, or is ambiguous in the use of waste prevention. However, it does appear that standards have some effect on waste prevention, but there is uncertainty on quantifying these effects.

Learning

- **The majority of evidence on standards with respect to waste prevention is associated with use of Environmental Management Systems.** EMSs do not explicitly require waste prevention activities, but this need can be implied under certain criteria. There is good evidence that EMSs reduce waste

^a <http://www.bsigroup.com/>

^b <http://www.footprintexpert.com/PCFKB/Lists/kbdocuments/Guide%20to%20PAS%202050.pdf>

^c <http://www.wrap.org.uk>

arising. However, the reports do not permit distinction in attribution between landfill diversion, waste minimisation and waste prevention.

- **The sustainable procurement standard is being taken up more widely in business as evidenced by a number of case studies, although the benefits are not well quantified.**

Insights

Due to the timeframe for development and implementation of new standards, it is likely that there will be a significant lag between publication and the appearance of good supporting evidence of impacts on waste prevention.

There are strong links between labelling and standards: labels generally require either formal or informal standards as award criteria.

When implemented, EMSs are commonly applied to target a wide range of environmental impacts, not just single issues. A strong enabler appears to be the linkage in managers' minds of environment, financial benefits and associated competitive advantage. However, the communication of environmental priorities both externally (customers and suppliers) and internally (between environmental and other functions) needs careful attention.

With respect to EMAS uptake in Europe, a financial incentive (as an output) rather than technical support (as an input) was deemed more valuable.

Research Gaps

- **Examine the need for a new environmental standard aimed at the service sector.** ISO 14001 is perceived as a standard for the manufacturing industry, uptake by the service sector is low; there may be a need to look at developing a service-sector specific standard for reducing environmental impact. **N.B.** A prior project WR1401 has explored the potential of standards in waste management and may have relevance.
- **Specific research into the role of EMSs on reduction in waste generation is needed.** Although there is inferred evidence of waste prevention, there is little evidence of EMSs preventing waste.
- **Learn from procurement:** Understanding the drivers that made the sustainable procurement standard successful may be useful in the development of new standards.
- **Examine what learning may be available from the voluntary IEMA standards.** Within the time of this review we were unable to conduct any significant examination of the Institute of Environmental Management & Assessments (www.iema.net) guidance and outcomes.

6.2 Labelling

In this review, we have used a broad definition of a label. Classically, labels that display environmental credentials are self-contained, verified either independently or by the producer of the product, and are often intended to differentiate the product from a competitor's. They can require performance benchmarks to be reached before a permit to display the label on the product is issued and as such are closely related to standards (both formal and informal).

A primary aim of labelling is as a driver to enable consumers and purchasers to differentiate similar products. The term 'product' is taken to mean any sold item whether it is a discrete finished item or a bulk intermediate material or even a service. In the context of this document, labelling has been viewed as a means to inform purchasers regarding environmental or sustainability choices. In doing so, labelling provides three key functions: Informing consumer choice, promoting economic efficiency, and stimulating market development. In addition to labelling schemes where they are used to differentiate between products, this report also references classes of label that can enable waste prevention, such as corporate brands.

The majority of identified labelling schemes address other environmental issues, namely energy efficiency, ethical food sourcing and sustainable timber. Of those which related to waste prevention, they generally focused on hazard reduction and recyclability of the product or packaging. As a result, this report extrapolates from these types of applications to speculate on the application to waste prevention.

Learning

- **There is evidence that labelling does reduce overall environmental impact of products.** However, there is sparse evidence of the effect of labelling on improving waste prevention. This is largely because waste prevention is not the primary measure, or reductions in waste generation are difficult to measure accurately.

Insights

Labels are most valuable when they have clearly defined standards to back up the environmental claims.

Although the effects of waste prevention are not direct, we infer that labels have driven down hazardous waste since this is the target of much of the rationale of, for example, EU Ecolabel.

The understandable difficulties associated with measuring, controlling and evidencing waste prevention means that developing a label for use on a product is likely to be difficult. In contrast, using labels to inform users of waste prevention activities (either during use or at the end of life) appears to be a more achievable aim.

Research Gaps

Two significant gaps have been identified:

- **Waste prevention has not been a focus for the majority of studies** examining the effect of labelling on the production phase of a product's lifetime. Further research is needed into the effect of producer's compliance with labels on waste prevention, particularly for EU Ecolabel where the agenda and remit closely match that of waste prevention.
- Whilst we have found evidence that labels can be used to reduce waste by purchasers, there appears to be **little research on effectiveness of labels in preventing waste during manufacture.**

6.3 Procurement

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" (2)^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 (3 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) (4 p. 41); or services in a closed loop. Alternatively, the organisation may decide to go without the product or service altogether, again preventing waste.

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.

While both forms of procurement prevent waste in the supply chain, the evidence reviewed here indicates that it is use as a driver of external change that 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.

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

^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.

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 the supplier's behaviour.

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.

The cost of a product or service, its functionality and perceived quality are key aspects of any procurement decision (5). 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 using 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

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. Similarly, appraisal techniques such as whole-life costing and discounted cash flow can encourage purchasers to avoid short-termist decision-making.

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" (3 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)'" (6 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.

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 the construction sector.

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

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 (OSM) 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.**

6.4 Commitments

Commitments are overt statements made in respect of 'signing up' to a waste prevention initiative, policy or philosophy. Researchers have grouped them into four main types: Public voluntary programmes; negotiated or bilateral agreements; unilateral commitments; and private agreements. Commitments as defined in the present review generally have the following features: voluntary; measurable; time-delimited; and auditable.

A key strength of voluntary initiatives such as commitments, as identified in a 2003 research paper, "is the flexibility afforded to participants which then enables them to respond innovatively in ways most appropriate to their own type of business" (7 p. 8). Mandatory targets and regulations tend to be too rigid in their prescriptions which sometimes dictate specific actions to be taken. In the context of this project, commitments should be viewed not only as interventions in their own right, but also as an enabling factor used in concert with other interventions. The most obvious example is their role in facilitating sustainable procurement (see Section 0).

This report assessed the evidence for waste prevention from voluntary initiatives only. However, mandatory instruments such as the UK's Carbon Reduction Commitment are also likely to have an impact in the future.

Learning

- **Since the 1990s, a large number of commitments and voluntary agreements have been launched with relevance to waste, but few explicitly target waste prevention.** Generally, the commitments focus on landfill diversion, with prevention an incidental outcome – this despite signatory companies and government bodies emphasising the importance of the 'waste hierarchy'.
- **There is evidence that commitments have resulted in some hazardous waste prevention.** Evidence is good for commitments driving Waste Minimisation, Clean Operations and Green Products approaches, but very few examples were found of Product/Service Innovation.
- Many of the examples come from the following three commitments:
 - the Food & Drink Federation's Five Fold Ambition
 - the Courtauld Commitment
 - WRAP's Halving Waste to Landfill.
- However, **good evidence of waste prevention has also been found as a result of other commitments** made both in the UK and overseas. Although most commitments have been developed by government bodies - often in close collaboration with trade associations – many unilateral or in-house commitments have been made (such as Marks & Spencer's Plan 'A').
- **Businesses appear generally favourable to commitments and voluntary agreements as a waste prevention intervention – although this may be less true for SMEs.** Key motivators for businesses

include CSR and customer pressures, a desire to engage with national policy, the opportunity to make financial savings and the implicit ‘threat’ of legislation should they refuse to participate. Few barriers to involvement were found except perhaps a lack of capability within individual companies to fulfil their commitments. In terms of behavioural aspects, much of the evidence centred on enablers: key success factors included the engagement of sector leaders and relevant trade associations.

- **WRAP’s engagement with the retail sector, particularly in its support of the Courtauld Commitment is notable.** The latter has resulted in numerous examples of waste reduction through packaging re-design.

Insights

Commitments and voluntary agreements appear to be successful because they adopt an inclusive, non-confrontational approach to delivering change while at the same time ‘keeping the door open’ for legislation. The implicit threat of regulation can motivate companies to sign up to commitments. However, the fact that signatories with an eye on their public image can claim that they are acting voluntarily rather than as a result of regulatory pressure is a powerful driver for their involvement. In addition, companies use their own initiative and skills to deliver the necessary innovations rather than having to follow prescribed measures, which provides valuable material for CSR reports.

Commitments and voluntary agreements have been most successful in industries where a few large companies dominate the sectors and can drive change across entire supply chains. Commitments are perhaps therefore most likely to work when applied to other sectors and products with similar structural conditions. Larger players seem more inclined to act in unison as they have greatest power and opportunities to cut waste in their own operations and elsewhere in the supply chain. Smaller companies appear less likely to sign up for commitments or indeed respond to any forms of voluntary intervention. However, change is still likely in smaller firms, albeit at a slower pace, as an indirect result of the engagement of the sector leaders. By contrast, additional regulation might be viewed as burdensome by businesses, particularly smaller ones which are often less well equipped to adapt than their large competitors.

Signatories tend to underplay the financial motives for signing up to commitments as public statements to this effect could undermine the public relations value of their involvement. However, few if any of the commitments reviewed in this report would result in a net financial loss to a signatory. It is probable that commitments would be less successful if this were the case.

The regular independent monitoring of a commitment is important, but this needs to be balanced as too onerous an auditing regime may dissuade companies from joining or persevering with a commitment.

Once established, the most successful commitments seem to ‘take on a life of their own’ with more and more businesses signing up. A 2005 report on the Mayor’s Green Procurement Code (MGPC) predicted that, as more signatories were attracted to the MGPC, “it would gain further momentum and kudos” with potential signatories joining “to avoid being ‘left out’, leaving their competitors with a competitive advantage”. Brook Lyndhurst, the paper’s author, recommends “concentrating on attracting those parties most interested in the issues” with companies more resistant to the MGPC being “drawn in over the longer term” (8 p. 41). This recommendation would apply more generally to any commitment.

Research Gaps

We identified one significant gap:

- **Valuable insights are likely when results of Courtauld Commitment Phase 2**, launched in March 2010, **become available**. In addition to taking a whole supply chain approach, Phase 2 moves away from solely weight-based targets and examines carbon impact.

6.5 Communications

Communication initiatives encourage initial engagement, they help to reinforce early change, or they encourage further change in those already engaged and are generally part of wider engagement programmes. This aspect of the report focuses on the messages and channels used for communication with businesses, whether as part of awareness raising, marketing, information transfer or other activities.

