

Mapping of Evidence on Sustainable Development Impacts that Occur in the Life Cycles of Clothing

A research report completed for the Department for Environment, Food and Rural Affairs by Environmental Resources Management (ERM) Ltd.

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Mapping of Evidence on Sustainable Development Impacts that Occur in the Life Cycles of Clothing – Final Report

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Glossary

AFTF	Asian Fair Trade Forum
ATC	Agreement on Textile and Clothing
CAD	Computer aided design
CAM	Computer assisted manufacturing
CC	Conventional cotton
CSR	Corporate social responsibility
Defra	Department for Environment, Food and Rural Affairs
DfID	Department for International Development (DFID)
EA	Environment Agency
ERM	Environmental Resources Management Ltd.
ETI	Ethical Trading Initiative
FLA	Fair Labour Association
FLO	Fairtrade Labelling Organizations
FWF	Fair Wear Foundation
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GRI	Global Reporting Initiative
IFAT	International Fair Trade Association
ILO	International Labour Organization
LCA	Life cycle assessment
MFA	Multi Fibre Agreement
OC	Organic cotton
RFID tags	Radio frequency identification tags
RoHS	Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (2002/95/EC)
SCP	Sustainable Consumption and Production
USA	United States of America
WEEE	Waste Electrical and Electronic Equipment Directive (2002/96/EC)
WTO	World Trade Organization

Executive Summary

I Objectives

As part of its Sustainable Consumption and Production Programme (SCP), the Department for Environment, Food and Rural Affairs (Defra) have commissioned ERM to undertake a review of existing literature on the life cycle of clothing. The aim of this review is to determine the overall social and environmental impact of the clothing life cycle along with any existing interventions and to make further recommendations for improving the overall sustainability of clothing.

The key objectives addressed in this report include:

- Analysis of the existing literature to determine the environmental and social impacts that occur in the clothing life cycle;
- Identification of any gaps in the literature addressing social and environmental impacts and assess the robustness of the evidence provided;
- Provision of recommendations for further research into the possible social and environmental impacts of the clothing life cycle so that a more complete view can be obtained; and
- A Review of existing interventions into the sustainability of clothing and to make recommendations on whether any additional UK interventions could make significant improvements.

The report is set out in a number of sections that explain the literature areas reviewed.

- The *Project Approach* gives an overview of the entire project and explains the scope, activities and any limitations applied.
- *Economic Indicators, Sector Trends, Technological Developments and Initiatives* identifies any economic indicators that characterise the clothing industry as well as presenting findings for trends, technological developments and initiatives that affect the clothing life cycle.
- The *Life Cycle of Clothing and Associated Impacts* details the environmental and social impacts found during the literature review for clothing production and consumption in the UK and abroad.

- *Significance of Findings* analyses the implications of the trends and developments on the social and environmental impacts previously identified.
- *Gap Analysis* identifies any areas in the reviewed literature where the influencing trends and developments on the social and environmental impacts of the clothing life cycle are not adequately explained.
- The *Recommendations* section addresses all conclusions derived from the review and identifies areas for possible intervention as well as any areas where further research is required.

II Economic Indicators, Sector Trends, Technological Developments and Initiatives

A summary of information collected during the review is listed below including statistics for economic indicators, trends discovered in both company policies and practices and consumer habits, technological developments that include consumer technologies and technologies aimed at reducing the impact of the clothing life cycle and any major initiatives that are currently in place.

II.I Economic Indicators

There is abundant literature available on economic indicators relating to the clothing industry. Some interesting statistics concerning economic indicators are shown below.

- The clothing industry is a relatively small component of the GDP however it represents a significant industry in the UK.
- Employment in the clothing and textiles industries is decreasing due to the increase in companies relocating production plants to developing countries.
- The three countries which import the most clothing into the UK are Hong Kong, China and Turkey which make up around 60% of all clothing imports.
- The three biggest export markets for clothing produced in the UK are Ireland, Germany and France, making up 65% of all clothing exports.

II.II Sector Trends

Trends explored in this study include economic interventions, company policies and practices and consumer trends.

Economic interventions cover a broad spectrum including minimum wages, taxations, import and production quotas, subsidies and tariffs.

II.III Clothing Manufactures Company Policies and Practices

Corporate policies have been expanding recently, with new corporate social responsibility (CSR) policies being formed. They are developed to include environmental, social, health and safety issues. Some companies have also incorporated issues that detail the sustainability of clothing into their policies.

A significant amount of clothing consumed in the UK is produced in developing countries. Companies are increasingly relocating to these areas as they can thereby produce quality clothing at lower costs.

A company that is in close proximity to local markets gives it the ability to change its products quickly to meet consumer trends.

II.IV Consumer Trends

Consumer trends include an increasing popularity of discount fashion, increased consumer awareness, more synthetic fibres being used in clothing production and an increase in the purchasing of clothing from online sources. Some notable trends are shown below.

- Discount fashion now makes up 20% of the clothing market in the UK.
- There is increasingly more clothing being produced from fair trade and organic materials, particularly organic cotton.
- Online clothing sales account for 3% of the clothing market but this has been dramatically increasing over the last few years. There is little information about the affect of online sales on the clothing industry.

II.V Technological Developments

There are many new technologies under development that aim at providing different services, ranging from integrating consumer electronics into garments to reducing the environmental impact of clothing production or use.

Integrating electronics with clothing is known as smart fibres. They currently incorporate such electronics as ipods, connections for mobile phones and GPS tracking to name a few examples. There is some development in the use of smart fibres for medical assistance. There is currently a high cost associated with smart fibres and this is still a limited, niche market. The end of life of smart fibres has not been investigated.

The waste and environmental impact caused by the production of clothing is being decreased by incorporating computer aided design (CAD) and automated systems into the production stages. CAD is primarily used to

reduce the production time of the garments and to further improve their quality and overall performance. Automation of production systems can drastically reduce lead times and the volume of waste produced during production.

A recent technology being investigated involves the use of radio frequency identification (RFID) tags. This is an identification system that can be used wirelessly instead of barcodes. The benefits of this technology are that it may aid in reducing theft, anti-counterfeiting and increasing security and safety for children and the elderly due to the monitoring possibilities.

There has been investigation into using biodegradable materials such as banana leaves, corn and bamboo for clothing production. These materials are designed to look and feel like natural fibres but have the strength and durability of synthetic materials. They are still considered to be a niche market at this stage.

A number of technologies have been developed so as to reduce the environmental impact associated with the use stage of the clothing life cycle.

- Fibre surface coating can be applied to textiles to protect against stains and spills and make the garment water resistant, flame retardant or antimicrobial. Another potential benefit of fibre surface coatings is that they need to be washed less frequently, therefore minimising energy expended during the uses phase.
- Waterless cleaning of garments uses negative ions, compressed air and deodorants to clean the clothing however there is limited information currently available on the subject.
- Non-solvent dry cleaning is becoming increasingly common. The option is now available for dry cleaning in all major UK cities.

Technologies are being developed that target the recycling and reuse of clothing. Currently most reuse of clothing is achieved by charity shops. The majority of clothing that is discarded however is sent to landfill sites.

II.VI Initiatives

The majority of initiatives focus on promoting fair trade, improving labour and work conditions or ensuring environmentally clean production.

- Fair trade aims at ensuring producers in developing countries get a fair price for their products and that production does not compromise community health or environmental sustainability.
- Most initiatives focused on labour and working conditions are based upon the principles of international labour organisation conventions.

They generally are targeted at trade unions, civil society and business and government stakeholders.

- Some initiatives focus on promoting environmental consciousness and encourage manufacturers to comply with applicable environmental standards.

III Life Cycle of Clothing and Associated Impacts

This section of the report outlines the possible environmental and social impacts that may be caused by the clothing life cycle. The impacts are

III.I Environmental Impacts

III.I.I Resource Consumption

There are significant depletion of resources throughout the clothing life cycle including fossil fuel consumption, energy use and water consumption. The majority of energy expended during the clothing life cycle occurs in the use stage with approximately two thirds of the energy used in this stage due to washing, including the heating of water whilst, the other third is consumed during the drying of clothing.

Non-synthetic materials such as cotton, consume large amounts of water during their cultivation whilst synthetic materials use large amounts of energy producing fibres from oil.

III.I.II GHG Emissions

Greenhouse gas emissions occur at all stages of the clothing life cycle including the growth of raw materials, production stages and use of the clothing. The predominant GHGs are CO₂ from energy use and CH₄, and N₂O from cotton production. Interestingly is that GHG emissions from the UK textiles industry have decreased during the past 20 years.

III.I.III Solid and Hazardous Waste

Waste is produced during all stages of the clothing life cycle however approximately 90% of the waste produced is from consumer use and garment disposal. The majority of studies consider the waste generation in the UK and to a lesser extend from manufacturing and production services from various other countries.

III.I.IV Air/Water Pollution and Toxicity

The majority of dangerous emissions from the clothing life cycle are caused by the use of pesticides and chemicals from raw material growth and production, specifically cotton. Pesticides are not used in the production of synthetic

materials however other chemicals are used in their production that can have a similar toxicity impact. When comparing conventional to organic cotton, organic cotton has the highest toxicity impact during its production stage rather than its raw material growth.

III.I.V Soil Degradation and Contamination

Degradation and contamination of soil by raw material growth or production can lead to deforestation, soil erosion, and water contamination and can drastically affect flora and fauna. Soil contamination is closely related to emissions to air and water and toxicity impacts.

III.I.VI Biodiversity/Land Use

Biodiversity is similarly affected by pesticides used in non-synthetic material growth. This is closely related to the toxicity impact of the process and soil contamination. The literature does not consider a single specific geographic region except for the case of the Aral Sea in Central Asia that is extensively covered.

III.II Social Impacts

III.II.I Worker rights

The increasing trend for discount clothing has caused production of clothing to be pushed to areas where cheaper production can occur and regulations are less stringent. These places are often found to be in developing countries. Workers in these countries are not always aware of their rights and are often restricted from forming their own trade unions.

III.II.II Worker Health and Safety

Due to relaxed regulations in some developing companies, workers can be more susceptible to workplace accidents, stress from shift work, injuries from repetitive actions and noise, and respiratory diseases. These are just a few of the health problems reported in these places. It is a common occurrence that in some developing countries, workers can be poisoned by the application of pesticides in the growth of cotton. The majority of health and safety data are available for the raw material growth and production stages of the clothing life cycle. Case studies analysed have identified major health concerns in raw material growth and production for countries such as China and India.

III.II.III Other Issues

A number of other important social issues are addressed in this report. The movement of production to developing countries provides work for many people which can benefit a local economy however, due to the underdeveloped worker rights and the lack of opportunity for advancement, there is the possibility for an increase in poverty in the affected areas.

The health of the wider community in developing countries can be affected by exposures to hazardous chemicals and nuisance odours caused by relocated clothing production plants.

Production of raw materials and textiles can lead to the loss of land resulting in the need for resettlement of communities' and potential loss of cultural assets. This is closely related to the affects of biodiversity and land use addressed above.

III.III Quantifying Impacts

There are a number of factors that make quantifying the data collected from the literature difficult. A significant issue is that there are not life cycle assessments available for all materials used in the production of clothing. It is also possible that two life cycle assessments on the same product can have significantly different outcomes as discovered when reviewing the literature. Quantification is generally presented in terms of different items of clothing (shirts and blouses, etc) and is difficult to compare their separate life cycle data.

IV Significance of Findings

The economic indicators, trends, technological developments and initiatives are specifically reviewed and related to any identified environmental and social impacts, the life cycle stages that they affect, the geographic location of the impacts and their relevance to synthetic and non-synthetic materials.

IV.I Environmental Impacts

There is a significant amount of energy consumed and GHG emissions produced from the washing and drying of clothing by the consumer, with cotton in particular requiring more intense washing and much longer drying times than synthetic materials such as polyester.

The processing of synthetic fibres from fossil fuels however causes considerable energy use, GHG emissions and resource depletion when compared to cotton production.

Evidence showed that conventional cotton growing has a high water impact from irrigation and energy and toxicity impact from pesticides and fertilizer use. Little literature is available comparing the relative impacts of conventional cotton growing to organic cotton growing.

The production stage of the clothing life cycle has a significant environmental impact, particularly from the dyes and finishes associated with production.

The majority of waste clothing and textiles is not reused or recycled, with a significant amount ending up in landfill areas. Non-synthetic materials can release methane when deposited in these environments and can potentially contribute to the overall climate change impact of the clothing life cycle.

IV.II Social Impacts

Poor working conditions for clothing production in developing countries are still occurring. Particular issues identified included poor wages, long hours, health and safety risks and general lack of knowledge of worker's rights.

The literature analysed gives evidence that there was limited access for farmers and workers to market information and trade terms.

IV.III Economic Interventions

Subsidies put in place are predominately focused on raw material growth and acquisition and the processing stage of the clothing life cycle. One result of subsidies is that it is possible, in some circumstances, to grow raw materials in areas that are not optimal for growing, resulting in increased energy and water use to maintain the crops. Subsidies provided to manufacturers in developed countries mean that manufacturers in developing countries are not able to compete in the market for the products.

A consequence of producing clothing and textiles in developing countries is that in many cases these clothing types have a significant environmental footprint since these countries have poor environmental standards.

IV.IV Company Policies and Practices

Corporate social responsibility (CSR) policies are aimed at reducing the environmental and social impacts throughout the clothing life cycle. It was found that there was little literature detailing the effectiveness of these policies.

There are standards and policies currently in place to work with CSR policies so that different companies' performances can be compared.

IV.V Consumer Trends

There has been a significant increase in the purchasing of discount clothing resulting in more clothing being thrown away rather than reused or recycled.

For natural fibre clothing (especially cotton) the biggest impact is from energy associated with the washing and drying of clothing during the use stage. The evidence showed that this is not the case for man made fibres such as polyester and viscose. The raw materials life cycle stage comes out as having the largest energy consumption due to the embodied energy in the fossil fuel based fibres. However, this is based on particular use scenarios where man made fibres are washed and dried separately from clothing made from cotton. The environmental impact introduced by the consumer could be dramatically reduced if clothing were separated into fibre types before laundering and drying.

IV.VI Technological Developments

A number of technologies have been introduced into clothing manufacture to decrease the environmental and social impacts. Computer aided manufacture is being used in production and this reduces the waste generated during the manufacture process.

Some technologies such as fibre surface coating are aimed at reducing the frequency required of washing the clothing however there is little literature available on whether consumers have changed their washing patterns accordingly.

Other technologies being developed to reduce resource consumption and emissions need to be analysed to assess whether they are having a positive or negative impact on the clothing life cycle.

IV.VII Initiatives

As a large proportion of the environmental impact in the clothing life cycle is from the use stage, potential initiatives could be focused upon changing consumer habits to consider sustainable methods for clothing care.

Most initiatives are focused upon a single aspect of the clothing life cycle and their effectiveness over the entire cycle is not well documented.

V Literature Gap Analysis

A review was undertaken in order to assess the present gaps in the literature with regard to any missing information relating environmental and social impacts to the indicators, trends, technological developments and initiatives discussed.

V.I Economic Indicators

There is substantial literature available with regard to economic indicators. Information such as import and export data, GDP and employment figures come from reliable data that are regularly updated.

