

Longer Product Lifetimes

Summary Report

Final Report

February 2011

Defra

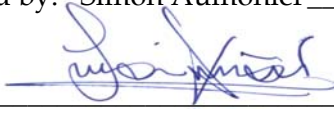
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Summary Report

Final Report

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Prepared by Jackie Downes, Bernie Thomas,
Carina Dunkerley and Howard Walker (Bridge
Economics)

For and on behalf of Environmental Resources Management
Approved by: Simon Aumônier _____
Signed:  _____
Position: Partner _____
Date: February 2011 _____

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1 INTRODUCTION

1.1 OBJECTIVES

The overall aim of this project was to understand:

- the potential for reducing the environmental impact of products by extending their lifetime; and
- how such improvements could be delivered in practice.

The specific objectives were as follows:

- to understand the scope and nature of the environmental problem associated with product lifetimes across different product groups;
- to understand how businesses currently make decisions about product lifetimes and what influences those decisions;
- to integrate this work with the parallel study on consumer attitudes to product lifetimes;
- to investigate the need and potential for Government intervention on product lifetimes within or across specific product groups; and
- to develop evidence-based suggestions on what, if any, future work could be developed in this area and on which products and interventions further work should focus.

1.2 STRUCTURE OF THE MAIN REPORT

The main report has three chapters. This summary report provides an overview of each chapter and the principal conclusions from each as they align to the main objectives outlined above.

Chapter 1, *The Scoping Report*, explains the background to this research into extending product lifetimes, the rationale for Government intervention and describes other work, policies and initiatives which consider lifetime extension in an environmental context. It provides a summary of the provisional findings of Defra's parallel study on consumer attitudes. It goes on to describe the selection process of nine example products for detailed review in the remainder of the project.

Chapter 2, *Life Cycle Impact of Nine Products*, describes in detail the product life cycle assessments (LCAs) which quantified the environmental benefits associated with extending the life of the example nine products. It goes on to draw conclusions about the environmental benefits of optimal lifetime extension strategies in general. Additionally, it includes a more detailed discussion on one environmental impact of products – waste arisings. The chapter looks at a first estimate of the total quantity of waste (in tonnes) which

could be prevented in the UK if around 10% of the selected products had extended lifetimes.

Chapter 3, *Impact Assessment of Potential Measures*, focuses on what practical steps or measures could be put in place to extend the life of products. It looks at the rationale for introducing particular measures to extend product lifetimes and presents ERM's approach to defining and to evaluating specific measures on the example products. It presents our conclusions on the potential environmental, economic and social impacts of implementing the specific measures and goes on to explain which measures are likely to be effective in extending the life of particular products.

The main report is supplemented with the following annexes:

- *Annex A* Summary of Literature Review
- *Annex B* Products and Short listing Process
- *Annex C* Life Cycle Optimisation (LCO) Model
- *Annex D* Stakeholder Workshops Materials
- *Annex E* Stocks and Sales Model
- *Annex F* Development Stage Impact Assessment Spreadsheets

Chapter 1: The Scoping Report

- Background to this research into extending product lifetimes
- Rationale for Government intervention
- Other policies and initiatives which consider lifetime extension
- A summary of Defra's study on consumer attitudes.
- Description of the selection process of nine example products

Chapter 2: Life Cycle Impact of Nine Products

- Describes in detail the product life cycle assessments (LCAs) of nine products.
- Draws conclusions about the environmental benefits of optimal lifetime extension strategies in general.
- Includes an additional focus on implications on waste arisings.

Chapter 3: Impact Assessment of Potential Measures,

- Focuses on practical steps/ measures to extend the life of products.
- Looks at the rationale for introducing measures.
- Presents ERM's approach to evaluating specific measures
- Presents conclusions on the potential environmental, economic and social impacts of
- Explain which measures are likely to be effective in extending the life of particular products.

- Annex A* Summary of Literature Review
 - Annex B* Products and Short listing Process
 - Annex C* Life Cycle Optimisation (LCO) Model Results
 - Annex D* Stakeholder Workshops Materials
 - Annex E* Stocks and Sales Model
 - Annex F* Development Stage Impact Assessment Spreadsheets
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2.1 BACKGROUND

We live in a world of 6 billion people, with the global population's impact on the planet's resources growing annually. We are making, transporting, buying, using and throwing away more products than ever before. In the process we are emitting more greenhouse gases, producing more waste, abstracting more water, destroying more forests, habitats and depleting biodiversity.

We need to consider ways in which we could reduce the UK's environmental impact from product consumption whilst maintaining growth and quality of life. This could be achieved through reduced product consumption or through innovation which results in fewer emissions. This needs to be achieved without meeting high levels of resistance from, for example, consumers or producers. One possible way of doing this is to extend the life of the products that we consume. The challenge is how to address this as given that increasing levels of product consumption could appear to be fundamental to UK economic growth.

2.2 RATIONALE FOR GOVERNMENT INTERVENTION

In looking at the potential for extending product lifetime, it is necessary to consider why the market has failed to deliver extended product lifetimes or why the Government should intervene.

In the context of sustainable consumption and production (SCP), there are three types of market failure which provide potential rationale for intervening to try to achieve longer product lifetimes:

- **Imperfect information.** Both consumers and producers require complete information if they are to make efficient decisions about what to buy and supply to the market. There are a number of related elements to this, such as *information asymmetry and adverse selection*.
- **Externality.** Markets deliver efficient amounts of goods and services when 'agents' bear the full costs of their activity. But if one agent imposes a cost or benefit on the other which is not charged or compensated for, there is said to be an 'externality'.
- **Imperfect competition** such as monopoly or oligopoly exists where one or a small number of sellers are able to control the supply and price of a good or service.

ERM's review of existing policy measures shows that none has extended product lifetimes as their *primary* objective.

- The Eco Design Directive includes specific reference to lifetime extension and parameters such as *minimum guaranteed lifetime, minimum time for availability of spare parts, modularity, upgradeability, reparability*. However, to date, the main focus has been in setting targets for improving the energy efficiency of these products.
- The Waste Framework Directive includes waste prevention as the first priority and one cited example is *the re-use of products or the extension of the life span of products*.
- The *EU Sale of Consumer Goods and Associated Guarantees Directive (99/44/EC)* ⁽¹⁾ is also notable in that it demands that all consumer goods sold in Europe have a two-year guarantee. If a defect is detected, buyers can demand a full refund. This area is considered in one of our proposed measures (entitled Extended Warranties) in *Chapter 3*.
- The EU Ecolabel ⁽²⁾ and Nordic Swan Ecolabel ⁽³⁾ have established some rules which define product durability standards and some labels require product manufacturers to make spare parts available in the future.

