

**WR1403: Business Waste Prevention
Evidence Review**
L2m2 – Approaches to Waste Prevention

OAKDENE HOLLINS
RESEARCH & CONSULTING

 **BROOKLYNDHURST**


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Context of Project WR1403

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

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

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

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

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

Context of this module

This module is one of a number of Level 2 modules that contain analyses of Approaches, Interventions, Sector Issues and other aspects of the review. This module deals specifically with the aspect of Approaches to waste prevention.

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

Glossary

EMS	environmental management system	SME	small/medium-sized enterprise (EU definition)
CO ₂ e	emissions of greenhouse gases expressed as equivalent mass of carbon dioxide	VOC	volatile organic chemical
CSR	corporate social responsibility	WRAP	Waste & Resources Action Programme
PSI	product/service innovation		

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}

1 Introduction

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 four broad but fundamentally different approaches. The purpose of this module is to compare and contrast these four approaches in order to draw out their strengths and weaknesses for business waste reduction.

The methodology has been to review and assess evidence gathered within the Sector and Interventions module reports. For reference, the following modules under **L2m5: Sectors** provide stand-alone evaluations of each of the sectors:

- L2m5-0: Introduction (to Sectors)
- L2m5-1: Construction & Demolition
- L2m5-2: Food & Drink
- L2m5-3: Hospitality
- L2m5-4: Retail
- L2m5-5: Automotive
- L2m5-6: Office-Based Services

The module set **L2m4: Interventions** provides a stand-alone evaluation of the following interventions:

- L2m4-0: Introduction (to Interventions)
- L2m4-1: Standards
- L2m4-2: Labelling
- L2m4-3: Procurement
- L2m4-4: Commitments & Voluntary Agreements
- L2m4-5: Communications
- L2m4-6: Incentives
- L2m4-7: Business Support - Waste Minimisation Clubs
- L2m4-8: Business Support - Other Business Support

2 Approaches Described

We have structured the review around four classes of approach. This section will explain what we mean by each approach and provide a clear, almost iconic, example of each. The examples given are well evidenced, exemplify the particular approach and are distinctly **not** the other approaches. 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 could also be 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.

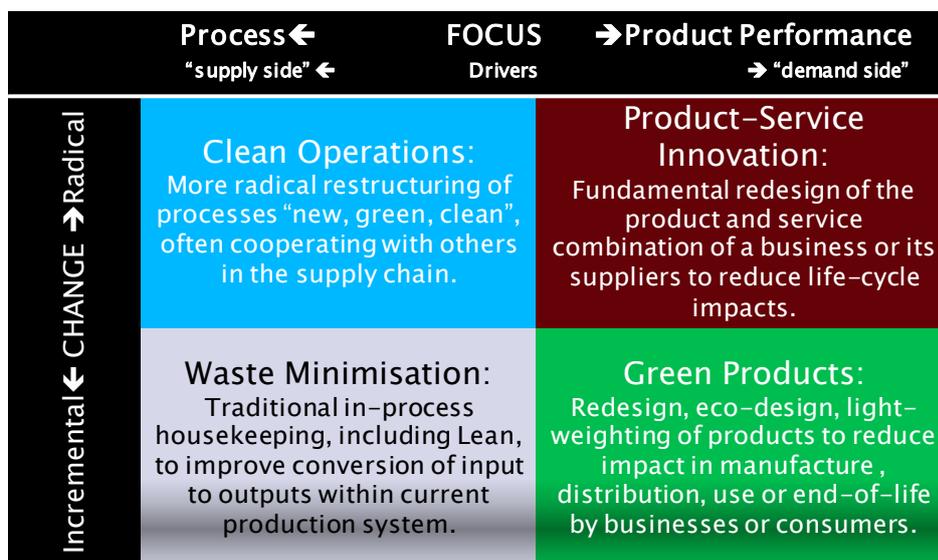
Common related terms – 'product/service systems', 'servicisation', 'servitization', 'product life extension', 'take-back', 'closed loop manufacture', 'remanufacture', 'reuse', 'business model innovation', 'dematerialisation', 'revalorisation', 'impact management'.

^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."

There are two ways of understanding the difference between these four approaches.

1. Firstly, one can think of these four approaches as moving from “incremental to radical” and “process to product performance”-oriented approaches as shown in the matrix diagram of Figure 1. At the incremental end, the Waste Minimisation approach looks at an existing operation and squeezes out waste. At the radical end, the Product/Service Innovation approach looks to fundamentally change the whole way a particular business operates. This may mean entirely new products but may also mean new modes of ownership, payment and delivery. The other two approaches (Cleaner Operations and Green Products) fit between these two extremes. An equivalent view of the “Process/Product Performance” dimensions is that Process change is driven by the supply side and Performance by the demand (consumer) side.