For the purpose of the review, the key objectives of business communication on waste prevention can be summarised as:

- to raise awareness of waste prevention
- to drive uptake of and recruitment to specific support programmes and initiatives
- to support ongoing engagement and long-term behaviour change.

Given the limitations of the available evidence, and in order to draw out key messages relevant to the effectiveness of communication initiatives, we have drawn on the wider literature relevant to communication with businesses, especially SMEs, on environmental issues. In particular, this includes the forthcoming report on research conducted during 2010 by Brook Lyndhurst for Defra titled *Improving Communication with SMEs – a review of six sectors* (1). Moreover, a number of surveys have been used to elicit SMEs' level of awareness, preferences and priorities when it comes to waste prevention communications.

Learning

- The literature search revealed **highly fragmented and limited evidence of communication initiatives** that directly addressed waste prevention behaviour in businesses.
- **There is strong evidence that communication can be used effectively to drive recruitment to business support initiatives** but the evidence is not robust enough to make conclusions on the impact of specific waste prevention communications on awareness raising or long-term behaviour change. There is sparse evidence of any effects on driving voluntary action.
- **'Cost' is an effective 'hook' in communications** but the effectiveness of this approach is heavily influenced by a lack of understanding and scepticism towards cost-saving opportunities from waste prevention, especially in SMEs (discussed under Attitudes & Behaviours). Even where waste prevention is a key objective of communication, businesses may not recognise that waste prevention goes beyond recycling or compliance with legislation – actions they may already be taking. However, the evidence does not tell us how prevalent this perception is amongst businesses. Waste prevention needs to be clearly framed so as to speak to different business audiences.
- **Distant, mass communications (such as email, online) alone seem to have limited traction or influence on changing behaviours**; businesses generally appear to respond better to some form of direct (such as face-to-face, telephone) contact or support, in particular SMEs. 'Word of mouth'

networks appear to enhance the effectiveness of information. Existing business advisors and trade associations can be important sources of information for SMEs.

- **Generic messages or information are not popular with business.** Communications need to be supported by messages on how to implement change within specific business processes and target the specific needs of different types of businesses, as well as senior management and operational staff, in a 'joined-up' way. This is likely to be more effective as part of a long-term engagement programme.
- **Communications can be costly.** No comprehensive evidence on return on investment and value for money with regards to waste prevention communications has been found within the scope and timing of this project. It is not clear whether this is because it is not widely measured, or because this information is not made public.

Insights

Businesses, and in particular SMEs, exhibit a range of behaviours when it comes to dealing with waste prevention information. Some may never actively be looking for it, while others use a range of sources for information. In this context, it is difficult to predict which channels will be most relevant or how businesses will respond to unsolicited information.

Moreover, 'waste' may be conceptualised in a 'box' that is separate from overall business performance and which may typically focus on end-of-pipe measures to reduce waste disposal costs, especially in SMEs.

Clarifying the concept of waste prevention to businesses and framing messages around business performance concepts – such as profitability, efficiency, productivity, and innovation – may help to increase traction. For example, initial qualitative research with a small sample of SMEs for Defra indicated that the terms 'waste minimisation' or 'reduction' were rated for relevance below terms associated with business performance or regulation. It may be useful to build on this research to investigate on a larger scale the issues around language and calls to action in order to establish which terms are most meaningful and relevant for different types and size of businesses.

Since there will be businesses of different size, capability and competence in all sectors, as well as managers with different motivations, it may not be enough simply to tailor messages to specific sectors. A better differentiation of target audiences is needed to understand which waste prevention (and resource efficiency) messages will work best for which audience, including different segments within the SME sector. (Further insight will come from current Defra research on SME segmentation which was not completed at the time of this review.^a)

Research Gaps

Several significant gaps have been identified:

- **Communications initiatives to promote business waste prevention are rarely run in isolation** from other engagement or support programmes and it is therefore difficult to isolate the specific impact of these campaigns on business behaviour or which elements of them were effective (such as messages, channels etc.). Current evidence relates mainly to awareness of providers or information and rating of the usefulness of different kinds of information.

^a Defra has a well-established environmental segmentation model for individuals and has conducted initial research to investigate segmentation of SME businesses. The latter was not published at the time of this review.

- A better understanding of the motivations and barriers for true waste prevention and their relative weight for different types of businesses is needed to effectively target communication.
- **There is currently a lack of published evidence from publicly supported business waste communication initiatives** on the detailed aspects of how communication has worked to address audience motivations and barriers, its impact on behaviours or take-up of measures, or return on investment.
- **More needs to be known about specific communications aspects**, such as audience reach and penetration, how messages were received, meaningful language and terms, and appropriate messengers and channels.
- **The existing evidence is skewed towards communications provided through public programmes directly to businesses** (such as Envirowise). We are not aware of guidance documents targeting other stakeholders or intermediaries beyond business support organisations that want to, or could, communicate with businesses on waste prevention (e.g. local authorities, professional services etc).

6.6 Incentives

Incentives are defined within this report as external rewards or pressures that encourage waste prevention. These can be in the guise of support to enable waste prevention (positive incentives such as grants or soft loans) or as a disincentive to continue with a behaviour that is deemed more wasteful than an alternative (negative incentives such as taxes and levies). Whilst much of the evidence within this report relates to incentives induced by policy and legislation, it is worth remembering that market competition and price signals often provide sufficient incentives for waste prevention. This becomes less likely where associated value is low, and where the environmental impact is high, so intervention may be desirable (9).

Certain types of intervention are specifically excluded from this report on the basis that they do not provide incentives as such, but rather represent a regulatory 'hurdle' to which businesses must comply such as interventions that ban the production or disposal of different substances. However mandatory schemes can offer inducements for waste prevention activities that go beyond mere compliance. A good example of such a mandatory intervention might be a producer responsibility scheme that incentivises weight reduction in order to reduce future compliance costs. A key distinction here that can be drawn between the two types of intervention is the extent to which continuous innovation is encouraged.

Learning

- **There is strong evidence that Landfill Tax has reduced landfill volumes and waste generation.** The relationship between C&I waste arisings and the standard rate of landfill tax also appears convincing even if the causality is less straightforward; with some of the effect attributable to other policies.
- **There is a significant body of evidence of the actual and potential financial savings achieved by businesses through providing R&D grants.** In the UK, grants that target waste prevention activities have been shown to divert 2.4m tonnes of waste from landfill and saved 2.1m tonnes of raw materials through resource efficiency savings, however, there is less direct evidence of waste prevention.

- **Extended producer responsibility has provided incentives to increase recycling of packaging and to minimise and light-weight packaging.** However there is little evidence on their effective use in encouraging reuse activity with the aim of waste prevention.

Insights

Financial incentives and penalties are most effective in achieving their intended environmental goal if the firm is already engaged and responsive to the issue being addressed. If the company does not recognise or is disinterested in the issues, financial rewards are unlikely to change the company's behaviour. A reason given for this is that the benefits or penalties may have a relatively minor impact on the overall operation of the business.

There are good European examples of using capital grants to reduce waste or hazardous waste generation. It may be possible to imitate these types of intervention to prevent waste in the UK.

The *Top Runner Scheme* in Japan has been showcased as a successful programme for highlighting environmentally sustainable products (largely focusing on energy efficiency). It may be possible to adopt a similar scheme in the UK that addresses waste prevention.

Research Gaps

The following three gaps were identified:

- Environmental awards highlight environmentally sustainable features and companies, but **as yet there is little evidence that the award enables waste prevention.** Further research into the effect of these types of incentives would be beneficial.
- Product-specific VAT changes have been discussed and recommended by a number of organisations to differentiate 'green products'. **Research has been undertaken** by DG-Environment **for energy saving products**, which highlighted its potential but also some problems. **Equivalent research in the area of waste prevention could be undertaken.**
- **Further investigation of whether amendments to or promotion of relevant features of the tax system could incentive product life extension as it has leasing.**

6.7 Business Support – Waste Minimisation Clubs

This review has considered a diverse range of business support mechanisms. Of these, the aspect of waste minimisation clubs proved large enough to justify its own section. This is largely because, after the pioneering example of the Aire & Calder initiative (reviewed by Peters et al. in (7)), there was a proliferation of clubs of diverse constitution and style of operation.

For the purposes of this work, waste minimisation clubs are a group of businesses within the same sector or a given geographical area that work together to achieve savings in waste minimisation, as well as some aspects of clean operations and product design. In addition to providing varying levels of training and consultancy support to participating companies, waste minimisation clubs provide members with the opportunity to share knowledge and experience through club meetings and events. However, numerous schemes have a 'virtual' existence, where no physical meetings take place at all – membership of the club simply gives preferential access to other resources, such as consultancy.

The first UK waste minimisation clubs were set up in the mid 1990s building on models from mainland Europe. They generally run for between one and three years, and have typically been supported by public agencies and funding. Participation is entirely voluntary and is secured through a recruitment drive of identified target businesses. No examples of purely business-led clubs were found.

'Waste minimisation' has been defined very broadly by clubs, reflecting different meanings to different groups. As such it often included activities to reduce landfill disposal and off-site recycling. In addition, most clubs link waste prevention with wider resource efficiency objectives, including energy management, water efficiency, legislative compliance and reduction of greenhouse gas emissions. Financial saving and other impact data will therefore need to be treated with caution, as discussed in the next section.

Learning

- **Well managed clubs have the potential to provide significant cost savings – in excess of £10 saved for each £1 invested.** Waste savings per club can range from a few thousand to hundreds of thousands of tonnes annually, depending on the number and type of business involved and the duration of the club activity. There is some evidence that a maximum number of 20 participants and a life-time of at least 2-3 years achieve the best outcomes.
- Overall, clubs appear to work particularly well when:
 - delivered by a lead organization with the necessary skills and expertise to facilitate running the club, and supported by a range of strategic partners, working together to provide financial and other support
 - recruitment is underpinned by a strategic marketing strategy that uses a range of tools and channels, puts message of cost savings at the forefront and reflects industry specific interests
 - frequent communication and close relationships between the lead organization and its members, as well as amongst members is taking place
 - services are tailored to the audience- sector or multi-sector- and provide a combination of one to one/handholding support, training and interaction to encourage peer learning.
- **Public funding has played a significant role in the running of clubs** although there is some limited evidence that suggests they could operate as self-funded projects, for example, through membership fees and charged-for services. However further work may be needed to ascertain the acceptability by businesses – especially SMEs – as well as the commercial viability of self-funded clubs.
- **Businesses are primarily motivated to participate in waste minimisation clubs due to the potential to reduce costs and increase profitability** (but also by additional benefits of collaborative working, a sense of community and free or subsidised training and consultancy support). The main barriers experienced were primarily around lack of time, resources and commitment from participants, in particular in SMEs.