V.II Economic Interventions

There is a significant group of data that details economic interventions such as quotas, tariffs and subsidies both internationally and for the UK however there is little that specifically applies to the clothing industry. There is also no information describing the affect that any interventions have on the overall environmental impact of the clothing life cycle.

V.III Company Policies and Practices

Literature that covers the relocation of production, localisation and employment trends is abundant however little of this literature applies to the clothing life cycle or its impact on the UK.

A small amount of information is available on the effectiveness of CSR policies and whether they truly provide environmental and social benefits.

V.IV Consumer Trends

There has been little research into the drivers of consumer trends and how these trends affect social and environmental impacts. The trend of purchasing discount clothing is well documented however its affect on environmental and social impacts is not. There has been a significant increase in clothing made of organic cotton, but there is no evidence that shows why organic cotton is so popular with the consumer.

Minimal investigation has been undertaken into the knowledge consumers have on the sustainability of clothing. This could be a significant factor if the environmental and social impact of the clothing life cycle is to be reduced.

V.V Alternative Crops

There have been studies into the life cycle of cotton, particularly organic cotton as this is an emerging alternative to conventional cotton. However, comparisons between the environmental and social impacts of organic to conventional cotton have not been documented. Although a large amount of research exists on organic cotton, there is little on other alternative crops such as hemp, flax, jute, bamboo or nettle.

There is an abundance of research available on genetically modified crops however there is very little that applies directly to the clothing industry.

V.VI Technological Developments

Little research has been undertaken on the environmental and social impact of introducing new clothing technologies or their impact on the overall clothing life cycle. There has also been minimal investigation into whether new clothing technologies are effective at reducing the environmental impact of the clothing life cycle.

V.VII Initiatives

There have been few investigations detailing the full life cycle of clothing or the effectiveness that any initiatives have on the social and environmental impacts associated with the process.

Some technologies are aimed at reducing the environmental burden during the use stage of clothing however little research has been done into whether the

consumer is adjusting their patterns and aiding in the reduction of the environmental impact of the clothing life cycle.

V.VIII Social Impacts

The social and health impacts of producing non-synthetic fibres is well documented in developed countries however these impacts may not transfer directly to the production of non-synthetic material production in developing countries as working standards may differ.

Minimal information is available on the cultural impacts of clothing production and consumption.

V.IX Environmental Impacts

There is a substantial amount of information available on the energy and fossil fuels usage throughout different stages of the clothing life cycle however only a small amount of this information is directly related to GHG emissions during mapped throughout the entire life cycle.

The affect of crop growth on soil degradation and contamination is not researched, particularly with reference to cotton. The impact of fossil fuel extraction is well documented however there is no evidence directly relating this impact to the production of synthetic fibres for use in the clothing industry.

V.X Life Cycle Stage

Only a small number of studies have been developed that consider all life cycle stages of clothing. These studies only include the production of clothing from materials such as cotton, polyester and wool.

Generally research to date has focused on the early stages of the clothing life cycle such as raw material growth, acquisition and processing. Distribution information is however available for materials such as cotton, polyester, rayon and wool and not for any alternative materials such as flax, hemp and jute.

V.XI Geographic Scope

Literature particularly focuses on the countries in which the clothing is produced rather than where it is consumed. There is a particular focus on countries involved in raw materials growth. Research into the social and health impacts of synthetic fibre production however is predominately focused on countries such as USA, Australia and the UK but data collected can generally be transferred to other countries producing synthetic materials.

The influence of sector trends is not documented when comparing various geographic locations. The impacts and potential benefits of emerging technologies are also not well documented for different geographic locations.

Environmental and social impacts of the clothing industry vary across geographic locations and are predominately related to the level of a country's legislative controls and whether they are enforced.

V.XII Clothing Material

There several papers published about fabrics and materials for uses other than clothing. Unfortunately this information does not easily transfer over to the clothing industry and so could not be used in the study.

Comparisons between clothing materials are primarily focused on synthetic vs. non-synthetic fibres, particularly cotton and polyester. Few studies have been undertaken into less common materials past their production stage.

VI Recommendations

Although businesses have begun to incorporate social and environmental issues into their policies, the effectiveness of these policies and CSR policies should be investigated. There is a need to identify which policies reduce social and environmental burdens caused by the clothing industry and which do not. If subsidies were relaxed, clothing production and raw material growth may shift further away from developed countries such as China and India. A study should be undertaken comparing the social and environmental impacts of raw materials growth and production in developed countries such as the US to those in developing countries. However, this study should also incorporate the knock-on effect that increasing production in china and India will have on other developing countries such as Bangladesh.

The use phase of the clothing life cycle which is significantly influenced by the consumer contributes a significant amount to overall resource consumption and environmental impact of the cycle. This burden is predominately due to the energy consumed whilst washing and drying the clothing. Further steps should be taken to reduce the energy consumption of this stage and also to educate consumers about sustainable clothing use.

The end of life phase of the clothing life cycle also provides a significant contribution to the overall environmental impact. This is primarily due to the disposal of unwanted clothing as household waste, which thereby increases the amount of landfill or incineration. Educating the consumer on the issues caused by throwing away clothing with household waste could significantly reduce the proportion of waste produced and increase the amount of clothing that is reused/recycled.

Although the use of organic cotton in clothing production is increasing, there is little research currently available on the reasons for this consumer trend. Further investigation is required as to whether the use of organic cotton results in reduced environmental/social impacts.

There are a number of technologies aimed at reducing the environmental impact of clothing through its life cycle. The bulk of these technologies have

not been investigated to consider their overall social and environmental impact.

Fibre surface coating is one such technology that can be designed to reduce the frequency that the clothing needs to be washed, thereby reducing the energy consumed. However, there has been no research into how this technology affects recycling of the product. There has also been no investigation into whether consumers are washing clothing that uses this technology any differently from normal clothing.

There has been research into the production of conventional and organic cottons however comparing the environmental and social impacts of the two cotton types has not been thoroughly investigated.. Biodegradable materials would need to undergo a sustainability assessment before they are incorporated into mainstream clothing production. For example, there has been media criticism into the use of food crops for non-food purposes

The growing of cotton uses a significant amount of water. An example of the water usage required can be seen when considering the Aral Sea disaster. The techniques used to grow cotton should be identified and any unsustainable methods should be mitigated.

There is currently little push for the recycling of waste clothing. A possible area of policy development could include the application of technologies to improve the recyclability of clothing.

Workers in developing countries can be affected by unacceptable health and safety issues. Research should be conducted developing cotton growing techniques in these regions so that workers do not come in direct contact with hazardous chemicals and pesticides.

1 Introduction

1.1 Project Background

Sustainable Consumption and Production (SCP) is a key priority for the Department for Environment, Food and Rural Affairs (Defra). It is one of the four priority areas for United Kingdom (UK) action set out in the new Sustainable Development Strategy. SCP is about breaking the link between, or '*de-coupling*', economic growth and environmental degradation (Ref. 72). As part of its SCP activities, Defra is developing roadmaps on ten priority products and services with significant environmental impacts, one of which is clothing. The roadmaps are aimed at improving the sustainability performance of these products. This project is designed to support the evidence base on the sustainability impacts and interventions for clothing.

Defra commissioned Environmental Resources Management Limited (ERM) to conduct a desk based review of the existing literature to determine the environmental and social impacts that occur in the life cycle of clothing, existing interventions and further recommendations for improving sustainability performance. There is a growing volume of existing evidence (UK and international) on sustainability performance of clothing which was collated and reviewed in this project. The project findings support identification of opportunities for improving the sustainability performance of clothing within the UK and internationally across the supply chain.

1.1.1 Key Definitions

There are a number of definitions for SCP and associated terms.

- **Clothing.** Apparel, garments or attire designed with the purpose of covering the body, including textiles used for the manufacturing of clothing. Footwear and carpets were not included within the scope of this work (Ref. 73).
- **Sustainability.** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Ref. 74).
- **Sustainable Consumption and Production (SCP).** Achieving economic growth whilst respecting environmental limits, finding ways to minimise damage to the natural world and making use of the earth's resources in a sustainable way (Ref. 72). SCP aims to **improve**

sustainability performance by focusing on products and services across their life cycle to include their consumption.

- **Life Cycle Assessment (LCA).** A technique for assessing the environmental aspects and potential impacts occurring in all life cycle stages of a product or service system. An LCA is separated into four phases:
 - definition of project goal and scope, ie defining the goal of the study and the scope of the system under study;
 - compiling an inventory of relevant inputs and outputs to each life cycle stage and to the system;
 - evaluating the potential environmental impacts associated with those inputs and outputs; and
 - interpreting the results of the inventory analysis and impact assessment phases in relation to the objectives of the LCA study (goal and scope) (Ref. 75).

1.2 Project Aims

The specific aims of this project are to:

- identify the sustainability impacts (environmental and social) across the life cycle of clothing, based on existing evidence;
- assess the robustness, uncertainties and to identify gaps in the evidence of impacts;
- make recommendations on further research required on life cycle impacts of clothing; and
- review and to assess the effectiveness of existing interventions to improve the sustainability performance of clothing and to make recommendations on where UK interventions could make a significant improvement.

1.3 Report Structure

The remainder of this report is structured as follows.

- *Section 2 Project Approach.* Provides an overview of the project approach (including scope, activities and limitations).

- *Section 3 Setting the Scene: Economic Indicators, Sector Trends, Technological Developments and Initiatives* Identifies key economic indicators characterising the clothing sector and presents the literature review findings on sector trends, technology developments and initiatives.
- *Section 4 The Life Cycle of Clothing and Associated Impacts.* Presents the impacts of clothing consumption and production as identified in the literature.
- *Section 5 The Significance of the Findings.* Analyses the implications of the trends and developments in the sector for the environmental and social impacts of clothing.
- *Section 6 Gap Analysis.* Identifies the gaps in our understanding of impacts, influencing trends and developments.
- *Section 7 Recommendations.* Shares the study conclusions and identifies evidence based opportunities for further research and policy debate.

The report is supported by the following annexes.

- *Annex A1 Literature Review Tables – Environmental Impacts.* Provides a summary of the environmental impacts identified in the literature review.
- *Annex A2 Literature Review Tables – Social Impacts.* Provides a summary of the social impacts identified in the literature review.
- *Annex B Technological Developments.* Provides a detailed listing of technological developments identified in the literature review.
- *Annex C Initiatives.* Provides a detailed listing of initiatives identified in the literature review.
- *Annex D Reference List.* Provides a numbered list of references.

2 Project Approach

2.1 Introduction

This section outlines the project approach and includes a summary of the project:

- scope;
- activities;
- robustness criteria; and
- limitations.

2.2 Project Scope

This section of the report presents a definition of clothing, information sources, the clothing materials reviewed, background on LCA and project limitations.

2.2.1 Clothing Definition

This report addresses apparel, garments or attire designed with the purpose of covering the body, including textiles used for the manufacturing of clothing. This report does not include footwear or carpets in the definition of clothing. These items are therefore outside the scope of this project, and specific impacts associated with their consumption and production have not been identified from the literature.

2.2.2 Information Sources

A range of information sources were reviewed as part of this project. These sources included:

- academic research;
- analysis from research institutes;
- media articles;
- National Statistics Online;

- third sector (social enterprises) as well as NGOs and campaign findings; and
- policy and research from international organisations.

Where ERM has access, academic databases were also reviewed including:

- the International Journal of LCA;
- Science Direct; and
- Wiley.

Information for this report was gathered through a desk based review and did not involve direct stakeholder consultation. Some information sources were secondary, and present data collected for another purpose, but could be re-analysed for this report. For example, Ref. 22 refers to the impacts of cotton, wool and polyester in relation to a sofa, not clothing.

A project steering group made up of Defra and the Department for International Development (DFID) representatives reviewed this report. This report was then circulated to key stakeholders before a peer review and publishing. This report will support an initial evidence review on this topic prior to engaging formally clothing sustainability stakeholders.

2.2.3 Clothing Materials

As the impacts vary dependent on whether the clothing raw materials are synthetic or non-synthetic, the literature was reviewed for evidence specific to impacts for 15 clothing materials, as agreed with Defra. These are identified in *Table 2.1* below.

Table 2.1 Clothing materials reviewed

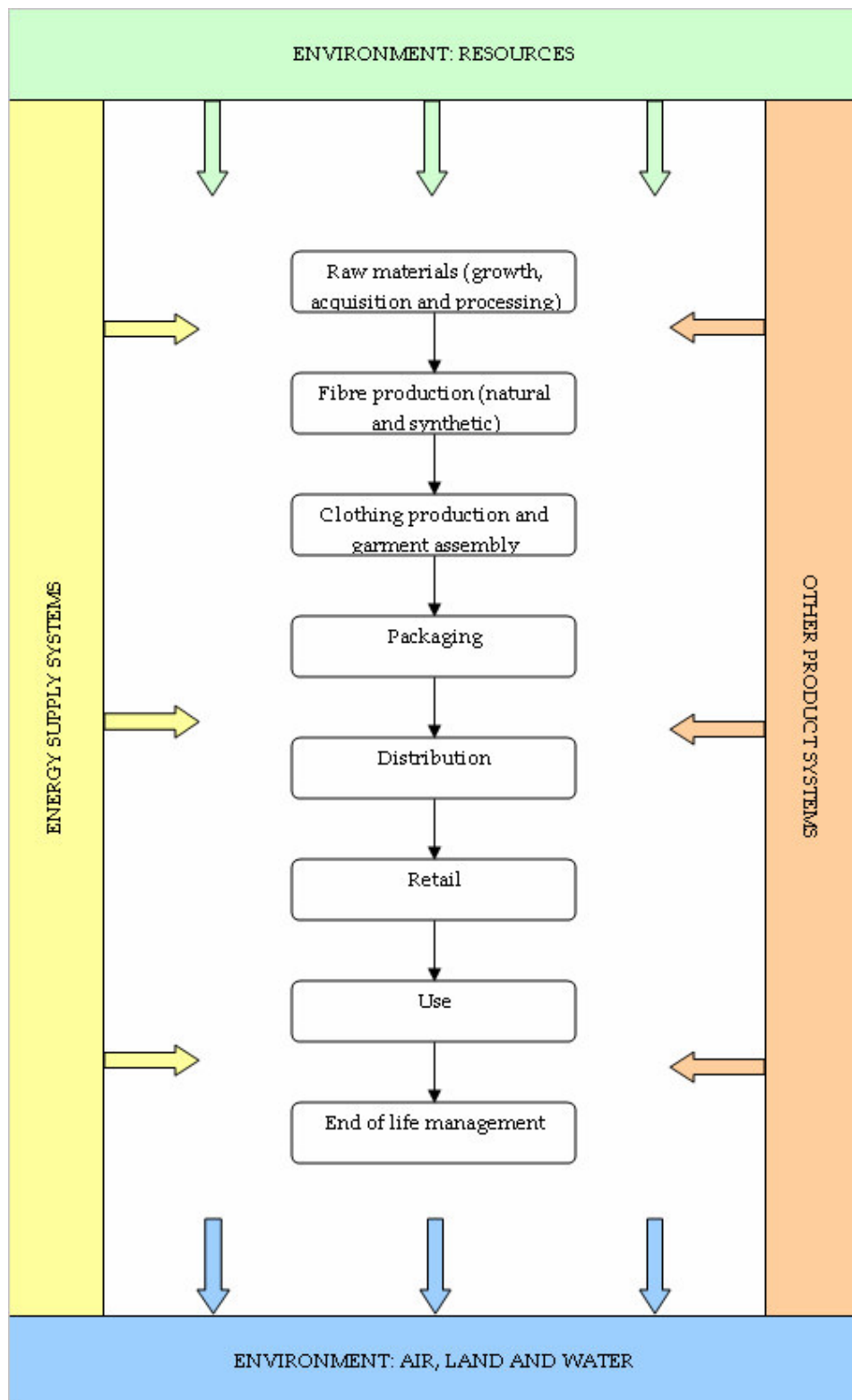
Synthetic	Non-synthetic
Polyester	Silk
Polypropylene	Wool
Acrylic	Cotton
Nylon	Hemp
PVC	Flax
Novel fabric materials	Jute
Rayon/viscose (man-made)	Down
	Leather

2.2.4 Life Cycle Assessment (LCA)

To collect evidence and to identify the environmental and social impacts of the UK consumption and production of clothing, a life cycle approach was adopted (refer to *Figure 2.1*). Literature was identified, which reviewed impacts throughout the following life cycle stages:

- raw materials (growth, acquisition and processing);
- fibre production (natural/non-synthetic and synthetic);
- clothing production and garment assembly;
- packaging;
- distribution;
- retail;
- use; and
- end of life management (reuse, recycling, remanufacture, energy recovery, treatment and disposal).

