SUSTAINABLE CLOTHING ROADMAP
BRIEFING NOTE - Sustainability Impacts of Clothing and Current Interventions

1.0 INTRODUCTION

This note provides a summary of the key sustainability impacts of clothing and current interventions aimed at improving clothing sustainability performance. This is based on the Defra commissioned Environmental Resources Management (ERM) study *Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycle of Clothing, 2007* and discussions with stakeholders engaged in sustainability and clothing within the Sustainable Clothing Roadmap. The note includes the following topics:-

- Background
  - Focus on products and services and the ten product roadmaps
  - Sustainable clothing roadmap
- Sustainability impacts of clothing and current interventions
- Further information.

2.0 BACKGROUND

2.1 Focus on products and services and the ten product roadmaps

The UK government is taking action to identify, understand and address the sustainability impacts arising from products, services and materials consumed and used in the UK. Defra, alongside BERR, is at the forefront of this work, which falls within its strategic priority of Sustainable Consumption and Production (SCP), and is taking it forward through several work strands. One of these work strands is an initial trial of ten product roadmaps, drawn from four high impact product areas as illustrated in Table 1. Clothing is one of these priority products.

Table 1: Priority area and ten product roadmaps

Priority Area	Product or service
Food	Milk
	Fish and shellfish
Transport	Passenger cars
Energy Using Products	TVs
	Domestic lighting
	Commercial motors
Housing	Window systems
	WCs
	Plasterboard
Clothing/Textiles	Clothing

The roadmaps capture evidence on the impacts of each product across its life cycle, develop a vision of the future, and begin to chart short, medium and long-term interventions to help transform each product towards that more sustainable future. The roadmaps are being developed and implemented gradually and collaboratively with a wide range of stakeholders. If successful this approach will be expanded to include other products and services.

2.2 Sustainable clothing roadmap

The clothing roadmap is focused on garments to include textiles used in the manufacture of clothing, but excluding shoes, accessories and commercial textiles. To date, evidence has been gathered on the sustainability impacts (environmental, social and economic) of clothing across the lifecycle as well as current interventions designed to improve sustainability performance through desk based research and stakeholder meetings. In support of this, Defra commissioned Environmental Resources Management (ERM) to conduct a project to map the sustainability impacts of clothing and interventions to address these impacts[1]. The briefing note summarises the sustainability impacts and interventions identified from this study and follow up meetings with stakeholders.

3.0 KEY SUSTAINABILITY IMPACTS OF CLOTHING AND CURRENT INTERVENTIONS

There is a diverse range of international and UK evidence on the sustainability impacts of clothing including recent studies e.g. *Well Dressed*[2]*, Fashioning Sustainability*[3] *, Recycling of Low Grade Clothing Waste*[4] *and the Environmental Impacts of Products (EIPRO)*[5]*.* Defra commissioned ERM to map this evidence with a view to determining the sustainability impacts across the lifecycle and supply chain of clothing.

In terms of its economic impact clothing is a high value sector, globally worth over $1 trillion and ranked the second biggest global economic activity for intensity of trade[7]. It contributes to 7% of world exports and employs approximately 26 million people, supporting a significant number of economies and individual incomes around the world. With only 10% of clothing manufactured in the UK, the UK textile and clothing industry is small in comparison to the global industry, accounting for approximately 0.78% of

[1] Defra, 2007, Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycles of Clothing, Environmental Resources Management (ERM)
[2] Allwood et al, 2006, Well dressed? The present and future sustainability of clothing and textiles in the United Kingdom, University of Cambridge Institute for Manufacturing, ISBN 1-902546052-0
[3] Forum for the Future, 2007, Fashioning sustainability – A review of the sustainability impacts of the clothing industry
[4] Defra, 2006, WS Project WRT152: Recycling of Low Grade Clothing waste (draft), expected to be published by end 2007
[5] EU, 2006, Environmental Impacts of Products (EIPRO), European Commission, http://ec.europa.eu/environment/ipp/identifying.htm

UK GDP, 3.3% of UK manufacturing (valued at £9.5 billion) and employing approximately 170,000 (clothing industry only)[6].