Insights

On the basis of the evidence available in this review, we were not able to disaggregate impacts at company level for a number of clubs. It may be that some companies benefit more than others from the advice and support provided through the club approach and further case studies and the collection of waste and attitudinal and behaviour change data could be useful in the evaluation of future clubs.

There is some evidence that waste minimisation clubs appear to have been more effective in terms of high tonnages and cost savings by engaging those with the highest potential for waste savings - for example, medium and large companies in the manufacturing sector, or those that are already 'warm' to the concept of waste prevention^a. This means that a substantial part of the SME population may currently not benefit from the waste minimisation club approach and there may be significant barriers to engaging their interest in such clubs (see module **L2m3: Attitudes & Behaviours** for more detailed information on SME barriers).

Research Gaps

- Out of the 200-plus waste minimisation clubs that have been set up and run only **a very small fraction has been publicly evaluated in terms of their impacts and effectiveness on waste prevention**. This includes a number of recently finished or ongoing clubs operating in different parts of the UK. Analysis of these clubs would allow further lessons to be learned in terms of their potential in achieving significant cost and waste savings.
- Evaluations of clubs tend to focus on quantitative cost and waste savings, which is essential information, but tend not to provide deep insights on **why businesses took part or the internal factors that enabled the club model to work effectively** for their business.
- Evaluations of the East Anglian Business Club (10), betre (11) and Canadian Enviroclub (12) show that waste minimisation clubs can have a positive impact on changing attitudes and behaviours, but results are indicative at best. This is an area that might benefit from further **research to better understand the social dimension of what motivates businesses to engage in waste prevention clubs**, what are the **key success factors** within member businesses that influence how knowledge gained in the clubs is applied, and **the benefits it brings in terms of catalysing wider behaviour change**. This could include pre and post action research with participants of current waste clubs to evaluate motivations and barriers in more depth.
- While the evidence is strong on the potential benefits of the club approach on long-term behaviour change, evaluations generally focus on immediate impacts during the lifetime of clubs. **More needs to be known about the long term legacy of waste clubs, both for participating companies** and in terms of wider diffusion of waste prevention activity in sectors or regions.

6.8 Business Support – Other

A significant number of programmes and initiatives currently running are aimed at improving the environmental performance of businesses. Such business support comes in many forms including: The provision of help-lines for advice; creation and dissemination of guidelines and other tools for self-analysis; the auditing of facilities and practices; technical assistance in implementation; and organisation of networks and application for finance. Even though the instruments and tools applied may differ, all these business support initiatives share some elements: Ambition to achieve a win-win situation for business and the environment; involvement of public bodies or trade associations; supply driven i.e. promoted by those offering support; and voluntary participation as opposed to mandatory involvement.

^a Critical review addendum: In the literature of Phillips et al (various papers) there are numerous tables that report the cost to savings ratio and then discuss the mean and median. A typical club may have a cost to savings of 1:10. According to Envirowise 1:5 is sustainable. However this may mask the number of companies that have achieved high values and those that are very low indeed. In the Hereford and Worcester club of mid 1990 some 3 companies provided the vast majority of the significant savings out of total >15, so consideration of the distribution is vital. Even in very well managed clubs there are clear cases of both best practice and of poor practice. We are uncertain, however, whether the data can be adequately segmented along the sectoral and other lines of interest to this review and thus gain further relevant insights.

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

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

Learning

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

Insights

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

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

A 'carrot and stick' approach¹ of offering business support to help companies adapt while using taxation to send a price signal has been considered effective by industry representatives such as EEF in (13).

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

Besides regulatory pressure, the supply chain is another important source of encouragement to look for support such as has been seen from retailers towards the food industry.

Moreover, business support seems to play an important role in encouraging and helping SMEs to reach full legal compliance. While the risk of enforcement seems to be sufficient for larger companies, some small businesses, if left without support, seem not to aspire to full compliance with environmental legislation.

Regarding achievements in waste prevention, it is difficult to separate the role of business support organisations from price signals set by taxation or the need for companies to comply with new regulations. A study by the National Audit Office on the BREW programme stated that it found it impossible to disentangle the effect of introducing the landfill tax from the effect of accompanying business support by the BREW programme (14). Neither academic literature nor the reviewed reports provide an indication regarding the right balance between regulatory or supply-chain pressure on the one hand and the enabling business support on the other hand, to achieve the most effective approach to waste prevention.

Research Gaps

The following three gaps were identified:

- Within the scope of this review we found little evidence of the effects of business support by non-governmental organisations or of failures in business support (15). **Further research into these fields, especially regarding business support by companies along the supply-chain, might be useful to generate further insights.**
- **An evaluation of the extent to which environmental business support actually benefits the environment would be useful for policy makers.** A 2001 study of waste minimisation clubs (15) showed that financial savings make up most of the overall total benefits with non-financial benefits for society only 1-27%. This implies that environmental benefits are only an added bonus. It is not known whether the same low share of societal benefits is also true for other forms of business support.
- **A systematic evaluation of the role of private consultancies could be beneficial.** Not only in self-motivated efforts, but also in supported interventions their assistance as providers of skills and knowledge may not be recorded. A better grasp on their contribution and its relative importance may indicate other intervention options.

7 Findings: Sectors

This review concentrated on the learning that could be gained by examining six core sectors. These were: construction and demolition, food and drink, hospitality, retail, automotive and office-based services, full reports of which may be found in the **L2m5** modules.

7.1 Construction and Demolition

The scope of this sector is confined to activities directly concerned with the sourcing, logistics, construction and demolition of buildings and infrastructure. It excludes material and component manufacture. Based on a 2008 survey the sector contributes around 8.5% directly to the economy, rising to about 10% overall when the entire value chain is considered (16). The construction industry value chain consists of around 300,000 firms, including many small- and medium-sized family and local businesses. The sector employs three million people in a multitude of roles representing 8% of UK employment. A significant proportion of construction employees (>60%) are low-skilled labourers.

Most identified evidenced examples are from delivery bodies, and their reports tend to provide projected savings – later follow-up studies as to whether or not the savings were actually achieved appear not to have been carried out (or not yet reported). The majority of reported evidence is for substantial construction sites and large companies. Although the nature of the industry means that a large portion of the work is subcontracted to smaller firms, there is little evidence relating to SME businesses (particularly micro-businesses).

Learning

- **Crushing hardcore and using it as backfill or aggregate on site leads to a significant reduction in waste generation.** However, this intervention and activity can cause adverse effects on more sustainable and profitable business practices such as deconstruction and building material reuse as evidenced by (17) et al.
- **Reuse of building products is on the decline,** but is a profitable way to reduce resource use in producing new products for construction. A change in the measurement of waste arisings or the activities undertaken in the name of waste prevention may be needed to prevent ‘down-cycling’ cannibalising high-quality reuse.
- **New building methods such as Off-Site Manufacture and more intelligent design can significantly reduce waste generation.** However, we did not find evidence of high levels of engagement and education in respect of both established architects and universities and training institutes.
- **Efficient management of raw materials onto site and whilst being used can lead to a reduction in wasted raw materials.** Minimisation of over-ordering and more intelligent logistics are an easy-win for the industry – they reduce waste and can result in significant financial savings, an opportunity currently valued at £1.5bn a year (18) and estimated to be between 12% (19) and 19% (20) of all CD&E waste entering landfill.
- **Landfill Tax is an important consideration in reducing waste to landfill;** further details of this finding can be found under Section 6.6.

Insights

Training current managers, establishing environmental knowledge requirements for new managers, and elucidating incentives for 'green' managers could increase green construction practices given the importance of managerial concern as a driver.^a

It appears that already available, simple tools and guidelines for identifying and implementing waste minimisation opportunities on-site, such as Envirowise's 5 step plasterboard waste minimisation guide (21), and WRAP's 'Reducing your construction waste' pamphlet (22) (as well as numerous tradesmen-oriented 2-pagers on WRAP's website) could benefit from wider promotion.

Optimisation of packaging has proven an effective tactic to reduce waste in the retail and food and drink sectors. It is likely that the construction sector could see significant savings by replication of those efforts.

Measurement of the waste is clearly an important issue, which may begin to be addressed through the application of Site Waste Management Plans. These are a statutory requirement from April 2008 that seek to measure and minimise this waste (23). However, conversations with stakeholders indicate that the uptake of these schemes is less than is required by law, suggesting that there is need for further education or enforcement.

There is a wealth of case studies produced by government-funded organisations, but the majority of the examples can be grouped into a small number of waste prevention approaches. Additional case studies or examples showing similar waste prevention interventions to those already described is unlikely to be beneficial using the media employed to date.

It is important to ensure that the language and format are appropriate. Substantial efforts have been placed into creating guidance and toolkits for practitioners, but they may not have struck a suitable balance between rigour and usability. For example, there is an example of a 40-page manual for site managers, which is likely to be too long to be practical.

Research Gaps

Four possible research areas have been identified:

- There is mention in the literature that the **deconstruction of OSM buildings at the end of life may present difficulties with reuse or recovery**. Further research is needed to examine the reality and severity of this.
- Most of the reported activities are focused on larger companies; **research into the best mechanisms to engage and encourage smaller construction companies** (without resorting to legislation) is needed.
- There is little evidence of the identified case studies being used effectively or being widely disseminated to target audiences. Indeed, in certain instances, delivery bodies were unaware of the material available, requiring manual trawls to identify appropriate evidence. In addition, where guidance documents were produced, we found little evidence of their effectiveness. **A fuller examination of the effectiveness and best delivery of such materials would be prudent.**

^a Also see: WRAPs NetWaste tool: www.wrap.org.uk/nwtool

- Most of the available literature has been focused on encouraging architects and builders to engage in waste prevention, whereas there are relatively few instances of engagement with clients. Where references to the clients have been made, they have been sweeping and usually from the contractor's viewpoint. **Understanding the client's motivations and the business case for sustainable buildings would assist in identifying points for intervention.**

7.2 Food and Drink

This section has assessed waste prevention in manufacturers with Standard Industry Classification (SIC) Division Codes 10 (Food manufacture) and 11 (Beverage manufacture). This includes meat, fish, vegetables, oils, grains, dairy, bakery, animal feeds and all beverages. Agricultural supply is excluded, as is wholesale and retail, which are covered in another module.