At a UK level a number of initiatives have touched on extending product lifetimes. This includes Defra's product roadmaps (eg on clothing, electronics and food products) and WRAP's Love Food Hate Waste campaign which includes initiatives to extend the lifetime of foodstuffs in the home. However, in general, few policy or government initiatives have lifetime extension within their remit.

WHICH PRODUCTS AND SERVICES HAVE THE GREATEST ENVIRONMENTAL IMPACT?

ERM identified a number of studies which have identified products and/or economic sectors which have high or significant environmental impacts. This includes the EIPRO work by the European Commission and the WRAP 2009 study entitled '*Meeting the UK climate change challenge: The contribution of resource efficiency*' ⁽⁴⁾

Whilst the EIPRO study provides an indication of the high impacting products in the economy it does not identify products where it may be possible to mitigate the impacts through extending product lifetime.

(1) http://europa.eu/legislation_summaries/consumers/protection_of_consumers/l32022_en.htm

(2) http://ec.europa.eu/environment/ecolabel/ecolabelled_products/product_categories_en.htm

(3) <http://www.svanen.nu/Default.aspx?tabName=CriteriaEng&menuItemID=7056>

(4) WRAP (2009) Meeting the UK climate change challenge: The contribution of resource efficiency http://www.wrap.org.uk/downloads/Final_Report_EVA128_SEI_1_JB_SC_JB3.c03bc484.8038.pdf

The WRAP study, however, aims to provide an indication of the possible resource efficiency savings of SCP measures. It describes four relevant strategies to optimise or extend product lifetime, namely: lifetime optimisation; shift from goods to services; restorative economy; and reducing food waste. It goes on to list generic categories of products within each of these.

2.5 *WHY AND WHEN ARE PRODUCTS DISCARDED ?*

Two main types of product obsolescence are described within academic literature on product lifetime issues. These are 'technological obsolescence' in which a product becomes outdated/ unusable and 'psychological obsolescence' (a subjective consumer decision).

Tim Cooper, a UK academic in this field, extended the theory to include a third category referred to as 'economic obsolescence'. This is where the consumer places little economic value on the product because it becomes more expensive to maintain or repair it compared to a purchasing a new product. His work is detailed in *Chapter 1* and provides insights into the status of appliances at the point they are discarded.

A key finding is that **product lifetimes are not routinely measured and there is extremely limited quantitative data available in the public domain regarding actual product lifetimes or trends concerning product lifetime.** In developing and assessing measures for lifetime extension (*Chapter 3*), ERM's assumptions on actual and possible lifetimes of products were primarily informed by anecdotal information from stakeholders.

2.6 *LIFE CYCLE STUDIES CONCERNING THE EXTENSION OF PRODUCT LIFETIME*

ERM was keen to identify quantitative and robust data on the environmental life cycle impacts of longer life products compared to the conventional volume-based business models.

Some comprehensive and quantitative studies were identified including research on the remanufacturing of engines, upgrading the components of personal computers, batteries, laundry services, lighting and the refurbishment of washing machines. Each study established there were potential environmental benefits to be gained from these alternative business models.

ERM was also keen to understand:

- whether remanufacturing/repair or refurbishment of products to extend their life can have a detrimental effect on subsequent product performance; and

- whether it is preferential to immediately replace less energy efficient appliances at the end of their life with the most efficient energy appliances available on the market.

The academic research reviewed in this work suggests that, on the basis of lifetime optimisation modelling, extending product lifetime is desirable in all instances, except where there is a significantly more efficient new product available.

This research raises some interesting ideas which policies on longer product lifetimes would need to consider. For example, if a frequently or continuously used product with A+ energy rating is only part way through its useful life, then there may be a switching point at which it will be worth replacing it, with a new, and higher efficiency product. Conversely it may be environmentally beneficial to keep a product in-service for longer in other circumstances. Naturally this switching point will be dependent on a range of factors relating to the product and how it is manufactured and powered.

2.7 *LIFE CYCLE COSTS FOR LIFETIME EXTENDED PRODUCTS*

An important finding of the initial evidence review is the lack of data in the public domain concerning the life cycle financial costs of lifetime extended products, relative to their less durable counterparts.

Which? Magazine ⁽¹⁾ periodically publishes product tests which include this information for selected product groups and some of the preparatory studies on Ecodesign for EUP also contain structured information. But it is clear that structured and actual life cycle costs data are generally not available.

2.8 *PARALLEL STUDY ON PUBLIC UNDERSTANDING OF PRODUCT LIFETIMES AND DURABILITY*

In the spring of 2010, Brook Lyndhurst ⁽²⁾ carried out research into consumer attitudes towards product lifetimes of a range of consumer products. This work involved canvassing the opinions of consumers (115 participants in total). The study examined purchasing and disposal decisions for recently bought products, expected lifetimes and consumer motivations for purchasing.

Consumers are aware that a product's 'lifetime' is not fixed and that it is determined by both the inherent durability of a product and the actions taken by the owner in use.

(1) <http://www.which.co.uk>

(2) Defra Research Project DE01-022: Public understanding of product lifetimes and durability (2010, unpublished). Brook Lyndhurst, 26th March 2010.

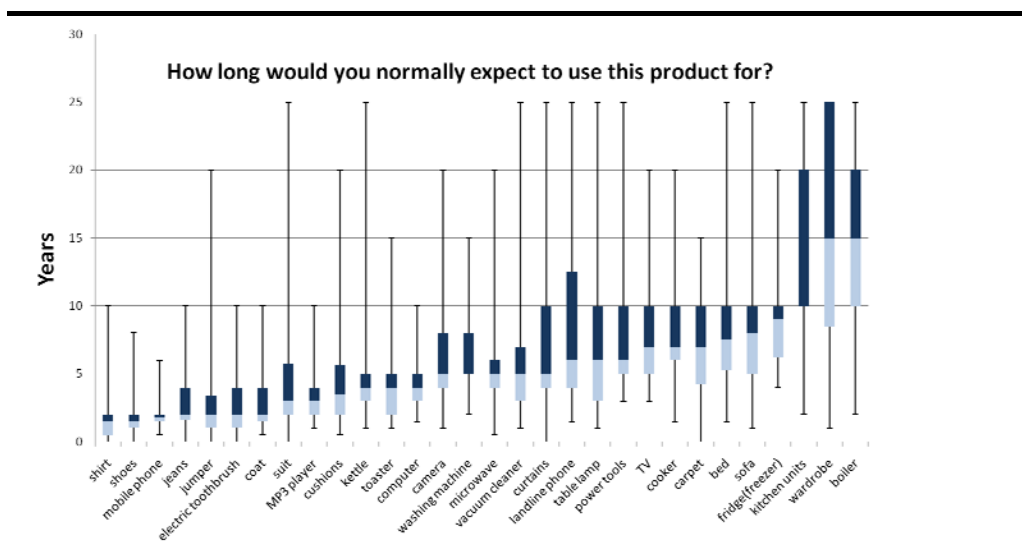
An important conclusion from the work was that products can be categorised into three types, according to consumer attitude towards product lifetime:

- *Up-to-date products* are defined in the study as products routinely disposed of by consumers because of their desire to update, eg fast fashion clothing, costume jewellery, mobile phones, televisions.
- *Investment products* are products worth spending extra on for either their style and/or their function eg. expensive/luxury clothing items, furniture.
- *Workhorse products* are products which are relied upon for their function. Such products tended to be kept in use by most consumers until they break (for example certain large and small appliances such as washing machines, irons, lawnmowers).

It is important to recognise that consumers view expected product lifetime as a subjective and variable entity that changes according to the product and person. In other words, what one person considers a *workhorse* product, another might see as an *up-to-date* product.

The research shows that consumers possess a wide range of views concerning the expectation of lifetime for individual products as depicted in *Figure 2.1* although the width of the main bars indicates there is more consensus for some product groups than others.

Figure 2.1 Findings of Brook Lyndhurst focus group expectation of product lifetimes (n = 113)⁽¹⁾



(1) Error bars show the maximum and minimum values given by participants in the survey (rather than confidence intervals). The top of the dark blue bar indicates the third quartile and the bottom of the light blue bar, the first quartile. The interface between the two coloured bar, indicates median value, the typical consumer expectation.

Brook Lyndhurst also compare their findings for consumer expectations of product lifetimes to that recorded from interviews and focus groups work by

Cooper and Mayers in 2000. Brook Lyndhurst is cautious about their findings but suggest there is a possibility that expected product lifetimes have actually shortened over the last decade.

2.9

POTENTIAL PRODUCTS FOR FURTHER ANALYSIS

Following the initial evidence review ERM compiled a list of 70 products for consideration for further research. These products were grouped into ten product groups according to their main characteristics (product type, size and propensity for technological innovation).

One of the objectives was to derive a simple means of categorising products in order to select a representative smaller number of products for detailed review with the objective of evaluating:

- the environmental impacts of extending the life of these sample products (Chapter 2); and
- the impacts of measures to extend the life of these sample products (Chapter 3).

The ultimate aim was to apply the findings from these sample products to wider groups of products. To achieve the short listing, ERM firstly developed five criteria which were agreed with Defra. Sub-criteria were developed to support each criterion.

Figure 2.2

Product Selection Criteria

Criterion 1: Is the scope to reduce the environmental impact of the product high?
Criterion 2: Is it a product which already demonstrates scope for extended lifetime?
Criterion 3: Is it a product for which there is sufficient environmental data/evidence to support action?
Criterion 4: Is it a product which has appropriate UK market engagement and penetration?
Criterion 5: Is this a product which features highly in the public domain?

ERM qualitatively ranked each of the products against each of the criteria. It was not possible to carry out a quantitative assessment of each product as this would have required detailed research for each of the 70 products.

The final process of selecting nine products became iterative (eg given existing government work on food waste and packaging, it was determined that this project should exclude these products).

The final products selected for more detailed review are listed below:

- Laptop computer
- Washing machine
- T-shirt
- Toaster
- Mobile phone
- Domestic carpet
- Carpet tile office flooring
- Printer/scanner
- Sofa

3.1 LIFE CYCLE OPTIMISATION MODELLING OF SAMPLE PRODUCTS

ERM developed a Life Cycle Optimisation (LCO) model which balances estimated production and end of life burdens for each product examined against use phase impacts over a 50 year time period. Three environmental impact indicators were considered:

- Global warming potential (GWP);
- Resource depletion; and
- Water use

For each of the nine example products, the LCO model compared two reference product scenarios – an example ‘typical’ lifetime and an ‘extended’ lifetime. In each case, we looked at the different phases of the product life cycle namely: production (raw materials and assembly); consumer use; refurbishment (if undertaken); and disposal (via recycling, incineration or landfill).

ERM conducted sensitivity analysis to establish whether the conclusions drawn from the reference scenarios would be likely to hold true under different circumstances.

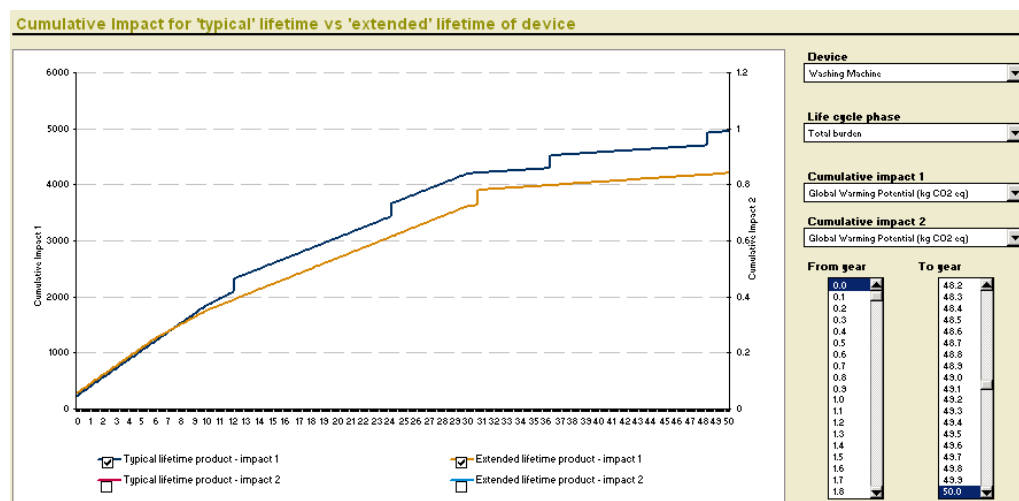
It was necessary to make a number of assumptions in the LCO model, these included: whether energy-using products may be replaced with more efficient models at the end of life; the manner in which electricity in the UK will be generated in the future; and forecasted trends in the energy efficiency of products etc.