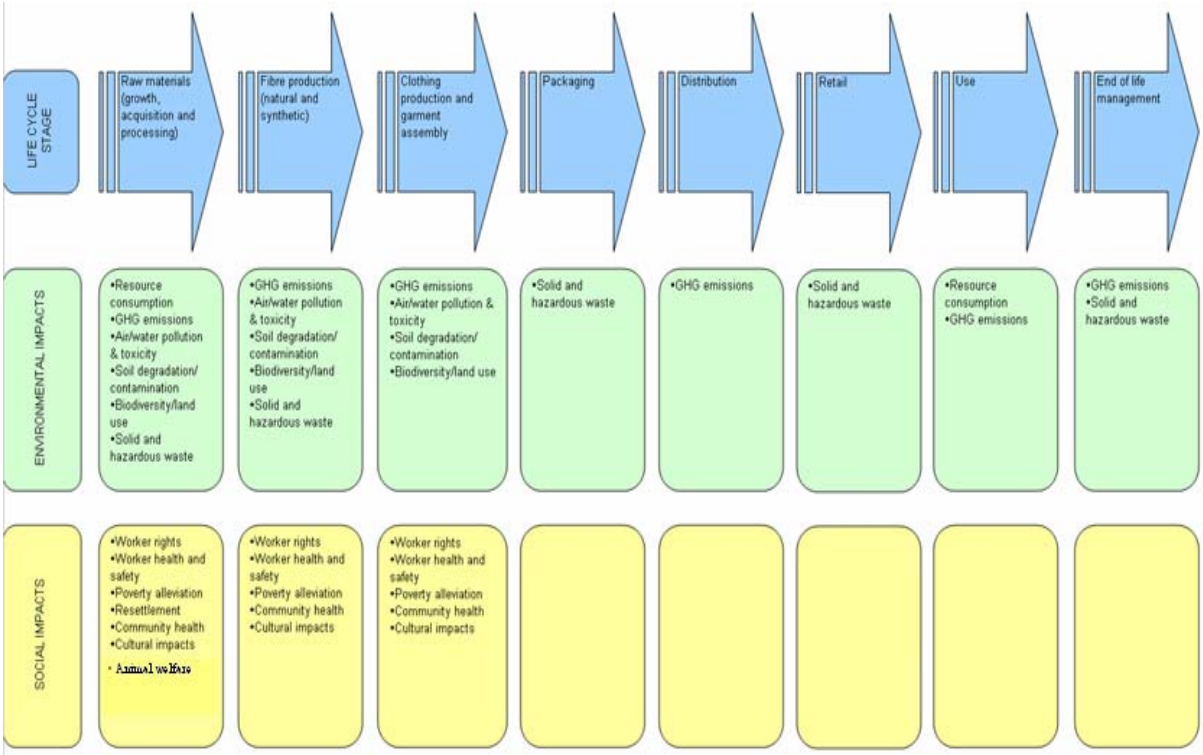
Figure 1 summarises the key environmental and social impacts per clothing lifecycle stage. Based on current evidence, the most significant environmental impacts include:-

- Energy use and generation of greenhouse gas (GHG) emissions from washing (water heating) and drying of clothing. Cotton in particular requires longer drying times compared to synthetics such as polyester. Interventions e.g. the Wash at 30º C and energy labels (i.e. the European Energy Label or Energy Saving Recommended) for washing machines and dryers are designed to reduce these impacts.
- Energy use, resource depletion and generation of GHG emissions from processing fossil fuels into synthetic fibres.
- Significant water use, toxicity from fertilizer, pesticide and herbicide use, energy use and GHG emissions associated with fertilizer generation and irrigation systems from conventional cotton growing. Organic and GM cotton reduce the toxicity related impacts, however other GM impacts are currently unclear.
- Water use, toxicity, hazardous waste and effluent associated with production stage pre-treatment chemicals, dyes and finishes.