Figure 1: Positioning of approaches in response to business drivers including waste



Source: Oakdene Hollins/Brook Lyndhurst

2. Secondly, these four approaches can be conceived as operating from different ‘altitudes’. Waste Minimisation operates ‘on the ground’ and is concerned with day-to-day detail. For Cleaner Operations it is often necessary to look further in both time (to plan longer-term investments in new technology or processes) and geography (to look across the entire supply-chain of operation for cooperative actions). For Green Products an even broader view is required which embraces how the consumer uses and disposes, so demanding a look at the product from its design right through to end of use. Finally, Product/Service Innovation demands the widest perspective of all since it considers the entire business operation – as the ultimate, a physical product be replaced by a virtual one.

It is important to stress that the four approaches are merely *different* not ‘bad to good’ or ‘good to bad’. Each approach has strengths and weaknesses which will be considered in Section 3 of this report. However, it is also true to say that these approaches would be tackled in a general sequence. That is, a business that creates a new product/service offering may well need to redesign its physical product; changes in products may demand process and operational changes. Once in stable production, improving the efficiency would become a priority. The reverse sequence is unlikely, even perverse and quite possibly counter-productive.

2.1 Waste Minimisation

The Waste Minimisation approach is closely aligned with a business approach called 'Lean production' which looks at minimising all waste (whether physical or not) from business processes. It works by identifying and then minimising unused materials between required 'inputs' and intended 'outputs'.

To understand this approach, consider an example from the Construction sector:

Over-ordering of (and damage to) materials prior to their use on a construction site is a major problem. The value of unused materials in the UK construction industry is estimated at £1.5bn a year (9).

Wilson James is one of the leading providers of construction logistics services in the UK and key customers include Bovis Lend Lease (11). Wilson James developed the 'Construction Consolidation Centre' (CCC) approach to managing construction logistics more effectively and effectively. This is a good example of the Waste Minimisation approach (which was developed from similar techniques in the car industry).

The CCC Waste Minimisation approach provides a distribution centre and delivery service to intercept and consolidate deliveries to site. On conventionally run projects the level of waste plasterboard dry-lining could be between 15% and 25% of the total volume used. Through careful planning and management Wilson James and Bovis Lend Lease have reduced this to only 6.4%, with the residual wastage being 100% re-used or recycled.

An equivalent example from a service-oriented business is that of Ernst & Young:

Waste Minimisation Essentials – Office-Based Services

Ernst & Young is one of the world's largest professional services firms. In 2004, the UK division, which has 430 partners and 8,600 staff based in 22 cities, established a corporate responsibility (CR) team. Following a benchmarking exercise and consultation with internal and external stakeholders, the team reviewed and reinforced the existing environment management strategy. The CR team championed both waste recycling and prevention. The team increased the efficiency of paper use by switching machines to default double-side printing and kept staff informed of the company's monthly paper use and the equivalent in trees. In addition, the easy availability of stationery items was reduced while bins were removed from under employee desks.

Business Benefits

- Between 2004 and 2006 Ernst & Young reduced its paper consumption by 18% through the introduction of default duplex printing. The financial savings which resulted are unknown but likely to be substantial.
- The waste reduction programme created a high level of interest among employees, challenging their attitudes to the environment and changing behaviour both in the office and at home. This in turn might demonstrate to stakeholders that staff share Ernst & Young's environmental values.

Source: (13)

In summary, the Waste Minimisation approach is about making existing operations more efficient. Often this can be brought about by changes to personal behaviours and systems of work rather than investments in processes, plant and equipment.

2.2 Clean Operations

If Waste Minimisation focuses on ensuring minimum waste within a process, Clean Operations is an approach that tackles the problem from a wider perspective: that of how can the production process be re-engineered to be inherently less wasteful or hazardous. This may require not only a redesign of local operations, but a collaborative action with neighbours up or down the supply chain, for example to renegotiate product specifications between businesses; or in the case of chemicals- and materials-related industries, to institute radical new solvent systems and 'back-to-supplier' loops.

To understand this approach, consider an example from the Food & Drink sector:

Within this sector, the introduction of returnable and reusable packaging has proved most effective for secondary (i.e. transit) rather than primary packaging (packaging disposed of by the consumer). This is because the prospect of packaging being returned to manufacturers is low whereas it can be returned to suppliers. This is a good example of the Clean Operations approach.

The *apetito* Group is one of Europe's leading suppliers of frozen food and a signatory of the Courtauld Commitment. It had previously used single-trip cardboard packaging to deliver goods to its hospital and care home clients. However, both the company and its customers were keen to look at the use of reusable crates. In response to this, *apetito* invested in new reusable plastic crates, replacing the previous corrugated cases (14; 6).

Any initial concerns of high replenishment costs as a result of product damage or theft were unfounded as the reusable crates' life-cycle proved much higher than expected. Operationally, the new crates have proved to have no negative impact on filling, packing and fitting the multi-portion food trays, and product protection and storage capacity has also improved, thereby reducing product damage.

