

# Maximising Reuse and Recycling of UK Clothing and Textiles

A research report completed for the Department for Environment, Food and Rural Affairs by Oakdene Hollins Ltd.

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# Glossary

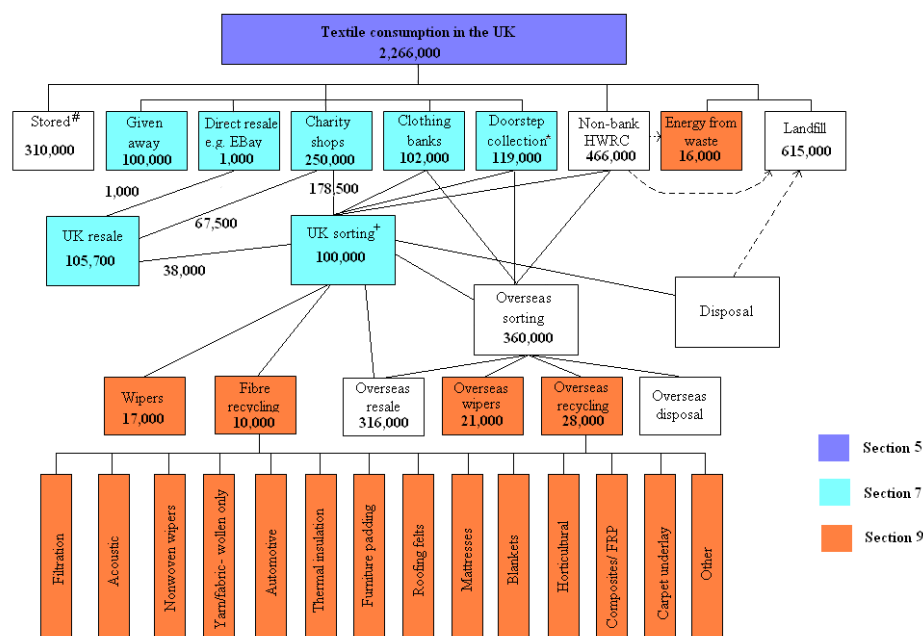
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BATC	British Apparel and Textile Confederation
CA	Competent Authority
CARE	Carpet America Recovery Effort
CBA	Cost Benefit Analysis
C&I	Commercial and Industry
CSR	Corporate Social Responsibility
DCSF	Department for Children, Schools and Families
Defra	Department for Environment, Food and Rural Affairs
DMT	Dimethyl terephthalate
EA	Environment Agency
EoL	End of life
HWRC	Household Waste Recycling Centre
Kg/hh/wk	Kilograms per household per week
LA	Local Authority
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
PAS	Publicly Available Specification
TFS	Transfrontier Shipment
TRA	Textile Recycling Association

# Executive Summary

This project was commissioned by Defra as part of the Sustainable Clothing Roadmap industry initiative. The study identifies facts and recommendations for maximising reuse and recycling of end of life UK clothing.

- 1 Textile collected for reuse and recycling has grown substantially in the last five years, reaching 523,000 tonnes in 2008 compared to 324,000 tonnes in 2003. At the same time the volume of textiles discarded as municipal solid waste has decreased from 1,165,000 tonnes to 1,081,000 tonnes. Hence the overall reuse and recycling rate has increased from 22% to 33% while total volumes discarded increased by 8%. UK sorting is that which is segregated to grades, not just



\*Including LA collections

<sup>+</sup>This figure varies largely depending on the definition of sorting used

<sup>#</sup>National wardrobe, including stored and not in use

separated from non-textiles.

- 2 Increased reuse and recycling over this period has been encouraged by increasing prices for used textiles, currently several hundred UK£ per tonne, such that both collectors and users of reused and recycled clothing have reported difficulty in sourcing sufficient UK clothing to meet demand. This has been exacerbated by the marked increased shipment of unsorted or partially sorted textiles to lower labour cost countries which may also be substantial markets for used textiles. Thus although international trade has been

instrumental in providing new markets to absorb the greater volume of textiles, it has also increased the dependence of the UK on overseas trading patterns. We recommend a risk management approach that develops UK markets and encourages UK sorting, without creating barriers to international trade. It should also be noted that prices rise and fall cyclically.

- 3 Outside of formal collection systems, internet-facilitated exchange and sale by individuals is growing from a very small base. Donation within family and friendship networks is still significant, but is believed to be declining.
- 4 Issues around definition of waste are still perceived to exist for textiles from banks, which should be widely understood to be product rather than waste.
- 5 Used textiles in residual household waste have increased slightly in the last decade, from 2.83% to 4.10%, whilst residual waste has decreased from 12.57 kg/hh/wk to 9.54 kg/hh/wk during this same period. The quality of textiles in residual household waste has declined, with 43% reusable clothes and shoes (2005 55%, 2006 60%). Sorting using textile recycling grades in a small trial in Birmingham concluded that around 75% of textiles would be of value to textile recyclers, though 33% of this was footwear, which is one of the main categories to be targeted. Lower socio-demographic groups discard the greatest percentage of textiles in residual waste. This is consistent with other research<sup>a</sup> which indicates that it is cheap, rather than out of fashion, clothing that is discarded.
- 6 A bring system of 18,500 charity shops and textile banks is growing as collection volumes increase, and can be expanded further if required. In order to achieve a higher reuse/recycling rate, the number of household collection schemes should be increased. This has grown, but lags collection of other recyclates substantially. The growth of co-mingled recyclate collection (where all recyclates are collected in a single box and sorted at a later point) is a threat to higher textile reuse/recycling if not controlled. This is because textiles can cause problems in MRF sorting, and require separate bagging at the collection stage to avoid becoming damp or contaminated, which destroys value. Separated storage is required on the collection vehicle, or a separate collection following on from other recyclates. This would also assist the avoidance of over-collection from some neighbourhoods by independent collectors, and under-collection from others where textile quality is not likely to be as high.
- 7 The collection systems above largely focus on used clothing. Issues in the collection of other textiles are:
  - **Carpet** is a large contributor (11%) to residual waste at HWRCs and has a very low recycling rate. Although some collection and sorting capacity for residential

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<sup>a</sup> "Second Hand Cultures" by Gregson, N. & Crewe, L., 2003



carpet waste is in place, there is no stimulus to process this due to lack of investment in new products and markets for the recycle. Take back and recycling/reuse/remanufacturing initiatives from some manufacturers of carpet tiles are currently active. Quality protocols and standards for recycling carpet waste do not exist. If developed they would encourage an increase in recycling rate. By following 'best practice' recommended by both Carpet Recycling UK and CARE, and with the support of industry and government, a positive impact on disposal of carpet waste to landfill could be achieved.

- **Corporate clothing** has the problems of logos/identification, of security and of the popularity of certain fibre types (notably polyester) that have depressed reuse and recycling below that of other textiles. Chemical recycling may become attractive, imitating an initiative from Japan which has been successful in attracting a number of partners. There is potential for using procurement to increase recycling and reuse in this sector.
- **Textile rental** has an existing collection infrastructure which enables recycling. This tends to involve business to business schemes, with corporate clothing and hospitality linens such as restaurant tablecloths and hotel bed linens offering the largest opportunities (where regular, thorough cleaning is required). Rental companies will take back end of first life textiles from the organisation, alongside those to be laundered, and whilst a proportion of these are often turned into wipers, there is still a large volume discarded to landfill or incineration. There are also problematic products such as mats and specialist workwear for which recycling routes do not currently exist.

8 Traditional textile recycling markets have declined in the UK:

- **Wipers** due to the decline of heavy manufacturing industry and the provision of substitutes based on virgin fibre non-wovens
- **Non-woven fibre products** including mattress flocking, automotive sound deadening and horticultural due to preferences (cost, appearance, technical performance) of virgin fibres, and also the reduced availability from UK suppliers of preferred fibre mixes, usually wool-rich, due to the changes in clothing fibres and some indirect impacts of movement of sorting overseas.

9 New non-woven applications are being slowly developed, but their potential has not been further realised since a previous assessment of this issue in a 2006 report<sup>b</sup>, with the exception of thermal insulation for buildings. Other potentially promising applications include concrete additives, soil stabilisation and geotextiles (permeable fabrics used as an integral part of a structure or system

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<sup>b</sup> Recycling of Low Grade Clothing, Oakdene Hollins, 2006

of foundation, soil, rock or similar), and horticultural/agricultural matting. Additives or further processing will be required in order to make recycled textiles attractive substitutes in these markets. We propose a number of market development interventions to stabilise traditional markets and to encourage the development of others.

# 1 Introduction

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## Introduction

- 10 Ten priority, high impact, products are being focussed on by Defra's Sustainable Consumption and Production (SCP) programme, with roadmaps being developed to identify lifecycle sustainability impacts and improve environmental performance. This project is one of three projects commissioned by Defra as part of the Sustainable Clothing Roadmap<sup>3</sup>. The Roadmap aims to improve the sustainability of clothing by gathering a robust evidence base of impacts and working with a wide range of stake holders, to build on existing interventions.
- 11 Studies on the environmental impact of products<sup>4</sup> identify clothing as having a significant environmental impact over its lifecycle. Maximising reuse and recycling of clothing helps to reduce this impact.
- 12 Previous studies on UK clothing reuse and recycling<sup>5,6</sup> have indicated that this is relatively low (between 14% and 22% of MSW). In addition, the percentage of textiles discarded as part of household waste has been forecast to rise more rapidly than other products or materials, albeit from a modest base<sup>7</sup>.