The review includes waste prevention measures taken by companies supplying food and drink products to the hospitality sector as well as to retailers. Importantly, it includes actions taken by businesses which enable companies and individuals (including consumers) down the supply chain to reduce waste. The light-weighting of primary packaging implemented as part of the Courtauld Commitment is perhaps the most well-known manifestation. Here, the site of waste prevention is generally in the household, but results from a change in the behaviour of a manufacturer.

Learning

- **Waste arisings in the UK food and drink sector are reported to be declining, possibly at an accelerating rate.** Major preoccupations of the sector are in satisfying retailers and complying with food safety and hygiene regulations. Waste reduction efforts are largely focused on landfill diversion (such as recycling, anaerobic digestion, composting, animal feeds) rather than waste prevention. As hazardous wastes are a minor feature of the sector, there is limited evidence of their reduction.
- In the context of the positive improvements in waste generation **there are several examples of waste prevention that could be more widely adopted.** These include:
 - reuse initiatives which have been restricted to transit packaging (controlled within the supply chain)
 - light-weighting approaches which have been applied to primary packaging (which is unlikely to be returned to manufacturers).
- **True product re-design was rarely evidenced,** the closest examples being the development by Tesco and its supplier, Princes, of double-strength squash drinks to reduce plastic bottle packaging, and Kenco's use of 'eco refill' packages to replace glass jars.
- In terms of behavioural aspects, on the basis of evidence reviewed, **a waste prevention culture is not yet embedded in the food and drink sector.** Nevertheless, the engagement of some leading trade associations – such as the Food & Drink Federation – is helping to address this shortcoming.
- Where progress towards waste prevention has been evidenced (mainly in packaging reduction), the change has apparently stemmed from voluntary agreements. The Courtauld Commitment, in particular, has been successful because it has engaged the retail sector to apply pressure on suppliers. To a lesser extent regulation has played a role. In addition to cultural resistance to change, barriers include financial and time constraints, consumer perceptions, information gaps and the complexity and length of supply chains.

Insights

The emphasis on landfill diversion rather than waste prevention has seemingly been encouraged by the Landfill Tax escalator, government support for anaerobic digestion and trade association commitments (such as FDF's Zero Waste to Landfill). Waste prevention could, however, save the industry far more money than does landfill diversion. The true cost in wasted raw materials, energy, labour and other inputs before retail is at least £500/t (24).

The recent reduction in overall waste arisings from the industry demonstrates a move in the right direction. However, it is impossible to say whether the apparent downward trend is due to manufacturers making conscious decisions to waste less or is the unintended result of slowly improving production, packaging and distribution technologies.

Efforts focused on larger companies seem to be productive: 75% of waste arisings are from companies with more than 100 employees (24). The value of harnessing entire supply chains in voluntary agreements is clear. The success of the approach can largely be attributed to the fact that a small number of large retailers and producers dominate the market, and might be productively applied to other sectors and products where similar structural conditions prevail. Larger players seem more inclined to act in unison as they have greatest power and opportunities to cut waste in their own operations and elsewhere in the supply chain.

Much of the emphasis to date has been on Clean Operations and Green Products, particularly with a view to reducing packaging waste. Other approaches (as defined for this project) have been less in evidence and are largely inappropriate for the bulk of businesses in this sector given the nature of food itself and the position of operators within supply chains.

Process waste audits, improved demand forecasting, switching to bulk supply of raw materials and moving preparation of raw materials up the supply chain are also commonly reported techniques. In addition, as part of Phase 2 of the Courtauld Commitment, WRAP is working with the IGD, retailers and suppliers to address the issue of incorrect demand forecasting.^a The project will conclude in March 2011.^b

Research Gaps

The following areas of research have been identified:

- Anecdotal evidence shows a trend away from identifying in-house process improvements toward identifying waste prevention opportunities that lie outside the boundaries of an individual firm. Future research could investigate **which, if any, of the voluntary frameworks (such as commitments and voluntary agreements) to address these opportunities are most effective** since this appears to be a growing area of opportunity to achieve larger scale waste prevention.
- **The importance of unchallenged 'shrinkage rates'** (a reduction or loss in inventory due to shoplifting, employee theft, paperwork errors and supplier fraud) as a cause of waste in the sector **could be further investigated.**
- Despite the large body of published evidence that considerable financial savings are available through simple and low-cost waste prevention measures in the food and drink sector, **managers in these businesses appear unwilling to act. Future research could investigate the reasons for this.**

^a http://www.wrap.org.uk/downloads/CC_Info_Sheet_23_sept_2010_final.88134f93.9220.pdf

^b WRAP, Personal Communication

7.3 Hospitality

This aspect assesses waste prevention in businesses which offer accommodation or serve food and beverages: i.e. organisations with Standard Industry Classification (SIC) codes 55 and 56. The hospitality sector is also referred to as 'hotel and catering', and is sometimes included in the 'tourism & leisure' sector. In this report the lessons learned on waste prevention in the hospitality sector apply equally to canteens and in-house catering services, as well as to public sector catering (i.e. schools, colleges and universities; hospitals; prisons; the armed services). This is important because about £2 billion per annum is spent on public catering in England alone (25 p. 52).

While rates of recycling are reasonably high, the hospitality sector seems not yet to recognise waste prevention as a major objective. The evidence base from which to draw conclusions is thus limited. For example, much of the evidence underlying the behavioural sections of the report has been drawn from research on general pro-environmental behaviour in the hospitality sector.

The evidence evaluated in this report is drawn from a limited number of peer-reviewed academic articles and case studies and reports published by delivery bodies such as the Waste & Resources Action Programme (WRAP) and Envirowise, government departments (such as Defra, The Cabinet Office), local authorities and regional development agencies. An international context is provided by evidence from Europe, (both from the EU and individual countries), USA, Canada, New Zealand and elsewhere. Certain news websites (such as www.hospitalityandcateringnews.com, www.greenhotelier.org) are also a rich vein of recent evidence.

Learning

- Despite recent growth in the UK hospitality sector, **overall waste arisings are in decline**, although the reasons for this are uncertain. The sector is extremely diverse and fragmented, with 85% of hospitality waste in England generated by companies with fewer than 50 employees. The waste closely resembles household waste in composition, with a sizeable proportion of food and packaging waste depending on the specific type of business. While energy savings offer 60% of a total of £184m low- or no-cost resource efficiency opportunities to the sector, preventing waste is important and offers 38% of the total.
- **Top level figures show that a considerable proportion of the waste from the sector is recycled or diverted from landfill** (65% in England). However, evidence of waste prevention is fragmented and anecdotal, although there are many examples from every sub-sector. The absence of trade associations or other data aggregators for these activities is a notable feature of the industry.
- **In terms of approaches to waste prevention, many of the examples can be categorised as Waste Minimisation.** Initiatives were found to reduce packaging by serving products in reusable containers, reusing products, packaging and raw materials (such as cooking oil) or redistributing surplus food to charities (such as the FareShare scheme). Evidence for Clean Operations was found for the use of bulk packaging (such as bulk soap dispensers) or purchasing remanufactured goods. As in other sectors (such as food and drink manufacture), Green Products took the form of lightweighted packaging or refillable packaging systems. In some cases the service itself may have been redesigned, as was the case for restaurant menus.
- **Cost-saving appears to be a motivating factor as do customer and media pressure.** However, customer expectations – or at least a business's perception of them – have also been cited as a barrier. Other motivators may include standards, labels, award schemes and peer pressure. Given the small size of many hospitality companies, barriers to waste prevention behaviour may include a lack of influence in the supply chain and the perceived cost of implementing waste saving measures

(even though doing may actually save the company money). The high rate of staff turnover can also hinder efforts to embed waste prevention practices.

Insights

The fact that hospitality waste closely resembles that from the household sector in its composition and pattern of arising, points to the relevance of lessons from Defra's work on promoting household waste prevention.

In the absence of trade association-led initiatives in the hospitality sector, labelling systems linked to award schemes may be a more promising avenue because the greatest pressure is likely to come from environmentally-conscious customers. Although such schemes have proliferated in recent years (such as Ireland's Green Hospitality Award, EU Ecolabel), few require businesses to demonstrate waste prevention as defined in this report.

It should be emphasised that the hospitality industry is highly fragmented, and the waste prevention activities of the local fish and chip shop or bed and breakfast can be as important as those of international hotel chains or branded fast food outlets. In reality, the hospitality sector is perhaps too large and diverse to be treated as a single entity; more useful learning might emerge from investigations into its discrete subsectors: i.e. separate reports on large hotels, restaurant chains, small and medium-sized enterprises (SMEs) and so on.

Research Gaps

We identified two significant gaps:

- **Research on waste management in the UK hospitality sector is extremely scarce compared with other business sectors** and could benefit from a co-ordinated and aggregated overview, for example by trade bodies. Some detailed work has been conducted on the motivators and barriers to general pro-environmental behaviour in certain sub-sectors of the sector (such as hotels), but almost nothing has been done on waste prevention beyond a handful of case studies published by WRAP, Envirowise and others.
- **Research might examine more closely the impact of high rates of staff turnover on waste prevention behaviour and the role of leadership both within and without companies.** Investigating the outcome of such schemes as Visit Britain's *Tomorrow's Tourism* initiative (26 p. 47) could also be useful.

7.4 Retail

This reports on waste prevention activity within the retail and wholesale sector with SIC 2007 Division codes 45 (Wholesale and retail trade and repair of motor vehicles and motorcycles), 46 (Wholesale trade, except of motor vehicles and motorcycles) and 47 (Retail trade, except of motor vehicles and motorcycles).