Cleaning is easily achieved using a jet wash and the handles on the crates make lifting and handling easier for staff. The company is already achieving commercial payback as a result of reuse against the cost of buying carton board. The change has reduced the use of corrugated cardboard by 112 tonnes each year, avoiding an estimated 230 tonnes of CO₂ equivalent.

In summary, the Clean Operations approach is about redesigning processes to be inherently less wasteful, 'greener' in the materials they use, and even more effective in closing loops within the supply chain. It almost inevitably requires investment in technology or process redesign.

2.3 Green Products

The Green Products approach (also called 'Eco-design', 'Design for the Environment' and 'Environmentally Conscious Design') involves a thorough re-examination of a particular product specifically to improve environmental performance.

To understand this approach, consider two examples compiled by WRAP from the Retail and Food & Drink sectors:

Green Products Essentials: Retail Sector

Tactic: Re-formatted products

This involves thinking through the entire lifecycle of a product and developing innovative and often radical solutions that inspire consumers.

Consider the example of Naturepaint's paint powder.

Naturepaint manufactures a sustainable, natural and non-toxic material which is produced as a lightweight dry powder in paper packs. Customers mix what they need with tap water at point of use, creating rich emulsion paint. At less than half the size and weight of liquid paint, a 60% reduction in transport emissions and storage costs is achieved.

The product contains no volatile organic compounds and the paper packaging is fully recyclable and easily compressed, meaning that there are no bulky containers for disposal.

Source: WRAP (7)

Green Products Essentials: Retail Sector

Tactic: Refillables

Product refills enable companies to significantly reduce packaging and raw material use, and can make financial savings through efficiencies in transportation and storage. Any cost savings in the supply chain may be passed on to consumers, and these products can help to engage them in environmental issues and generate product loyalty. Communicating the benefits to consumers is therefore important.

Consider the example of Robert McBride with its 'i-clean' product.

This company has introduced an innovative multi-surface cleaner – 'i-clean' - with concentrated refills. It enables consumers to reuse each trigger bottle up to 10 times. Once the initial bottle has been purchased, consumers are able to buy the 'i-clean' refill packs which provide enough formula for two bottles of product, therefore lasting twice as long and offering value for money. The environmental benefits are considerable – if each bottle is refilled 10 times it represents a potential packaging saving of 340g of plastic and cardboard. Robert McBride estimates that it takes around 342 truck loads to deliver a year's supply of standard trigger cleaner, which compares to 58 for the 'i-clean' refillable solution. This could potentially reduce lorry loads by around 85%, as well as avoiding the transportation of 4.2 million litres of water over a year.

Refills are growing in popularity in the grocery sector. Hand wash refills, such as Radox, are becoming mainstream and coffee refill pouches were launched by Kenco in 2009, supported by a major advertising campaign. The coffee refill packs can be sent for recycling to make into products like shopping bags or umbrellas.

Source: WRAP (7)

The Green Products approach is about redesigning the product and/or its packaging; it may often be seen in as an enabler for new Product/Service Innovations, as described below.

2.4 **Product/Service Innovation**

The Green Products approach requires a redesign of individual products. However, the Product/Service Innovation approach requires a redesign of a company's business model, the way it makes money from delivering products or service of products, with less waste. The literature of Product/Services has identified three basic types: Product-oriented where the user buys a product, then pays for repairs, consumables or upgrades; use-oriented, where the supplier retains ownership, but the user pays 'per use', such as renting or pooling; and results-oriented, where the product is a means to an end, the customer has no control over the product and the outcome is the promise (e.g. painting services, couriers).

To understand this approach, consider a hybrid product/use-oriented service example from the heavy commercial vehicles arm of the Automotive sector:

Product/Service Innovation Essentials: Automotive Sector

Caterpillar (CAT) is a technology leader and the world's largest maker of construction and mining equipment. Business evolution at CAT began in 1972 following demand from its customers in the US for high quality, low cost replacement engines for their on-road truck fleets (10). This led them to use the Product/Service Innovation approach to reinvent their business not merely to produce new products but to take back old components, fully remanufacture them (return to as-new condition) and then sell them back via their dealer network. This is a good example of Product/Service Innovation.

Every remanufactured product that leaves their Shrewsbury factory has been through a stringent quality test procedure, often having been passed along the same production line as a new product. This is backed up by a full warranty, the same as is issued with a new product.

When a customer purchases a remanufactured part from CAT it is delivered to them in a reusable container, for which they pay a deposit. When returning a worn part (core), customers are expected to use this container. The customer also pays a "core deposit" which is refunded upon receipt of their worn part (provided it is complete and has no extreme damage). The worn parts are then sorted at Shrewsbury and given a basic visual inspection. Some parts will be remanufactured on site and others will be shipped to facilities elsewhere.