More information on the environmental impacts per life cycle stage is set out in Appendix 1.

[6] HM Customs & Excise, Provided by the British Apparel & Textile Confederation (2005)

Figure 1 Environmental and Social impacts across the life cycle of clothing (Source: modified from Defra, 2007[7])



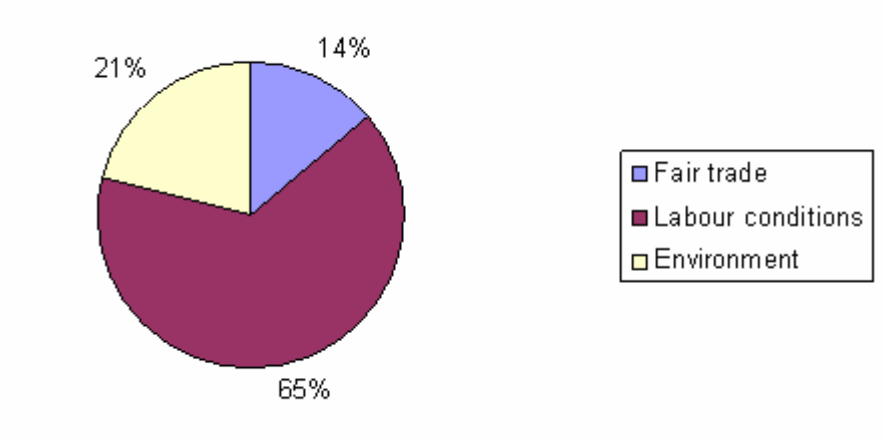
Social and Ethical Impacts include:-

- Poor working conditions, more often than not in developing countries, are the main adverse social impact on a large scale. These impacts include child labour (especially for cotton picking and hand sewing) and sweatshop conditions e.g. low wages, long hours, non respect of workers rights and health & safety risks[8].
- Limited market access, information and trade terms for farmers and workers[8]. Loss of resources, economic and cultural assets from resettlement to enable access to resources e.g. fossil fuels, timber plantations or crop growth.
- Animal welfare is a key impact for sheep, cows and fur producing animals used in garments.
- In terms of poverty alleviation, the clothing and textile industry is seen as a catalyst for economic growth in developing countries. However it can fail to provide social mobility as training and skills development at this lower value end of the supply chain are not a priority[9].

[7] Defra, 2007, Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycles of Clothing, Environmental Resources Management (ERM)
[8] Fairtrade Foundation (2005), Redressing a Global Imbalance: The Case for Fairtrade Certified Cotton, Nov. 2005
[9] Defra, 2007, Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycles of Clothing, Environmental Resources Management (ERM) (draft)

As illustrated in figure 2, current interventions in place can be categorised as focusing on environmental, trade or labour conditions objectives[10]. Examples of current interventions are summarised in Appendix 1.

Figure 2 Current Sustainability Interventions (Source: Defra, 2007[10])



3.0 FURTHER INFORMATION

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APPENDIX 1 – SUSTAINABILITY IMPACTS AND INTERVENTIONS

A1. SUSTAINABILITY IMPACTS

Clothing and textile sector statistics relevant to the UK (2004-2006) include the following:-

GDP	0.78% of UK GDP	
Employment UK	170,000 (clothing)	
Import	90% (1.7 million tonnes) (textiles & clothing)	£11 billion
Export	10% (281,000 tonnes) (textiles & clothing)	£3 billion
UK Production	3.3 % of UK mft.(697,000 tonnes) (textiles & clothing)	£9.5 billion
UK Consumption	2 million tonnes (textiles & clothing)	£38 billion