Figure 2.1 Life cycle stages for clothing



A description of LCA is provided in *Box 2.1* below.

Box 2.1 What is life cycle assessment?

LCA is an established method for assessing the environmental impacts of products. LCA studies assess the potential environmental impacts throughout a product's life, (ie from cradle to grave), from raw material acquisition through production, use and disposal (Ref. 73).

The LCA method has been standardised by the International Standards Organisation (ISO) (Ref. 75). The life cycle perspective ensures that any emerging policies or interventions do not simply shift the environmental burden or the social impacts to another life cycle stage.

LCA is the most appropriate method to quantify environmental impacts that occur in the supply chain of a product system.

Social impacts are more difficult to quantify than environmental impacts and have therefore not been traditionally included in LCA methods.

2.2.5 Project Limitations

Limitations to this project are set out below.

- **Exclusions.** A consideration of animal welfare in the production of clothing from animal products (ie leather, fur, down and silk) was not included in this scope of work. Similarly, the impacts associated with carpets and footwear were outside the project scope.
- **Availability of information.** Some literature related to the production and consumption of clothing is held in academic journals and industry reports that could not be accessed as part of this review. These literature sources, which are believed to contain some relevant information, are presented in *Annex A1* and *A2* and highlighted in blue. This report presents an assessment of literature that is publicly available and is identified in the literature review tables.
- **Quantification of impacts.** Although the literature quantifies environmental impacts, there is no consistency in calculation methods and scope (eg which life cycles stages, impact categories, etc are included in the study). This can result in a flawed comparison; therefore, the quantitative data included is limited by this.

- **Secondary impacts.** A review of the secondary impacts on individuals and communities (eg the impact of water pollution on drinking resources used by a local community and consequent health issues) is outside the scope of this study. This report identifies primary impacts.
- **Boundaries.** The scope of this project did not include a review of evidence related to the impacts of production of products (ie fertilisers, dyes and chemicals) used in the clothing industry. However, the impacts of their use were within the scope.
- **Interventions.** There is a large body of literature on economic interventions. A comprehensive literature review of this area was not undertaken for this study and only key interventions relating to environmental and social impacts are documented in this report.

2.3 Project Activities

This section of the report presents information on the scoping/kick-off meeting, literature review, robustness of data, gap assessment and recommendations.

2.3.1 Scoping Meeting/ Kick-Off Meeting

ERM and Defra met on 15 December 2006 to confirm the scope of work, based on the detailed project specification, and to finalise project tasks and deliverables.

2.3.2 Literature Review and Literature Summary Tables

The data sources were reviewed for evidence on:

- economic indicators to describe the clothing sector;
- sector trends;
- technological developments; and
- clothing-related sustainability initiatives.

The evidence on these issues are summarised in *Section 3* of this report.

The data sources were also reviewed for evidence on the environmental and social impacts of UK clothing consumption and production. The contents of these data sources are summarised (see *Table 2.2*) In *Annex A1* and *Annex*

A2. Key impact information from the literature is summarised in *Section 4* of this report.

Table 2.2 Contents of literature summary tables

Contents of tables
1. Title
2. Author and date of publication
3. Scope of study: <ul style="list-style-type: none">a. textile materials;b. clothing products;c. life cycle stages;d. impacts identified/addressed; ande. geographic scope.
4. Scale of impact (where possible)
5. Significant impacts identified
6. Significant part of the life cycle identified
7. Other relevant issues
8. Source/contact details
9. Robustness of evidence (high, medium, low)

2.3.3 Robustness of Data

The evidence collected underwent a robustness test, which considered the following criteria.

1. **Credibility:** whether the source of evidence is reliable.
2. **Reliability:** whether the evidence is supported by quantitative data or analytical methods.
3. **Objectivity:** whether the evidence acknowledges any bias or appears to have inconsistencies.
4. **Transferability:** whether the nature of the impacts discussed for other sectors provide transferable evidence that is relevant to clothing consumption and production.

Based on the available evidence, each criterion was rated high, medium or low. Details of the data quality assessment for each document reviewed can be found in *Annex A1* and *Annex A2*.

2.3.4 Gap Assessment and Recommendations

ERM analysed the literature to identify the significance of the findings and gaps in the evidence base in terms of:

- sector trends;
- technological developments;
- clothing-related initiatives; and
- environmental and social impacts.

The significance of the findings and the impact gaps were further considered by life cycle stage, geographical coverage and clothing material. The significance of the findings is summarised in *Section 5* and the results of the gap analysis are summarised in *Section 6*.

The results of the gap analysis and the analysis of the significance of sector trends and developments for environmental and social impacts supported the identification of recommendations in *Section 7*.

3 Setting the Scene: Economic Indicators, Sector Trends, Technological Developments and Initiatives

3.1 Introduction

This section establishes the project context by providing an overview of key economic indicators for the clothing sector in the UK. This is followed by a summary of evidence relating to:

- sector trends;
- technological developments; and
- global and UK initiatives.

3.2 Economic Indicators for the Clothing Sector

Highlights for the UK clothing sector are listed in the *Table 3.1*.

Table 3.1 Economic indicators for the clothing and textile sector

Economic indicator	Statistics	Reference
Amount spent on clothing worldwide	US\$1 trillion	(Ref. 64)
Gross Domestic Product (GDP)	0.78% of UK GDP (2002)	(Ref. 76)
Market growth	4.2% (b/w 2003 and 2004)	(Ref. 78)
Global employment	26.5 million (2000)	(Ref. 64)
UK employment	167 000 (2005)	(Ref. 77)
UK imports	1.70 million tonnes (textiles and clothing): • £10.86 billion (clothing) • £4.66 billion (textiles)	(Ref. 64)
UK exports	281 000 tonnes (textiles and clothing): • £2.72 billion (clothing) • £3.36 billion (textiles)	(Ref. 64)
Global exports	Textiles and clothing represent about 7% of world exports	(Ref. 64)
UK production	697 000 tonnes (textiles and clothing): • £3.92 billion (clothing) • £5.66 billion (textiles)	(Ref. 64)
UK consumption	2.16 million tonnes (textiles and clothing) • £38.40 billion (clothing)	(Ref. 64)

3.2.1 GDP

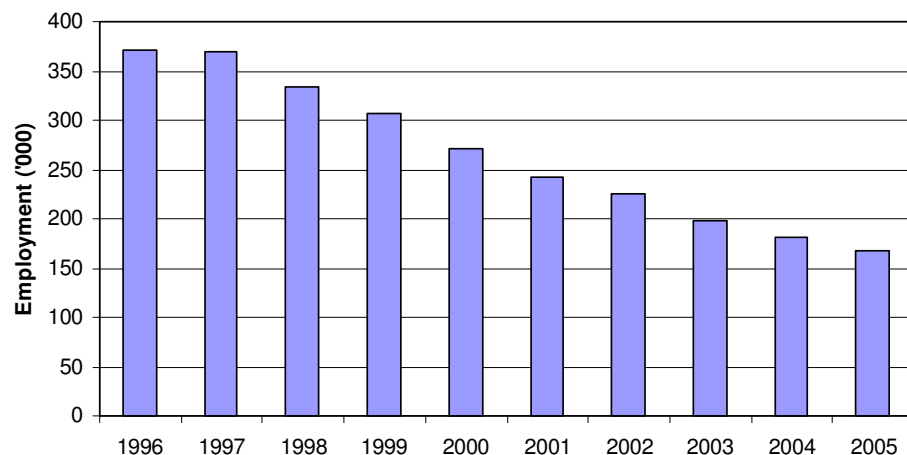
Textiles and clothing comprises a relatively small proportion of UK GDP, at 0.78%. However, this still represents a significant industry (Ref. 76).

3.2.2 Employment

The clothing and textile sector employed 167 000 people in 2005, but employment in this sector has been steadily decreasing in the last decade. There has been a 45% decrease in employment since 1996. *Figure 3.1* depicts employment trends in the sector over the last ten years (Ref. 77). Approximately 47% of the employment is in textiles and 53% in clothing (Ref. 64).

There is no evidence available on the number of people employed as market traders who sell clothing. In central London alone there are more than 2000 market stalls, many of which sell clothing (Ref. 229).

Figure 3.1 UK employment in the apparel and textile industry (Ref. 80)

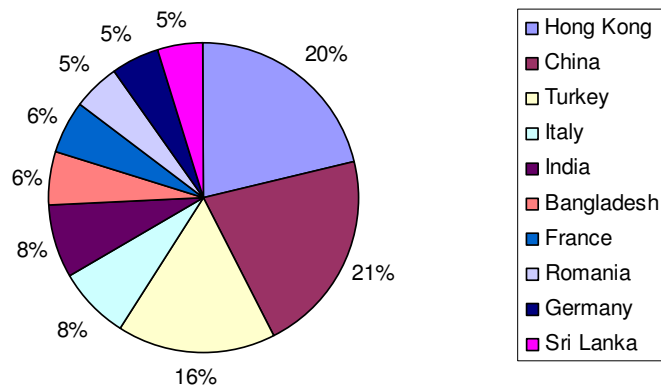


3.2.3 Imports

Annually, the UK imports 1.70 million tonnes of clothing and textile products with a total value of £15.52 billion: £10.86 billion for clothing and £4.66 billion for textiles (Ref. 64).

The three largest suppliers of UK clothing are Hong Kong, other areas in China and Turkey, which provide nearly 60% of all imports (refer to *Figure 3.2*). Trousers, t-shirts and pullovers are the most common imports (refer to *Figure 3.4*) (Ref. 80). Approximately two-thirds of the UK import of fibres, yarns and fabrics by mass is man-made, the rest is of natural origin, primarily cotton (15%) and wool (10%) (Ref. 64).

Figure 3.2 Top ten suppliers of UK apparel (2005) (Ref. 80)



3.2.4 Exports

Annually, the UK exports 281 000 tonnes of clothing and textile products with a total value of £6.08 billion: £2.72 billion for clothing and £3.36 billion for textiles (Ref. 64).

The three largest markets for UK clothing are Ireland, Germany and France, which receive 65% of all exports (refer to *Figure 3.3*). Trousers, t-shirts and pullovers are also the most common exports (refer to *Figure 3.4*) (Ref. 80). Approximately two-thirds of the UK exports of fibres, yarns and fabrics by mass are man-made; the rest is of natural origin (Ref. 64).

Figure 3.3 Top ten markets for UK produced apparel (2005) (Ref. 80)

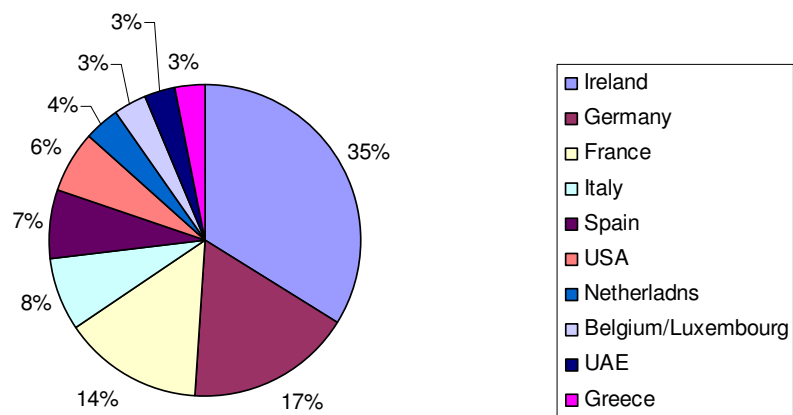
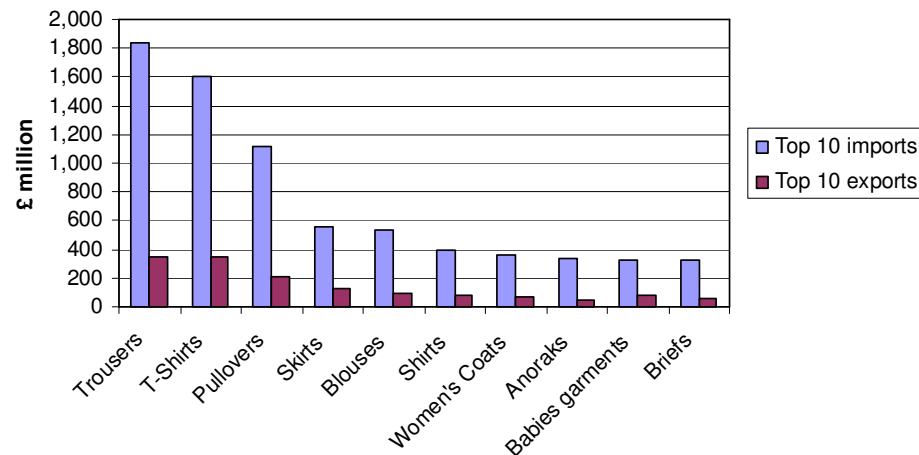


Figure 3.4 Top ten imports and exports by clothing type (2005) (Ref. 80)



3.2.5 Production

Annually, the UK produces 697 000 tonnes of clothing and textile products with a total value of £9.58 billion: £3.92 billion for clothing and £5.66 billion for textiles. One fifth of the UK's annual consumption (by weight) of clothing and textile products is manufactured in the UK. Of the fibres, yarns and fabrics that are exported, 19% are natural, 64% are man-made and 17% unspecified (Ref. 64).

3.2.6 Consumption

Annually, the UK consumes 2.16 million tonnes of clothing and textile products and spends approximately £38.40 billion on clothing. This is equivalent to approximately 35kg per capita (Ref. 64). National Statistics Online consumer trends state that the consumers spend approximately £37.57 billion on clothing (Ref. 81). Total UK consumer expenditure on clothing has steadily increased by approximately 34% between 1996 and 2005 (refer to *Figure 3.5*) (Ref. 81).

In 2004, the average UK citizen spent £780 on textiles and clothing, of which £625 was on clothes (Ref. 64). Sales of women's-wear is nearly 54% higher than that of men's-wear, and more than 75% that of children's-wear. Trousers, pullovers and t-shirts account for about half of the total consumption by mass (Ref. 64).