## Scope and Definitions

- 13 This project considers the end of first product life, with a scope that includes both domestic and commercial textiles such as carpets, corporatewear and textile rental products, as well as domestic clothing. It is important to note that the Sustainable Clothing Roadmap excludes carpet; however, for this project, carpets were included because there are some industry examples of recycling and remanufacture from which lessons could be drawn for clothing. Its scope includes closed loop recycling of textiles, but not textiles made from non-textile recyclates such as plastic bottles. Nor does it include post-industrial scrap such as garment cuttings, but only textiles discarded after use.
- 14 Footwear is also outside the scope of this study, though figures have been included in places for reference. This is also partly due to a number of organisations who include footwear in textiles collection figures, making breakdown difficult.

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<sup>3</sup> See <http://www.defra.gov.uk/environment/business/products/roadmaps/clothing.htm>

<sup>4</sup> EDIPTEX; Environmental Assessment of textiles, 2007

<sup>5</sup> "Well Dressed?" Cambridge University, 2006

<sup>6</sup> "Recycling of Low Grade Clothing Waste" Oakdene Hollins Ltd, Salvation Army Trading Co. Ltd., Nonwoven Research Institute, Defra WS Project WRT152, 2006

<sup>7</sup> "Modelling the Impact of Lifestyle Changes on Household Waste Arisings" Maunder A. et al. Paper presented at Waste 06, Stratford upon Avon, September 2006

- 15 Textiles in this study are defined to comprise common consumer textiles such as clothing, carpet, bed linen, towels, whether they are provided via a corporate organisation (e.g. NHS uniforms) or purchased by the end consumer. Reuse of textiles is defined as the original **product** function (e.g. clothing reused as clothing to cover a body), whereas recycling is use of the clothing **material** properties (e.g. as a fire retardant non-woven in a mattress spring cover, as a precursor chemical to manufacturing more fibre). Recycled textiles can be **upcycled** into higher value or more technically demanding applications, or **downcycled** into less demanding, lower value applications.

### **Aims and Objectives**

- 16 The overall aim of this project is to report up-to-date, comprehensive and robust data on the quality and quantity of clothing and textiles waste in the UK and present and evaluate strategies for increasing reuse and recycling rates. This includes a detailed assessment of:
- Barriers and enablers to maximising reuse and recycling
  - Technical feasibility of options
  - Infrastructure requirements
  - Examples of best practice from overseas.
- 17 Detailed recommendations for maximising the recycling and reuse of clothing and textiles waste generated in the UK are made, specifically addressing the role of a variety of stakeholders in any interventions (voluntary or mandatory).

### **Report Format**

- 18 The key methodology, findings and recommendations of this study are expressed in the main body of this report, over the following 25 pages. For more in-depth discussion and additional data disclosure, a more detailed Technical Report is included in Appendix 1. A further report, by M·E·L Research, focussing on municipal waste composition and consumer socio-demography, is attached in Appendix 2.
- 19 Stakeholder input highlighted key areas of focus, and these are discussed in individual chapters, with some of the main policy recommendations made throughout the report at the end of each section. For a quick summary of the key recommendations, read the final section of the Technical Report, Chapter 10.

## 2 Conclusions

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### Introduction

- 20 The project's scope is very wide, encompassing a variety of used textile types, diverse evidence needs, and assessment of a number of possible interventions. We also present new empirical evidence on the quality of textiles discarded to residual household waste from the perspective of a textile recycler.

### Legislation

- 21 The legislation in place affecting the secondary markets and collection of textiles has changed very little in recent years. However, the issues raised in 2006<sup>8</sup> do not seem to have been resolved adequately, with the main problems occurring around the clarity and enforcement of regulations involved.

### Data

- 22 Textile collected for reuse and recycling has grown substantially in the last five years, reaching 523,000 tonnes in 2008 compared to 324,000 tonnes in 2003. At the same time the volume of textiles discarded as municipal solid waste has decreased from 1,165,000 tonnes to 1,081,000 tonnes. Hence the overall reuse and recycling rate has increased from 22% to 33% while total volumes discarded increased by 8%.

### Quality

- 23 Sufficiently high levels of quality textiles have been identified in residual waste to make further increases in current recycling levels feasible. Targeting of lower socio-demographic households will yield higher weight percentages of textiles, so arrangements for systematic collection from all households is to be preferred.

### Collection, Sorting and Reuse

- 24 Direct reuse within family/friendship networks is significant but may be declining, whilst that facilitated by the internet is growing strongly from a small base. There is little or no UK experience of in-store collection, but experiences with battery collection may inform retailers better in this regard.
- 25 The availability of kerbside collection of used textiles has almost doubled since 2002 to over 30%, but is still only half of that for glass, plastics and metals. The

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<sup>8</sup> Recycling of Low Grade Clothing, Oakdene Hollins, 2006

growth of co-mingled household collections is a threat to greater recycling and reuse, as textiles are unattractive to MRF operators and the collection methods often result in poor quality.

- 26 Lower levels of UK sorting and the direct shipping abroad of unsorted clothing is increasing, encouraged by current robust overseas reuse and recycling markets and declining UK recycling markets. Whilst not discouraging this, a level of UK sorting is desirable in order to service UK markets and also to reduce risk of exposure to more volatile overseas trading markets. Greater transparency on fates of clothing is required from individual companies and from trade organisations, and will help to identify responsible operators with whom long term co-operation is beneficial.
- 27 Collection and reuse/recycling of corporate clothing at end of life is lower than with conventional clothing due to the large volume of identical clothing, security and branding concerns and tax treatment. There are opportunities due to its consistency, the increasing management by companies at end of life and increasing awareness of its environmental impact. Public procurement should be used to increase the overall sustainability of corporate clothing.
- 28 A carpet collection infrastructure is being created to accept carpets from HWRCs, albeit from a small base, facilitated by Carpet Recycling UK. The structure and operations of the organisation CARE (Carpet America Recovery Effort) which is being replicated by Carpet Recycling UK offers a good model for the promotion of carpet stewardship. Both organisations have established a close relationship and have common goals.

### **Barriers and Opportunities for Recycling**

- 29 Traditional UK markets for recycled textiles are declining. Market development funding, including innovation, demonstration, standards and/or capital funding for selected new markets will help to stabilise this decline and also create new markets. The latter include thermal insulation, agricultural and geotextile matting and concrete reinforcement.

### **Quality and Protocols**

- 30 Several examples of the potential benefits of standards have been identified within textile fibre recycling. Standards within this area should be explored both in traditional and novel fibre markets. Publicly Available Specifications (PASs) form a possible approach to some of these. A quality protocol may assist, particularly in the area of carpets

## 3 Methodology

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### Introduction

- 31 The project is comprised of a desk- and interview-based study with some empirical work related to quality of clothing. Information was obtained from sources including:
- Internet searches - i.e. business, academic, UK and overseas trade and industry association websites.
  - Literature searches - i.e. trade and academic journals, company literature, 'grey' literature and datasets.
  - A project Steering Group made up of Sustainable Clothing Roadmap stakeholders with an interest in reuse and recycling of clothing. Their input and feedback formed an important part of this study and was obtained partly through a stakeholder workshop held to present and discuss the interim results of the research. The list of Steering Group members is in Appendix 3.
  - Other key stakeholders who are not directly involved in the Defra Clothing Roadmap (e.g. Carpet Recycling UK, Reeds Recycling, Spruce Carpet Tiles).
  - Site visits such as to I&G Cohen, Wilcox Textile Recycling.
- 32 A literature/data review and survey of key stakeholders was carried out to clarify the information gathered and identify key themes. Quantities of clothing and textiles collected for recycling and disposed of in the household waste stream were estimated using a variety of sources including surveys by the Association of Charity Shops, industry estimates by key participants, and previous research on waste management statistics. In addition M·E·L Research were contracted to identify the quality of the textile waste stream disposed of in household waste and its suitability for reuse and recycling – an evidence gap that was identified in the 2006 study. This was done not only by interrogation of M·E·L's previous survey work on waste composition, but also by a sorting trial in Birmingham using textile recycling and reuse grades to categorise textiles from residual household waste.
- 33 The robustness of the evidence gathered was assessed in terms of credibility, reliability and objectivity. Once collated, the information (qualitative and quantitative) was analysed to form the basis for a series of key recommendations, devised by Oakdene Hollins and circulated among the project

Steering Group for comment and review and then included in the final report. A dissemination event was held to discuss the draft findings and obtain feedback.



## 4 Policy and Legislation

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### Introduction

- 34 The relevant legislation and policy affecting the UK secondary textiles industry has changed little since the 2006 Recycling Low Grade Clothing report<sup>i</sup>. However, many of the issues queried in the report remain unresolved and are discussed here.

### Definition of Waste

- 35 The Waste Framework Directive (WFD) (2006/12/EC) states that “*waste shall mean any substance or object...which the holder discards or intends or is required to discard.*” This means textiles destined for reuse in the same purpose are not waste. The WFD is an EU-wide directive, with each Member State responsible for translation into national law. In the case of the UK, Defra is responsible.
- 36 Collections from textile banks have often (wrongly) been perceived by industry as waste, as there is an expected presence of unsuitable material, from soiling, or deposit of unwanted foreign objects. The Environment Agency, however, has issued guidance to try and address misconception, stating that “*...second-hand goods for continued use for their original purpose are not waste. This could include donations to charity shops, door to door collections and textiles placed in banks for this purpose.*”<sup>j</sup> There is still some confusion among stakeholders in the sector over this position as this legal position is being interpreted differently within the sector, and by different regulators.