The following clothing sector characteristics are key factors affecting the sustainability impacts of clothing:-

- As clothing and textiles are the second biggest global economic activity for intensity of trade[10], in terms of consumption volume alone, this makes it globally significant from an environmental and social impacts perspective.
- UK clothing consumption is high at approximately 2 million tonnes (value £38 billion) per annum. UK consumers spend approximately 7% of their total retail expenditure (£23 billion average) on clothing and footwear .For the period 1996-2005, consumer expenditure on clothing and textiles has grown 34%, with predicted demand increases[11].
- 90% of clothing consumed in the UK is imported. This is very significant for potential interventions as significant sustainability impacts e.g. at the raw material and production lifecycle stages occur outside the UK.
- The fast/discount fashion/value clothing sector, characterised by low cost, low quality fibres and short lifetime garments, makes up one fifth of the UK market and has doubled its growth during 1999-2006. Fast supply chains are driven by the demand and capacity to change collections every 2-3 weeks. Localisation is a trend enabling proximity of manufacturers to the market to facilitate fast fashion.
- The price of new clothing from low labour cost countries has been declining over the past decade. This is believed to be exacerbated by the end of the World Trade Organisation's Multi-Fibre Agreement in January 2005. Strong competition, low cost labour as well as technology e.g.

[10] HM Customs & Excise, Provided by the British Apparel & Textile Confederation (2005)
[11] ONS Consumer trends (2005), http://www.ukfashionexports.com/stats_six.htm

computer aided design and vertically integrated structures are improving productivity and factors in reducing costs.

- From a UK perspective, the market structure is characterised by UK clothing producers relocating to the developing world with the majority of clothing consumed in the UK produced in other countries. The highest import volumes are from China, Turkey, Italy, India, Bangladesh and Sri Lanka. Overall, clothing imports to Western Europe are estimated at 42% of the global market[12] .
- Globally, textile and clothing represent approximately 7% of world exports[13] and support a significant number of economies and incomes around the world e.g. Cambodia, Bangladesh, Sri Lanka and Nepal. The interconnectedness of the industry means that changes in the trade and production of textiles and clothing can have significant positive and negative impacts on national economies, and/or the growth or subsidence of the industry[14].
- The clothing supply chain is complex, global and characterised by sub contractors in the developing world and the use of migrant workers. These characteristics can limit transparency and the ability to effectively manage impacts across the supply chain. Most fabrics are bought on global commodity markets to make clothing. Retailers can buy clothing from known suppliers, through agents or vendors. Determining origin and sustainability credentials of raw materials and stock are key challenges.
- Quotas and subsidies designed to protect domestic agriculture and industry from the free market have economic, social and environmental implications e.g. artificially reducing the price of cotton or growing cotton in climates where the impacts are increased.
- Geographic factor - the environmental and social impacts will vary based on the country they occur in with variations in local sensitivities as well as local environmental and social standards, regulation and enforcement.

Environmental Impacts

The main textile fibres used in clothing are manmade fibres (these can be natural polymers e.g. viscose or synthetic petrochemical based e.g. polyester), natural fibres (e.g. cotton, wool, silk, hemp, flax) or composites. The environmental impacts vary for each fibre type and at each life cycle stage. These are outlined in Text Box 1.

As outlined in Table 3 for UK clothing imports and exports, the fibres, yarns and fabrics are mainly manmade (e.g. polyester), with cotton accounting for

[12] Oxfam (2004), Stitched Up – How Rich Country protectionism in textiles and clothing trade prevents policy alleviation

[13] Allwood et al, 2006, Well dressed? The present and future sustainability of clothing and textiles in the United Kingdom, University of Cambridge Institute for Manufacturing, ISBN 1-902546052-0

[14] Defra, 2007, Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycles of Clothing, ERM

the largest percentage of the natural contribution. Globally, cotton is the largest single fibre in production with global demand currently driving large scale production[15].