In 2005 CAT's global remanufacturing operation reused 43,000 tons of core material. This means that by remanufacturing rather than recycling, CAT prevented 52,000 tonnes of CO₂e entering the atmosphere. It also means that other associated waste due to raw material extraction was substantially reduced.

The Product/Service Innovation approach is about redesigning the business model.

2.5 Mixed Approaches

Within our review we have come across actions that do not fall exclusively within the approaches described above and neither do they comprise a distinct intervention. These we have called Mixed Approaches.

A prime example is that of Site Waste Management Plans (SWMPs) which – possibly prompted by an organisation such as WRAP or a Regional Development Agency – adopt a line of attack or methodology for waste prevention; putting the plan into action may require a number of agencies and a number of approaches, modest on their own, but adding up to significant totals. The following illustration is taken from the construction sector:

Mixed Approaches Essentials: Construction & Demolition Sector

Through the development and identification in a SWMP, Bovis Lend Lease and Morgan Ashurst refurbished offices and workshops in a naval base in Portsmouth. The following key actions were identified and implemented:

- Ceiling heights were adjusted to match plasterboard panels (Green Products/Clean Operations), and
- Blocks and bricks were reused diverting 1,013m³ of material from landfill (Waste Minimisation)

This resulted in a £2,860 saving.

Source (5)

An alternative from the retail sector concerns the Carrier Bag Commitments:

Mixed Approaches Essentials: Retail Sector

Carrier Bag Commitments represent a mixed approach as they combine the following:

- simply issuing fewer carrier bags (Waste Minimisation)
- replacing single-use bags with reusable bags (Clean Operations)
- redesign of carrier bags to use less material (and also greater recycled content) (Green Products)

Two Carrier Bag Commitments have been implemented:

- 25% Commitment: to reduce the environmental impact of carrier bags by 25% by the end of 2008 (against a 2006 baseline). This target was exceeded, with a 40% reduction achieved through reducing the number of carrier bags issued, increasing recycled content and reducing carrier bag weight.
- 50% Commitment: to cut the number of single-use carrier bags issued by 50% by spring 2009 (against a 2006 baseline). This target was narrowly missed, with a 48% reduction in single-used carrier bags achieved, although a 56% reduction in weight in single use bags was achieved (3,859 tonnes) and virgin polymer content fell by 65%.

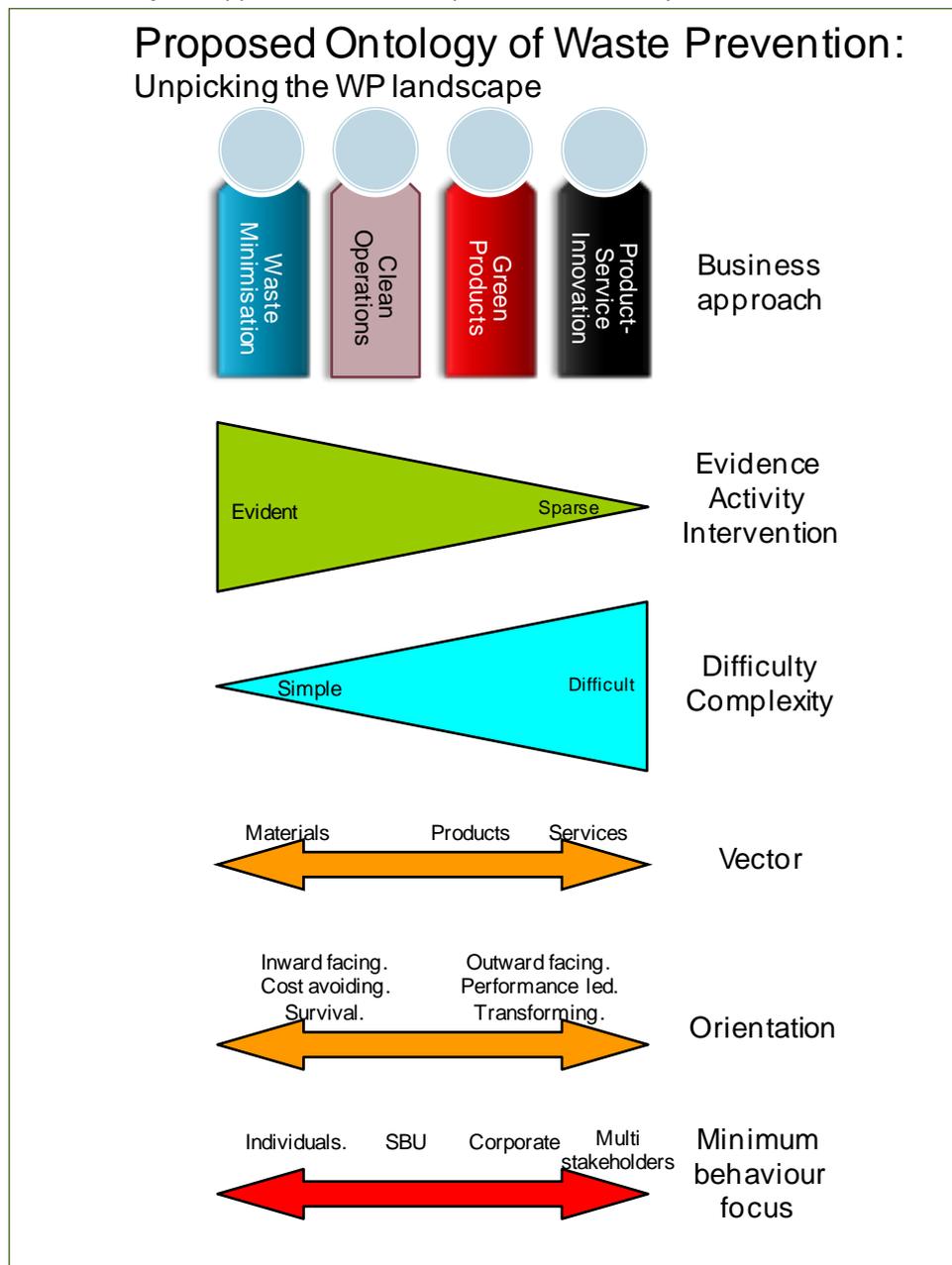
Sources (8) and (12)