### Transfrontier Shipment of Waste Regulations

- 37 Textiles appear on the European Waste List, and it is up to the Competent Authorities (CAs) in each of the EU countries to decide when textiles are, or are not, being used for original purpose, and therefore whether they should fall under TFS. Clothing and textiles exported as such from the UK may be deemed waste by another CA, leading to legal complications and possible impounding of goods.

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<sup>i</sup> Recycling of Low Grade Clothing, Oakdene Hollins, 2006

<sup>j</sup> Personal communication, Alan Owers, Environment Agency, 2009

## **Charity Commission**

- 38 The Charity Commission is the body responsible for registering charities. These registered bodies then have to gain permission from each individual Local Authority (or in the case of London, the police), in the form of a collection licence, to collect in a particular area. The Charities Act is currently under review, and the regulation of these collections is potentially due to change, probably to a greater emphasis on self regulation. See the Technical Report for a fuller discussion.
- 39 Our contacts with local licensing authorities indicate very few instances of refusal to licence collection. There appears to be little enforcement of regulations and the current management of frequency of collections in particular areas appears variable. The possible alterations to the Charities Act may help to regulate the situation, but enforcement remains problematic. This also excludes entirely commercial collection companies, who do not fall under the boundaries of charity legislation. Self regulation through an industry-wide standard, and the greater involvement of Trading Standards, rather than licensing authorities, may improve the situation.

## **Local Authorities**

- 40 Local Authorities can opt to pay third party organisations credits for diversion of materials from landfill, in the form of either recycling or reuse credits. Reuse credits do not appear to be a great incentive for textiles, however, and a small survey of Local Authorities known to offer reuse credits found only a single Authority that paid these for textiles - and only in combination with furniture. The average price paid was £48, with a range of £44-£52. The use of credits is not a strong motivation given the high current price for textiles. However it may be more important in the future if textile recycling becomes economically more marginal.

## **Recommendations**

- 41 Specific recommendations are as follows:
- Greater clarity is needed on waste definitions, particularly in regard to textile banks. Where the content is reusable, this is not defined as a waste and as such is exempt from waste regulations. However, clothing which is exported unsorted should become more traceable, with recycling and reuse rates published by individual recyclers or industry bodies, in order to ensure responsible recovery methods are being carried out.

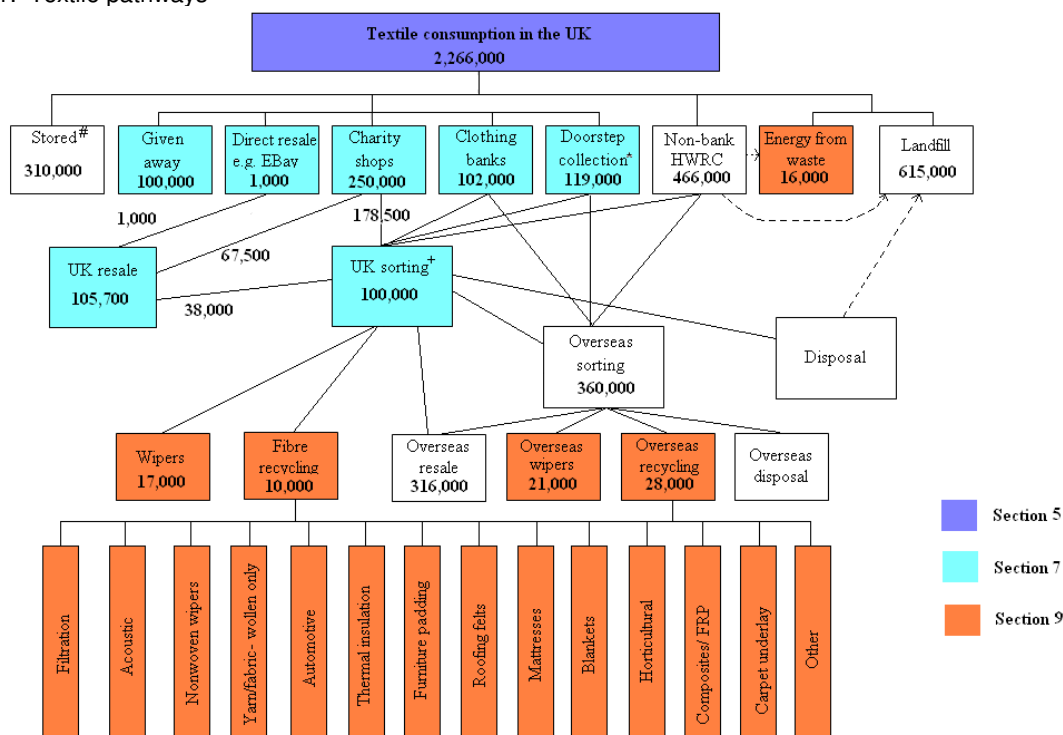
- The TFS Regulations require stronger enforcement. Where textiles are deemed as waste, regulations require enforcement to discourage inappropriate export of unsorted garments. This may also help to stimulate UK sorting, and may help reduce the occurrence of unregulated collections.
- Increased communication is needed between charities, textile reclamation merchants and public authorities in regards to identification of 'bogus' collections, and appropriate enforcement actions once these organisations have been recognised.
- Development of a universal code of practice with regard to door-to-door collections. This may better regulate frequency and, if marketed well, give the public a greater ease of recognition of non-legitimate collectors.
- Removal of the licensing of door-to-door charitable collectors from Local Authority control, as little resource appears to be available for strict vetting.
- Focus on Trading Standards as the most appropriate enforcement authority for unlicensed collectors.

## 5 Quantities of Used Textiles

### Introduction

- 42 The different collection mechanisms are discussed in depth in Section 7. These, along with some of the tonnages processed, are mapped in **Error! Reference source not found.** below. Commercial and exhibition carpet is not included in the process map, because it enters the non-municipal waste stream, and also as the recovery opportunities available vary to some degree.

Figure 5.1: Textile pathways



\*Including LA collections

<sup>#</sup>National wardrobe, including stored and not in use

<sup>†</sup>This figure varies largely depending on the definition of sorting used

- 43 Most collected textiles go towards reuse, either in the UK or abroad. The typical collection option has a number of secondary markets available to it, be they direct use themselves (e.g. charity shops reselling locally), sale to textile reprocessors in the UK, or export to be sorted and distributed overseas. Little is known about the final destination of exported goods, and therefore the tonnage to resale (316,000 tonnes) is likely to actually be lower, with some material unsuitable for wear, and some too badly soiled or damaged for any recovery and ultimately ending up in landfill. The proportion of recovered material is contested, with some industry members believing it to be lower than in the UK –

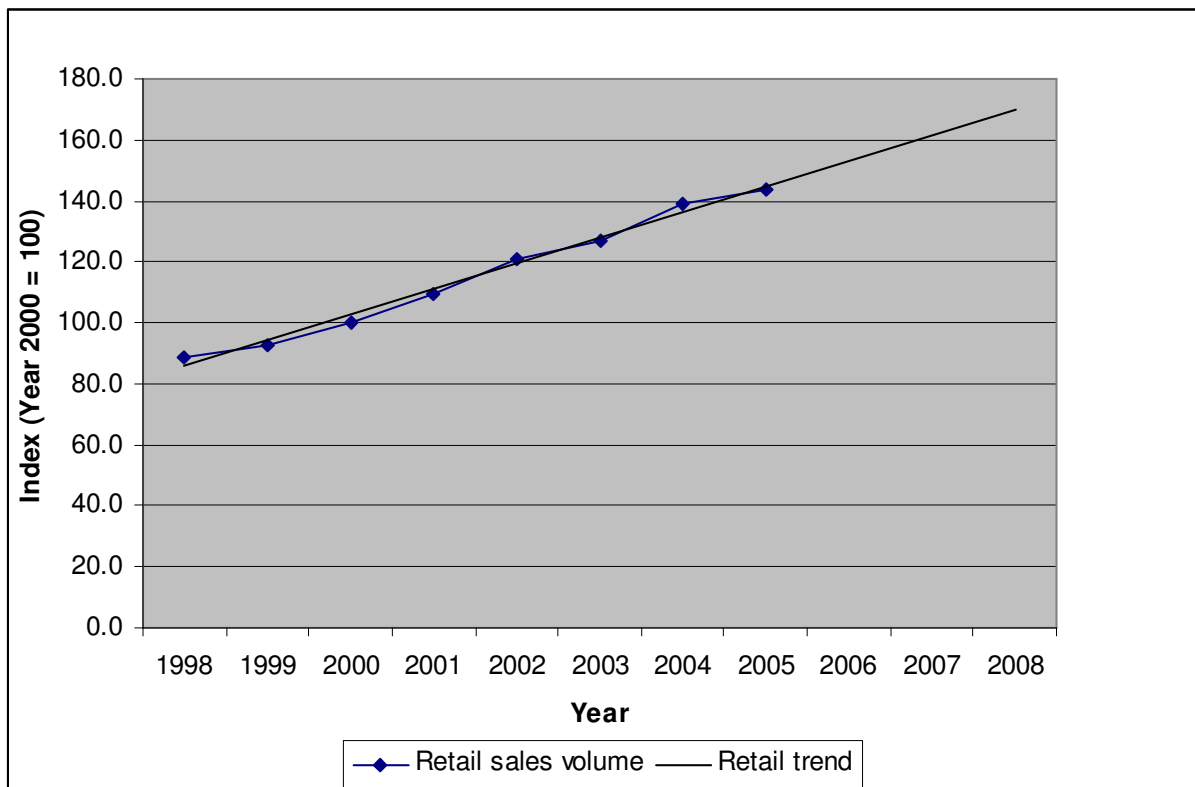
resulting in a significant quantity of textiles to overseas landfill. However, it is more likely that, due to the inherent value of textiles and the infrastructures known to be available in a number of the more popular export countries, any unusable items are likely to be reclaimed if possible.