The UK average weekly spend on clothing is highest in Northern Ireland at £31.10, and lowest in the South West of England at £20.20. By age, the UK average weekly spend on clothing is highest for thirty to fifty year olds and lowest for those seventy five and over (Ref. 81).

Textiles are the fastest growing sector in terms of household waste (Ref. 64). Sales of new clothing in the UK have increased by 60% in ten years. Textile waste is forecast to continue increasing as sales of new clothing continue to rise (Ref. 234).

3.2.7 Retail Distribution

Customers spend 49% of their money on clothing from independent retailers, 44% from chain stores and 7% from supermarkets (Ref. 82). In 2005, 19% of all clothing and footwear items were bought in supermarkets (Ref. 64 based on Euromonitor data, 2006) (see *Figure 3.6*). As noted above, there is no evidence available on the role of market traders who sell clothing.

Figure 3.5 Total consumer expenditure on clothing (2005) (Ref. 81)

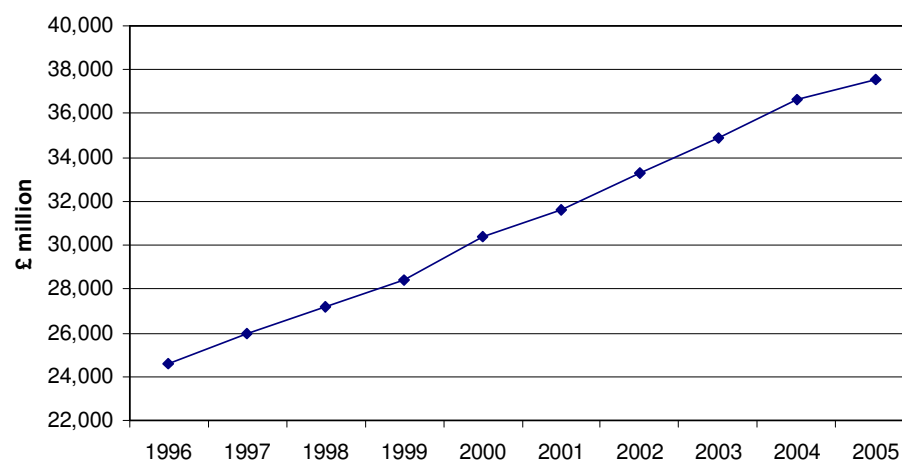
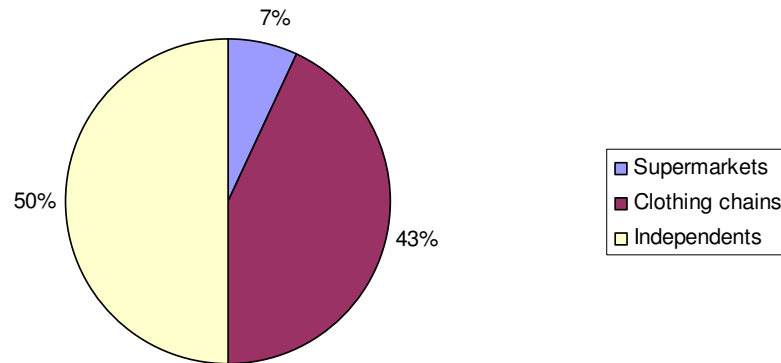


Figure 3.6 Retail distribution of clothing sales (2005) (Ref. 80)



3.3 Sector trends

Changing trends will inevitably influence the environmental and social impacts of clothing consumption and production. The primary trends documented in the literature relate to:

- economic interventions:
- company policies and practices; and
- consumer trends.

3.3.1 Economic Interventions

Economic interventions are wide-ranging and include minimum wages, taxation, production quotas, import quotas and tariffs. The key interventions relating to environmental and social impacts are documented in this section.

- **Quotas and tariffs.** Until 2005, the Multi Fibre Agreement (MFA) and the Agreement on Textile and Clothing (ATC) regulated international trade in textiles and clothing. The MFA (1974 – 1994) set out rules for bilateral negotiation of trade on textiles and clothing, providing for the application of selected quantitative restrictions when surges in imports of a particular product might damage the industry of the importing country.

The MFA was replaced by the WTO ATC which set in place a transitional process for the removal of quotas and integration of textiles and clothing into the General Agreement on Tariffs and Trade (GATT 1994) (Ref. 124).

The prospect of the end of quotas prior to 2005 was ambivalent. On one hand, distorting quotas set by the United States of America (USA) and Europe has led to an inefficient global allocation of textile and clothing production which prevented costs to consumers from being reduced (Ref. 125). On the other hand, the benefits felt by developing countries would be unevenly distributed with the largest producers, namely India and China, being able significantly to increase exports with smaller (and poorer) producers being pushed to the periphery (Ref. 126).

When the ATC ended, Chinese exports did surge, and the USA and Europe have subsequently negotiated further quotas on Chinese exports. The new EU quotas, signed by all EU member states and the Chinese ministry of commerce, began in June 2005 and will continue until 2007 (Ref. 127). The intention of the temporary EU quotas is to protect textile businesses and jobs across Europe. However, this has been in conflict with the retail sector which fears it will not be able to access enough goods to meet demand (Ref. 128).

- **Subsidies.** A subsidy is defined as money, usually paid by government to:

1. keep prices below what they would be in a free market;
2. support businesses that would otherwise fail; or
3. stimulate activities.

Subsidies can be a form of protectionism that makes domestic goods (or services) artificially competitive against imports (Ref. 129).

A significant part of the literature on subsidies in the textiles and clothing industry discusses agricultural subsidies on cotton in the USA. The USA produces half of the world's cotton and is the largest exporter (Ref. 64). American cotton farms have historically been highly subsidised by both the private and public sectors. These subsidies have been criticised for creating unfair competition as unsubsidised industry in developing countries is unable to export cotton at competitive prices. Brazil claims that, between 2001 and 2002, it lost \$600 million in cotton exports due to USA cotton subsidies, and brought a case against the USA at the WTO (Ref. 130).

In 2004, the WTO ruled that USA subsidies to its cotton farmers were unfair. The USA appealed this decision. However, there is insufficient literature on the actions taken to address the ruling and the consequences of these.

3.3.2 Company Policies and Practices

Company policies and practises include corporate social responsibility and integration. The key policies and practises related to environmental and social impacts are documented in this section.

- **Corporate social responsibility (CSR).** Company policies are being expanded to include environmental, social and health and safety issues. A number of high profile companies, including the GAP, Hennes & Mauritz (H&M) and Marks and Spencer have created CSR policies and guidelines incorporating the sustainability impacts of clothing (Ref. 131, 132 and 133). This trend of identifying, managing and reporting on non-financial issues is well documented in the literature.
- **Relocation of production and manufacturing.** The majority of clothing consumed in the UK is produced in other countries (Ref. 80). Clothing producers and manufacturers are relocating to markets that are capable of producing quality clothing at a lower cost than the UK (Ref. 64). For example, in January 2007, Burberry announced plans to relocate their factory to China to reduce costs (Ref. 83).
- **Localisation.** Proximity to developed markets is an influential variable, and some companies have developed new models for clothing supply based on rapid response to changes in fashion. Clothing manufacturers in European countries can compete by supplying clothing very quickly. For example, the Spanish retail company Zara manufactures products in Spain and Portugal. This adds a premium to their products, but also allows the company to respond to consumer trends more rapidly than competitors and avoid expensive discounting of end-of season stock. Eastern European and Mediterranean countries also have the advantage of being close to the Western European market (Ref. 64).
- **Employment.** Relocation of production and manufacturing has led to a drop in employment in the UK clothing and textile industry (refer to *Figure 3.1*). Increased competition from countries with low labour costs

has influenced the decrease in employment in the UK clothing and textile sector (Ref. 64).

- **Integration.** Integration of various production requirements, such as textile finishing and dyeing with textile weaving is increasingly common. This allows manufacturers to increase production speeds to meet the demands of retailers and customers (Ref. 64).

It is clear that business plays a vital role in achieving sustainability. Increasingly, business is being asked to play a role in providing solutions to global challenges. The World Business Council for Sustainable Development (WBCSD) is a coalition of 180 global companies committed to sustainable development. The WBCSD recently published a report where eight members and global business leaders reflected on the global challenges facing business and society (Ref. 230).

- Economic context: since 1992, there has been an 80% increase in world trade. The balance of business power is shifting to the East. Investment in companies is becoming more global and the ownership of companies is becoming more international and less transparent.
- Poverty: the gap between rich and poor is increasing within countries and across countries, both in developed and developing countries.
- Globalisation: globalisation has highlighted the world's contrasts. Consumers in rich countries buy goods made in poorer ones. Employees in advanced economies are priced out of jobs by workers in emerging ones.
- Environment: according to the Millennium Ecosystem Assessment report, about 2/3rds of the ecosystem services that it evaluated were being degraded or used unsustainably; and
- Demographic change: by 2050, the global population will have grown to more than 9 billion, with all the growth in developing countries, creating major pressure on health and education.

The final message from the global leaders of WBCSD is (Ref 230): *In each of the phases above, we will engage broadly with a range of groups and organizations, including governments, international bodies, customers, employees, partners, academics, NGOs, civil society institutions, and the general public.*

- *We will then use our experiences to move to new starting points for understanding and action. If we can deploy this model with the full*

creativity, focus and resources of business, we believe we will significantly contribute to resolving the major issues that society faces.

- *We will develop technologies and products that enable the world to address its environmental and social challenges.*
- *We will help to create new businesses, new markets, new livelihoods, and new customers among the three billion people who live in poverty today and the three billion who will be added to the world's population in the next 50 years.*
- *We will help to set global benchmarks and global frameworks that create universal standards and raise the bar for all companies.*
- *We will operate and compete successfully in a range of countries, markets, and cultures, maintaining consistent global standards while acting as part of the local community.*
- *We will responsibly manage the challenge of moving assets and activities between regions to make the most of the benefits of global scale.*
- *We will act responsibly in addressing the issues raised by ageing populations in the developed world and growing populations in the developing world.*
- *We will attract new generations of employees, creating an inclusive culture, advancing more women, and enabling people from any nationality, race, or background to fulfil their potential.*
- *We will set high standards of corporate governance, demonstrating openness about our business activities and building trust.*

These are very ambitious targets, but it is clear that business is recognising their role in the challenges to improve sustainability.

3.3.3 Consumer Trends

The key consumer trends include increased popularity of discount fashion, increased consumer awareness, more synthetic fibres being used and online shopping.

- **Discount fashion.** The discount or value clothing sector commands a fifth of the clothing market. This is approximately double its share in 1999. While the value sector's 2004 growth far outperformed the clothing market growth, the main drivers of this growth were Tesco and TK Maxx (Ref. 84). These companies use flexible, fast supply chains that allow clothing collections to be changed every two to three weeks (Ref. 64).
- **Consumer awareness.** More clothing is being produced from fair-trade and organic materials. Sales of organic cotton are set to triple to US\$2.6 billion by the end of 2008 from its current US\$900 million level (2006). *Table 3.2* presents key clothing and textile producers who have made commitments to sustainability.

Sector growth is dependent on commitments to cotton growers from brands and retailers. Currently, cotton farmers are forced to speculate on the demand for organics and some are unwilling to take the risk to convert to organic unless there are firm pre-plant commitments or long-term contracts in place (Ref. 85).

Organic cotton products can be found in over 120 brands, 150 retail shops and 170 online shops in the UK (Ref. 86). Fairtrade clothing can be purchased from over 24 major retailers, including: Sainsburys; Tesco and Marks and Spencer (Ref. 87).

- **Synthetic versus non-synthetic materials.** The demand for natural fibres has been almost constant for the last 15 years, whereas the demand for synthetic fibres has nearly doubled, with polyester driving this demand. Approximately two-thirds of the UK imports of basic textile materials (fibres, yarns and fabrics) by mass to the industry are synthetic. The remaining portion is of natural origin, with cotton and wool accounting for 15% and 10% respectively (Ref. 64 - based on information from Textiles Intelligence Technical Textile Markets Report).
- **Online sales.** Internet clothing sales reached £1.2 billion in 2006 and have increased by 461% over the last five years. Online clothing sales account for only 3% of the overall market, but this share is growing quickly. There was a 44% rise in sales last year, an increase of 138% is expected between now and 2011, when sales are predicted to reach £2.9 billion (Ref. 88). There is no evidence on the amount of merchandise that is returned from online purchases.

Table 3.2 Examples of clothing companies with activities that influence environmental and social impacts

Clothing company	Description of activities related to environmental and social impacts	Source
H + M	H+M has a license to use the Flower, the official eco-label of the European Union. The Flower stands for restriction of hazardous substances and reduced water pollution throughout the production chain, from the raw cotton to the finished product.	(Ref. 204)
Marks and Spencer	First major retailer to develop a special code of conduct for their clothing suppliers on dyeing, printing and finishing. Banned PVC from children's clothing and packaging. M&S launched a scheme to recycle or reuse unwanted clothes hangers in their stores in 1975.	(Ref. 205)
Beirholms	BV producers shall at the very least meet all relevant local and national environmental regulations. In addition, they expect their producers steadily to improve environmental performance, and to reduce waste and emissions to air, ground and water; handle, store and dispose of hazardous waste and chemicals in an environmentally safe manner; contribute to recycling; and to work to implement an environment management system.	(Ref. 206)
Klopman International Srl	Klopman was one of the first European textile manufacturers to become eligible to display the prestigious Öko-Tex Standard 100 'Confidence in Textile' label for polyester/cotton blends. Klopman is the first polyester cotton fabric manufacturer to be awarded European Eco-label accreditation.	(Ref. 207)
Hybler	European Eco-label accreditation. All the realised technological procedures meet all the ecological requirements upon the textile production.	(Ref. 208)
Krenholm Holding Ltd	European Eco-label accreditation	(Ref. 209)
Industria Tessile Sanesi Spa Company	European Eco-label accreditation	(Ref. 210)
J. Mørup Stof	European Eco-label accreditation. Products are chosen that have the lowest impact on the environment as possible.	(Ref. 211)
iZWool International P/L	European Eco-label accreditation. i-merino is a sustainable performance activewear fabric. Growing merino wool has an impact on the immediate environment, but they advocate best management practice amongst all their growers to minimise the ecological footprint of the i-merino production chain.	(Ref. 212)
Naturapura Clothing	European Eco-label accreditation	(Ref. 213)
Bloch & Behrens Wool (NZ) Ltd	European Eco-label accreditation	(Ref. 214)
AB Ludvig Svensson	European Eco-label accreditation	(Ref. 215)
View Sustainable Design AB	European Eco-label accreditation	(Ref. 216)
F. Engel K/S	European Eco-label accreditation	(Ref. 217)
Kvadrat A/S	European Eco-label accreditation	(Ref. 218)
Novotex A S	Growing, production, dyeing, wastewater treatment and disposal are all managed in accordance with best practice.	(Ref. 219)
GAP Inc	GAP is committed to improving factory conditions through a comprehensive factory-monitoring and labour-standards program. GAP has also taken efforts to conserve energy, reduce waste, explore sustainable design in their products and buildings and minimise environmental impacts throughout their supply chain.	(Ref. 220)