Much of the evidence available for review on waste prevention has been published by two UK delivery bodies, WRAP and Envirowise, which understandably focus on the positive exemplars in their mission to encourage other participants and demonstrate progress. A considerable weight of evidence is concentrated upon the grocery retail sector, which accounts for approximately 15% of the retail and

wholesale sector's turnover^a and 14% of the sector's waste generation^b, and much evidence relates to the Courtauld Commitment. In contrast, other types of retail are relatively under-represented with relatively few waste prevention actions identified. Additionally, the majority of the evidence found concentrates on actions within large enterprises and in the UK. This may reflect limitations of the search methodology or incentives to report waste activity.

Learning

- **Waste generated by the sector is falling** as evidenced by Defra's own statistics which show a drop from around 16 to 11 million tonnes between 2006 and 2009. (However, we advise caution as there is a change in reporting basis resulting in interpolation within the services sector in 2006 and extrapolation from England to the UK for the 2009. There appears, however, to be no correlation with underlying business activity.)
- **The weight of evidence for business waste prevention is strongest for the following areas:**
 - Reusable and returnable transit packaging (RTP) systems between retailers and their suppliers. A wide range of retailers have successfully introduced reusable packaging, with collective savings from reported initiatives of over 150,000 tonnes of packaging and £450,000 per year.
 - Light-weighting of packaging with the effect of reducing household waste. An estimated 520,000 tonnes of primary packaging has been removed as a result of the Courtauld Commitment from initiatives by retailers and food manufacturers.
 - Carrier bag reduction where a mixed approach has been used of issuing fewer carrier bags, introducing reusable bags and redesign to use less material. A 48% reduction in the number of bags issued and a 56% reduction in weight of single use bags are among the achievements.
- **Other currently small-scale activities are occurring:** There is evidence that changes through Product/Service Innovation can have beneficial effects, notably in the use of refillable consumer packaging (such as *Eziserv*) and this may have significant potential if adopted more widely. Retailers have also engaged in reuse and life-extension activities of their own equipment - for example by the remanufacture of their in-store refrigeration units and other equipment.
- **Evidence outside of these areas is relatively limited** (a considerable level of activity is reported within food waste minimisation but quantified outcomes are seldom reported).
- **Commitments have been a significant driver within the sector**, with the Courtauld Commitment in particular generating a large body of evidence of waste prevention within the grocery retail sub-sector. Engagement of senior management and the sharing of information between peers are considered to be among the factors that have led to its success. The Carrier Bag Commitment is another example of a successful commitment, albeit within a narrowly defined area.

Insights

The action being taken by retailers for the waste associated with their own operations appears to focus more on diversion of waste from landfill, and less on waste prevention. Waste prevention offers larger financial and CO₂ savings than diversion since it eliminates not only disposal costs, but also un-necessary

^a IGD put the grocery retail market size at £146.3bn in 2009 [website accessed 23/12/2010] vs. £994.0 for the retail & wholesale sector turnover

^b Waste arisings from grocery retail and distribution were 1.56 million tonnes in 2008 vs. 11.18 million tonnes for retail & wholesale waste in 2009

raw material manufacturing, processing, shipment etc. One study estimated that savings of £627 per tonne from prevention compared to £70 from diversion. Even with such incentives, the barriers to implementation seem to be such that easier waste diversion activities are preferred.

For packaging, where appropriate, some retailers have introduced RTP systems to reduce the volume of packaging being used, and for food waste a number of retailers are donating surplus food to charitable organisations such as FareShare. Initiatives such as this and Courtauld 2, which addresses also the carbon impact of packaging, will help move the emphasis from diversion to prevention.

The action being used by retailers to tackle household food and drink and packaging waste is relatively advanced as it has a strong emphasis on waste reduction, particularly through voluntary agreements such as the Courtauld Commitment, which are comparatively well-evidenced. Other initiatives, such as the BRC's *Better Retailing Climate* do not currently address waste prevention. However *Better Retailing Climate's* broad representation across all types of retailers could make it a suitable vehicle for driving improvements in waste prevention outside of food retail, were its objectives extended to include it.

In the aspect of reuse and Product/Service Innovation, we know anecdotally that leading retailers such as Sainsbury's are centrally aggregating and redistributing business equipment, furniture and other goods for reuse elsewhere within their enterprises. This waste avoidance is unlikely to be captured using traditional metrics; we believe that these enterprises are interested in using the Scope 3 carbon benefits of this avoidance to demonstrate low-carbon credentials to local authority planners. These form useful pioneering actions amenable to wider promotion.

Research Gaps

We could not locate evidence giving insights into the following topics where evidence might have been expected. These are therefore suggested as possible research gaps:

- **The impact of increased online retail activity**, which is taking growing and increasing share of retailing activity, but the waste implications of this have not been found in the evidence.
- **The impact of moving to 'just-in-time' production**, which is known to have occurred within the sector, but the effect on waste has not been established, unlike for other sectors such as construction.
- **The impact on waste of shelf-ready packaging**, which is being used to speed-up shelf filling. The effect on waste is unclear. On the one hand anecdotal evidence suggests it may increase corrugate usage, but on the other hand material substitution (such as to plastic pouches) can sometimes be introduced alongside the changes.
- **The impact of moving towards convenience food** such as microwaveable ready meals, where packaging may be added to improve convenience for customers.

7.5 Automotive

This report concentrates largely on the core business of automotive manufacture by the main global brands. This largely excludes dealership and servicing as well as the upstream supply of components. However, these aspects have been touched upon in certain circumstances. For example, the introduction of Product/Service Innovations, such as remanufacturing, entails efforts of dealerships and service outlets in retrieving vehicles from customers; and upstream in the servicing of vehicle components – motors, alternators, braking systems etc. - through reverse logistics chains from dealerships on behalf of the

vehicle brands. These systems invariably employ large 'Tier 1' suppliers who are exposed to similar cost and CSR pressures to the assemblers. Beneath Tier 1 is a large cohort of diverse sub-suppliers, most likely serving local or regional assembly operations. These are not explicitly covered in this report.

There is significant evidence on waste prevention in the automotive sector. Both reports and case studies from various support initiatives to reduce waste and/or pollution have been found. The evidence of these reports is heavily oriented to successful activities with little report of unsuccessful initiatives.

Reports from companies themselves form an important element of the evidence. Within these, the sustainability reports of leading manufacturers tend to focus on energy consumption, whereas waste is mainly reported in the context of diversion from landfill. A strong emphasis on achieving 'zero waste to landfill' detracts from the more fundamental activity of waste prevention. These alternative agendas are reasons for the low number of reports and the lack of data on waste generation. However, the absence of evidence does not mean that waste prevention efforts are not occurring, as the identified examples show.

Learning

- **Based on the case studies and data identified, most initiatives to reduce waste in the automotive sector appear to be voluntary and driven by competitive pressure to reduce the costs of operation.** The main cost saving achieved from waste prevention are due to less raw material being purchased and reduction in re-work costs. The disposal costs (such as Landfill Tax or incineration costs for hazardous wastes) are an additional incentive. However, they can be easily minimised by achieving high recycling rates and do not necessarily push the waste prevention agenda.
- Two main areas of waste prevention were identified:
 - Waste prevention as a by-product of Lean activities aimed at improving throughput, quality and use of capital.
 - Waste prevention as part of projects to improve environmental and health/safety-sensitive processes (such as painting). Painting and cleaning activities have focused on minimising hazardous waste. Due to regulatory pressure (both environmental and workplace health and safety) significant improvements have been achieved.
- **Lean management appears to be a strong basis for waste prevention.** It fosters a culture of continuous improvement, involves shop-floor employees and targets preventing problems rather than rectifying them. Even though from an environmental point of view there are 'blind spots' in the Lean approach (such as hazardous materials, life-cycle approach) these shortcomings can be overcome by providing incentives to companies and information to Lean practitioners. Similarly, because Lean does not explicitly target waste prevention, we found counter-examples of increases in waste generation in order to satisfy other Lean objectives. However, the strong customer focus included in Lean implies that this methodology will be most effective once waste prevention is considered of value to the customer.
- **SMEs often lack the expertise and knowledge both with respect to Lean management and best practice in waste prevention** and have been the main target for business support. Such business support has come from either larger companies in the supply chain or bodies with public funding. However, a report from the US EPA states that even large companies may lack the knowledge of best practices of waste prevention, especially where they apply to problems of avoiding hazardous substances and life-cycle aspects (27).

- **We found limited evidence for waste prevention by eco-design.** The focus in eco-design has largely been to reduce the CO₂ emissions of vehicles in use. Light-weighting has been largely used to partially offset increases in vehicle weight due to addition of convenience features (28). Reduction of hazardous content has received attention due to its ability to facilitate de-pollution and recycling at end of life.
- **Examples of Product/Service Innovation such as reuse and remanufacturing have been found** in the fleet management of commercial vehicles (such as lorries, construction vehicles, tyres for commercial vehicle fleets). Most vehicle manufacturers have component remanufacturing services linked to (and limited to) their own dealership and supply chains. These are driven by cost saving; they have limited material waste saving but large energy-saving due to reduction of metal recycling. However, they do not yet appear to be widespread outside of fleet management.

Insights

The main examples of policy intervention to foster process improvements involve SMEs, which often lack the necessary know-how.

The automotive sector has attached more priority to landfill diversion and materials recovery targets under the End of Life Vehicle Directive than waste prevention. Recycling systems and efficient shredder technologies have therefore developed to suit. Changing the way companies report waste from the existing focus on diversion from landfill to a more complete picture by including waste generation could mitigate the problem of recycling being seen as the sole measure.

There are examples of using reused and remanufactured parts for car repairs, but there does not appear to be sufficient motivation to promote this activity and abandon the prevalent strategy of substituting damaged parts by completely new ones, despite some support from insurance companies.

Business support is expected to be very helpful, especially for SMEs. However, it needs to be structured and in depth because the automotive industry is process intensive and developing cleaner production strategies cannot generally be copied from one company to another.

In summary, the automotive sector is seen as both responsive to the current public environmental debate and capable of improving its processes. As the issue of waste has so far been framed as a disposal problem, the sector has made impressive progress towards 'zero waste to landfill' and recycling rates. Shifting the debate towards waste prevention is expected to give extra momentum to such initiatives in this sector.