Product roadmaps may also fall into the same category.

3 Approaches Placed In Context

In Section 2 we gave a clear example of each of the four main approaches for reducing business waste. However, some of these approaches are not aimed solely at reducing business waste and are therefore not equally suitable for implementation in all sectors. This section of the report will lay out the strengths, limitations and barriers for each approach with respect to business waste prevention. Firstly, however, having outlined the basic differences between the approaches, we present in Figure 2 a graphical overview of the characteristic differences between them. Some of these have been discussed explicitly by previous description, but others bear further explanation.

Figure 2: An overview of the approaches to waste prevention taken by businesses



Source: Oakdene Hollins/Brook Lyndhurst

Evidence/Activity

As will be described in Section 5, the bulk of evidence pertains to Waste Minimisation and least to Product/Service Innovation (PSI). The reasons for this we hope are apparent from the rest of this section, but can essentially be traced to two sources: difficulty/complexity (described next) and orientation (discussed thereafter).

Difficulty/Complexity

This describes both the complexity of the changes required and the difficulty in motivating the actions to make those changes. Waste Minimisation is least difficult and complex since it deals with essentially incremental improvements to a well-established operation at a single business site. By contrast Innovations require entirely new business models, product concepts, supply chains, processes and customers, perhaps with novel delivery channels.

Vector

As described, Waste Minimisation is predominantly focused on material efficiency of use as the measured 'activity'; Clean Operations also uses materials metrics, but is concerned with breaking the constraints of the current production basis, possibly to address multiple resource efficiency goals; Green Products clearly focuses on products and (largely) their embodied environmental impacts in critical phases of the life-cycle; and PSI on utility, service or performance as the activity under examination.

Orientation

In Waste Minimisation, the degrees of freedom are quite limited. Material efficiencies translate generally either into cost savings or, in the case of hazardous materials, a license to operate. The dominant metaphor is that of an internal focus on cost reduction and survival. At the other end, PSI is outwardly focused, demanding engagement with numerous stakeholders, seeking advantage through performance to expand the business in new directions.

Behaviour Focus

Waste Minimisation is commonly enabled by engaging with individuals or units within a company to alter attitudes and behaviours to be more aligned to waste prevention mentalities. Clean Operations demand at least a business unit commitment to changed processes and relationships with suppliers, customers or partners; Green Products may push further into the corporate ethos, policies on producer responsibility and life-cycle management whereas PSI requires engagement and cooperation of the business with several or new stakeholders and most importantly enhanced customer relationships.

Within the following sections, the strengths and limitations of each approach are outlined in further detail.

3.1 Waste Minimisation

Strengths

A core strength of this approach is that it is easy to understand and appeals at a practical, operational level. In essence, it simply requires people to look at what goes into a process and what comes out as useful 'product'. Whatever is 'lost in the middle' can be seen as 'waste' and therefore investigated and minimised. In this respect, waste can be measured as a relative material efficiency, an appealingly simple metric.

Whilst it may not always be called Waste Minimisation (for example, Lean production can be employed as a tool if waste is taken as an objective) its close connection with cost means that a number of different people can quickly evaluate the need to do something, even if it is merely to reduce financial loss and not material loss. Further, these savings have been identified within the business and so are, to a large extent, independent of others in the supply chain.

The approach is therefore commonly not reliant on any environmental motivation within the organisation as it involves the language of ‘profitability’, ‘competitive advantage’ and ‘efficiency’ rather than ‘waste prevention’. Please see module **L2m3: Behaviours**, for more on these issues.