Clothing company	Description of activities related to environmental and social impacts	Source
Tesco	The Tesco range uses raw materials that have been grown without chemical fertilisers and manufactured and dyed in an environmentally sustainable way. The cotton is grown by farmers in India working in a series of co-operatives, enabling them to be taught skills such as how to control pests organically, without harming the land and other beneficial creatures, and their habitat.	(Ref. 221)
Sainsbury's	Sainsbury's launched a range of clothing made from Fairtrade certified cotton. All of the Fairtrade certified cotton will be sourced from West Africa, including Mali, Senegal and the Cameroon. As well as marking a significant increase in the volume of Fairtrade certified cotton sold in UK stores, Sainsbury's was the first retailer to bring Fairtrade certified cotton from West Africa to the UK High Street. Fairtrade guarantees farmers a fair and stable price that covers their costs of production and allows them to plan for the future. The additional Fairtrade premium is paid into a bank account controlled by an elected committee of co-op members who consult with the other members before deciding which projects to fund with the premium. These can range from the construction of schools to agricultural training programmes, alternative income-generating schemes or environmental protection projects. Fairtrade is a rapidly growing part of the supermarket's overall business, sales of Fairtrade is up 70% this year compared to 2005.	(Ref. 222)
Patagonia	In 2005 Patagonia launched their Common Threads Garment Recycling Program, through which customers could return their worn out Capilene® Performance Baselayers to them for recycling. They have now added Patagonia fleece, Polartec® fleece from other manufacturers and Patagonia organic cotton T-shirts to their list of recyclables. Argentina's first coastal national park was created on November 14, 2002, when Conservacion Patagonica, formerly known as the Patagonia Land Trust, and its Argentine partner, Fundación Vida Silvestre, donated the 155,000-acre Estancia Monte León to Argentine National Parks. In 2004, Conservacion Patagonica bought the 173,000-acre Estancia Chacabuco, one of Chile's largest ranches and the number one conservation priority for the Chilean National Parks. Patagonia also has a 'green building' with Leadership in Energy and Environmental Design (LEED) certification from the U.S. Green Building Council (USGBC).	(Ref. 223)
Howies	Howies clothing is a brand of ethical clothing on the market that offers ethical clothing, organic, hemp and natural dyes. Although Howies are not officially fairtrade, they operate by fairtrade principles.	(Ref. 224)
American Apparel	American Apparel, a T-shirt manufacturer based in California, has a line of shirts called The Sustainable Edition T, which are made of organically-combined cotton. American Apparel has always been dedicated to socially responsible business practices, such as paying living wages; now, with the support and cooperation of the Organic Consumers Association [OCA], the company is setting its sights on environmental responsibility.	(Ref. 225)
Uni Qlo	Since 2001, UNIQLO has collected used fleece products sold at UNIQLO stores for recycling as a fuel to generate electricity. UNIQLO has now expanded this collection and recycling operation to include each and every product that UNIQLO produces. They conducted a limited trial for one month in September 2006 before deciding to conduct regular collection and recycling operations twice a year during the months of March and September. UNIQLO also supports a foundation, which plants olive and other trees on islands in Japan's Seto Inland Sea. All UNIQLO stores have donation boxes so that customers can make contributions. In addition, they match all customer donations.	(Ref. 226)
Edun	EDUN is a socially conscious clothing company launched in Spring 2005. Edun uses ethical conditions and to help create long-term sustainable employment in the developing world, particularly sub-Saharan Africa.	(Ref. 227)

3.4 Technological Developments

Evidence on technological developments in clothing is limited in relation to environmental and social impacts. Key developments are described below and their significance to environmental and social impacts is discussed in *Section 5*. A matrix with detailed information on the literature reviewed for this section can be found in *Annex B*.

- **Computer aided design (CAD).** This is the use of computers to reduce production time and to improve the quality and performance of products. Technology that has traditionally been used for industrial purposes, such as auto manufacturing, has been transferred to the clothing and textile industry (Ref. 89).

The combination of CAD and seamless knitting technologies can enable the delivery of a whole garment while allowing the product to remain digital until final manufacture. Digital communication of designs may also allow a clothing manufacturer to distribute production details to multiple locations, such as retail stores, all over the country. Production and retail could then take place in a joint facility. This allows the customer to be involved in the design of the garment. 3D design technology allows the simulation of true-to-life garment and fabric draping using an 'Avatar' – a personalised body created by scanning techniques that form a virtual 3D garment over a virtual body using a 2D pattern input. This ensures that the lead-time in getting the prototype right is reduced and gives a customised final sample which is error free. Novel digital pigment ink printing technologies can also be added to enhance this form of product innovation (Ref. 64).

- **Automated systems.** Production system control, stock control and replenishment and trend monitoring can be completed by automated systems. Techniques to shorten lead times have been adapted by many manufacturers and retailers in industrialised countries, where costs are high (Ref. 89).
- **Biodegradable clothing (non-cotton).** Fibres have been developed from a number of non-traditional items, such as: corn; banana leaves; and bamboo. Biodegradable textiles have been created to have the look and feel of natural fibres, as well as the strength and durability of synthetic fibres. These characteristics allow them to be used in a variety of applications, including: clothing; carpet; and furnishings (Ref. 122 and 123). There is no evidence to support that biodegradable clothing is mainstream or commonly available in the UK. The limited availability of evidence suggests that biodegradable clothing products are produced for and consumed by a niche market.

- **'Smart' fibres.** The combination of electronics with clothing is known as 'smart' fibres. These include textiles that contain thermally sensitive fibres and various types of wearable electronics and chips.

Numerous companies are now producing fashion clothing with integrated electronics as a main feature (Ref. 191-195). Electronics company Motorola has paired with sport clothing company Burton to produce a winter jacket in which the user can connect a Bluetooth-enabled mobile phone to the panel wirelessly, and hook up an ipod via hidden wires within the jacket. The control buttons are located on the left-hand sleeve, while the speakers and a microphone are stitched into the hood. Other clothing manufacturers such as Zegna (Ref. 193) and Kenpo (Ref. 194 and 195) have produced similar 'smart' clothing items. Similar applications have also been used with global positioning systems (GPS) (Ref. 196).

Research is also ongoing to use 'smart' fibres to provide medical assistance. Clothing will be used monitor vital health data, to communicate with remote health centres and to present data in a variety of formats for further analysis by doctors and researchers. It is expected that those who will benefit from health data monitored by 'smart' fibres will include soldiers under extreme conditions in the field, athletes, personnel in high-risk jobs like fire fighting, or the sick and vulnerable (Ref. 108).

'Smart' fibres that contain electronics must be managed at end of life in accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) and may be subject to the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive (2002/95/EC) (Ref. 197) and the Battery Directive (2006/66/EC). In accordance with the WEEE Directive, producers of products containing WEEE are responsible for the take-back of their products.

'Smart' fibres are becoming more readily available in the UK, with the aid of online sales, but the high cost of this clothing would limit consumption to a niche market.

- **Fibre surface coatings.** Coatings that are applied to textiles to provide a level of protection against stains and spills (with implications for laundering) as well as to make the clothing water resistant, flame retardant, moisture repellent and antimicrobial. Coatings are designed to make clothing more resilient and longer lasting with less laundering. This can prevent waste clothing and also reduce the impact of the use

stage. There is little evidence available that discusses the impacts of the chemicals used to create fibre surface coatings.

- **RFID chips.** An automatic identification method that stores and remotely retrieves data using devices called radio frequency identification (RFID) tags. The tags are generally an object that can be attached to clothing and can be used to improve stock accuracy and product availability. RFIDs differ from bar codes in that they do not require a line of sight for reading. In addition, they can be linked to other electronic communication systems (Ref. 197). Levi's, Calvin Klein and Marks and Spencer are among the high street companies that have tested RFID tags (Ref. 110, 111 and 112). RFIDs, at end of life must be managed in accordance with the WEEE, RoHS and Battery Directives (Ref. 197). In accordance with the WEEE Directive, producers of products containing WEEE are responsible for the take-back of their products.

RFIDs are an emerging technology and there are a wide number of potential uses, which include, but are not limited to: anti-counterfeiting; theft prevention; and security and safety.

- **Waterless cleaning.** Waterless washing methods have been created that use negative ions, compressed air and deodorants to clean clothes. Methods have also been developed that use oxidation to kill bacteria and to eliminate odours and ozone to break down dirt (Ref. 113). There is limited information available on waterless cleaning.
- **Non-solvent dry cleaning.** An alternative method to traditional dry cleaning that eliminates the use of hazardous chemicals, such as perchlorethylene.

GreenEarth® is a cleaning process that uses a siloxane based solution rather than the traditional chlorinated solvents. All large, and some smaller, cities in the UK have access to a dry cleaner that uses this process (Ref. 198). Johnsons Cleaners, part of the group that owns Sketchley and Jeeves, had converted around 150 of its 630 branches to GreenEarth in 2005, and plans to convert the remaining by 2007. Carbon dioxide based cleaning is also being promoted as an alternative to traditional dry cleaning methods (Ref. 199). There are also 'home' dry cleaning systems that offer an alternative to traditional methods (Ref. 114).

In relation to the number of traditional dry cleaners, 'environmentally friendly' or 'green' alternatives are limited, but their prevalence is on the rise.

- **Textile colouration technologies.** Toxic chemicals are used widely in clothing production in many manufacturing stages, including dyeing and printing. The most promising universal, digitally-generated, non-contact textile patterning technique yet available is ink-jet printing. The patent activity and development effort currently underway in this area are evidence of its prospects (Ref. 89). There are also new dyes and additives that shorten the dyeing process and the amount of water required (Ref. 89).

The Textile Confidence Label produced by Oeko-Tex sets limit values for dyes that are hazardous (Ref. 200). Less toxic and natural dyes are used as alternatives.

The evidence available does not support a conclusion of whether textile colourations technologies are mainstream in the clothing sector through-out the world.

- **Clothing recycling and reuse technologies.** Most clothing collection that is destined for reuse or recycling takes place through 'clothes banks', charity shops or collections for jumble sales (Ref. 115). There are an estimated 9 500 charity and non-charity textile banks in the UK. Current levels of reuse and recycling of clothes are low despite the excellent work of charity shops and the availability of textile banks, and the economics of reuse and recycling are deteriorating (Ref. 228). Differences in reported arisings and recycling rates of clothing and textiles are detailed in the Annex of Defra's *National Waste Strategy for England 2007* (Ref. 228).

Textiles make up approximately 3% of the domestic waste stream in the UK (Ref. 228). Approximately 170 000 tonnes of the one million tonnes of textile and clothing waste in the UK are recycled. However, the economics of textile recycling are deteriorating because the reuse proportion (60%) is declining due to competition from low cost Far Eastern imports in Africa, the traditional market for much collected clothing. Although the recycling proportion (30%) is increasing, selling for flocking or shoddy generates only about 10% of collection costs because there is a lack of value added markets for recycling grades of textiles (Ref. 203).

Of the post-consumer household textiles recovered annually:

- 54% are exported for reuse overseas;
- 13% are reused in the UK;

- 19% are recycled in the UK;
- 8% are recycled overseas; and
- 6% are disposed of in landfill (Ref. 228).

Disposal costs of residues not suitable for recycling are increasing. In addition, the cessation of the Multi-Fibre Agreement, policed by the WTO, is likely to increase net volumes of clothing purchased (and hence discarded) through reduction in the price of clothing. It will also increase the proportion of recycling rather than resale grades, which will further weaken collection economics and depress the sales and margins of second hand clothes (Ref. 203).

There have been improvements in the collection and sorting of used clothing and methods of extracting fibres from used clothing. However, the diversity of clothing composition is a challenge for recycling methods. Wool and synthetic materials can be pulled apart and recycled easily, but cotton and cotton blend materials are more difficult because the cotton fibre length is too short for reuse (Ref. 116). The University of Leeds, Non-Wovens Research Group at the Centre for Technical Textiles is leading a number of studies that may have applications in textile recycling (Ref. 117).

3.5 Initiatives

A number of voluntary initiatives have been introduced to reduce and manage the impacts associated with the clothing industry. These initiatives are summarised in *Figure 3.1* and *Figure 3.2* and documented in *Annex C*. Initiatives identified in the literature are discussed below by:

1. objective;
2. activity; and
3. success.

3.5.1 Objective

The initiatives reviewed can broadly be classified by objective, specifically: promoting fair trade; improving labour and working conditions; and ensuring environmentally clean production.

- **Fair trade.** This is a system of trade that is based on establishing direct relationships and partnerships between buyers and producers/

producing communities. The objective of the movement is to ensure that producers in the developing world receive a fair price for their products, and that production does not compromise the health of the community or environmental sustainability. The most widely used definition of Fair Trade was developed by FINE (FINE is represented by 1) Fair Labelling Organisations International, 2) International Federation for Alternative Trade, 3) Network of European World Shops, and 4) European Fairtrade Association) and noted in *Box 3.1* (Ref 118).

Some of the key fair trade initiatives include Fairtrade Labelling Organizations (FLO) International (Ref. 135); the International Fair Trade Association (IFAT) (Ref. 135); and the Asian Fair Trade Forum (AFTF) (Ref. 136).

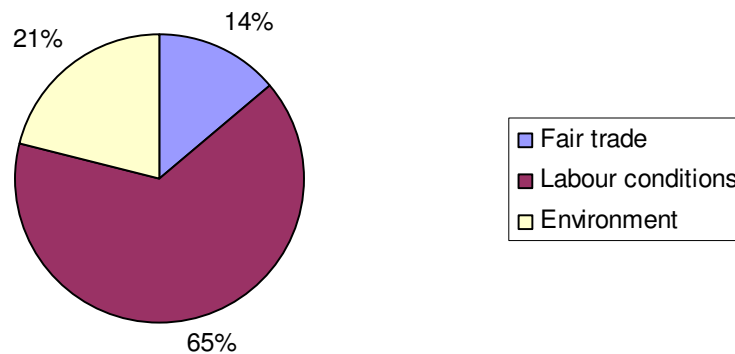
Box 3.1 Defining fair trade

“Fair Trade is a trading partnership, based on dialogue, transparency and respect, that seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to, and securing the rights of, marginalized producers and workers – especially in the South. Fair Trade organisations, backed by consumers, are engaged actively in supporting producers, awareness raising and in campaigning for changes in the rules and practice of conventional international trade (Ref. 118).”

- **Labour and working conditions.** Worker rights are often considered components of Fair Trade. However, they are also issues that exist independently of the Fair Trade movement. Initiatives that support working conditions and worker rights base their activities on the principles of the International Labour Organisation (ILO) Conventions (Ref. 119). Their efforts target trade unions, civil society, business and government stakeholders and encourage implementation of international labour standards. Many of these networks and programmes exist. However, three of the key initiatives are the Fair Labour Association (FLA) (Ref. 138); the Ethical Trading Initiative (ETI) (Ref. 139); and the Fair Wear Foundation (FWF) (Ref. 140).
- **Environmentally clean production.** Initiatives that encourage manufacturers to comply with the applicable environmental rules, regulations and standards, as well as promoting environmentally

conscious practice. In other initiatives, organic production is the focus, increasing production and use of organically grown fibres (eg cotton). Key clean production initiatives include the Organic Exchange (Ref. 141); the Sustainable Cotton Project (SCP) (Ref. 142); and the Pesticide Action Network (Ref. 143).