- 44 Not all pathways had enough available data to provide breakdown of figures, but those that did have been included. The figure for UK sorting is difficult to quantify, as most textiles collected have some very marginal sort process, even if just to remove bulky foreign matter. Even if sorted in the UK, a significant proportion is exported, to be sorted further. The figure of 100,000 tonnes is an approximation of the more in-depth sort that results in textile grades being segregated.

### Arisings

- 45 Using historic BATC (British Apparel and Textile Confederation) data, the growth in volume of new clothing and textile sales in the UK is as displayed in Figure 5.2. Although the data are only available until 2005, the trend line is extrapolated to present an estimate of sales volume in the UK for 2007 of 2.04 million tonnes.

Figure 5.2: Growth in new clothing and textile sales in the UK



- 46 The total arisings for the UK in 2007 are given in Table 5.1 below. Data are largely gathered from industry sources and ONS figures (see Section 4.1 in the Technical Report for full details.)

Table 5.1: Textile consumption in UK in 2007

Textile	Consumption ('000 tonnes)
Men's clothing	538
Women's clothing	713
Household fabrics	265
Domestic carpet	370
Footwear	150
Subtotal	2,036
Commercial and event carpets	200
<b>Total</b>	<b>2,236</b>

- 47 Textiles are sorted into up to 140 different grades by industry, with some of the pathways shown in Table 5.2 below. As a simplification, the five major categories considered in the report are; UK resale, export reuse, wiper grade, recycling grade and waste.

### End-of-Life Pathways

- 48 The tonnages of textiles entering each pathway in 2008 are listed in Table 5.2 below. Data for 2008 were collected via a number of sources, (see Section 4.4 in the Technical Report) including, but not limited to; results of a survey of Textile Recycling Association (TRA) members and other textile collectors and reprocessors and industry statistics. The 2005 data are from a 2006 report for Defra on textile waste<sup>k</sup>.

Table 5.2: Summary of fate of textiles in the UK, 2008

End Use	2005		2008	
	Tonnage (000s)	Percentage	Tonnage (000s)	Percentage
Resale in UK	41	12.7	106	20.2
Export reuse	174	53.7	316	60.5
Wiper grade UK	28	8.6	17	3.3
Export for wiper	6	1.9	21	4.0
Recycling - UK	34	10.5	10	1.3
Export for recycling	20	6.2	28	5.9
Waste	21	6.5	25	4.7
<b>Total</b>	<b>324</b>	<b>100%</b>	<b>523</b>	<b>100%</b>

- 49 The tonnage of textiles recovered in recent years has increased by around 200,000 tonnes. Over 140,000 tonnes of this is an increase in textiles exported

<sup>k</sup> Recycling of Low Grade Clothing, Oakdene Hollins, 2006

for reuse overseas, though resale in the UK has also shown substantial growth. Overall, reuse as wipers and recycling of fibres has seen a decrease, though export tonnages for each have increased. The 10,000 tonnes given for recycling in the UK may be slightly misleading, as the actual consumption of textiles for recycling in the UK is higher than this, believed to be around 27,000 tonnes. Much of the textile is sourced from overseas, or is exported as clothing and re-imported back for processing in the UK after initial sorting and removal of best quality pieces for resale. Our estimates, based on survey results and industry viewpoint, put these figures as follows:

- Total UK sourced textile to recycling: 38,000t
  - 10,000 tonnes UK sourced, UK sorted and UK processed
  - 21,000 tonnes UK sourced, overseas sorted and processed
  - 7,000 tonnes UK sourced, overseas sorted and re-imported to UK.
  
- Total non-UK sourced: 10,000t
  - 10,000 tonnes overseas sourced, UK processed.

This gives a total of 27,000t available for processing within the UK

- 50 The different arisings and methods of EoL management of textiles in the UK in 2007 are displayed in Table 5.3. For comparison with the previous report's figures, and also due to the varied disposal route (through C&I waste stream), commercial and exhibition carpet is excluded from this table.

Table 5.3: Summary of arisings and disposal methods of textiles in 2007

	'000 tonnes	'000 tonnes	% of new consumption
Apparent consumption of new textiles	2,036		
Imports of used textiles	24		
Consumption of used textiles	206		
<b>Total consumption</b>		<b>2,266</b>	<b>100</b>
<b>Textiles entering the MSW waste stream</b>		<b>1,081</b>	<b>47</b>
Textiles collected for resale and recycling	523		24
Of which:			
Resale for reuse in UK	106		
Exported for resale for reuse	316		
Recycled in UK	23		
Exported for recycling	52		
Rubbish, returned to waste stream	25		
<b>Net textiles diverted from waste stream</b>		<b>498</b>	<b>23</b>
Textiles directly given away	100		4
Textiles to trade waste	44		2

Textiles unaccounted for		310	14
Textiles already accounted for		206	9

- 51 523,000 tonnes of textiles were collected in the UK for recovery in 2007, a substantial increase over the 2004/5 data given in Table 5.2. Only 25,000 tonnes of the textiles collected were deemed unsuitable for any recovery option, and therefore were disposed of to the waste stream, resulting in 498,000 tonnes actually recovered.
- 52 An additional 100,000 tonnes are believed to be given away between family members and friends, but as this process does not involve a third party, and is basically a life extension of the garment, the figure was kept separate from other recovered textile data.
- 53 The figure for textiles to trade waste is largely due to domestic carpet collected by the trade for disposal, and this figure also concurs with the Carpet Recycling UK data.
- 54 Consistent with the 2006 Oakdene Hollins report<sup>1</sup>, a considerable quantity of textiles was unaccounted for, and believed to be part of the 'national wardrobe'. This tonnage has decreased from 397,000 tonnes in 2004/5 to 310,000 tonnes in 2007.
- 55 The overall consumption is shown at 2,266,000t of textiles per year. Due to the reuse of clothing (206,000t) already being within the system, this does not increase the tonnage to be disposed of as there is an issue of double counting. The actual quantity of textiles to be disposed of therefore lies at the 2,060,000t, and using this figure as the actual consumption gives percentage total of disposal methods as 100%, but the consumption of secondary textiles was felt to be important to highlight as an input, hence the total EoL options are shown as 91% of the total consumed, with 9% accounted for already.

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<sup>1</sup> Recycling of Low Grade Clothing, Oakdene Hollins, 2006

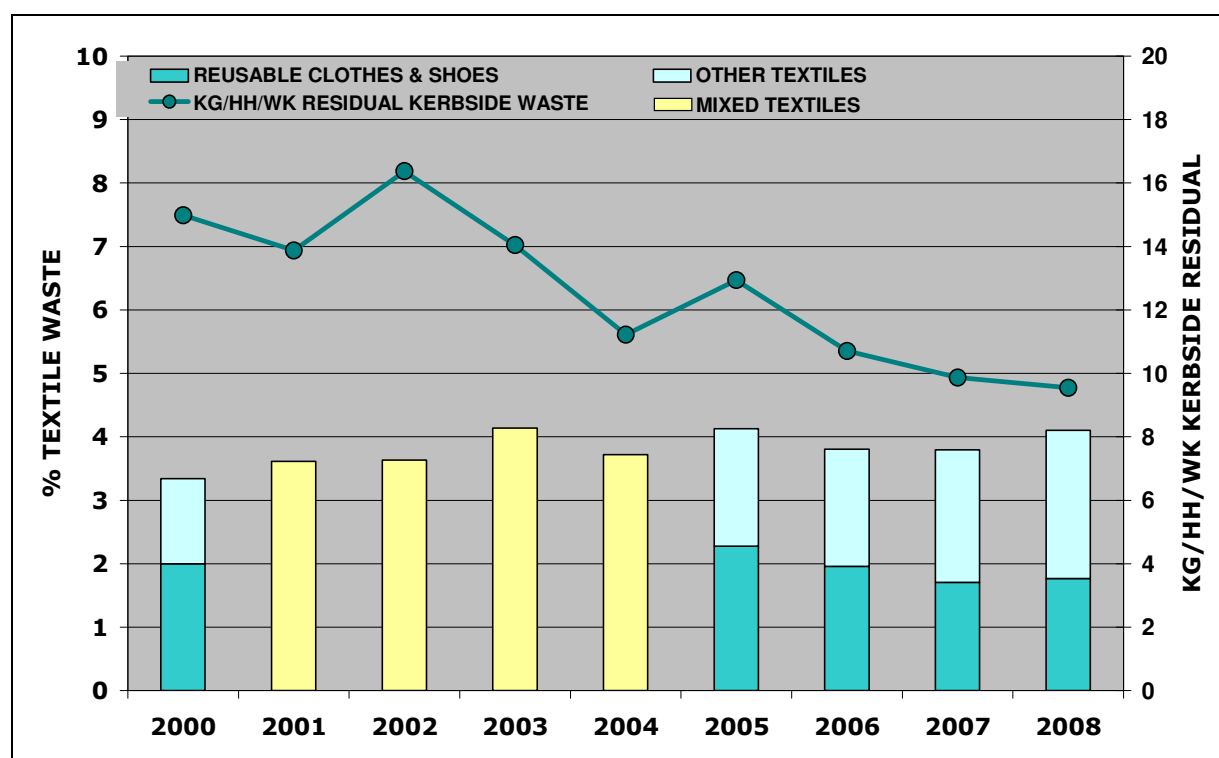


## 6 Quality of Used Textiles

### Introduction

- 56 M·E·L Research (see report in Appendix 2) carried out a comprehensive survey of waste data from information dating back to 1999. Using an archive of compositional waste data from numerous Local Authorities, information on the types and quantities of residual waste entering landfill from kerbside and HWRC sources was analysed. For the basis of this survey, data were used to identify the general disposal rates for kerbside residual waste and the concentrations of textile waste within it.
- 57 Figure 6.1 shows the decline in total quantity of household kerbside waste collections, from 14.98kg to 9.54kg per household per week (kg/hh/wk), over the previous decade. In this period, the textile proportion has been marginally increasing, though at a slow rate. Overall, the actual tonnage of textiles in household waste per week has decreased from 0.5kg to 0.39kg.