Table 3 Imports and Export percentages of Fibres, Yarns and Fabrics for the UK Clothing and Textile Industry 2004 (Source: Allwood et al, 2006[16])

Fibres, Yarns and Fabrics	UK Imports	UK Exports
Manmade	60%	64%
Natural	29% (of this cotton =15%; wool = 8%)	19%
Unspecified	11%	17%

Text Box 1: Environmental impacts per life cycle stage[17]

Raw material growth, acquisition and processing:-

- For natural fibres, the key impacts are from growth and processing. The growth of fibre crops includes small to large scale farming. The impacts include land use, water use, toxicity from pesticide, herbicide and fertilizer use, generation of contaminated run off, soil erosion, biodiversity and ecosystem damage. For example in the case of cotton, while it accounts for < 3% of the world's farmed land, it consumes a quarter of insecticides and 10% of herbicides. It is the 4th most heavily fertilised crop in the world (after corn, winter wheat and soybeans). Production of fertilizer, pesticides and herbicides have their own impacts e.g. significant energy use (in fertilizer production), generation of emissions to air, water and waste. Organic and GM cotton can reduce toxicity impacts due to reduced herbicides and pesticide use.
- In terms of water use, cotton growth is heavily water intensive with approximately 70% irrigated, and only 30% rain fed.
- The impacts of other fibre crops e.g. hemp and flax vary in intensity in terms of fertilizer/pesticide/water requirements with hemp requiring little herbicide and flax requiring less water as it is grown typically in cooler climates than cotton. For wool fibre generation, there are the added impacts of sheep farming. The key impacts of this include methane GHG emissions, use of sheep dip chemicals e.g. organophosphates with significant toxicity and pollution impacts.
- For manmade fibres the impacts are from extraction and processing. The impacts of synthetic fibres derived from petrochemicals (e.g. polyester) include depletion of fossil fuels, energy and water use, emissions to air (to include the GHG gas nitrous oxide), effluent and waste (hazardous and non-hazardous) generation.

Production

- Fibre manufacture incorporates spinning, weaving and knitting processes

[15] World production of manmade fibres, wool and cotton, 1970-2005

[16] Allwood et al, 2006, Well dressed? The present and future sustainability of clothing and textiles in the United Kingdom, University of Cambridge Institute for Manufacturing, ISBN 1-902546052-0

which use energy, large water volumes, create effluent and air pollution and waste which can be difficult to recover for reuse/recycling and has a long decomposition period. Synthetic fibres use more water than natural fibres.

- Yarn manufacture impacts include dust, noise and vibration having worker health and safety/nuisance implications.
- Once fibres are produced they can be subject to dyeing, bleaching, printing and finishing which consume large volumes of water, energy, chemicals, release air emissions, generate effluent and waste (hazardous and non hazardous).
- Finishing and coating chemical preparations can be used for longevity, strengthening or stain removal purposes. These can impact end of life waste recovery options, generate hazardous waste and in some case include hazardous substances with health implications.
- Waste textiles are generated from garment production but compared to end of life waste textiles are small with CAD enabling production efficiencies reducing waste generation.
- Packaging is manufactured for clothing presentation and transport. This incorporates plastic, metal and cardboard packaging. Impacts include resource use, effluent and waste generation.

Distribution & Retail

- Clothing imported to the UK is mainly transported by sea in large freighters and then road. Impacts include resource depletion (fossil fuel use), GHG emissions and air pollutants from ship and vehicle exhausts. Shipping accounts for the majority of transport related impacts across the lifecycle. At the retail shops, the key impacts are associated with building operations to include electricity, heating, and lighting. Impacts include resource depletion (fossil fuels), emission of GHGs, waste generation and small volumes of water use.