Figure 3.1 Initiatives by objective



3.5.2 Activities

The initiatives reviewed focus on a range of activities that vary in application and philosophy, but fall broadly into five categories: public awareness; corporate lobbying; monitoring/auditing; legislation/standards; and capacity building.

- **Public awareness.** Public opinion, and thereby consumer pressure, is a significant factor in the clothing sector. It can influence the style and fashion of clothes available, supply chain dynamics and corporate policies. Clothing initiatives strive to use this pressure to their advantage through public awareness campaigns and mobilising the consumer to support corporate accountability campaigns. This can take the form of promotional campaigns, conferences, forums and briefings, or public reporting on the records of companies that meet or violate environmental and social standards. Key examples include China Labor Watch (Ref. 144); the National Labor Committee (Ref. 145); and the Organic Consumers Association's Clothes for a Change campaign (Ref. 146).

- **Corporate lobbying.** This includes campaigns to influence public opinion. In some cases, initiatives (such as Organic Exchange (Ref. 147) and the Clean Clothes Campaign (Ref. 149)) work in partnership with the companies to build understanding of issues, and to educate them on the benefits of socially/ environmentally responsible production. Companies are urged to sign on to the principles espoused by the initiative, which binds them to a set of (non-legal and voluntary) standards.

In other cases, the relationship is less symbiotic, and companies are pressured to take responsibility for the impacts of their clothing production through public information campaigns and organised boycotts. Organisations like Coop America (Ref. 148) engage in such initiatives by alerting the public about corporate impacts and organising consumer boycotts.

Science in the Box is a scientific information portal on laundry detergents and household cleaning products from Procter & Gamble (Ref. 231). It offers a 'formulator' that identifies the impact of wash habits on the cost, the performance and the environment.

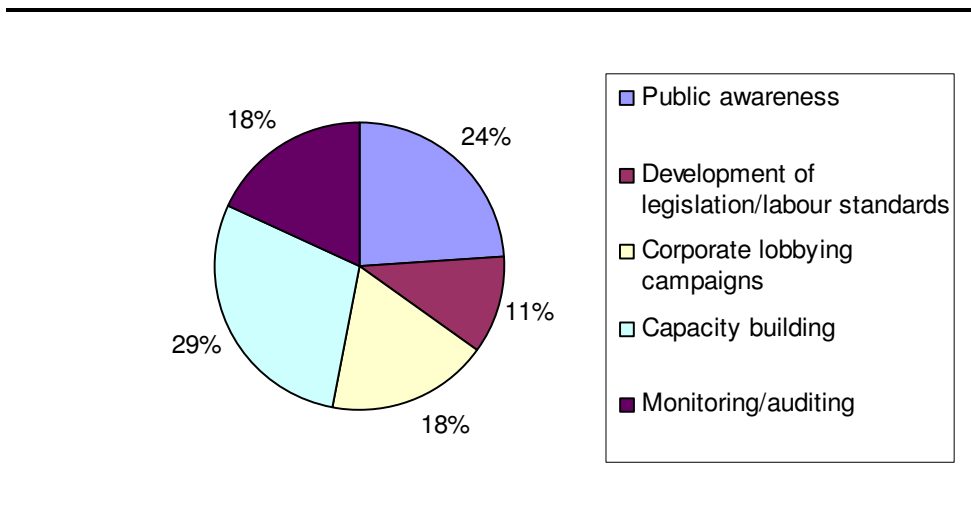
- **Monitoring/auditing.** Corporate lobbying campaigns also generally involve monitoring and auditing of corporate commitments to responsible production, and this also feeds into public awareness-raising. When companies voluntarily sign on to an organisation's set of standards and policies, as in the case of the Fair Labour Association (Ref. 150) or the Ethical Trading Initiative (ETI) (Ref. 139), implementation is ensured through long-term monitoring and certifications programmes, carried out independently or by the organisation itself. Where there is no established cooperation between the organisation and the company, organisations will publish reports on violations to the media, public and purchasing organisations (such as universities and colleges). The Global Reporting Initiative (GRI) has sustainable reporting guidelines and a reporting framework that nearly 1000 organisations in over 60 countries have used (Ref. 232). AccountAbility standards, the AA1000 Series, are principle-based standards intended to provide the basis for improving the sustainability performance of organisations. They are applicable to organisations in any sector, including the public sector and civil society, of any size and in any region (Ref. 233).
- **Legislation/standards.** Initiatives also target the basis for the development of labour and environmental standards. Some initiatives incorporate legal action to establish and develop legislation, testifying before relevant agencies on labour standards and violations. Such

initiatives, which include Child Labor Watch (Ref. 151) and Sweatshop Watch (Ref. 152), also advocate for stronger worker and environmental protection and improved enforcement of laws.

- **Capacity building.** A key part of most organisations' activities, which focuses on all levels of the supply chain. Initiatives such as the Sustainable Cotton Project (SCP) (Ref. 153) and the Pesticide Action Network (Ref. 154) engage in training for producers and raw material suppliers to introduce alternatives to traditional production (such as organic farming and non-pesticide use among farmers), and to facilitate implementation of codes at the local level, informing workers of their legal rights and available grievance mechanisms in cases of violation.

Another focus of capacity-building efforts is the development of networks, linking relevant NGOs, trade unions, corporations and other stakeholders to build good practice and collaborate on code implementation. The Ethical Trading Initiative (ETI) (Ref. 139) is a good example of this approach, which also contributes to the development of business opportunities; matching fair trade/ organic etc supply with demand and strengthening capacity to access and build opportunities.

Figure 3.2 Initiatives by activity



3.5.3 Initiative Success

Evaluation of the success of initiatives is challenged by the lack of impartial, standardised monitoring and assessment. Whether the assessment is carried out internally or externally, there is no standardised set of criteria against

which to measure impacts. This compromises not only the impartiality of existing evaluation, but also the usefulness in comparing initiatives against one another.

In most cases, evaluation is carried out internally, as organisations monitor implementation of codes and standards, and measure the success of their initiatives by the list of companies that have voluntarily signed themselves to those principles, and through public reporting on the major activities and achievements of their programme. In addition to the evaluation carried out by individual programmes and organisations, assessment is carried out within associations and networks. One example of this is the European Fair Trade Association (EFTA), which has published a collection of Fair Trade impact studies (Ref. 120).

External assessment of initiatives is relatively ad hoc, with analysis and editorial commentary published through conference reporting, journal and newspaper articles, and other media forums (Ref. 121). Although these assessments do not carry the same bias as internal monitoring strategies, they often do portray their own prejudices; moreover, as informal externals, they generally lack access to the full range of information necessary to provide accurate evaluation.

3.6 Summary of Trends, Developments and Initiatives

A summary of the trends, developments and initiatives that are relevant to the clothing sector is presented in *Table 3.3*. This table presents the following information:

- a brief description of the trend, development or initiative; and
- the availability of information (High (green); Medium (yellow) and Low (red)).

Although there is abundant literature on many of these issues, the information available is not presented in relation to life cycle stages or environmental or social impacts. Therefore, the robustness of this information was not assessed.

Table 3.3 Summary table of economic interventions, trends, developments and initiatives

	Description	Availability of information
ECONOMIC INTERVENTIONS		
Quotas and tariffs	Fees and taxes on imports/exports	Medium
Subsidies	Government funding for specific industries (ie cotton farming)	Medium
SECTOR TRENDS - COMPANY POLICIES AND PRACTICES		
Corporate social responsibility (CSR)	Company policies are being expanded to include environmental, social and health and safety issues	High
Relocation of production & manufacturing	Manufacturers relocating from UK and other developed countries to countries with lower costs	Medium
Localisation	Proximity of manufacturers to market	Medium
Employment	Relocation of production and manufacturing has led to a drop in employment in the UK clothing and textile industry	Medium
Integration	Integration of various production requirements, such as, textile finishing and dyeing with textile weaving	Medium
SECTOR TRENDS - CONSUMER TRENDS		
Discount fashion	Low cost clothing	Low
Consumer awareness	Demand for clothing produced from fair-trade and organic materials	Low
Synthetic versus non-synthetic materials	Demand for clothing made from different materials	High
Online sales	Clothing shopping via the internet	Low
TECHNOLOGICAL DEVELOPMENTS		
Computer aided design (CAD)	Use of computers for production and manufacturing	Low

Automated systems	Production system control, stock control and replenishment and trend monitoring can be completed by automated systems	Low
Biodegradable clothing	Fibres developed from non-traditional materials the biodegrade at end of life	Low
'Smart' fibres	Incorporation of technology in clothing, such as ipod or cameras in jackets	Low
Fibre surface coatings	Coatings that are applied to textiles to provide a level of protection	Low
RFID chips	An automatic identification method using radio frequency chips	Low
Waterless cleaning	Techniques to clean clothing without water	Low
Non-solvent dry cleaning	Alternative to traditional dry-cleaning solvents	Low
Textile colouration technologies	Less toxic dyes, natural dyes and new dyes and additives that shorten the dyeing process	Low
Clothing recycling and reuse technologies	Technologies to improve clothing reuse and recycling	Low
INITIATIVES		
Fair trade	Movement is to ensure that producers in the developing world receive a fair price for their products	High
Labour and working conditions	Promotion of worker rights and health and safety	High
Environmentally clean production	Promotion of processes that do not harm the environment	High

4 The Life Cycle of Clothing and Associated Impacts

4.1 Introduction

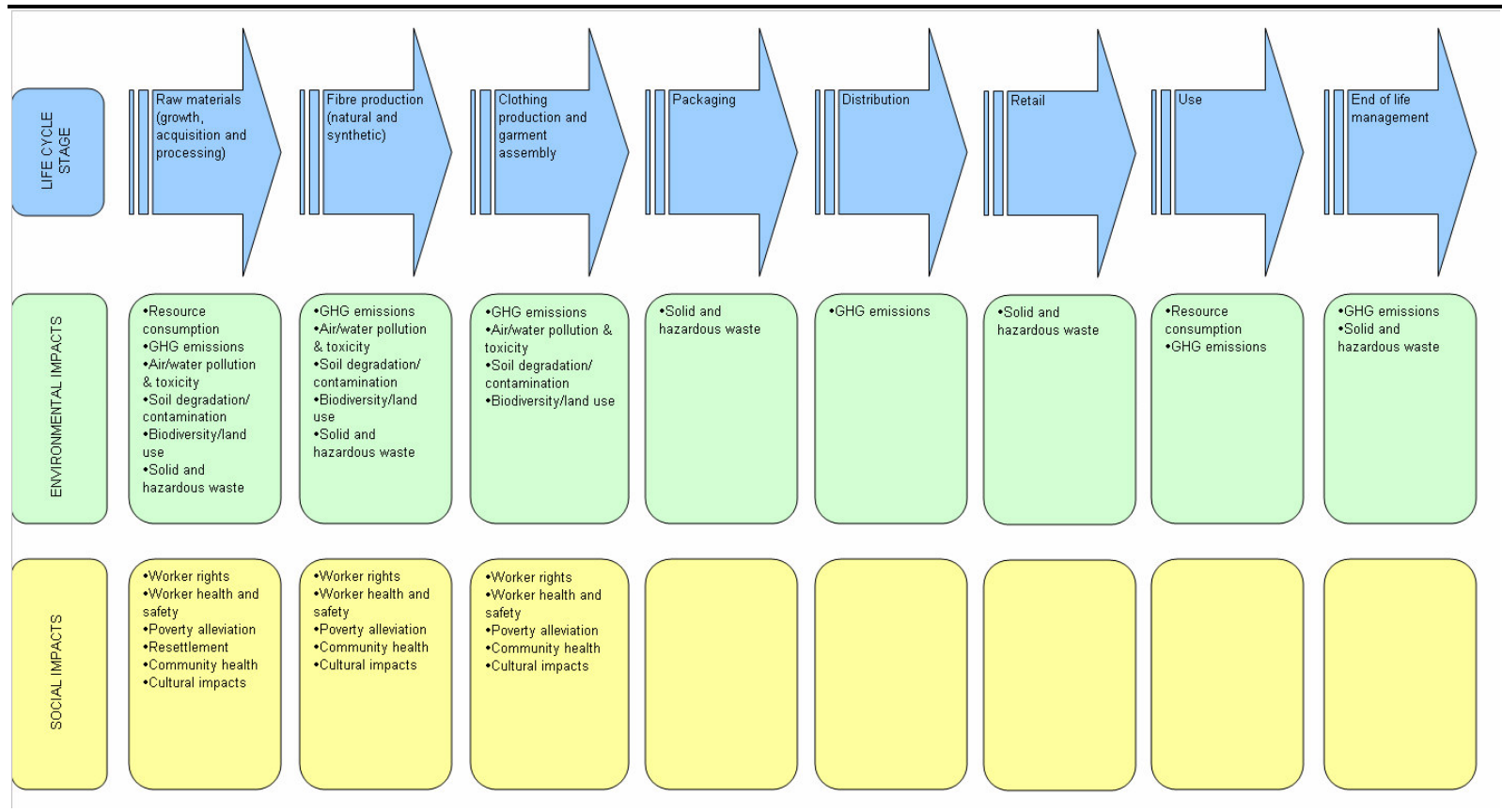
The literature review identified numerous key environmental and social impact areas throughout the life cycle of clothing consumption and production in the UK (refer to *Figure 4.1*). The matrices in *Annex A1* and *A2* provide detailed information for each literature source. Understanding and addressing the impacts throughout the life cycle of clothing ensures that emerging policies and interventions do not simply shift the environmental or social impact to another life cycle stage.

This section documents the literature findings for each of the identified environmental and social impacts, including:

- impact description;
- relevance to life cycle stage;
- geographical scope of impact; and
- relevance to material type (synthetic or non-synthetic).

The impact review is followed by a section on quantifying impacts. This section provides key statistics and identifies difficulties associated with them. This section concludes with a summary table of impacts and their relationship to life cycle stages, geography and material type.

Figure 4.1 Summary of relationships between life cycle stages and impacts



4.2 Summary of Environmental Impacts

Key environmental impacts for the clothing sector that were identified in the literature are described below.

4.2.1 Resource Consumption

- **Impact description.** Resource consumption includes the use of natural products such as fossil fuel and water. Fossil fuels are required for raw material growth and acquisition; production and manufacturing of clothing; and transport required for distribution. Water is consumed during the cultivation of non-synthetic crops and during the production and manufacturing of clothing.

Fossil Fuel Consumption

The UK clothing and textile industry consumes 989 000 tonnes (0.4% of total UK consumption) of oil equivalent for primary energy use. Approximately 0.6kg of oil equivalent primary energy is used in the industry per kg of output (Ref 64).

Energy Use

Energy use by the textile, clothing and leather industry saw a peak in 2001 at over 5.5 million tonnes of oil equivalent. In 2004, energy use was 11% higher than in 1990, at 4.7 million tonnes of oil equivalent (refer to *Figure 4.2*) (Ref. 70).

Figure 4.2 Energy use for UK textiles, clothing and leather sector (Ref. 70)



In terms of fibre type, *Table 4.1* notes that polyester consumes the most energy (Ref. 22). Another study noted that the production of cotton fibres consumes about 40% less energy than the production of polyester fibres (Ref. 38). These figures are for the raw material and textiles production life cycle stages.