Research Gaps

The following five research topics have been identified:

- The evidence shows increased waste generation by the sector as a whole with reduced waste by some. However, the **reasons for differential company behaviour** bear further investigation.
- Of the available case studies, most of them are from operations overseas and it is not clear whether the same initiatives have been implemented here in the UK. This is an important point to note; although there are no major UK-owned car manufacturers, **there is a significant manufacturing base in the UK and further research into their activities could be worthwhile.**

- **More research on the range of waste prevention performance across vehicle manufacturers and on the depth of take-up in the Tier 1 suppliers would be highly instructive.** Their commitment to Lean thinking is perceived as high and their factories are known to be very similar. This means that comparison research can be especially powerful.
- The arguments around environmental benefits of initiatives in the sector are often made in a narrow context rather than a whole life cycle consideration. Insight into whether, based on the current state, it is better for the environment to target waste prevention, recycling or fuel efficiency would be beneficial for **setting sector priorities in respect of whole vehicles.** (This does not detract from general efforts to increase process efficiencies and light-weighting of components in general.)
- **The emergence of electric vehicles will offer radically different challenges** in all life phases of vehicles. How waste prevention opportunities will change, or could be actively managed, for hybrid and pure electric vehicles would be a significant contribution to road-mapping of future transport solutions and their impacts.

7.6 Office-Based Services

Within official statistics there is no single sector defined as ‘office-based services’. For the purposes of this review, ‘business services’ were used as a proxy, recognising that other office-based activities fall outside this definition – for example, offices of manufacturing companies, in the public sector, and in other parts of the service sector (such as transport). Figures quoted here for waste prevention potential are therefore minimum estimates arising from all office-based activity.

‘Business services’ include activities such as finance, professional and other business services, real estate, computer related activities and travel agents.^a A large proportion of UK SMEs are found in this sector. Some 60% of ‘business services’ activities are estimated to be office-based, generating 5.8 million tonnes of waste in 2006 (of a total 9.62 million tonnes in the sector as a whole) (29):

- 1.15 million tonnes are reckoned to be white paper waste (29), with single-sided printing making a significant contribution.
- Other waste includes printer and toner cartridges, WEEE waste, office furniture, packaging, employee waste (food and packaging from lunches) and stationery.
- Approximately 165,000 tonnes of office furniture are thrown away yearly from British businesses; 50% of the office furniture sent to landfill each year is estimated to be reusable.^b

Extending the lifetime in use of IT equipment and office furniture, and switching to Product/Service Innovation arrangements with suppliers, are means of preventing waste in the sector but current practice and impact are not well evidenced.

The literature search revealed highly fragmented and limited evidence that had a direct focus on waste prevention activity in office-based services as defined here. No evaluation studies or synthesis reports were found that were relevant and much of the material in this module has therefore been pieced together from case studies and a small number of surveys. Some of these were very brief and were developed by their authors for information rather than evaluative purposes.

^a SIC 2003 J & K.

^b <http://www.remanufacturing.org.uk/furniture/>

Learning

- **Increasing awareness of and encouraging business to control unnecessary paper use could lead to further significant reduction in waste generation.** Possible savings from low cost or no cost paper reduction measures, such as through double-sided printing, multiple page per side and employee-coded printing services, have been estimated at £165.6 million out of a total of £233 million waste savings available in the sector.
- Because waste prevention opportunities relate to everyday ‘housekeeping’ measures, **changing employee attitudes and behaviours will play a crucial role in determining the effectiveness of office-based initiatives.** A small number of case studies have demonstrated savings through such initiatives; however little robust or systematic evidence was found on how companies address the issue, what specific actions or behaviours have resulted in the cost or waste savings, and the reasons why employees did or did not participate.
- **There is some evidence that the introduction of green products (office furniture, ICT equipment and other fixtures) can provide waste and cost savings to businesses.** However, the published evidence appears skewed towards the producer and the environmental benefits of their products. No detailed and robust evidence was found from the perspective of office-based businesses as to why they switch to buying greener products, or have closer collaboration with suppliers^a, and what the costs and benefits are from the purchaser’s angle.
- **No evidence was found of the reduction of the hazardousness of waste being considered or acted on by the sector.**

Insights

The limited evidence we reviewed suggests that efforts to reduce waste appear to focus primarily on landfill diversion and in particular recycling. Waste prevention behaviours may in fact be more prevalent than the evidence suggests, albeit being reported under wider CSR or sustainability initiatives, or not reported at all.

Despite self-reported high environmental awareness and accountability by employees when it comes to waste prevention, these attitudes do not necessarily translate into action on the ground. There appear to be a number of potential reasons for this. Employees may experience moral struggles between their home and work identities, or look to their employers to put the right structures and incentives in place to enable waste prevention behaviour. Current behaviours may also be ‘routinised’ and ‘unthinking’, and hence difficult to overcome.

While it is necessary to disaggregate recycling from waste prevention behaviours in future communication with the sector (for example, by business support providers), it is important that the audience is not alienated by suggesting that previous behaviour (i.e. focus on recycling) was wrong. Advice and support for managers helping them to engage, incentivise and communicate with staff throughout the organisation may also help to facilitate wider uptake. This is a consideration for business support services. Managers may need information not only on practical measures they could take but also guidance on effective behaviour change approaches.

^a A forthcoming report for Defra by consultants ERM on longer product lifetimes (EVO445) may provide further insights in the issue of carpets; however this report was not available to this review.

Given the potential role of procurement in driving waste minimisation down the supply chain, this is an area of likely opportunity for prevention too. For example, a change in the behaviour of large scale procurers in the public and private sectors might be capable of extending product lifetimes and shifting the balance between end of life management and PSI for office furniture, ICT and carpets (though this would need to be assessed further). Building new case studies from large companies might help to demonstrate how these options can be 'fit for purpose' for the sector.

Research Gaps

The following research gaps have been identified:

- The current evidence base largely exists in the form of case studies (for large companies) or non-sector specific information on motivations and barriers for SMEs. **There is a need for more systematic evidence on both current practice and the outcome of voluntary initiatives being undertaken by companies in the sector.** This is unlikely to be available from secondary sources because initiatives in the sector are likely to be largely voluntary, often private and probably commercially sensitive. Further primary research could include:
 - Desk research to review a representative sample of CSR reports to identify best practice in big office-based corporates, although this might be limited by the way in which prevention is rarely reported as a separate outcome.
 - A roundtable of large and medium size companies to identify opportunities for encouraging greater paper reduction, furniture and WEEE re-use, and collaboration with PSI suppliers, which might form the basis of guidance or case studies to office-based services more widely. The Strategic Supply Chain Group might be one such forum.
- **More research into the behavioural/social dimension of waste prevention activities would provide greater insight into the reasons why internal change management programmes do or do not work.** This would need to examine how staff and managers respond to such initiatives, what works in terms of maximising internal engagement, and which activities are most effective in leading directly to waste prevention. This could perhaps be achieved through action research with businesses wanting to pilot a waste prevention/resource efficiency initiative, or in action research to accompany any future business support programmes.
- Since the viability of reuse and remanufacturing business models in the UK largely depends on customer demand, **further research could be undertaken to understand the key factors influencing purchasing behaviours in the office-based sector,** as well as the key challenges and opportunities for the service based sector as a whole when it comes to reducing their waste impacts through purchasing and engagement with PSI suppliers.

8 Findings: Approaches

Whatever has motivated businesses to tackle waste prevention it must ultimately result in decisions about what practical actions and changes will be made. For the purposes of this work we have analysed actions found within the evidence review into the four broad but fundamentally different approaches outlined in Section 2.1. This aspect of the review provided a great deal of context, but has also drawn together some broad findings based largely on the apparent weight of evidence for each approach in the review materials. The following summarise those observations and implications.

Learning

- **The evidence shows that Waste Minimisation and Clean Operations activities are more prevalent than Green Products and Product/Service Innovation.** The former elements are more amenable to simple or unified intervention tactics being based on systems and behaviours, or to incentivise funding for, for example, R&D.
- **The study conducted for WRAP by the Stockholm Environmental Institute (4) into the contribution of various resource efficiency measures serves as a good proxy for waste prevention:** the results indicate that demand-side measures related to extended product lives have greater potential than those on the supply side. This has already provided a generic endorsement for greater attention to be paid in the direction of Product/Service Innovation than the more traditional Waste Minimisation activities.

Insights

Waste Minimisation is very similar to Lean Production principles increasingly taught in Universities during the 1980s. Their widespread uptake may reflect the fact that current staff have improved understanding of these principles and have been relatively receptive to supporting process efficiency targets. However, Lean has a general resource saving objective that does not necessarily give priority to the reduction of material waste compared to, for example, time, labour or inventory. Examples from the automotive sector further illustrate this point.

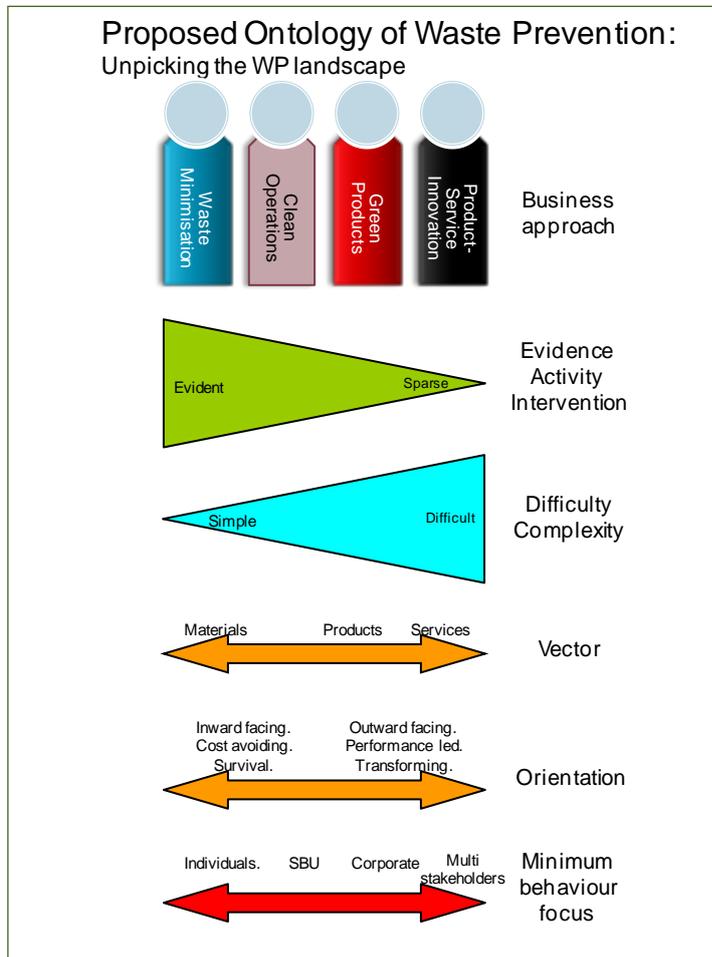
Clean Operations and Green Products approaches are less widespread. Both have seen uptake in some sectors, but the potential for application elsewhere is significant. Both require engagement with supply chain partners and embedded sector practices can act as a barrier to innovation. The evidence suggests, therefore, that sector-based voluntary approaches are relevant to more widespread adoption of these two approaches. Appropriately managed they could offer the additional advantage of involving businesses that might otherwise be disadvantaged by an overt declaration of higher performance standards.