3.2 AN EXAMPLE: PRODUCT THE WASHING MACHINE

For each product, ERM produced an estimate of the cumulative impacts resulting from the use of both the typical and the lifetime extended product over a 50 year period from 2010.

Figure 3.1 shows an example chart of the global warming impact for a washing machine. The result for the more durable washing machine is shown in yellow, that for the example typical product is shown in blue. The gap between the curves highlights the magnitude of potential savings from pursuing the extended product lifetime strategy at a point in time. For example, in this case the savings are estimated to amount to approximately 0.75 tonnes CO₂ eq for the provision of one product to the market after 50 years.

Figure 3.1 Cumulative GWP comparison over time between typical and extended lifetime washing machine



Overall the findings of the separate product studies indicate the following:

- Product lifetime extension is likely to reduce environmental impacts across the lifecycle for the vast majority of products examined. This is with the exception of the analysis for domestic carpets for GWP and water use which did not indicate benefits. It is noted that potentially significant uncertainties are evident in the research base for this product group ⁽¹⁾.
- The benefits largely result from ‘avoiding’ manufacturing and supply chain impacts because lifetime extended products are kept in service for longer, so do not need to be replaced as frequently.
- Since the manufacturing of consumer products is predominantly undertaken outside the UK, the majority of the benefits would be reported as being realised outside the UK.
- Environmental benefits will also be realised in the UK due to reduced final waste volumes. These tend to be comparatively small relative to avoided production impacts gained through lifetime extension.
- Product refurbishment impacts were shown to be negligible in size relative to the benefits that can be gained through avoiding manufacturing impacts through lifetime extension.
- For the energy-using products, foreseen improvements in their energy efficiency do not compensate for the impacts associated with manufacture.

(1) The domestic carpet analysis noted uncertainty in the impacts associated with the production of UK wool for the durable wool carpet examined in the research (relative to the surrogated process for US wool production which had to be used in the analysis).

- The findings were generally consistent for both GWP and resource depletion impact indicators. Water use only showed negligible differences between the typical and extended lifetime products.
- Where benefits for lifetime extension were identified, these were confirmed under all the different sensitivity analyses.

3.3

SCALING UP FINDINGS FOR THE UK

ERM's life cycle modelling work aimed to quantify the environmental benefits of extending the life of one product rather than a proportion of UK products on the market.

To provide an indication of the environmental impact on the UK market, a simple 'size of prize' estimate for the benefits of extending product lifetime was performed. This assumes a notional 10% of the product stock was changed from typical products to extended lifetime products. An indicator for the potential waste prevented in the UK was also calculated. This included the prevented discarded product and packaging waste and also the wastes from production, refurbishment and servicing wastes (if appropriate).

The analysis indicated the following:

- The estimated benefit varies considerably between products. This is due to the scope of the product category covered in each estimate, assumed product ownership and the size of annual sales (as determined by the lifespan).
- The greatest benefits to be gained for GWP would be for the T-shirt in which circa 100,000 tonnes of CO₂ eq would be reduced per annum through a 10% change in the market. The majority of this saving would result from non-UK operations. To put this into context, a comparable saving would be achieved by reducing circa 80,000 vehicles, from a UK fleet of 25 million cars ⁽¹⁾.

Approximately 2000 tonnes of waste T-shirts would not need to be managed each year if the market was changed by 10%. Again, to put this into context, ~1 million tonnes of post-consumer clothing waste is estimated to arise in the UK each year.

- Changing the toaster market by 10% would save ~4000 tonnes of CO₂ eq and prevent ~60 tonnes of waste per annum.
- With the exceptions listed below, benefits are indicated for the other products analysed.

(1) Assuming small car vehicle emission factor of 0.128kg CO₂/km
<http://directgov.transportdirect.info/Web2/Home.aspx> and each vehicle in the UK travel 15,000 km per annum

There are two instances where no overall benefits are observed, namely:

1. For domestic carpets, the wool-based durable carpet scenario over the typical nylon-based product results in a net increase in impacts for GWP and water use, but not for resource depletion and waste production.
2. For sofas, water use in the extended lifetime scenario of refurbishment through loose covers was shown to be very slightly (insignificantly) higher than the typical product. This is due to increased textile use.

3.4

HEADLINE CONCLUSIONS FROM LCO MODELLING

The modelling indicates that extending product lifetimes is likely to result in environmental benefits in most instances.

From an environmental perspective there is an argument for optimised lifetime extension strategies for all consumer products and in particular, for products in which manufacturing, supply chain and waste management impacts dominate over the life cycle.

This rationale for lifetime extension assumes the consumer actually uses a more durable product for longer. There would be no benefit of course in buying a more durable product or a better preserved product but then discarding it at the same frequency as the old product.

An important finding of the study is that for the energy using products examined in the research the predicted improvements in energy efficiency do not overcome the 'avoided' manufacturing impacts which result from extending product lifetime. This research however did not examine products such as vehicles, heating systems and TVs because it was identified (although not quantified) that foreseen and paradigm shift types of energy efficiency innovation had the potential to outweigh the benefits of lifetime extension.