Use

- In the use phase, washing, drying, dry cleaning and ironing result in energy, water and chemicals use, generation of effluent and hazardous waste.
- The extent of the energy and water use depends on the washing method (temperature, capacity of load, mixtures of fibres etc.), equipment used and clothing lifetimes. A range of Life Cycle Assessments (LCA)[18] have shown that for cotton and polyester, the highest energy use across the lifecycle is from washing and drying. In particular the energy used to heat the water in the washing machine is the most significant contributor. This has largely been the precursor for the “Wash at 30ºC” initiatives now seen in the market. However, this is not the case for all fibres with viscose showing the highest energy consumption associated with raw material extraction and processing. Figure 4, which shows the energy profile for a cotton T-shirt and a viscose blouse, illustrates this distinction. The average lifetime estimates for clothes requiring washing are expected to be overestimates in light of fast fashion[18].
- Detergents and other washing substances generate effluent with phosphate

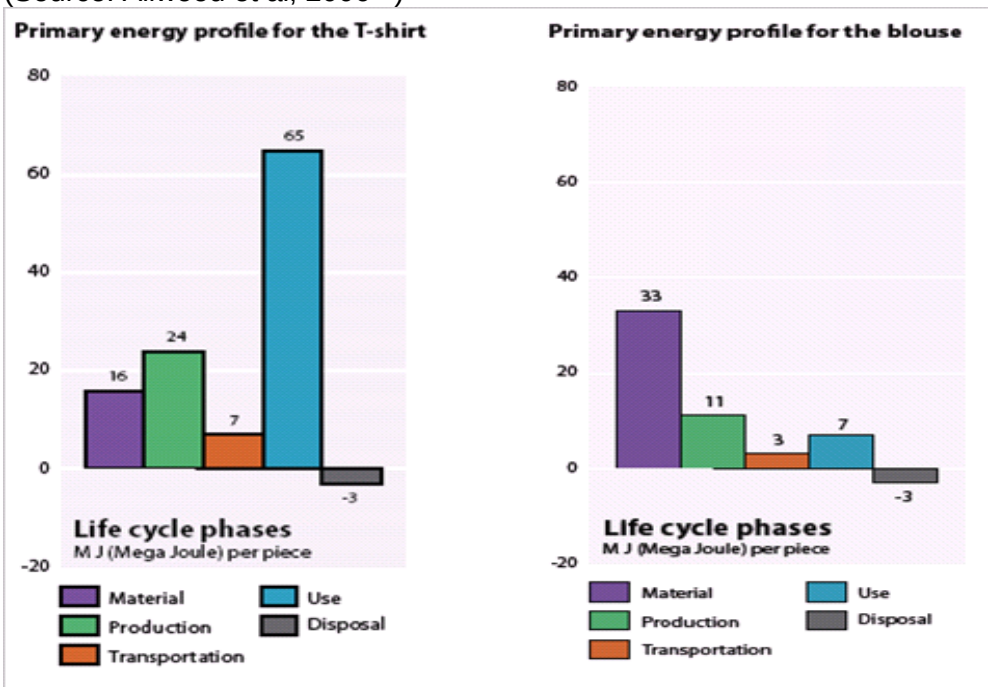
[17] Defra, 2007, Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycles of Clothing, ERM

[18] Allwood et al, 2006, Well dressed? The present and future sustainability of clothing and textiles in the United Kingdom, University of Cambridge Institute for Manufacturing, ISBN 1-902546052-0

[19] Defra, 2006, WS Project WRT152: Recycling of Low Grade Clothing waste (draft)

concentration causing eutrophication impacts. For dry cleaning the use of solvents e.g. perchloroethylene can cause the generation of Volatile Organic Compounds (VOCs) and solvent waste.