Limitations & Barriers

The major limitation of this approach is that it works within a company’s current mode of operation. If a company only goes through studies to squeeze out waste, this can lead to the false impression that no more can be done. However the other approaches require businesses to look beyond their boundaries to embrace more fundamental changes. By doing this, the same company may find that a Cleaner Operation or Green Product can entirely remove (rather than merely squeeze) waste.

Conversely – and perversely – another limitation can be that small improvements seem too small or mundane for organisations to voluntarily report. However, as all publicly funded projects require and fund reporting, they are better known. This may lead to false assumption that public funding for Waste Minimisation is needed, when in fact it is merely that they will be better reported. A ‘long tail’ of small improvements is therefore a barrier to us knowing just how much of this activity is taking place.

3.2 Clean Operations

Strengths

A strength of this approach is that by joining up aspects of a supply chain a step reduction in business waste can be achieved. This is because, in contrast with waste minimisation, the constraints of optimising within a fixed, localised operation can be challenged. The approach clearly requires greater investment in processes so – in capital intensive sectors – may only be justified with high volume activities. However, the corresponding cumulative reductions can be significant with savings shared amongst the various players in the supply chain.

It can also ‘piggy back’ other initiatives (such as Zero Waste to Landfill, reduced VOC emissions or Packaging Waste Regulations). See modules **L2m5-5: Automotive Sector**, Section 3.2 and **L2m5-2: Food & Drink Sector**, Section 4.2.

Limitations & Barriers

Clean Operations often requires the introduction of new technology (as with new paint shop procedures in the automotive sector) or new equipment (as with the returnable packing crates in the food & drink sector). These require significant start-up investment and thus the approach is limited where a clear payback is not apparent for the necessary investment. The result of this limitation is to make the approach more suitable where high volumes of production bring faster returns on investment. See module **L2m5-2: Food & Drink Sector**, Section 3.3.

Many of the examples given in the literature are along supply chains and so there is a requirement of good supply chain relations. Sectors where suppliers change often, or are global and difficult to establish deep relationships, will find this a barrier.

3.3 Green Products

Strengths

The redesign of a product brings the opportunity to design out waste rather than to merely 'squeeze out' waste during its production and distribution. There is therefore significant potential with this approach for a single design decision (often made by a small group of people) to yield far reaching waste prevention benefits. These may manifest themselves in manufacture, use and end-of-life phases. Indeed, they are the primary mechanism for tackling hazard content issues.

Limitations & Barriers

The converse to the strength is that waste reduction is often the minor environmental saving from a Green Product redesign. This is simply because greater environmental savings are found in redesigning Green Products to reduce energy consumption or increasing end of life recyclability, particularly with the emphasis in emissions in key product sectors such as automotive and electronics. This means that few designers have business waste reduction in mind when considering Green Products (to date – EU Eco-design Directives target a more holistic view of impacts).

This approach may simply not be amenable to businesses that are constrained within a supply chain, at the mercy of customers who specify what products and functions are needed. A case in point is in construction where a Green Product might, for example, be a light-weight, pre-cast, pre-insulated wall panel which fulfils the functions of a traditional wall but effectively makes brick construction redundant. It is therefore possible that the creation of Green Products results in the growth in some industries at the expense of others, but with overall lower waste production.

Perhaps the greatest barrier to this approach is the education of designers. At present engineering and product design programmes focus more on post-consumer waste prevention than they do on pre-consumer (i.e. business) waste prevention.

3.4 Product/Service Innovation

Strengths

The core of this approach is that it brings significant waste prevention through elimination rather than incremental reductions. This is based on the assumption that eliminating the need for or fundamentally re-engineering major production activities will yield greater reductions in waste than merely finding the most efficient and clean ways. So, although Green Products can bring about a step change in waste reduction, radical innovation of business models and service delivery can deliver a quantum leap.

The radical nature of this approach means that it often allows other knock-on savings in logistics and administration. As 'servicing' requires a longer relationship between 'producer' and 'consumer', two way logistics allow return trips to return materials. Models in which the manufacturer retains control of a product are conducive to a 'whole life' mentality which focuses on maximum value extraction, commonly with material and efficiency spin-offs; compliance with end-of-life legislation and other producer responsibility obligations come as side benefit. These are often apparent in 'closed loop' business models based on performance delivery (Rolls Royce aero engines), reuse (Regeneris mobile phones) or remanufacture (Caterpillar off-road machinery).

Product/service systems can also offer significant benefits in business-to-business relationships by placing waste prevention on a sound financial footing. For example, over the last decade, a solid business has developed in the provision of so-called Chemical Management Services. Here, third party agents have

taken control of the provision and use of chemicals within other businesses, especially where they are not the core competence of that business. In aerospace, automotive and chemicals industries, waste prevention ('Waste Minimisation' in our nomenclature) has been achieved using these agents, largely motivated by a mutual financial benefit.