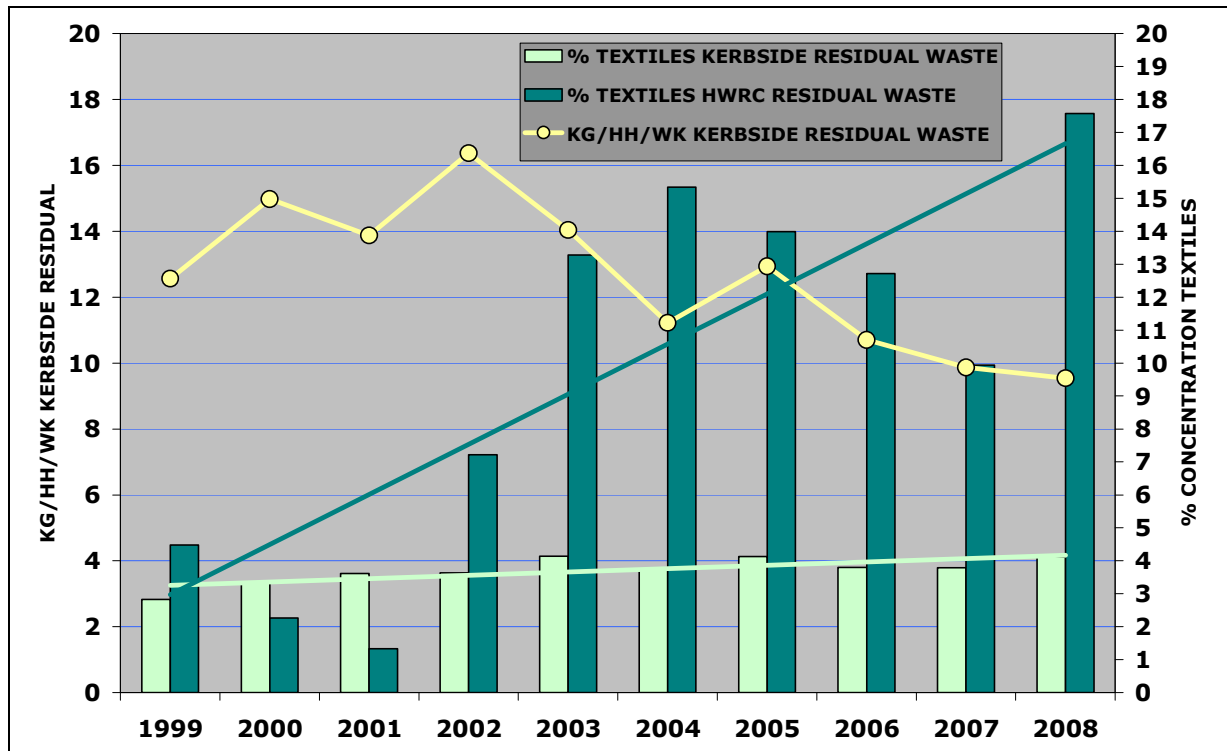
Figure 6.1: Textiles in household kerbside collection



- 58 The percentage of textile waste at HWRC sites has been increasing sharply over the decade, though year by year the values vary (see Figure 6.2). Carpet is known to be the largest percentage of textile waste at HWRC sites (65% in 2008)

and therefore carpet waste offers opportunity for improved collection and recovery.

Figure 6.2: Average residual waste generation rates



### Summary and recommendations

- 59 Overall, textiles in the household waste stream have shown a reduction in quantity over the past eight years, although as a proportion of total waste, the percentage attributed to textiles has increased. Textiles in HWRC sites, however, have seen a steep increase, with majority of material from carpet waste. This gives a good opportunity to improve collection and recycling options for carpet.
- 60 Of the textiles that are discarded to the household waste bin, nationally 43% is reusable. According to the empirical study in Birmingham, 61% is reusable or recyclable. Of this reusable/recyclable fraction, 42% is reusable clothing and 33% is shoes, leaving 25% as recyclable textile. Lower socio-demographic groups appear to discard greater quantities of textiles as residual waste.
- Attempts by textile reclamation merchants, charities and waste authorities to increase the rate of diversion of clothing and shoes from residual household waste is worthwhile and should be encouraged, particularly since lower value textiles are still worth recycling.

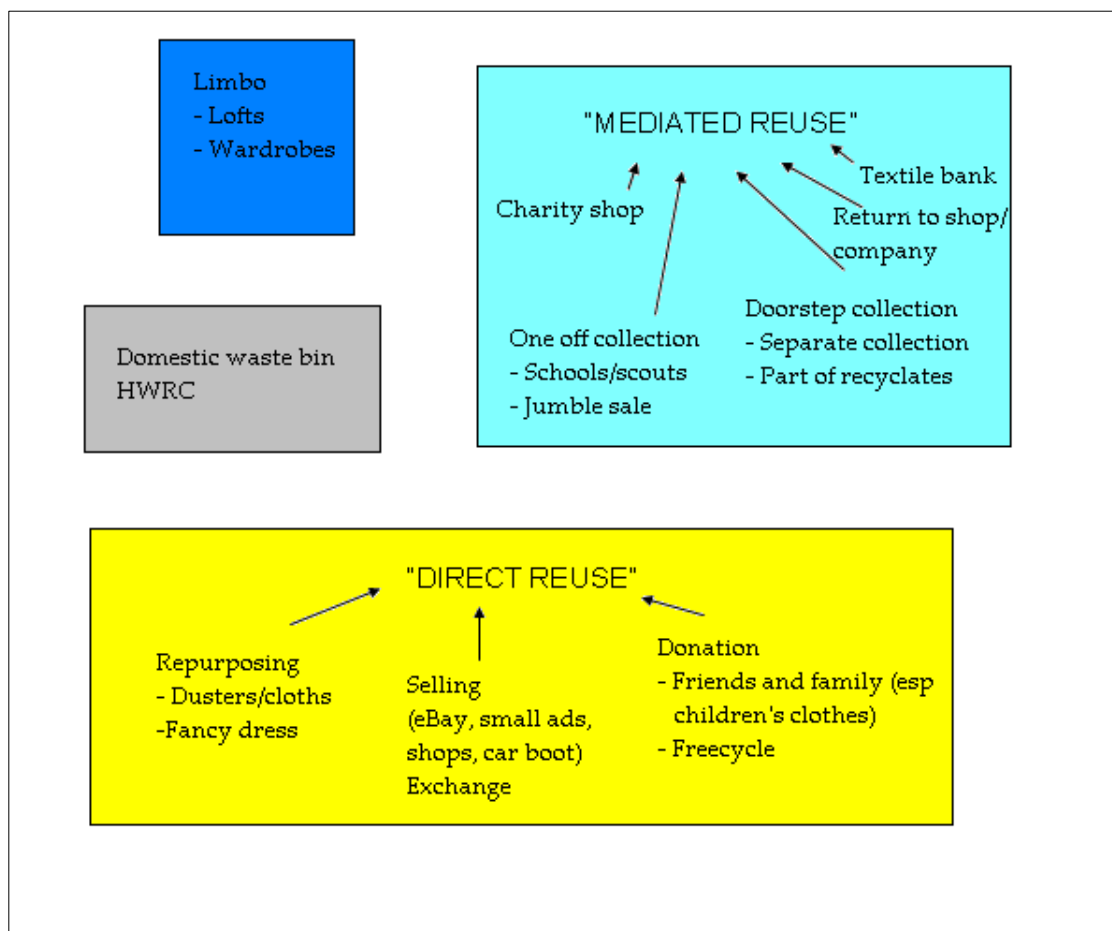
- Targeting of lower socio-demographic households will yield higher percentages of textiles. Partnerships with textile collectors should therefore ensure that higher socio-demographic households are not selected at the expense of others.