Figure 4 Primary Energy Profiles for a Cotton T shirt and Viscose Blouse
(Source: Allwood et al, 2006[18])

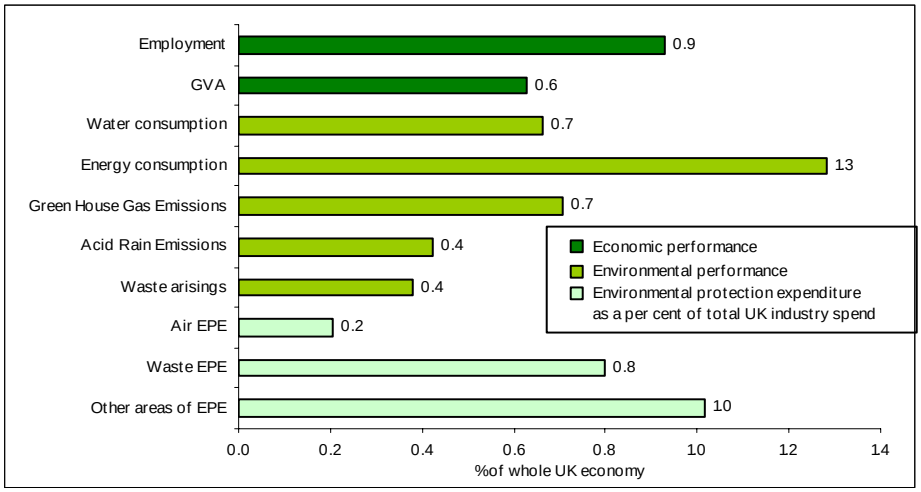


End of Life

- Fast fashion characteristics of reduced unit prices, increased retail pressure to sell greater volumes, increasing clothing turnover and consumption trends are resulting in increased end of life clothing waste. Textiles waste is currently the fastest growing stream in household waste and forecast to continue increasing as sales of new clothing continue to rise[19].
- The UK generates approximately 1.5 - 2 million tonnes per annum (2006) of clothing waste. Of this 63% (1.2 million tonnes) enters the household waste stream going to landfill, 16% (300,000 tonnes) is recovered and 21% unaccounted for in what is assumed the "national wardrobe"[20]. Most of the recovered stream is exported for resale for reuse overseas (Africa being the main market) with the remainder being downcycled (in the UK or overseas) into lower value products (e.g. mattresses, wipes, carpet underlay, automotive components or niche clothing e.g. by the company TRAID) or resold for reuse by charities.
- Over the medium term, it is expected that the volume of waste clothing will increase, given that stockpiling space is limited and expected growth in new clothing sales.
- Interventions increasing the volume of recovered end of life clothing waste and recovery for remanufacture into clothing, reuse or recycling into new products have been identified as a potential intervention opportunity with waste reduction as well as GHG benefits from embodied energy impacts. Potential enablers include mainstreaming fibre and garment production technology innovations to enable cost effective closed loop remanufacturing of clothing. Barriers are market demand, recovery of end of life clothing and fibre separation technologies.

For the UK based sector only, figure 5 illustrates the textiles, clothing and leather sector as a proportion of the UK non-domestic sector for employment, Gross Value Added and key environmental impacts (various reference years).

Figure 5 The textiles, clothing and leather products sector as a proportion of the UK non-domestic sector[20]



[20] Defra Environmental Expenditure & Wildlife Statistics data 2006.

The UK clothing and textile sector impacts (2006) are summarised below[21].

UK Clothing & Textile Impacts (2006)	
Waste	1.5 - 2 million
GHG emissions	3.1 million tonnes CO_2 equivalent
Water consumption	90 million tonnes
Waste water generated	70 million tonnes
Energy consumption	989,000 tonnes of oil equivalent

The trends for energy use and GHG emissions are declining for the UK sector in line with the reduction in the UK clothing production.

A2 CURRENT INTERVENTIONS FOR IMPROVING SUSTAINABILITY PERFORMANCE

As per figure 2 above, current interventions can be categorised as focusing on environmental, trade or labour conditions[21]. Current examples are summarised as follows.