Limitations & Barriers

In contrast to Waste Minimisation, the PSI approach requires a reorientation in thinking from the very top of the organisation. Any change from the current business model (which may currently be a linear make-sell-dispose operation) is fraught with perceptions of risk. These may range from the fear of cannibalising existing business, alienating customers and potential shareholder reactions; to the highly personal impacts inherent in new modes of thinking, retraining and threats to established hierarchies.

Radical product re-conceptualisation and restructuring can have major implications throughout the supply chain: Whole businesses may need to change (or even disappear) and thus the approach is limited to a small number of entrepreneurial organisations who have strong leadership to 'test and prove concepts'.

Often, when ownership of products remains with the service provider – such as leasing and renting – a substantial capital investment in the inventory of products is needed. This can be a significant barrier for small, innovative companies wishing to challenge the status quo.

Although consumer demand for change is an issue, the major barrier appears to be the education of business leaders to understand how radical new business models can and do work. Undertaking the start-up of a Product/Service Innovation is one thing; knowing how to change an existing operation into such is quite another.

4 Interventions Used in Approaches

So far this report has explained the four different approaches and highlighted their individual strengths and limitations. We next examine what can be done to encourage more business waste prevention using one or more of these approaches.

A separate module **L2m4-0: Interventions** gives a fuller description of the different types of Intervention we have discerned at in this mapping exercise. The specific interventions are listed in the introduction to this module and refer to their own evidence review modules.

By consulting the evidence gathered in the different Sector, Intervention and Behaviours reports, Table 1 has been compiled. This gives a quick assessment on **evidence found** where Interventions appear to have had an influence on the application of the different approaches. The evidence of the table is that which **has** been found and can be mapped to approaches. The fact that some boxes are empty may simply reflect that no evidence was found, not that no evidence exists.

Highlights from this mapping are:

- Voluntary Agreements and Commitments do appear to have an influence (although the literature is not well stocked with clear evidence as to the basic motivators).
- Communications are vital. It was frequently reported that more waste prevention could be possible if only staff were made aware (and motivated) to take action.
- Procurement has the potential to leverage more radical change provided that EU Procurement Rules are more clearly understood.

Table 1: Summary mapping of evidence of approaches in particular interventions

Intervention	Waste Minimisation	Clean Operations	Green Products	Product/Service Innovation
Standards	EMS requirements (14001) have affected operations in the Auto sector in Germany.		EU Procurement rules are seen to prevent Specifications being set that require certain Standards or Labels being met.	
Labelling	Food Standards Agency consistent use of 'best before' and 'use by' and date labelling has reduced waste.			
Procurement			Public Sector has leverage to buy Green Products	Sustainable Events (such as Olympics) has led to some PSI activities.
Commitments	Voluntary Commitments (such as the Courtauld Commitment) have motivated action.			
Business Support (inc Waste Clubs)	Delivery Bodies (such as WRAP and Envirowise) have given much help and support to stimulate interest.			
Communications	In sectors with high staff turnover (such as retail and hospitality) good communications and staff training are vital. In offices, awareness of double-sided printing is low although behaviour change is possible.			
Incentives	Avoiding Landfill tax has been important for C&I sector.	The CSR advantages for 'cleaning and greening' has been a motivation for activity within the Retail sector. Financial incentives still appear greatest overall.		

Source: Oakdene Hollins/Brook Lyndhurst

5 Prevalence of Approaches

How common are each of these approaches in delivering Business Waste prevention? Like any attempt to infer prevalence the answer will be contingent on the particulars of the method or sources examined. In particular, simply assessing volume of literature may not reflect the actual degree of impact. For example, publicly supported programmes have a strong incentive to report and justify their actions; hence they may appear more prevalent than equivalent in-house efforts that remain unreported. Accordingly, we have used three methods to provide a balanced assessment of the prevalence of these four approaches.

5.1 Existing Surveys

First we reviewed existing industrial surveys. These give different indications of the proportion of businesses that are currently taking action on waste prevention. A more detailed assessment is available in module **L2m3: Behaviours, Section 4**.