Table 4.1 **Energy and water consumption (per kg of material output) (Ref. 12) based on a Danish study**

Material	Energy consumption/kg	Water consumption/kg
Cotton	48.65 MJ	7 000 – 29 000 L
Wool	8 MJ	125 L and 5 – 40 L (scouring)
Viscose	71.3 MJ	640 L
Polyester	109.41 GJ	n/a
Acrylic	0.157 GJ	210 L

Figure 4.3 and *Figure 4.4* present energy uses for each life cycle stage for men's cotton briefs and polyester trousers, respectively. Consumer use is identified as the most significant life cycle stage; transport and packaging are notably insignificant contributors to the total burden (Ref. 42).

Figure 4.3 Energy use during the life cycle of men's cotton briefs (104.9 kWh) (Ref. 42)

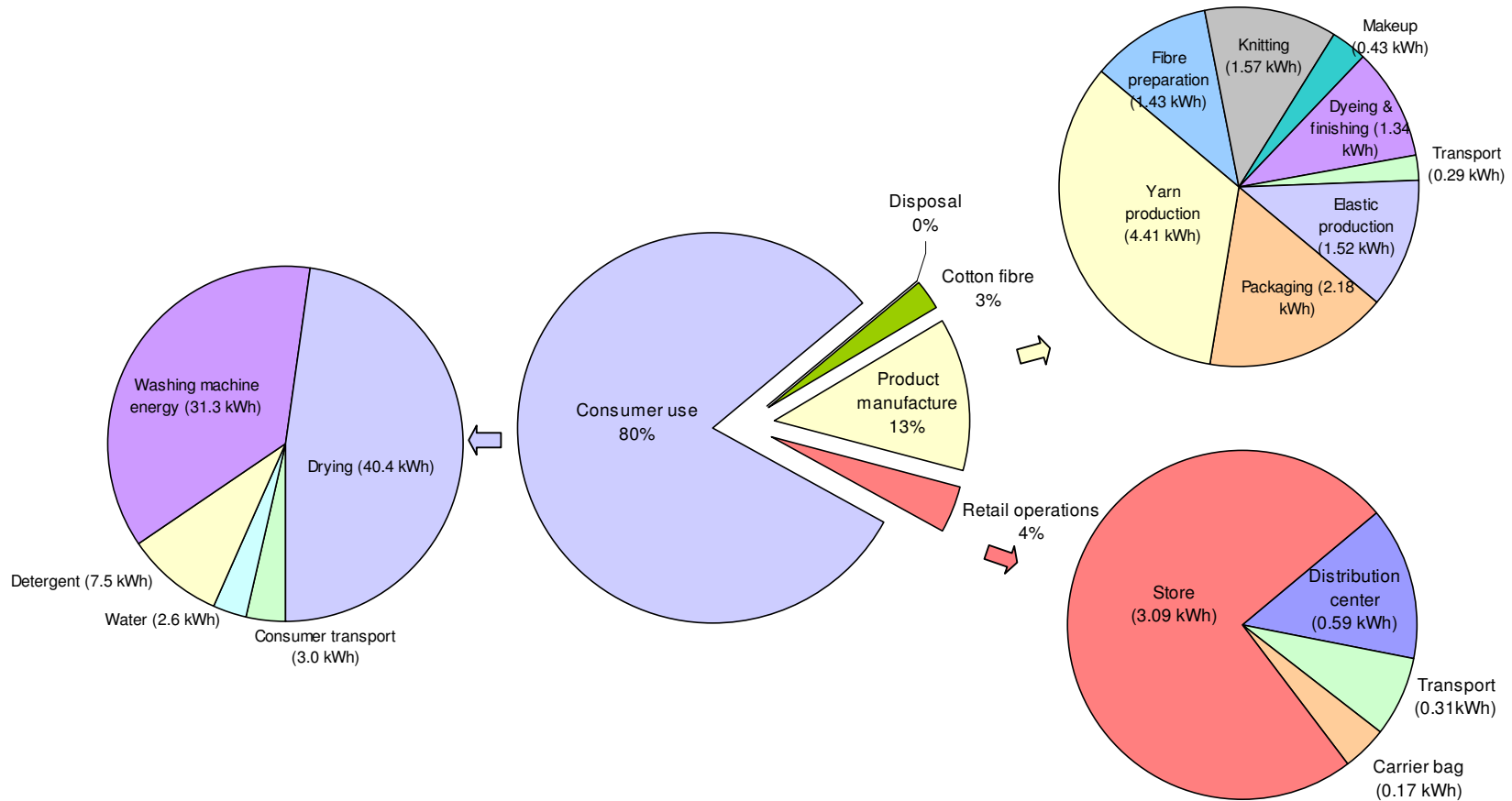
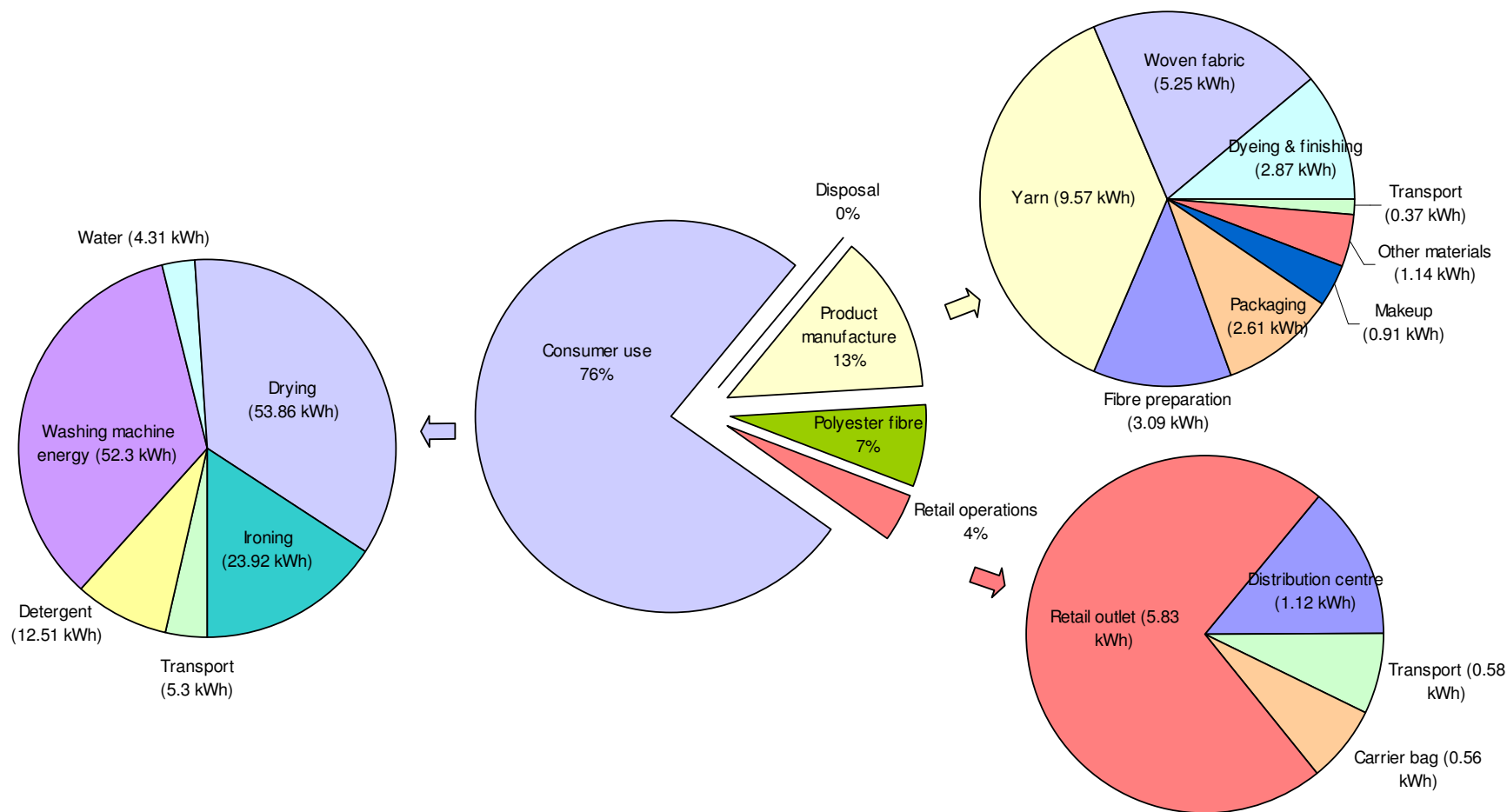


Figure 4.4 Energy use during the life cycle of polyester trousers (199.6 kWh) (Ref. 42)



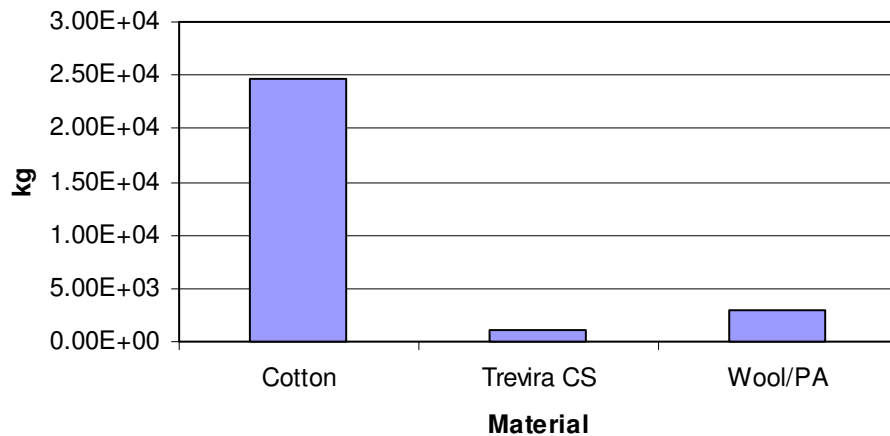
Merino wool fibre production has a total energy use of 46MJ/kg for wool tops. Approximately half of the total energy cost is attributed to farm production and the remaining is accounted for in scouring and top making (47%) and transport (3%). Scouring is the highest single energy use and accounts for almost 90% of the energy used in processing to Merino wool top (Ref. 61). It should be noted that the total energy use presented in Ref. 61 is significantly different from that of Ref.12. It is likely that is due to different boundaries and parameters in each study.

Water Consumption

The UK clothing and textile industry consumes 90 million m³ (0.5% of total UK consumption) of water (Ref. 70). From a global perspective, approximately, 60kg of water is used and about 45kg of waste water is discharged per kg of output. The difference is lost as evaporation during textile wet processes (eg dyeing). A Finnish study found that the average water consumption for cotton production is in the range of 7000 to 29 000 l/kg of cotton fibres, which is approximately 20 times greater than the amount of water used in the subsequent production of textile products (eg dyeing and finishing) (Ref. 10, 38 and 64). In comparison, polyester fibre production uses approximately 17 l/kg (Ref. 38).

Figure 4.5 presents data from a Swedish study regarding the amount of water consumed for the raw material and production life cycle stages for cotton, polyester (Trevira CS) and wool/PA (wool with polyamide (nylon)). *Table 4.1*, above, presents the water consumption per kg of material output. Cotton consumes significantly more water than polyester and wool (Ref. 22).

Figure 4.5 Water consumption (Ref. 10)



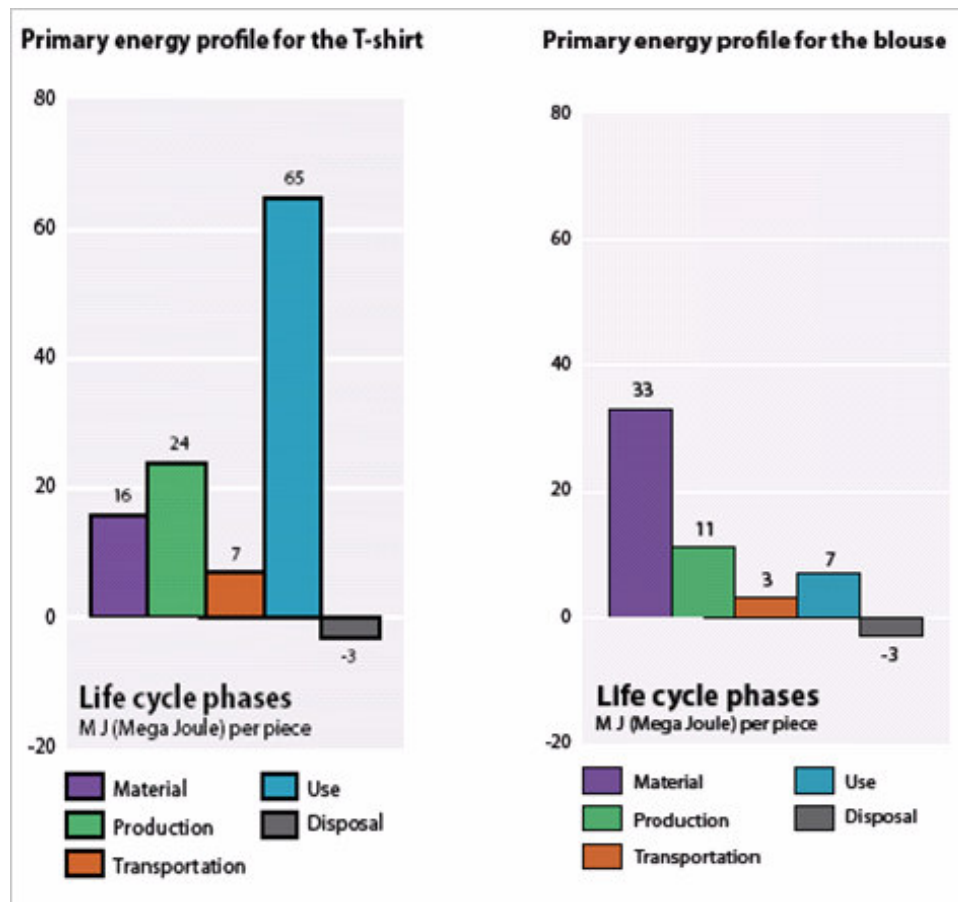
- **Relevance to life cycle stage**

Figure 4.6 provides energy profiles for each life cycle stage for the production of a cotton t-shirt and a viscose blouse. The use stage is most significant for cotton and the raw material stage is most significant for viscose (Ref. 64).

Most of the energy that is consumed in the use stage is from home laundry operation. Of this energy requirement, approximately two thirds of the energy is for washing (including heating water) and one-third for drying (Ref. 1).

The cultivation of cotton during the raw material life cycle stage is the most significant for water consumption (Ref. 22).

Figure 4.6 Primary energy profiles for a cotton t-shirt and a viscose blouse (Ref. 64)



- Geographical scope of literature.** The literature does not focus on particular countries, rather on areas that produce the same product. There is ample evidence on the Aral Sea in Central Asia. The Aral Sea is now half its original size due to overuse from irrigation and has become a symbol of extensive water use in cotton production (Ref. 64).
- Relevance to material.** For non-synthetic fibres, resource consumption is driven by the requirement of water for raw material growth and for energy needed during the use stage. Resource consumption for synthetic fibres is dominated by production and the fact that they are derived from oil (Ref. 38, 42, 54 and 64). Primary energy use for non-synthetic fibres is approximately twice that of synthetic fibres (Ref. 64).

Different types of fossil fuels are used for the production of cotton, polyester and wool. Crude oil is the major fuel for cotton fabric production and hard coal for wool. For polyester (Trevira CS), less of both crude oil and hard coal than both other fiber types is used (Ref. 10).