# 7 Sorting and Collection Infrastructure

## Introduction

61 The overwhelming reason the public gives for getting rid of clothes is lack of space<sup>m</sup>. A wide variety of disposal routes is available: clothes may be put into further storage in the same house; they may be donated, sold or exchanged between individuals (including, sale on eBay etc) or may be given to a third party such as a charity or contractor which may be associated with the conventional waste management collection system to varying degrees. Thus these 'routes to ridding' may involve physical displacement of the clothes out of the house, or simply a mental one within it<sup>n</sup>. The latter process will lead to an increase in the "national wardrobe", as a greater stock of clothes is retained within UK houses. There is some evidence from previous research that this stock is increasing<sup>o</sup>

Figure7.1: Routes to clothing disposal



<sup>m</sup> "Second Hand Cultures" by Gregson, N., Crewe, L., p119 Berg 2003

<sup>n</sup> Gregson et al, ibid

<sup>o</sup> Oakdene Hollins Ltd, 2006 ibid

## Summary of Collection Methods and Recommendations

- 62 Perceptions of the “dumping” of the West’s surplus clothing on lower income families in the UK and overseas do not reflect accurately the long tradition of trade in used clothing.
- 63 Previous research on consumer behaviour has identified opportunities to increase recycling by increasing the convenience of textiles collection; by communicating that cheap or damaged clothing has value to a charity or recycler and should not be disposed of as residual waste; and by the promotion of reuse between individuals. Charities and recyclers should encourage customers to donate cheap and damaged clothing, which can still be recycled as fibre but avoid increased collection of contaminated or damp clothing, for which the only outlet is landfill or incineration.
- 64 Direct reuse within family/friendship networks is significant, but may be declining. Exchange or sale between individuals facilitated by the internet is growing strongly, albeit from a small base. Combined with evidence of innovation and hybrid approaches, continued growth is expected. Encouragement of slowly changing fashion (e.g. within school clothing) will assist this. The latter issue could be addressed by DCSF (Department for Children, Schools and Families) in discussion with retailers over retention of similar styles over several years. This will also make thrift shop operations within schools more effective.
- 65 Use of textile banks is growing as a collection method for used textiles. There are no significant barriers to the expansion of these schemes as long as the economics of textile recycling remain attractive.
- 66 There is little or no UK experience of in-store collection. International experience is of both continuous and campaign collections. Continuous collections allied with synthetic fibre recycling have experienced some problems with consumer awareness, identification/labelling and the consequent costs. Familiarisation with other in-store collections (e.g. batteries) may change retailer perceptions.
- 67 The availability of kerbside collection of used textiles has almost doubled since 2002 to over 30%, but is still only half of that for glass, plastics and metals. Previous consumer behaviour studies show that convenience is a major factor in increasing recycling/reuse rates for clothing. A greater proportion of Local Authorities (LAs) should offer kerbside collection of textiles, to increase recycling availability to that of other recyclates.
- 68 Growth of co-mingled household collections (where recyclates are collected in a single box and sorted at a later point) is a threat to greater recycling and reuse of textiles. This is because textiles are often seen as unattractive to MRF operators

and collection by this method often results in poor condition of the textiles. Where co-mingled collection takes place, LAs should offer alternative textile recycling options such as partnership with commercial companies to collect textiles separately, in good condition.

- 69 Lower levels of UK sorting and the direct shipping abroad of unsorted clothing is increasing, encouraged by robust overseas reuse and recycling markets and declining or stable UK recycling markets. A level of UK sorting is desirable in order to service UK markets and also to reduce risk of exposure to overseas trading markets. Experience with other recyclates has shown that such markets can be volatile, although this can be reduced by offering higher quality products/materials. Greater transparency on fates of clothing is required from both companies and trade organisations. Interventions such as innovation funding, demonstration projects and capital equipment grants should be used to create new markets for recycled fibre in the UK.
- 70 Collection and reuse/recycling of corporate clothing at end of life is lower than with conventional clothing due to identical pieces, security and branding concerns and tax treatment. Use of public procurement initiatives may increase the sustainability of corporate clothing used in the public sector, including improved end-of-life management. Greater consistency in the application of tax rules to corporate clothing, with more detailed guidance on what constitutes acceptable corporate identification that also maximises the potential for reuse. Increased collection of used corporate clothing by companies or their agents is recommended.
- 71 Textile rental already possesses the collection infrastructure for efficient recycling. Particular problems remain with some products such as mats and specialist uniforms such as for clean rooms. Market development via innovation or demonstration funding for specific problem products will help increase recycling rates in this sector
- 72 A carpet collection infrastructure is being created to accept carpets from HWRCs, albeit from a small base, facilitated by Carpet Recycling UK. There exists a small collection, sorting and reuse industry for carpet tiles and carpets, often based on social enterprises and - in the case of carpet tiles - reuse schemes can sometimes be operated in partnership with carpet tile manufacturers. There are also remanufacturing opportunities in carpet tiles, currently shipped to the USA and thereby operating on a larger scale. Market development via innovation, demonstration or capital equipment funding will assist in creating more robust markets for the carpet fibre and backing that will be produced from collection and sorting, and for investment in remanufacturing technology.

## 8 Used Textile Experience Outside the UK

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### Japan

- 73 Japan disposes of approximately 1 million tonnes of worn clothing every year, with only 12% being recovered in some way. This has prompted the Japanese Ministry of Economy, Trade and Industry (METI) to increase the drive to reduce textiles entering landfill. Voluntary guidelines have been introduced by METI to help establish recycling activities, and funding has been available to improve and develop technologies to recycle fibres. This has resulted in a number of interesting schemes across the country, one of the most successful being the Teijin ECOCIRCLE™.
- 74 ECOCIRCLE™ is a closed-loop recycling system for polyester products, which was developed by Japanese company Teijin Fibers Ltd in 2000. The process firstly breaks down polyester products and granulates them into small pellets. These pellets are decomposed using chemicals and returned into the raw material (DMT, dimethyl terephthalate) which can then be polymerized again and finally spun into new ECOCIRCLE™ polyester fibres.

### Finland

- 75 The Finnish textile company Lindström Ltd has an unusual approach to reuse of its workwear products, offering a complete life service. This service includes aspects from design and manufacture to recovery and disposal of the garments. The workwear users, a wide range including industrial and service organisations, have the option to design for reuse initially, and garments are therefore developed to be easy-care, durable and easily repaired. They are then able to be reused a number of times, with detachable logos which can be replaced with new ones at end of service.

### France

- 76 Whilst not necessarily recommended for transfer to the UK, the French scheme for extended producer responsibility for textiles is worthy of note and examination. All organisations that place onto the French market new clothing textile products, pairs of shoes or household linen aimed at private households pay a financial contribution. Taking a whole life cycle approach, contributions may be reduced for textile products that have ecolabels. This money funds an organisation, now named EcoTLC, whose responsibility is to encourage the further reuse, recycling and creation of value from used clothing, acting to support the collectors and sorters of textiles. Such support can be used for

technological innovation, for market development or for cost reduction, but is aimed at meeting the reuse/recycling commitments of the contributors. It also supports the employment (in sorting) of difficult-to-employ people. The organisation will work with textile recyclers and local authorities to communicate the value of recycling textiles to the general public.

## **Germany**

- 77 The German outdoor wear company vauDe has an innovative approach to improving the recyclability of its garments. After much discussion and work with component and fabric suppliers, the Ecolog brand was developed out of 100% polyester. All zips, labels, cords, snap fasteners and fabric is created from polyester, making recycling of the garment far more straightforward.
- 78 Textile recycling typically involves the process of removing metals and other contaminants. By removing this stage, costs of recycling are reduced and quality of end product tends to be high. Retailers of vauDe are responsible for the return of the garments which are granulated by Ecolog GmbH, and turned back into polyester products, including fabric. Whilst not necessarily of the quality required for outdoor apparel, the fabric is suitable for seat covers and office furniture etc.

## **USA – Carpet Initiative**

- 79 The USA has CARE (Carpet America Recovery Effort), an organisation managed and funded by the carpet and rug manufacturers. It is backed by the Carpet and Rug Institute (CRI) and various national and federal government agencies. Importantly, the Federal Government is represented on the CARE Board and takes an active interest in the development of carpet recycling. CARE is extremely focused on recycling issues and develops future targets for carpet and rug recycling through a stage of negotiation with various stakeholders. Although their ambitious targets through the period 2002 to 2007 have not been met, the growth in diversion of carpet from landfill has been impressive. CARE has been able to bring together the majority of producers with a common aim of “Carpet Stewardship”. The information that it provides to the general public and the world at large is thorough and open, thus allowing others to follow their example.
- 80 The world’s largest modular carpet manufacturer, Interface, has developed a number of schemes to either reuse or recycle both carpet and carpet tiles. Their ReEntry® programme offers collection of carpet and carpet tiles at the end of their first life. If suitable for reuse, these will be sold to non-profit organisations for a minimal fee, or if not, recycled into new products. Where possible, the recycled material is converted back into floor covering products, with any that is



unsuitable being downcycled into car parts and industrial matting. Interface does offer a European ReEntry® service, but does not have the same level of facilities in place to recycle the collected material. For more detail on UK schemes see Section 6.9.4 in the Technical Report.

## 9 Recycling of Used Textiles

### Introduction

- 81 Total available recycled textile in 2008 was 27,000 tonnes. Much of this material would have been mechanically recycled into fibre for mattresses and upholstery, carpet underlay and products for the automotive industry such as acoustic damping, panelling and interior upholstery. A smaller amount of this available recycled fibre would have been used for the manufacture of such diverse products as horticultural basket liners and thermal insulation, see Figure 9.1. These traditional markets for recycled textiles are mature and are perceived to offer very little opportunity for added-value by textile recyclers.

### Recycling Opportunities

- 82 There are numerous applications for fibres and fabric recycling, which are discussed in detail in the Technical Report. Figure 9.2 provides a five year forecast of the possible new and existing applications for recycled fibres.
- 83 The typical options, and their associated obstacles and opportunities, are summarised in Table 9.1 below. The volume of recycled textiles for use in upcycled products will rarely exceed 10% of the total available recycled material. Although these are higher added value products, they require higher specification on the source fibres used and consequently add cost to the recycling process.