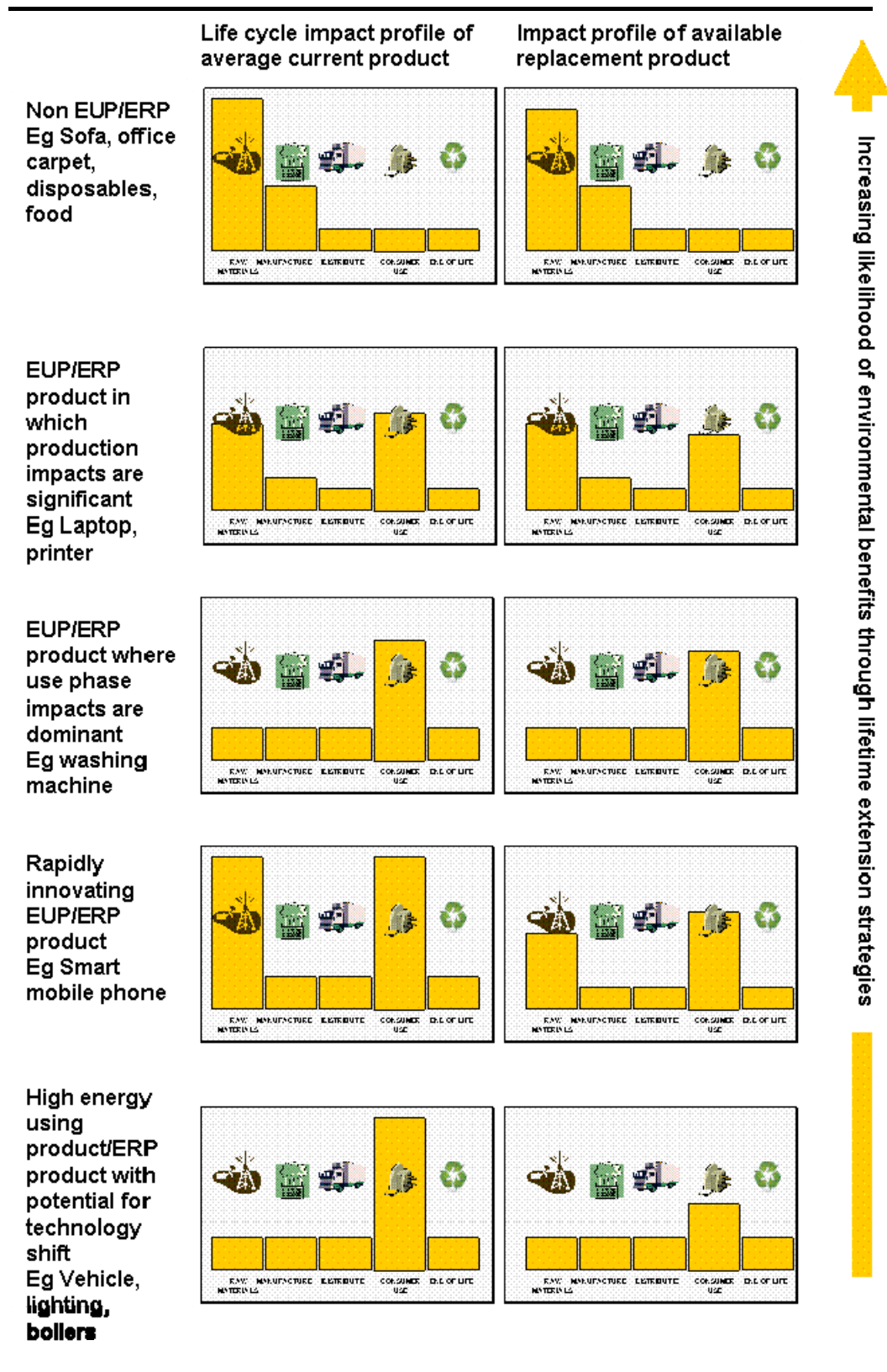
Lastly, for ICT products, that are currently experiencing the highest levels of innovation, of which the mobile phone is an example in this research, a limitation of the modelling is that the benefits of product convergence is not quantified in the analysis.

The findings for the nine products indicate that lifetime extension strategies will probably result in environmental benefits for other products from the long list of 70 products too. This is provided that the replacement product has not become radically and abruptly resource efficient. There is also a high likelihood that benefits would also result for other groups of products which were not examined in the study (ie household consumables and food products).

Figure 3.2 provides an indication of the types of products which are most likely to result in environmental benefits based on their current and near future life cycle impact profile.

However, the evidence base can still be challenged. For this reason, further life cycle optimisation studies are suggested on both a product category and individual product basis if specific life time extension measures on specific products were to be taken forward.

Figure 3.2 Summary of Transferability of Findings



4.1 PRACTICAL STEPS TO ACHIEVE LONGER PRODUCT LIFETIMES

At this stage, the focus of the project moved to the practical steps or measures which could be taken to extend the life of products. It began with two initial stakeholder workshops. Following the workshops, ERM collated a long list of suggestions for possible measures from the feedback and internal discussions. 13 measures were ultimately selected for further review on eight of the sample products ⁽¹⁾.

Table 4.1 Measure and Example Product

Proposed Measure		Example Product for purposes of conducting Impact Assessment
1.	Design for durability	T shirt
2.	Leasing business models	Commercial flooring
3.	After-care services	Sofa
4.	Deposits schemes/ product buy-back	Mobile phone
5.	Consumer awareness campaigns	Toaster
6.	Government support	Printer
7.	Enhanced Capital Allowances (ECAs)	Laptop
8.	VAT incentive	T shirt
9.	Voluntary product durability standards	Washing machine
10.	Mandatory durability declaration	Washing machine
11.	Green public procurement	Laptop
12.	IPR	Sofa
13.	Extended warranties	Washing machine

ERM carried out 13 Development Stage Impact Assessments (IA). Each IA assessed the impacts on the economy, society and the environment of a particular measure being introduced on one of the sample products.

A Development Stage IA is not expected to be a rigorous analysis of the impacts of a potential measure, it is meant to help inform strategic direction at an introductory level.

All 13 measures aimed to address the high environmental externalities of standard products relative to longer life products. 9 measures were also deemed to address the market failure of imperfect information and in particular 'information asymmetry' concerning life cycle impacts.

In each IA, ERM developed two scenarios for a sample product for the year 2030: a 'business as usual' or 'do nothing' scenario; and a 'measure on scenario'.

(1) Domestic carpet was not used as a sample product in these IAs. This was due to the findings from the Life Cycle Optimisation Modelling (Chapter 2).

4.2

ASSUMPTIONS

The level of environmental, economic and social impact of any measure which is introduced to extend product lifetime is directly related to the likely change to the market (ie the extent to which longer-lasting products take up a larger share of the market relative to standard life products) and the size of the market to which the measure is being applied.

In order to undertake the IAs, it was necessary to make a range of assumptions about each specific sample product including:

- the physical characteristics of both the standard and longer life product;
- the lifetime in years of the standard and longer life products;
- the number of products required to satisfy demand now and in the future;
- the relative market share of standard to longer life products both now and in the future; and
- the financial value of both standard and longer life products.

Preliminary sensitivity analysis shows that the 'direction of travel' appears not to change if the main variables are varied. However, ERM's findings are limited to those preliminary IAs we have carried out.

4.3

ENVIRONMENTAL, ECONOMIC AND SOCIAL IMPACTS

ERM has assessed specific measures on specific products, as it was impractical to assess generic impacts on a group of products. The assessment of the 13 measures/approaches to extend product lifetime shows the following.

- All measures lead to **environmental savings**, but these tend to be relatively small overall, since the market shift to longer life products is comparatively small in most instances, especially for voluntary measures. In general terms, the magnitude of the reduction in impact varies from measure to measure and by product, depending on the place of manufacture, UK or overseas, the impact associated with manufacture of the product, whether the product is an energy using product or not, and the ownership pattern of the product in the UK.