Green Products and Product/Service Innovation (PSI) often require more complex approaches and might be seen as aspirational in policy terms. In particular, PSI is a substantially more ambitious business development which may not be amenable to the traditional direct business interventions used to good effect for waste minimisation nor the sector based voluntary approaches for clean operations and green products. The evidence suggests, therefore, that PSI approaches are likely to require educational interventions to inspire and inform the current and next generation of business staff.

Not all approaches are relevant to or achievable by particular sectors. For example, those 'stuck in the middle' of supply chains, supplying processed materials or sub-components, may have their opportunities

for altering products or services severely constrained; they may then be restricted to the process efficiency/effectiveness measures of Waste Minimisation or Clean Operations.

Figure 7: An overview of the approaches to waste prevention taken by businesses



Source: Oakdene Hollins/Brook Lyndhurst

Figure 7, which is explained more fully within module **L2m2: Approaches**, provides a graphical overview of the characteristic differences between these different Approaches. There are broad trends which reveal the relative difficulty of action, depth of evidence, motivation, focus of action and the complexity of stakeholder relationships in engaging action.

Research Gaps

Two research gaps have been identified:

- The evidence has indicated that Clean Operations and Green Product approaches can offer wider benefits than the well-trying single company Waste Minimisation approaches, and sector-based voluntary interventions appear effective in motivating their introduction. If this mechanism is to be expanded more widely, **research that reviews best practice in the management of such voluntary approaches is needed.**

- **Any aspiration to stimulate greater exploitation of Clean Operations and Green Products approaches demands a review of sector road-mapping activities to drill down to specific points in sector supply chains to determine where most the appropriate points of intervention lie** (a question of power) and in what form. This would enable government to partition more effectively the process-oriented interventions (which are prevalent, well-tried and easier to deliver) from the product-oriented ones (which may benefit better from indirect and longer-term interventions, such as through higher education or in the short term through procurement standards).

9 Findings: Hazard Reduction

The Waste Framework Directive obliges Member States to consider hazardous materials within the scope of waste prevention. Reduced hazardousness is deemed a desirable objective even if it results in increased weights of non-hazardous waste. For the purposes of this work, we have considered the following two classes of hazardousness:

- Hazardous wastes arising from and during the manufacture or processing of materials. Reduction could be achieved by switching to an alternative manufacturing system not involving hazardous materials as well as simply reducing the hazardous materials to a minimum within the current system by sound management or recovery.
- Hazardous content of products of manufacture which might cause environmental or health damage during use or after disposal. Reduction could be achieved by simple lowering of content; *pro rata* lowering by light-weighting or substitution by a lower hazard alternative. A more radical alternative could be the isolation of hazardous components such that their recovery and possibly reuse at end of life could be managed, thus also avoiding further manufacturing wastes.

Examples of both approaches in concert were found and are reported in **L2m6: Hazard Reduction**.

Learning

- **Legislation has been a powerful driver in reducing the amount of hazardous waste.** It has not only used classic 'command-and-control' instruments, like restrictions and bans, but also installed strong economic incentives by making disposal of hazardous waste onerous and expensive.
- **Evidence of a high awareness of businesses to the issues around hazardous waste has been found.** This has been mainly fostered by strict regulations and high costs of disposal. Systematic investigations of areas of waste minimisation have become routine for the large generators of hazardous waste. Nevertheless, there is also evidence for a significant share of companies not participating, especially among small and medium-sized companies.
- **The main route to the prevention of hazardous waste is substitution of hazardous materials by less harmful ones.** This strategy is applied both to hazardous substances contained in the final product, as well as to hazardous materials used as process aids and treatment agents in the production process. Most of these changes have been driven by bans and restrictions on certain substances, additionally fuelled by fear of liabilities or public opinion.
- **Additionally many companies try to implement small changes in their processes in order to become more efficient and reduce the amount of hazardous waste being generated.** Most of these actions do not involve investment in new equipment, but are organisational involving managerial techniques and training (classic waste minimisation).

Insights

The achieved reductions in hazardous waste clearly demonstrate the power of regulations in achieving environmental goals. Even if a regulation is enacted in only a single major market it may still force beneficial changes in other areas of the globe. This is shown by the example of mercury in the automotive industry, the phase-out of which by some US automotive companies was triggered by bans in

Europe. (European vehicle emissions limits similarly force global standards as they form an effective barrier to sale.)

From the waste prevention point of view bans are especially useful, as prohibiting the use of a certain hazardous substance automatically prevents the generation of any associated hazardous waste.

On a policy level, studies have shown the importance of reduction planning and reporting requirements. Such requirements do not prescribe companies what to do, but force them to investigate the issues and to develop solutions on their own. Waste audits in a company seem to lead to the identification of 'low-hanging fruit' and significant waste reductions, but in order to maximise these reductions, in-depth technical support is required. Consequently, although a broad brush approach to business support may be helpful to initiate hazard identification and audit, it may not be sufficient to help companies progress beyond the simple to more intractable hazards.

Uncertainty stems from the fact that many companies report a reduction of the amounts of hazardous materials being used. A reduction in use of hazardous materials is not equivalent to a reduction in hazardous waste: On the one hand, products made by using hazardous substances may not become hazardous themselves due to sufficient dilution of hazardous components or to chemical transformations rendering the hazardous material harmless. On the other, a small share of highly hazardous material may render otherwise non-hazardous waste hazardous (such as mercury-containing fluorescent lights in general mixed waste). A clearer distinction of these effects in the reporting and analysis of impacts is required.

The role of 'naming and shaming' and public ranking lists of company performance is a powerful tool: Maintaining a positive public image and a low investment risk profile to stakeholders, many companies try to reduce the amount of hazardous waste being produced below the 'significance' level at which they are exempt from reporting. Again such a measure does not prescribe methods to companies, but lets the companies evaluate for themselves the urgency of change and the means appropriate to improve their environmental performance.

As many businesses have been working on hazardous waste issues for some time now, the ability to capitalise on further waste minimisation-type projects seem to have levelled off. Further opportunities will need to be very specific to the actual processes, and probably more expensive. In this context business support becomes difficult. It needs to be capable of delivering in-depth and bespoke solutions, which is often difficult within the remits of the available funding.

A caveat we apply is that much of the evidence is provided by examples from outside the UK. Whilst not highlighted as a research gap, examination of proxies – such as the amount of intellectual property filed – in the UK compared to elsewhere might provide a useful check on whether it is a laggard or a leader in addressing root causes and solutions, if not actual implementation of that research.

Research gaps

Two significant research gaps have been identified.

- **The extent of action by SMEs on hazard reduction could bear further investigation.** The majority of evidence located relates to actions of large enterprises.
- The revised Waste Framework Directive of 2008 now includes an additional criterion (H13 sensitizing) and a re-ordering of the Hazard criteria such that H15 (yields another substance after disposal) is now subject to H14 – Ecotoxic. **This may extend the range of hazardous wastes and hence the scope for hazard reduction. This needs to be examined to gain foresight of specific sector impacts.**

10 Findings: Metrics

The purpose of the metrics report is to supplement and commentate on the metrics used for waste prevention, over time and by different audiences. It is not intended to be a comprehensive review of either metrics for resource efficiency in general or waste prevention in particular. Metrics is a broad area of concern to many stakeholders which must reflect a balance of priorities – activities, outputs and outcomes – that are not within scope of this evidence review. The analysis here is intended to show what metrics have been used by which agents over time and infer some general conclusions.

For this, the evidence was culled to a list of 32 substantive reports spanning 1995 to 2010. Each summarised the waste prevention outcomes of a substantial portfolio of projects resulting in reports of greater than ten pages. We could reasonably assume that the analysis was from a meaningful sample covering a range of sponsoring bodies and audiences namely: policy makers (including delivery bodies), regional agencies, academics and businesses.

Mapping the Metrics used for Waste Prevention

The following conclusions can be drawn from the mapping exercise:

- A wide range of metrics has been used to measure waste prevention, but **by far the most common metrics are financial savings** (which is also most likely to be reported first) **and material/waste reduction**.
- The metrics used have varied considerably by audience:
 - Policy audiences have the most metrics and they are the main audience interested in hazardous waste reduction.
 - Regional audiences have particular interests in jobs created and saved, number of employees trained and payments made into the project.
 - Academic audiences limit the metrics used to two or three, and may develop their own metrics.
 - Business audiences have the fewest metrics and tend to focus only on financial savings and material/waste reduction.
- **The metrics used have changed over time**, becoming more complex and latterly including carbon savings as a priority alongside financial savings and material/waste reductions.

Learning

The evidence suggests a number of learning points regarding best practice in measuring waste prevention:

- Ensure that savings are attributed according to whether savings were implemented and the extent to which the initiative was responsible.
- Ensure ease of comparison by developing common metrics and following common assumptions and methodologies for calculating them. Peer-reviewing may aid this process.
- Ensure that metrics are credible to business by keeping them appropriate and simple, and by reporting the financial impacts that are observed by business.

Historically, metrics have sought to link waste prevention with waste disposal costs and subsequently to avoidance of raw material costs. Of late, the introduction of carbon metrics offers a route to link virgin materials to embodied carbon to Carbon Reduction Commitments / Scope 3 costs, especially for larger businesses which are obliged to report on them. This would link waste prevention to an existing incentive mechanism, integrate it within wider resource efficiency policy and align it with competing business pressures - legislative, economic and social.