Table 9.1: Summary of major textile recycling opportunities

Product/ Process	Barriers	Opportunities and Benefits
Textile fibre reinforced concrete	Post-industrial waste is more appropriate as post-consumer carpet requires cleaning and separating. Only applicable to waste polypropylene and nylon fibre. Specification and construction standards precluding such additions. Shape and length of fibres recovered from carpets.	High volume, although low added value. Concrete structures are generally long lasting and can be recycled for hardcore.
Soil reinforcement	Certain standards throughout the world will not allow the use of post-consumer waste product to be used in geotextile (permeable woven or non-woven fabrics used as an integral part of a structure or system of foundation, soil, rock or similar) applications.	High volume, low added value. Any waste carpet product fibre can be used. Trials have shown that shredded carpet waste can be blended into soil with conventional equipment.
Non load bearing composites	Lack of investment in R&D. Glass fibre reinforcement still competitive on cost.	Possibly cost-effective in markets where mechanical and physical properties not as stringent as for load-bearing composites.
Filtration systems	The market is price sensitive and only lower value products would be acceptable, unless functionality could be improved.	Easily adapted nonwoven structures are possible. A wide variety of products could be developed.

Product/ Process	Barriers	Opportunities and Benefits
Acoustic insulation	Granulation of PVC product	Less reliance on virgin fibres. Reasonably large market.
Building insulation	Requires the continuous availability of recycle.	Already being marketed throughout Europe. Simple process. Many thermal insulation opportunities in the building sector. Products manufactured using recycled textiles do not require safety equipment when installing.
Horticultural matting	Risk assessment for human health and environmental impact Specification within green roof system Low cost of many existing systems	Potentially large volume. Existing market for certain recycled textiles Potential to improve performance and added value to recycled textiles. Wool rich carpet fibres have shown benefits in growing trials.
Composting	Most compostable fabrics unlikely to be suitable for municipal UK composting facilities. Environmental benefits versus recycling are not quantified. Confusion between compostable and recyclable products by consumers. High level of synthetics used in carpets.	Potential environmental benefit at end of life. Company-led collection schemes likely to be the most practical.
Chemical recycling of post consumer textiles	Cost. Selectivity of processes. Sorting costs.	Closed loop recycling possible. Substantial reduction in certain impacts possible. Attractive to end users
Mechanical recycling of carpets	Previous failures in UK/European carpet recycling. Lack of pulling capacity for carpet fibres. No current incentive for investment.	Technically successful projects. Recycling proven in niche markets. Market development potential in several large markets. Commercially feasible US ventures.
Chemical recycling of carpets	Previous failures. High costs. Collection logistics. Lack of end markets for some chemical products. Lack of UK-based capacity for extruding nylon extracted from carpets	Long term energy/carbon costs should improve economics.
Energy recovery - carpets	Regulation concerning waste incineration.	High calorific value

Figure 9.1: Market for recycled textiles as nonwovens

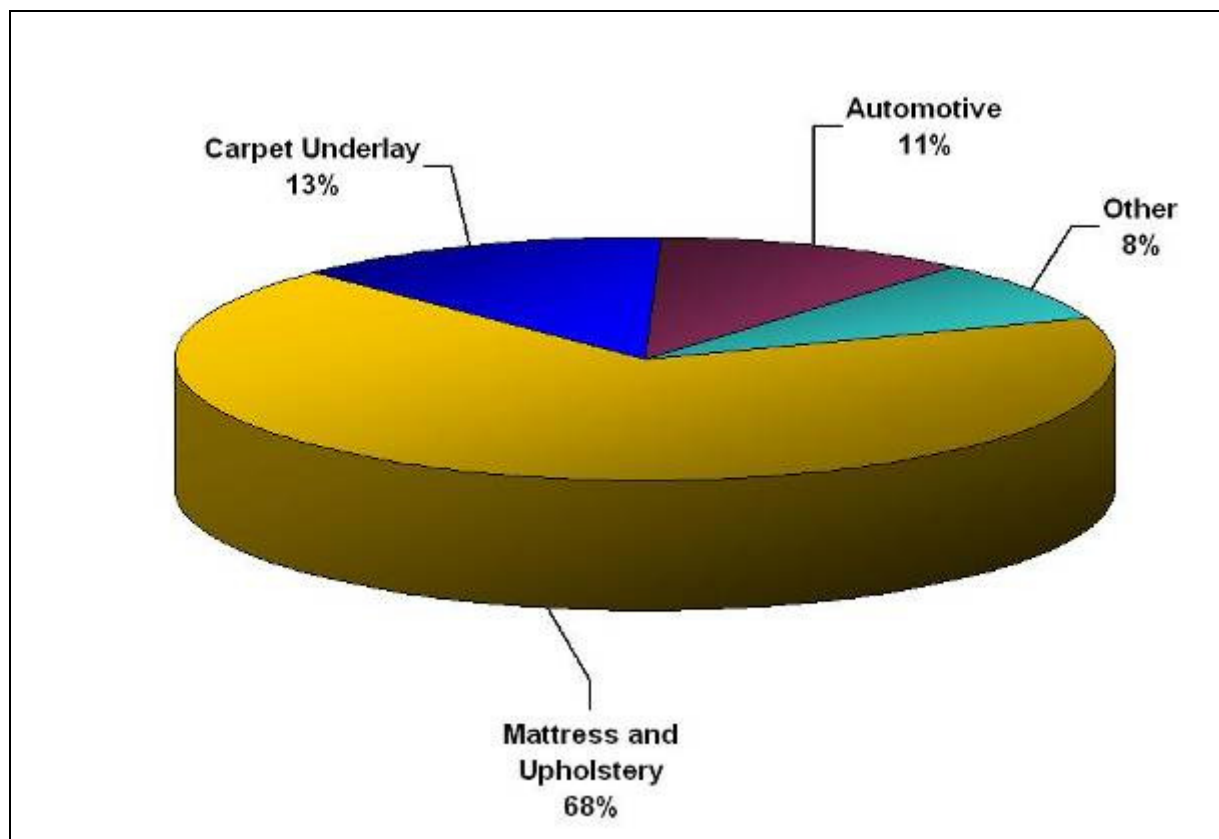
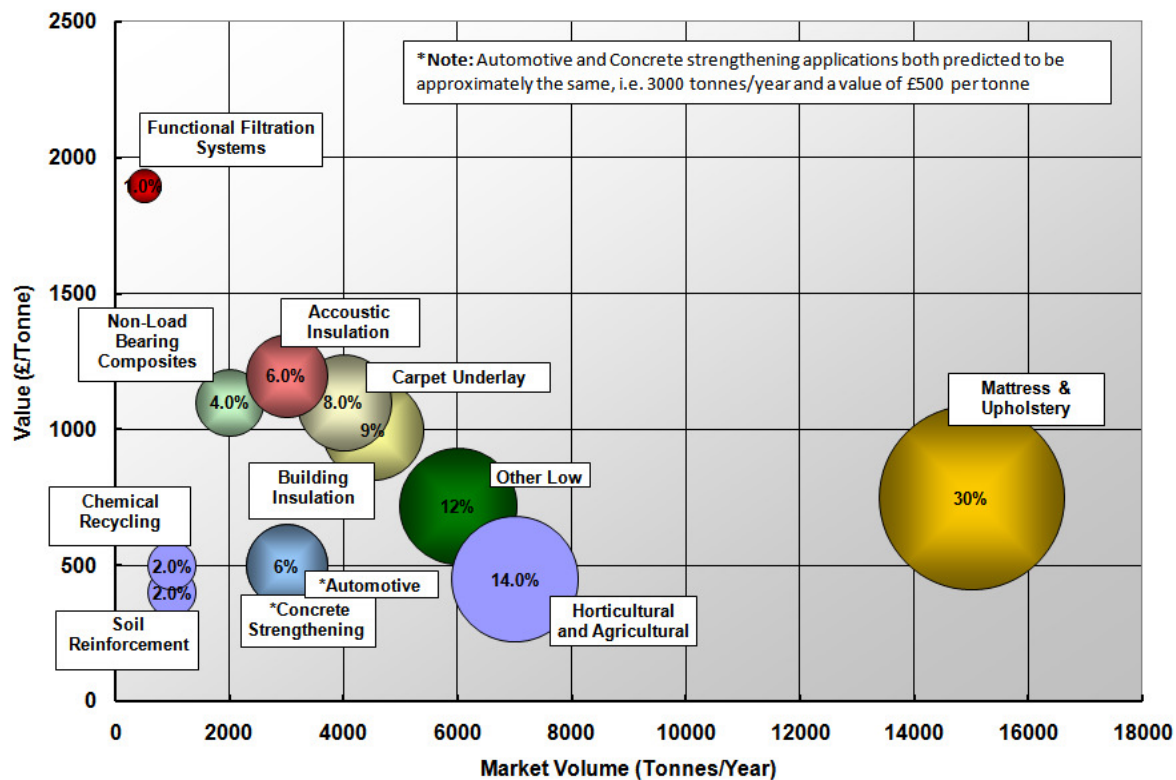