For all measures, the environmental savings are largely due to a decrease in product manufacturing volumes. As such, environmental savings are particularly significant for products where the product is resource intense to manufacture and the product lifetime is extended significantly.

As manufacturing activities for consumer products tend to take place overseas, most environmental benefits, reduced materials use and savings in manufacturing and materials extraction energy are achieved overseas in the country of manufacture, or of raw material extraction. For some types

of products, for example hi-tech, the extended lifetime measures will result in less demand being placed on critical raw materials (ie rare or supply constrained materials).

UK product distribution, retail and disposal impacts will also be reduced marginally, due to reduced volumes handled in the supply chain.

- Overall, the **economic impact** of the measures is mixed in terms of their effect on the UK economy. Most of the relative changes are fairly small in proportionate terms in nearly all cases; of the order of up to 10% either up or down. ERM believes it is inappropriate to emphasise particular figures as the IAs are only at an early development stage, however impacts of the order between £10m-£99m appear to be common, with some IAs exceeding this.

Looking across the measures, the effect on manufacturing is broadly negative but limited (probably because UK exposure is limited in this sector), and R&D is also lightly affected across the piece. The measures' impacts on distribution and retail are negative in seven cases and positive in five although, on balance, the negative impacts are likely to be deeper. As would be expected, repair, refurbishment and maintenance does well (no negatives at all, and some significant positives as well) and the second hand market is similarly advantaged, though to a lesser extent.

The measures also present UK growth opportunities in a number of areas, including high skilled research and development activities, and low-skilled or semi-skilled repair and maintenance activities.

- In terms of **household/consumer expenditure**, for some measures (most notably, Enhanced Capital Allowances on laptops and design for durability on t-shirts), there are very substantial gains expected for business and household consumers, respectively. However the effect of this is that their lower spends are reflected in lower turnover for retailers and lower VAT receipts for Government. Elsewhere, the measures encouraging green procurement on laptops, after care services on sofas and government support on printers, are not expected to impact substantially on businesses or household consumers.

The measures are expected to have negligible or small impacts on UK society. The measures are not expected to affect product functionality, but could increase product cost. The measures could increase household expenditure on products, particularly if longer-lasting products are not used to their full potential. Moreover, without compensating mechanisms, the measures could disproportionately benefit higher and middle income households, as they are more likely to pay the higher upfront cost of the longer lasting product. Compensating mechanisms could include payments for products being spread over several years.

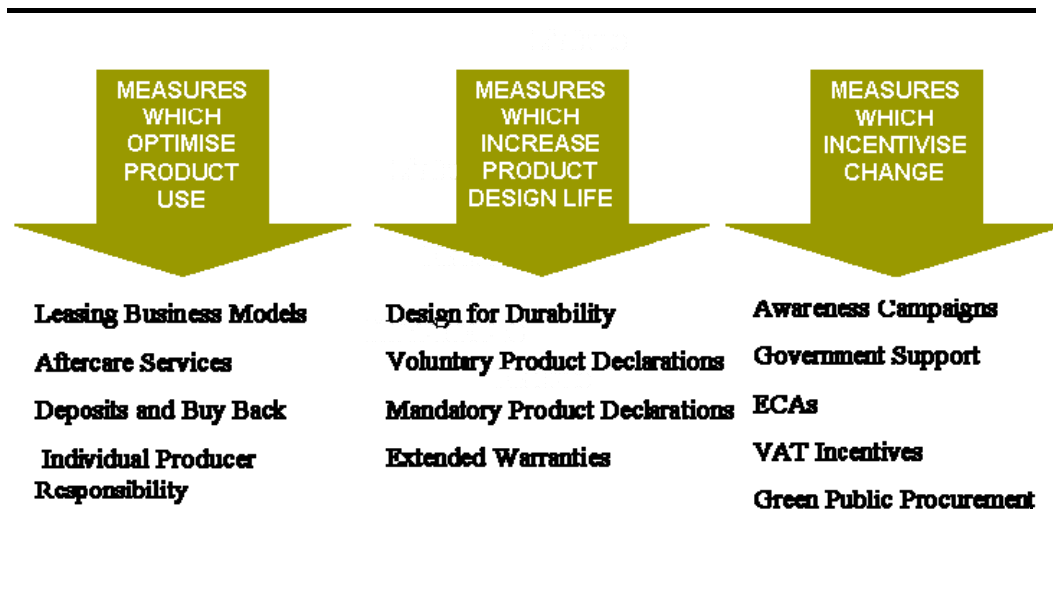
This IA work has shown that the appropriateness or effectiveness of a measure is not necessarily related to a product's group, as defined in the framework developed in *Chapter 1*.

Eight product features have been identified to categorise products in order to assess the suitability or appropriateness of measures. Some categorisations are subjective, as they rely on an individual consumer's perspective.

- The **product's consumer classification**. This is based on the consumer product categorisation identified in the Brook Lyndhurst study (2010) namely: up-to-date products; investment products; and workhorse.
- The **end user or customer** of the product will determine the appropriateness of various measures.
- The **purchase price** of the product, high or low unit cost.
- The **location of the design/production base** namely UK or overseas.
- The **product consumes significant resources during its use**, termed non-energy using and 'energy using products' here for convenience.
- The **stability of the product in design terms**.
- The **frequency of care required**.
- The **frequency of use**.
- The **ease of reuse**.

The overriding objectives of all the measures are to optimise the lifetime of the existing stock of products, or to increase the product design life of new products in the market. Some measures are primarily there to support or incentivise change in the market to bring about these changes. *Figure 4.1* seeks to categorise the measures according to their principal objectives.

Figure 4.1 Principal Objectives of Specific Measures



4.6 LIKELIHOOD OF LONGER PRODUCT LIFETIMES/CRITICAL SUCCESS FACTORS

In conducting the IA for each product, it was necessary to consider the practicalities, the strengths and weakness of each measure. A review of the principal issues across all 13 measures shows the following:

- A lack of consumer demand for longer-lasting products*

All measures with the exception of Extended Warranties will require an increase in demand for more durable products or services to extend product life if they are applied to consumer products. In ERM’s view, the key barrier is encouraging consumers to keep products for longer (or optimising product use).

Extended Warranties is the exception as this measure will result in all products being manufactured and sold with an extended guarantee and so products will be manufactured to last longer whether the consumer demands this or not (and also whether the consumer retains the products for longer or not)

Stakeholders supported the idea of a consumer awareness campaign, however ensuring the effectiveness of the campaign was considered difficult yet critical.