For environment "plus":-

- EU and UK Environmental Policy and law focusing on:-
    - Reducing toxicity and pollution impacts of chemicals (e.g. for dyes and detergents to include regulations on detergents, solvents and forthcoming Registration, Evaluation and Authorisation of Chemicals (REACH)),
    - Pollution management (e.g. textile activities covered under EU Integrated Pollution Prevention & Control legislation),
    - Resource and waste management (e.g. Waste Strategy for England 2007 which highlights waste textiles as a priority area.
- Labels e.g. Organic, Bluesign, Oeko-Tex Confidence in Textiles, EU ecolabels for textiles and footwear, Energy Rating on white goods e.g. washers and dryers and a growing interest in Country of Origin labeling on cotton.
- Industry standards e.g. for fabric dyes or the US ANSI standard on environmental sustainability of textiles currently in development
- Wash at 30º C to reduce the energy use and climate change impacts of laundering.
- EU detergent voluntary industry agreement Washright campaign on minimising detergent packaging and encouraging consumers to use the correct detergent.
- Sustainable design incorporating a range of environmental and social criteria to differing extents is in increasing evidence in the niche (e.g. Edun, Howies, Adili, Enamore and People Tree) and mass markets (Katherine E Hamnett for Tesco, Patagonia, American Apparel and Nike.
- Industry management initiatives e.g. Environmental Management Systems (EMS) on environment, Corporate Social Responsibility (CSR) for environmental and social issues and reporting e.g. using Global Reporting Initiative (GRI) which is completing an apparel and footwear sector reporting guide.
- The EU High Level Group on Textiles and Clothing focusing on the European textiles and clothing sector competitiveness conditions incorporates proposals for CSR and REACH implementation for this sector[22].
- Sustainable clothing guides, networks and information sources include:-

[21] Defra, 2007, Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycles of Clothing, ERM

[22] EU Textiles industry in 2020, An attempt for a vision - http://ec.europa.eu/enterprise/textile/high_level_group.htm

- EU Best Available Techniques Reference (BREF) guidance note for Textile Processing
- www.textileinstitutebooks.com
- www.Envirowise.co.uk
- UNEP Eco-Textiles online guide
- World Bank Pollution Abatement Handbook – Textiles, 1998
- Worldwide Responsible Apparel Production www.wrapapparel.org
- Fair Labour Association, USA www.fairlabour.org
- SMART Textiles Network
- Sedex Ethical Suppliers database
- Reducing the Environmental Impact of Textiles (RITE) group, UK
- Ecotextile News, UK
- Proposed BSI Community of Practice on Ethical Fashion (2006).

For fair trade:-

- Quotas and subsidies e.g. Multifibre Agreement (MFA) which ended in 2005 and the new MFA Forum multi-stakeholder Collaborative Framework for Guiding Post-MFA Actions currently focusing on Bangledesh and Lesotho.
- Standards e.g. Fair trade Foundation standards for fair trade cotton or the International Fair Trade Association (IFAT) standards and certification schemes. Fairly traded cotton, while in evidence in over 150 retail shops[23] in the UK and in increasing demand, is still < 1 % of total cotton production.[24]

For labour conditions:-

- The Ethical Trading Initiative (ETI) voluntary initiative to improve the lives of workers in global supply chains for food, clothing and other markets.
- Standards e.g. SA8000 which have approximately 980 certifications worldwide.
- International Clean Clothes Campaign urging textile brands and distributors to improve manufacturing working conditions in the sector. The UK version is Labour Behind the Label
- Fashioning an Ethical Industry (FEI) is also supported by Labour Behind the Label and aims to educate fashion college students and tutors.

For animal welfare:-

- RSPCA initiatives e.g. RSPCA awards
- PETA campaign.

[23] Defra, 2007, Mapping of Evidence on Sustainable Development Impacts that occur in the Life Cycles of Clothing, ERM
[24] Organic Exchange, 2006, Organic Cotton Fibre Report, April 2006