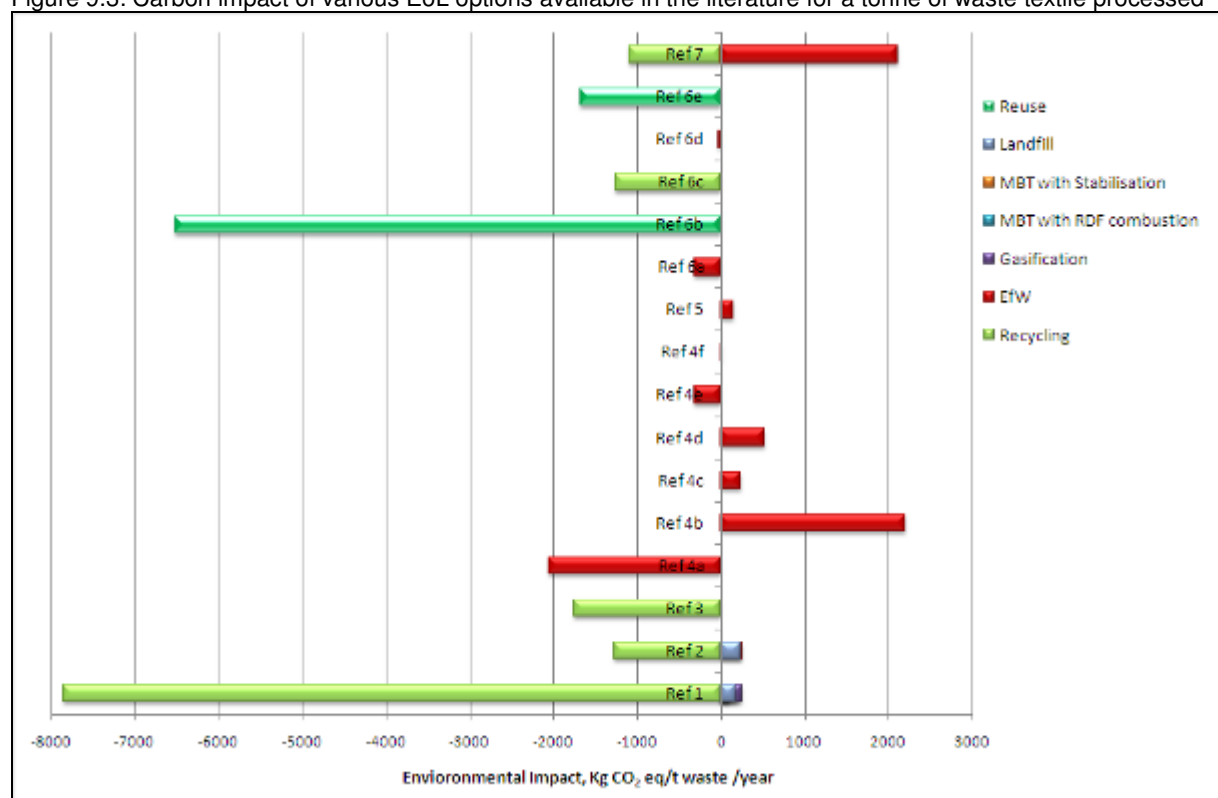
Figure 9.2: Five year forecast for new market applications



## **Carbon Impacts of End-of-Life Options**

- 84 Having reviewed reuse, recycling and energy-from-waste options from a technical and market perspective, carbon impacts arising from one tonne of waste textile were determined. Ignoring 'Recycling Ref1' in Figure 9.3, which we believe is anomalous, the literature supports the waste hierarchy's proposition that product reuse is of greater benefit than recycling, which in turn is 'better' than energy from waste or landfill.

Figure 9.3: Carbon impact of various EoL options available in the literature for a tonne of waste textile processed



## Conclusions and Recommendations

- 85 Using the analysis of the waste, resource and carbon impacts of textiles across their whole lifecycle, we may prioritise the reuse and recycling of textiles as follows, summarising the barriers and opportunities.

Table 9.2: Summary of waste hierarchy strategies for textiles

Strategy	Barriers	Opportunities
<b>Reuse - UK</b>	General negative perception of reused clothing	Eco- and thrift image among certain customer market segments
	Low pricing of budget retailers	Internet-based sale / donation / swapping
		Greater doorstep collection possible via Local Authorities
		Favourable economics due to very low prices
	Contamination in post consumer carpet can be a health and safety issue when processing	Carpet tile reuse has been shown to be economically feasible.
<b>Reuse - Overseas</b>	Perceptions of damage to indigenous textiles industries	Large markets with current strong demand
	Recycling rates and eventual fates of textiles not well known	Favourable economics for sorting and sale

Strategy	Barriers	Opportunities
<b>Recycling</b>	Many markets are low or negative growth with low prices	Possible new markets in concrete reinforcement agriculture/horticulture and insulation (thermal and acoustic)
	Attractive fibres (e.g. wool) are declining in availability	Poor public understanding of attractiveness of collecting recycling grades
	Many potentially recyclable fibres lack markets e.g. carpet	Added value to recycled fibres through the use of additives
	Reluctance to change from existing materials to recyclates (e.g. fibres for concrete), particularly where these materials may already be low cost	Chemical recycling of corporate clothing and other synthetic-fibre rich consistent streams
	Post-consumer textile waste is forbidden (draft BS for geotextiles)	Copying of US carpet recycling initiatives e.g. nylon 6 recycling
	Separation of fibre from backing of carpets difficult to achieve	Lessons can be learnt from Los Angeles Fiber and Interface in the USA
	Several economic failures of UK/European textile recycling operations inhibiting action	
	Logos and branding of corporate clothing	

86 We have therefore proposed the following recommendations:

- Many projects that attempt to use recycled textiles and fibres, particularly for higher added value applications, are unsuccessful due to the costs incurred during the recycling process. Industry must be guaranteed a consistent and well specified source of recyclate which at present is not the case. A means of clearly identifying textile constituents, and the infrastructure for dealing with recyclate streams, are very important if industry is to invest in the use of this source material for further applications.
- Encourage investment, where appropriate, in new technologies for increasing the value of recycled textiles (upcycling) including market development funding, demonstration, standards and/or capital funding. This includes not only advances in mechanical and chemical processing but also managing the recycling of fibre and textiles containing larger quantities of biodegradable and compostable materials entering the waste stream. The greatest volume of recycled textiles will be in low-to-medium value applications (downcycling). However, research and development into new alternative applications for downcycling should be encouraged.
- Encourage manufacturers of textiles and textile products using biodegradable and compostable fibre to differentiate clearly between the types of fibre used, and to apply the most appropriate labelling. This would assist downstream or secondary recycling.

- The structure and operations of the organisation CARE (Carpet America Recovery Effort) offer a good business model for the promotion of carpet stewardship. Further support and encouragement should be given to Carpet Recycling UK in order to strengthen the UK carpet manufacturing and recycling industries.
- Promote a positive image of reused clothing by charities, designers and those concerned with sustainable clothing.
- Provide audit trails and published recycling/reuse rates by textile recyclers and charities in order to give public confidence through transparency, and to identify serious long term organisations with whom LAs would want to collaborate.
- Create partnership with indigenous industries (e.g. remaking/modification) to impact textile industries in developing countries more positively.
- Review past failures of UK/European recycling to determine key factors for success in future initiatives.
- Geotextile fabrics have long been used for soil reinforcement during road construction. There have been successful examples of the use of virgin polypropylene and glass to reinforce soil and sand. However, geotextile specifications should be developed for the use of recycled textiles from both post-industrial and post-consumer applications.
- Promote recycling of fibres as an option to the general public to improve donation of 'non-wearable' textiles. Try to dispel the perception that holed or torn fabric needs to be discarded to the household bin – there is little awareness of recycling opportunities. The M·E·L research (see full report in Appendix 2) shows that a significant quantity of textile suitable for recycling is still going to the household bin, with 43% of textiles discarded being of recyclable quality.



## 10 The Role of Standards and Protocols

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### Introduction

- 87 One of the primary uses of an industry standard is to ensure that the product is of an expected quality. This usually commits the producer to a series of quality checks that will give purchasers confidence in the material. The development of standards within textile recycling needs to examine all aspects of the industry from collection through sorting, reuse and recycling. It is likely that a single standard will be too broad or restrictive to be effective because of the diverse nature of the industry. However, there is also a danger that multiple standards may not achieve universal recognition or may confuse the market.

### Issues for Standards and Protocols

- 88 Conversations with stakeholders have been used to identify areas where standards may be necessary. Key findings are:
- Due to the nature of current collection systems, such as through charitable donations from the public, it is difficult to envisage an effective and enforceable standard that would improve the quality of post-consumer collected textiles and garments.
  - Garment reuse is largely market and fashion driven and is therefore unlikely to respond to standards.
  - There is a need for international harmonisation of waste laws to ensure free movement of mixed textiles. This could be facilitated by standards.
  - Buyers of sorted textiles for both rag use and fibre recycling expressed interest in the development of standards to ensure that the quality of post consumer textiles. However, there may be opposition from sorters of textiles who believe that this is unnecessary. In addition, the diversity in both types and blends of textiles makes identification and grading difficult, and labour intensive, possibly making standards impractical.
  - The large volume of carpet waste entering landfill and the success of overseas' schemes with carpet recycling, if facilities are in place, suggests an opportunity to develop standards that remove correctly processed waste carpet from waste handling regulatory constraints. Such standards are currently being advocated by WRAP and the Environment Agency.

## **Recommendations**

89 Three areas where the waste textile industry may benefit from standards are:

- The international harmonisation of the interpretation of the definition of waste for exporting mixed textiles.
- The sale of textiles and fibres into the rag and fibre recycling industry.
- Quality protocols on recycling carpet waste.

90 PASs, which are industry recognised standards that are considerably faster to draft than full British Standards, could be used to implement standards in waste textiles. Such standards have been successfully deployed, through WRAP, for a series of waste materials including plastic, glass, wood, tyres and gypsum.