- The low cost of products*

Those measures that aim to optimise product lifetime with repair and maintenance activities are likely to be difficult to implement due to the current low cost of new products relative to the high cost of repair in the UK. The high volumes of low cost imports represent a significant barrier to the uptake of these measures. The issue of low cost imports would need to be addressed at supranational level, while measures could be put

in place to make repairs cheaper in the UK, eg skills, training, support to repair businesses etc.

The financial incentives demonstrated in the measures, particularly the proposed measure on reduced VAT, but also the ECA arrangements, may not prove to be sufficiently effective to drive purchasing of more durable goods or to affect the competitiveness of **low cost products** with shorter lives. In both cases, additional resources are required to establish the system, ie defining which products qualify for the arrangements.

- *The difficulty of defining durability*

Those measures that require durability standards to be produced, namely measures 8 to 11, are likely to face considerable difficulties associated with developing and maintaining standards for product durability. In ERM's view, this could be a significant barrier to the success of these measures. The definition of durability standards for individual products is likely to be a time-consuming process requiring the investment of significant resources/time both from industry and from government, as well as cooperation amongst industry competitors. Standards will need to be reviewed regularly to ensure that they remain up-to-date and relevant.

Measures which rely on the development of durability standards will be more difficult to implement for products where the design function is controlled overseas, eg where the same models are manufactured for multiple international markets.

Table 4.2 summaries ERM's findings in relation to each of the proposed measures in terms of the applicability of a measure to particular products, the critical success factors of each measure and ERM's views on the likelihood of success.

Table 4.2 Summary of Measures

Measure	Applicability to Products	Critical success factors	Likelihood of Success
1. Design for durability	<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products items where durability is not a key factor in the purchasing decision. products experiencing rapid innovation, ie new functionality, materials, fashion infrequently used consumer products, where the product is likely to last for a long time without the need for better design, due to its infrequent use pattern 	<p>Key factors are:</p> <ul style="list-style-type: none"> retailer support for sales of more durable products consumer demand for longer life products manufacturer desire to develop financially competitive longer lived designs longer-term increase in commodity prices/resource scarcity could encourage manufacturers to rethink sales-based business models 	<p>Likelihood of success - low:</p> <ul style="list-style-type: none"> durability as a factor in purchasing is generally low in consumer psyche, relative to costs. More durable products generally likely to cost more to produce and retail at higher prices in order to maintain margin retailers satisfy consumer demand
2. Leasing business models	<p>Less suited to:</p> <ul style="list-style-type: none"> low value products as leasing costs are less financially/ commercially attractive to customers. frequently used consumer products, where occasional access to the product would be insufficient 	<p>Key factors are:</p> <ul style="list-style-type: none"> retailer interest in alternatives business model to unit sales customer willingness to lease products rather than to own them desire/practicability for more complex business models repeated hire/repair 	<p>Likelihood of success - medium:</p> <ul style="list-style-type: none"> requires fundamental change to PSS business model, possible in commerce and public sector low likelihood in domestic market because consumers like to own items
3. Aftercare services	<p>Unsuitable for:</p> <ul style="list-style-type: none"> products which cannot be nurtured to increase their lifetime. <p>Less suited to:</p> <ul style="list-style-type: none"> low value products, as servicing costs may be disproportionately high compared to cost of purchasing the product. up-to-date products items where the desire to update is strong. infrequently used products that are less likely to require aftercare & maintenance services 	<p>Key factors are:</p> <ul style="list-style-type: none"> retailer interest in extension to current business models and entering into long term relationship with customer customer recognition of life cycle cost savings and preparedness to pay upfront for services desire/practicability for more complex business models repair/servicing 	<p>Likelihood of success - low:</p> <ul style="list-style-type: none"> likelihood of success may be higher for expensive workhorse and 'on show' investment products, but limited for other products where purchase cost is low relative to repair services (labour costs) appears to be limited interest in 'care/repair' amongst many consumers

Measure	Applicability to Products	Critical success factors	Likelihood of Success
4. Deposits / product buy-back	<p>Less suited to</p> <ul style="list-style-type: none"> workhorse products which are more likely to be used by consumers until the end of life. low value products where the price differential between new and second hand product could be insufficient to attract customers of second hand products products with no second hand market /low resale value 	<p>Key factors are:</p> <ul style="list-style-type: none"> retailer interest in providing deposit scheme setting cost of deposit, low enough for customer preparedness to pay up front, but high enough for them to want to return product financial and non-financial incentives to enter existence of wide consumer base with different expectations/tastes/purchasing power in order to enable multiple redeployment of product 	<p>Likelihood of success - medium:</p> <ul style="list-style-type: none"> with the exception of rapid turnover high tech electronics, and out-of-favour investment products, products are likely to have low inherent value at discard some consumers are adverse to reused products
5. Consumer awareness campaigns	<p>Unsuitable for:</p> <ul style="list-style-type: none"> commercial or public sector customers <p>Less suited to</p> <ul style="list-style-type: none"> workhorse products which are more likely to be used by consumers until the end of life. functional or valued investment products which are not likely to be discarded prematurely 	<p>Key factors are:</p> <ul style="list-style-type: none"> overcoming manufacturer/retailer/ institutional resistance to such a campaign in what is likely to be perceived by many as anti economic growth effectiveness of design of campaign in hard to target groups and clear message – nudge theory, influencing amenable and leading social groups 	<p>Likelihood of success - medium:</p> <ul style="list-style-type: none"> essential to change consumer psyche if any voluntary measures are likely to be effective
6. Government support	<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products where durability is not a key factor in the purchasing decision. imported electrical products with design and manufacturing bases outside UK 	<p>Key factors are:</p> <ul style="list-style-type: none"> requires partnership and joint working in industry requires customer demand and retailer interest for this measure to work specific measure demands consumers to consider whole life cost of products rather than impulse buy or buy only on cost. Consumer attitudes research showed limited interest at present 	<p>Likelihood of success - low:</p> <ul style="list-style-type: none"> limited funding likely to be available, so only select products would be covered. limited number of products for which UK will have sufficient influence
7. ECAs	<p>Unsuitable for:</p> <ul style="list-style-type: none"> products purchased by consumers/ householders. <p>Less suited to:</p> <ul style="list-style-type: none"> low value purchases, although a high number of low value products would be suitable, where the value taxable benefits are insufficient to drive demand for the allowance. 	<p>Key factors are:</p> <ul style="list-style-type: none"> promotion of measure and take up by procurers manufacturer interest in/ability to develop standards for more durable products 	<p>Likelihood of success - low:</p> <ul style="list-style-type: none"> promotion of measure and take up by procurers commerce focused labour costs, rather than product costs are main driver – limited impact on balance sheet of most companies
8. VAT incentive	<p>Unsuitable for:</p> <ul style="list-style-type: none"> VAT registered commerce and public sector organisations <p>Less suited to:</p>	<p>Key factors are:</p> <ul style="list-style-type: none"> government willingness/ability to implement variable VAT on products. difficulties/costs associated with 	<p>Likelihood of success - low:</p> <ul style="list-style-type: none"> limited impact on low value products.