11 Cross-cutting Themes

This last section of the report pulls together a number of strands, named cross-cutting themes, identified as of topical interest to policy and strategy development. Separate sections are motivated by the fact that the evidence might otherwise be too dispersed within the reports so is conveniently drawn together here, such as self-motivated waste prevention; or because we are able to relate core waste prevention activities to others considered outside or marginal to the scope, such as aspects of reuse and material exchange; or because there is some other segmentation of the evidence not otherwise addressed by the framework, such as particular SME behaviours.

11.1 *Self-Motivated Initiatives*

This section provides a précis of the text of module **L3m1: Self Motivation**. By self motivation we mean actions that were not overtly induced or catalysed by the actions of publicly funded agents. In general this means the initiatives were wholly funded by the companies themselves. Whilst the entire review has not included the effects of compliance legislation, this aspect recognises that some companies may have acted either in anticipation of legislation, or as a by-product of other legislation not directly related to waste prevention. A consideration of initiatives that have failed has been included, though evidence in the review for this was extremely limited.

Our analysis suggests that self-motivated waste prevention behaviour is more common in some sectors (i.e. hospitality, automotive, office-based services) than others (i.e. construction, food and drink, retail). However, this impression may be false, and result simply from the fact that far more business support has been directed at the latter sectors than the former; reports and case studies on supported initiatives in the latter sectors far outweigh published evidence for self-motivated action.

Several themes do though emerge. Firstly, larger companies seem more prepared to take unilateral action to prevent waste than do SMEs. Not only are they more likely to possess the necessary skills and resources to effect change, but they are more subject to public scrutiny. Another key observation is that although self-motivated actions seem rarer than supported ones, they cut across the range of waste prevention approaches: Waste Minimisation (such as plot-lot ordering), Clean Operations (such as returnable transit packaging), Green Products (such as packaging light-weighting) and Product-Service Innovation (such as remanufacturing).

Moreover, the drivers for self-motivated action generally mirror those for supported initiatives: the opportunity to save on costs, concerns over legislative compliance, CSR goals, customer and procurement pressure, and sometimes EMSs.

These observations highlight the need to consider if external intervention, for example through the support of market development, is always necessary. Reasons for doing so could include bringing innovations forward in time and putting them into the public domain.

Failed Initiatives

As expected, few companies deciding to take waste prevention action were willing to publicise examples of failure. Where lessons can be learned, these are probably equally applicable to situations where waste prevention has received external business support. The following factors may explain why self-motivated waste prevention fails:

- lack of in-house expertise
- lack of supply chain power
- unintended consequences
- poor internal communications
- lack of employee or change manager power.

11.2 Reuse and Material Use Efficiency

This section provides a précis of the text of module **L3m2: Reuse & Material Use Efficiency**. WR1403 has uncovered reuse activities involving a change of perspective in the supply chain such that a surplus material or end-of-life product, previously regarded as waste is now treated as a valuable resource to be exploited in its current form or processed into something else. These differ from traditional approaches in that they do not concern efforts to prevent surpluses arising in the first instance. Approaches fall into two categories^a: **Reuse** and **Material Use Efficiency (MUE)**.

Reuse

Reuse is defined as extending useful life and reducing net resource use over the useful lifetime of a finished product, including repair, remanufacture, and servicing; and concerns *the redeployment of identical fabricated products.*

The remanufacturing of parts or products^b and retreading of tyres are prominent examples in the automotive sector (30). See the module **L2m5-5: Automotive Sector**. Similarly, the construction industry has a tradition of reclamation where surplus building components are removed from sites for reuse or resale in their primary function. However, reclamation in the UK has declined, apparently in response to pressure to increase recycling rates, e.g. by crushing materials for use as aggregates. See **L2m5-1: Construction & Demolition Sector**.

The selling on of surplus food for animal feed, as seen in the food and drink sector and among larger food retailers, could be considered as either reuse or material use efficiency depending on whether the surplus is a final product or a raw ingredient/process by-product. Businesses not only avoid disposal costs but also achieve a modest revenue, although more money would be saved by preventing the surpluses in the first place (24). Assuming the surplus is fit for human consumption, it may also be donated to charities. In the UK, FareShare is well known for its work with retailers, food manufacturers and hospitality companies in redistributing surplus food in the community. See **L2m5-2: Food & Drink Sector** and **L2m5-4: Retail Sector**, and **L4m2: Case Studies**. Reuse of surpluses for charitable purposes is manifested in other contexts e.g. hotels have donated towels, bed linen and toiletries to various good causes (31; 32; 33). See **L2m5-3-Hospitality Sector**.

^a N.B. There is substantial parallel work sponsored by Defra to examine “Product Life Extension” interpreted as designing for longer product lifetimes. The Reuse strategies here consider improvements to useful life of products already in service or materials already in the market.

^b Remanufacturing is defined as a series of manufacturing steps acting on an end-of-life part or product to return it to like-new or better performance, with warranty to match.

The reuse of furniture is common, particularly when conducted on a commercial basis^a. For instance, the delivery body NISP (National Industrial Symbiosis Programme) facilitated a partnership between consultancy group Scott Wilson and Park Road Baptist Church wherein the church reused furniture in its buildings, extending product life and saving £1,940 (34). Despite such initiatives, some 165,000 tonnes of office furniture alone is thrown away annually in the UK, half of which is thought reusable^b.

NISP has also produced numerous cases of “cascaded” reuse across several sectors, typically involving transfer of packaging from one organisation no longer requiring them to a second one.

Material Use Efficiency

Material Use Efficiency (MUE) is less a strategy, more an *ad hoc* response to virgin material surpluses (e.g. from over-ordering), but still requiring a shift in perspective such that the value of unwanted excess materials is recognised and exploited. Material Use Efficiency concerns *continuous resources*.

MUE is notably evidenced in the chemicals sector where NISP reports several instances of businesses exchanging excess raw materials with others rather than disposing of them. For example, the biotech firm Axis-Shield passes on excess chemicals - still within their use-by dates and frequently unopened - from one UK site to a different company in the same sector located nearby (35). Similarly, Chemson moved off-spec plasticisers to Polymer Industries UK avoiding 120 tonnes of disposals (and virgin) and saving £8,000 (36).

Equivalent examples come from the construction sector with numerous instances of surplus aggregate materials being reused for related or different purposes, often again with NISP support. See **L2m5-1: Construction & Demolition Sector**.

MUE is a theme too in the food and drink sector. Although evidence of actual savings is limited, research is on-going into the exploitation of ‘co-products’, converting what would otherwise be sent to disposal into valuable by-products. Examples include the diversion of peelings into bio-derived fuels or wine production residues into cosmetics (37). See **L2m5-2: Food & Drink Sector**.

What stimulates the change in approach?

Reuse and MUE seem motivated by an opportunity to save costs both for the donor and recipient – and, for example in the case of selling surpluses as animal feed – to generate additional revenues. However, financial motivations are not always enough given, for instance, the decline in potentially lucrative reclamation activities in the construction sector resulting from the heavy promotion of recycling. The need to reduce greenhouse gas emissions is also a driver. Examples of charitable donation and the desire to be seen as ‘green’ are more commonly associated with larger organisations and likely taken in response to Corporate Social Responsibility pressures.

External business support from Government (e.g. Centre for Remanufacturing and Reuse, NISP) or non-governmental organisations (e.g. Wastewatch, Furniture Reuse Network, Green-Works) is behind many initiatives. Support takes the form of identifying markets for the surpluses, external agents for ‘closed loop’ treatment and ‘extended life’ opportunities for products. New technologies may also be trialled. Sometimes governments can be more prescriptive: in Taiwan, new regulations required that reuse and exchange were considered first and only then the options of disposal, treatment and recycling.

^a Furniture reuse which involves post disposal recovery and repair would be classified as “Preparation for Reuse”; this is not the subject of this work.

^b <http://www.remanufacturing.org.uk/furniture/>

Conclusions

Reuse covers activities ranging from informal approaches, often facilitated by social enterprises (e.g. refurbishment of furniture, white goods), where assistance is needed to professionalise operations through to formal, commercially-driven Product/Service Innovation approaches (e.g. product servicing, remanufacture) which flourish with little external support. NISP is most active in the centre ground of 'cascaded reuse' where the life of relatively simple products and materials is extended.

11.3 Summary of Key Findings: SMEs

This final element of the report brings together distinct learnings relevant to SMEs. To a large extent this is an uncomfortable task since much of the evidence reviewed in this report relates to SMEs and indeed they dominate the economy. Treating them as a distinct segment therefore ignores the fact that they pervade all sectors and manifest themselves in many forms, so in truth cannot be considered a homogenous target for examination (this is comparable to describing a continent as a country). Nevertheless, the key findings for SMEs are:

- **Small companies are largely unaware of waste prevention issues, and less likely to act compared to medium or large companies.** There is some evidence that awareness of and perception of importance of waste prevention/resource efficiency increases with size of business. While this suggests that there is a link between company size and waste prevention action, a number of sources have highlighted the importance of attitudinal barriers, in particular the attitudes and perceptions of the owner-manager towards the importance of waste prevention to their business.
- **Cost saving is a key driver for SMEs to engage in waste prevention:** However, many do not understand the true costs of their waste, which includes not only the disposal costs avoided but also e.g. the raw material and labour costs embedded in off-specification products. They are, therefore, sceptical of any savings that can be achieved through waste prevention, whether that is because of other business priorities or because they think they already do everything that they can.
- **Lack of resources – staff, time, skills and finance – appears to be the biggest barrier to waste prevention in SMEs,** as it is for environmental improvement generally. The evidence suggests that SMEs are less likely to invest in waste prevention, with some sources suggesting that larger companies find it easier to allocate resources for these types of activities. However, while SMEs generally have less capacity in terms of staff and capital than large companies, some of these financial and internal capacity barriers are closely linked with a lack of appreciation and understanding of the true cost of waste embedded in resource inefficient processes. There is some evidence that SMEs require a more 'hands-on' approach compared to medium to large companies.
- **SMEs may feel powerless to act on waste prevention,** even within their own operations, because they feel shaped by customer demands and by their suppliers. While they agree that waste prevention would make sense, they tend to see their own behaviour as being determined by what their customers want and what their suppliers will provide. Small companies often feel unable to influence the behaviour of their supply chains in a way that would reduce their waste generation. There is some evidence that using large businesses to disseminate waste prevention knowledge and information through supply chains may be more effective.

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