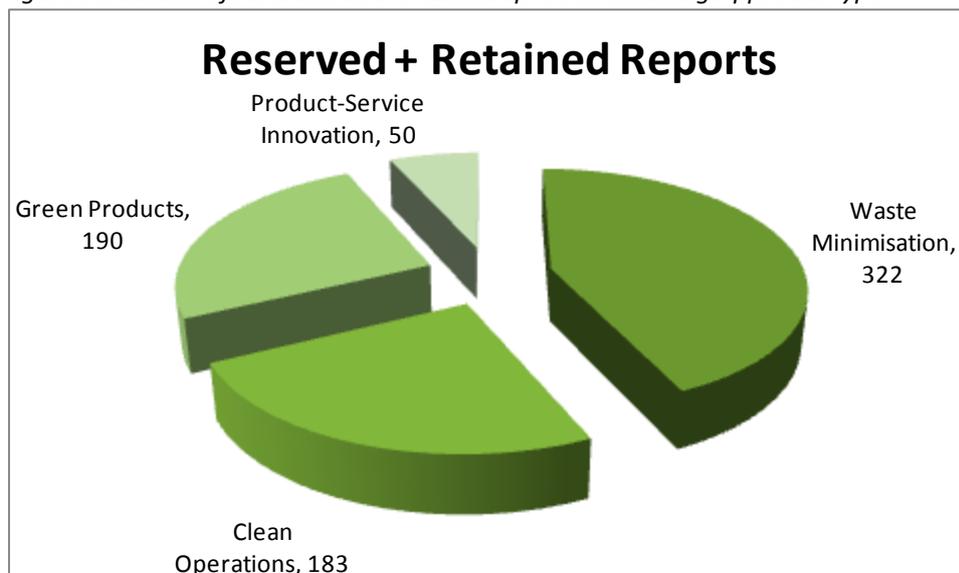
- The Federation of Small Businesses surveyed 9,761 small businesses in 2009 and found that 15% claimed that they “use raw materials more efficiently”, and 23% “raise awareness of waste with staff” (1).
- In a survey of 7,000 UK SMEs in 2009, 41% of those businesses who claimed to have introduced measures to reduce harm to the environment (base not given) also claimed that they “cut down on business waste” (2).
- An Envirowise survey of 3,250 sites in four sectors reported 53% had taken action to make changes to their products or processes to “minimise waste and reduce their environmental impact” (3).

In summary, this brief review showed that formal survey data cannot be used to reliably gauge the prevalence of these individual approaches because few surveys distinguish between them.

5.2 Raw Data Classification

The second method was by analysis of the classification of reports gathered from the entire initial literature search. During the review and abstraction stage, each report was classified against the four approaches (with some being classified for more than one approach). Figure 3 shows the crude frequencies obtained by a simple count of these within the evidence base. The statistics are based on the evidence review database as of 30 November 2010, and are in respect of the reports of all quality that have been retained or reserved for further analysis.

Figure 3: Number of reserved and retained reports mentioning Approach type



Source: Oakdene Hollins/Brook Lyndhurst

This broad-brush assessment shows that the literature gave more evidence for the Waste Minimisation approach and least for the Product/Service Innovation approach. It should be noted that the evidence for Green Products is significantly boosted by multiple reports (often duplicated or very similar) as a result of limited high-profile initiatives in the field.

5.3 Sector-Level Evidence

The third measure was based on the total number of higher quality reports classified during the detailed analysis of the literature from the perspective of each sector. Table 2 below shows the frequency of these approaches within the evidence base.

Table 2: Frequency of approach classification of higher quality^a evidence review documents

Sector	Approach			
	Waste Minimisation	Clean Operations	Green Products	Product/Service Innovation
Construction & Demolition	19	9	5	6
Food & Drink	6	14	13	1
Hospitality	7	3	3	1
Retail	3	7	12	5
Automotive	8	6	4	3
Office-Based Services	6	9	0	2

Source: Oakdene Hollins/Brook Lyndhurst

Although this more detailed breakdown helps show the likely prevalence at large (based as it is on the prevalence in reviewed literature) a number of important caveats must be made:

- Some reports were meta-reviews that listed a number of separate interventions in one report.

^a For an explanation of “quality” criteria, please refer to module L2m1: Introduction

- The high incidence of Green Product examples, especially in the Food & Drink and Retail sectors, is based on the repeated reporting of product light-weighting studies.
- With respect to Product/Service Innovations, a number of those activities recorded are not strictly attributable to the business under consideration, but rather to a third party (another business) which has met their Waste Minimisation needs by supplying them with a product/service. With the relative scarcity of examples, we have included them since they are clearly valid examples from sectors other than our core six; and because they reveal the value of engaging with more sophisticated systems to deliver profitably better a basic business need.
- The number of reports likely also reflects the nature of government support which has been more directed at some sectors than others (and particularly as such projects are mandated to make such reports publically available).
- Finally, the prevalence suggested here is based merely on the available literature gathered by the resources available to this study within the scope and timescale of that part of the review. Other instances are likely to exist which have not been traced by the search terms and reach of this work.

In conclusion, the prevalence data does suggest that the more incremental and supply-chain based approaches (Waste Minimisation and Cleaner Operations) are more prevalent than the redesign approach of Green Products and the radical business model change approach of Product/Service Innovation.

6 Conclusions

6.1 Learning

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

6.2 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 (see module **L2m5-5: Automotive Sector**).

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.

6.3 *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-tried 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).

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