Measure	Applicability to Products	Critical success factors	Likelihood of Success
	<ul style="list-style-type: none"> low value products where the price differential between VAT-reduced longer life products and VAT- standard life products is insufficient to drive demand. 	developing/ revising product specific standards	
9. Voluntary Product durability standards	<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products where durability is not a key factor in the purchasing decision. products where variables make it difficult to agree standards, eg uses per day, high innovation, routine care extends life. 	<p>Key factors are:</p> <ul style="list-style-type: none"> difficulties/ costs associated with developing/ revising product specific standards. lack of incentive for industry to engage. 	<p>Likelihood of success - low:</p> <ul style="list-style-type: none"> durability factor are generally low in the consumer psyche, relative to costs. more durable products generally likely to cost more to produce and retail at higher prices in order to maintain margin retailers satisfy consumer demand
10. Mandatory Durability Declaration	<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products where durability is not a key factor in the purchasing decision. products where variables make it difficult to agree standards, eg uses per day, high innovation, routine care extends life. 	<p>Key factors are:</p> <ul style="list-style-type: none"> difficulties/ costs associated with developing/ revising product specific standards. 	<p>Likelihood of success - medium:</p> <ul style="list-style-type: none"> durability factor generally low in consumer psyche, relative to costs. more durable products generally likely to cost more to produce and retail at higher prices in order to maintain margin retailers satisfy consumer demand
11. Green Public Procurement	<p>Unsuitable for:</p> <ul style="list-style-type: none"> commercial and domestic purchased products up-to-date products where durability is not a key factor in the purchasing decision. low value/low volume products, as there is an insufficient incentive to develop standard 	<p>Key factors are:</p> <ul style="list-style-type: none"> restricted to government procurers. difficulties/ costs associated with developing/ revising product specific standards. 	<p>Likelihood of success – low:</p> <ul style="list-style-type: none"> more durable products generally likely to cost more to produce, causing difficulties for public sector procurers. may fail unless in conjunction with mandatory government standard due to lack of significant incentive for industry to develop standards.
12. IPR	<p>Unsuitable for:</p> <ul style="list-style-type: none"> products which cannot be refurbished. <p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products , especially where resale value is low/ no effective second hand market. 	<p>Key factors are:</p> <ul style="list-style-type: none"> restricted to products with high value and high potential for refurbishment, otherwise will not be a mechanism for extending product life. difficulties in enforcement, ensuring reuse/ refurbishment potential is achieved. 	<p>Likelihood of success - medium:</p> <ul style="list-style-type: none"> measure may not increase refurbishment/ extended life if waste management costs significantly cheaper. could result in refurbishment of products without subsequent market for products.
13. Extended Warranties	<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date and rapidly innovating products, since an outright ban could stifle innovation/ lead to illegal import. 	<p>Key factors are:</p> <ul style="list-style-type: none"> raises the 'bar' for all products independent of consumer choice / demand significant opposition from industry. uncompetitive for UK industry – so EU wide implementation encouraged. 	<p>Likelihood of success - high:</p> <ul style="list-style-type: none"> legally defined, not standards based

One objective of this work was to consider which products are most suited to lifetime extension/optimisation measures. In this respect there are a number of key conclusions.

- ERM's work has shown that from an environmental perspective, there is an argument to support lifetime extension strategies for all consumer products and, in particular, for products in which manufacturing, supply chain and waste management impacts dominate over the lifecycle. However, the manner in which lifetime extension is achieved can impact on the benefits. So in the case of carpets it is important to understand that other lifetime extension scenarios (eg with different assumed lifetimes, or maintenance programmes) could well show environmental benefits although ERM has not assessed any further scenarios.
- The most benefit is likely to be achieved by extending the life of non EuPs (sofas, office flooring) or EuPs where the impacts of product manufacturing are significant.
- This work has only focused on nine products (and has used model specific data from manufacturers in each case) to progress the study. Obviously there are many models and types of products available on the market at any one time. A further area of research could include considering whether it is appropriate to focus lifetime extension/optimisation measures at a national level on specific products and, if so, which products.

For example, a non-energy using product which has low market penetration (niche product) or which is resource-efficient in production will not realise the same global environmental benefits as a product which has high market penetration and which is resource-intensive in production. At this stage, there is no clear summary of products which would fall into various categories.

- From an environmental perspective, it is critical that consumers use all products to their full potential, so focusing on products which are discarded prematurely, which are still in working order, or which can be refurbished, should be prioritised.
- Another means of prioritisation could respond to consumer demand for longer life products or related services. The Brook Lyndhurst work has shown that consumers have, in most cases, little interest in product durability, nevertheless there are circumstances where consumer demand appears to exist (i.e for some workhorse products). Further research could be conducted to pinpoint which kind of products this would apply to.

It is unreasonable to assume that you can not apply one measure to all products to the same degree of effectiveness. The effectiveness of any measure

is more closely aligned to a range of product characteristics rather than a classification of a product in a traditional product group.

- These characteristics include:
 - customer type (household, business or government);
 - consumer view of product (workhorse, investment, up-to-date);
 - relative purchase price;
 - geographical location of product design/production (UK or non UK);
 - product which does/does not consume resource during use phase;
 - relative rate of innovation;
 - care/servicing requirements; and
 - how readily a product can be reused.

- It appears that fewer measures are likely to be effective for up-to-date, low cost and rapidly innovating products. Further work could be carried out to understand what influences or motivates individuals' 'classifications' of products and what can be done to encourage customers to consider their products as 'investment' or 'workhorse' products.

- As the measures are not all suitable for all product types, a combination of measures will be more effective in bringing about more significant market change across the UK.

- The mandatory measures evaluated here, primarily the Extended Warranties, and to a lesser extent the Mandatory Durability Standards, are expected to be successful at extending product lifetime. However, both are likely to face opposition from industry.

The Extended Warranties measure appears to show significant opportunity for shifting the market in terms of making available longer lasting products. This is without relying on consumer demand to shift the market; as products will be manufactured to new standards regardless of whether a consumer is demanding such product characteristics.