The major use of crude oil for cotton fabric is in the wet treatment and cotton cultivation activities, 60% and 21% of the total use, respectively. In the case of wool, it is the spinning of yarn and wool scouring that use most hard coal, 46% and 43% of the total use respectively. Electricity use in the spinning activity, and a coal-fired plant in the wool scouring activity, are the reasons for the hard coal use (Ref. 22).

Fabric manufacture from yarn is the main activity that consumes crude oil in cotton production. Wet treatment, yarn manufacture and cotton cultivation are the next most significant activities, respectively, following fabric manufacture.

For polyester (Trevira CS), polyester yarn production is the main activity that consumes crude oil. Polyester yarn production is the main activity that consumes hard coal.

Yarn manufacture is the main activity that consumes hard coal in wool production. Spinning of yarn and wool scouring are the next most significant activities, respectively, following yarn manufacture.

4.2.2 Greenhouse Gas (GHG) Emissions

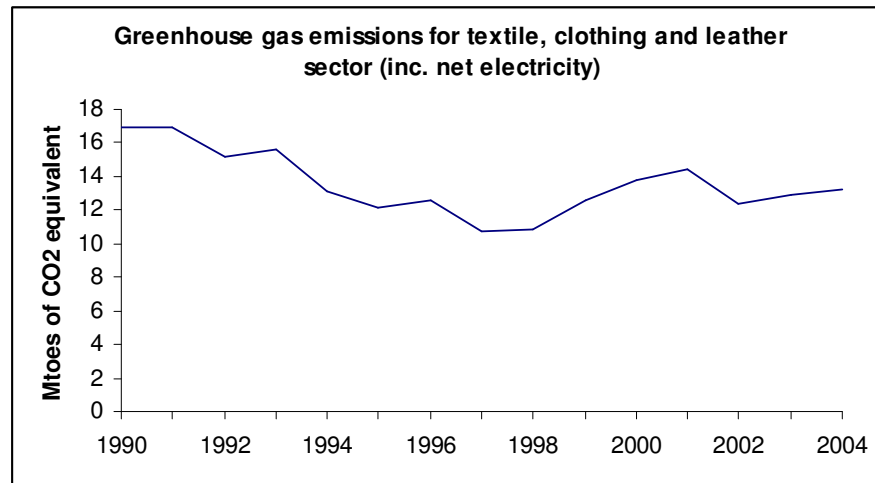
- **Impact description.** GHG emissions are gaseous emissions caused by a number of activities, primarily the burning of fossil fuels, which contribute to global warming. For clothing this is most common in the use (eg laundering), material growth/acquisition and production stages (eg fossil fuel extraction for production). The six main greenhouse gas types are: CO₂ (carbon dioxide), CH₄ (methane), N₂O (dinitrogen (nitrous) oxide), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons) and SF₆ (sulphur hexafluoride) (Ref. 69).

Only four sources (Ref. 22, 55, 64 and 70) refer directly to GHG emissions and global warming potential. The UK clothing and textile industry produces 3.1 million tonnes of CO₂ equivalent (0.4% of total UK emissions). Approximately 2 kg of CO₂ equivalent is emitted to air per kg output (Ref. 64).

Greenhouse gas emissions from the UK textile, clothing and leather industry have declined between 1990 and 2004 (refer to *Figure 4.7*)

and are currently 22% lower than in 1990. Approximately 99% of these emissions are CO₂, 0.4% is N₂O and 0.3% is HFCs (Ref. 70).

Figure 4.7 GHG emissions for the UK clothing, textile and leather sector (Ref. 70)



- **Relevance to life cycle stage.** GHG emissions were presented in the *Well Dressed?* report (Ref. 64). This report states that the sector's contribution to climate change is dominated by the requirement for burning fossil fuel to create electricity for heating water and air in laundering. Other major energy uses arise in providing fuel for agricultural machinery and electricity for production. The use of fossil fuels for energy production is directly linked to GHG emissions. *Figure 4.6*, above, presents the life cycle stages that have the highest energy use (Ref. 64). The consumer use stage is responsible for the most significant energy use for cotton and the material acquisition stage is most significant for polyester.

In the life cycle study of a cotton/polyester blend, the element of the production stage that contributes the most GHG emissions is steaming (refer to *Figure 4.10*). CO₂ accounted for approximately 97% of the emissions (Ref. 55).

The processes required for raw material growth, acquisition and processing produce a large amount of emissions, as does manufacturing and processing processes. Distribution of clothing is

often over long distances by air, land and sea – each action producing emissions.

The majority of textiles and clothing that are imported to the UK from countries abroad use shipping with large freighters for transport (Ref. 22, 64). Shipping from abroad accounts for the majority of the transportation allocation during the life cycle of clothing (Ref. 64). However, the impact of the transportation stage is low in comparison with use and production stages (Ref. 38, 42 and 54).

The majority of waste textiles in the UK are landfilled. *Figure 4.8* indicates that diverting textiles from landfill can produce significant carbon benefits. The carbon benefits are nearly equal to that of wood and greater than paper/card, kitchen/food waste, garden/plant waste, plastic, ferrous metal and glass (Ref. 228).

Figure 4.8 Estimated carbon benefits of diverting different waste materials from landfill (Ref. 228)

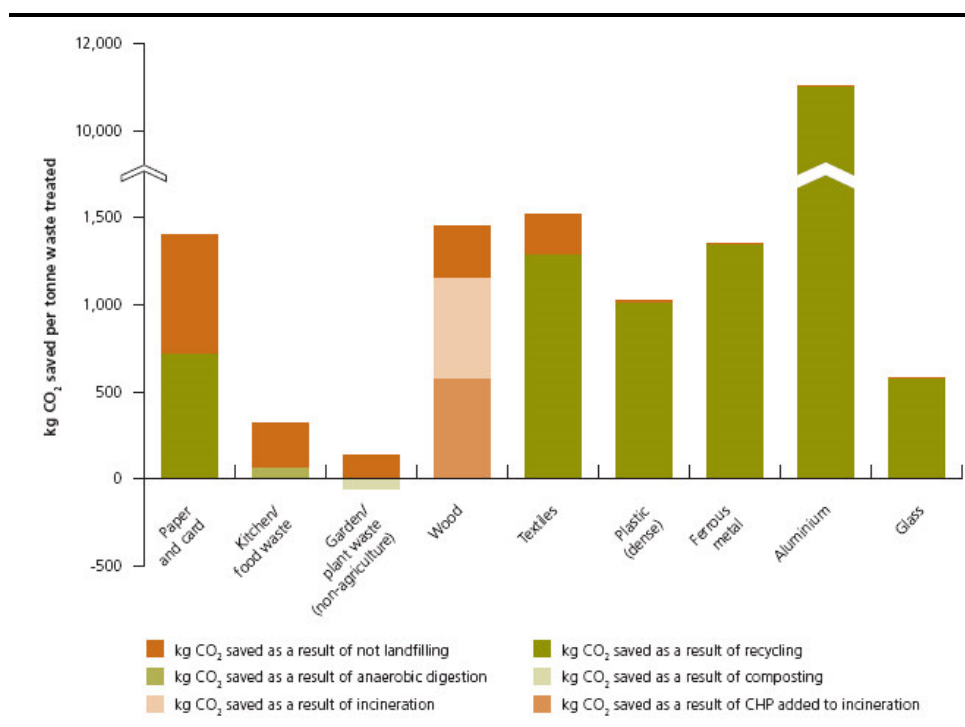


Figure 4.9 indicated that the estimated additional recycling/treatment of textiles that is feasible by 2020 is less than 500 000 tonnes. The quantities of textiles are overshadowed by other waste materials.

Figure 4.9 Estimated carbon benefit of feasible additional treatment by 2020 (Ref. 228)

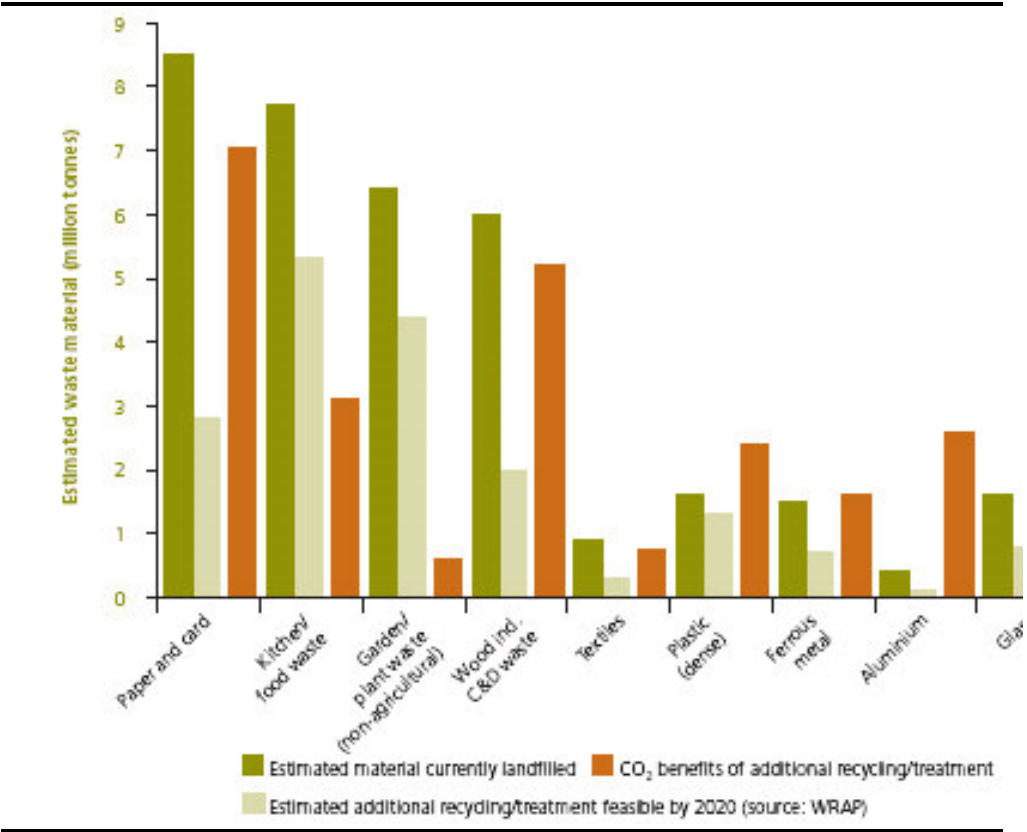
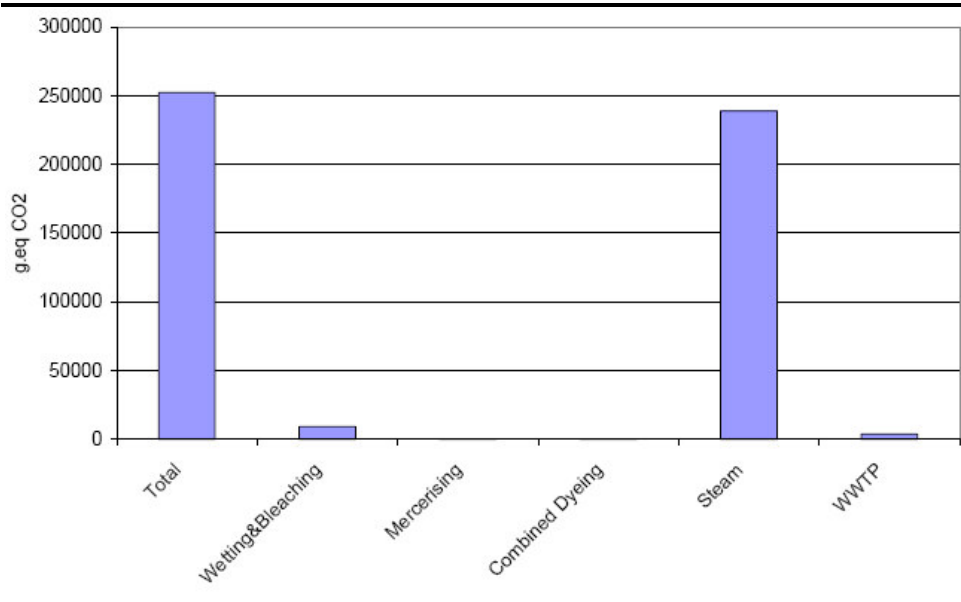


Figure 4.10 Greenhouse gas emissions over the production life cycle stage of a cotton/polyester blend fabric (Ref. 55)



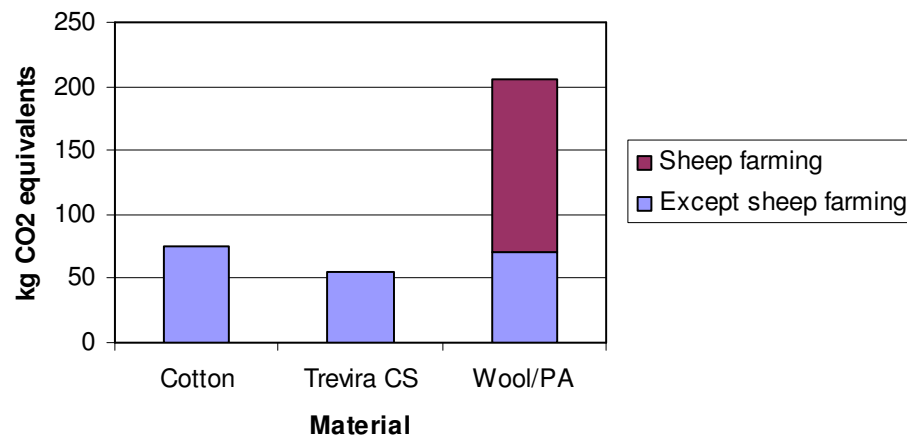
- **Geographical scope of literature.** The literature focuses on energy consumption. This data can be extrapolated and used to determine approximate levels of GHG emissions. However, the majority of the evidence in the reports reviewed did not do this.

The impacts associated with transportation are normally allocated to the country that benefits economically from the trade. For example, impacts from clothing transported by boat from China to the UK would be allocated to China. Transportation within a country is allocated to the country where the transportation occurs (Ref. 64).

- **Relevance to material.** For non-synthetic fibres, energy use and therefore GHG emissions are predominant during the use stage, which includes heating water for washing and tumble drying. For synthetic fibres, GHG emissions are most prevalent in the raw material acquisition and production stages (Ref. 38, 42 and 64).

The global warming potential for wool (up until the manufacturing stage only) is significantly greater than that for cotton and polyester (refer to *Figure 4.11*). This is due to methane emissions from sheep. These emissions can be reduced by about 16% by feeding sheep plants high in condensed tannins (Ref. 22). This comparison does not include the GHG emissions that are generated after manufacturing of the material is complete.

Figure 4.11 Global warming potential (Ref. 10)



4.2.3 Solid and Hazardous Waste

- **Impact description.** Waste is considered a material or substance produced during a process that does not have a use or a product when it is no longer deemed usable. Of the waste clothing in the UK, approximately 13% going to material recovery, 13% to incineration and 74% to landfill. Approximately one kg of solid waste arises per kg of output (Ref. 64).

Defra reported that the secondary textile industry collects just 17% of all textiles consumed, with the balance being either stockpiled or discarded to the household waste stream (Ref. 234).

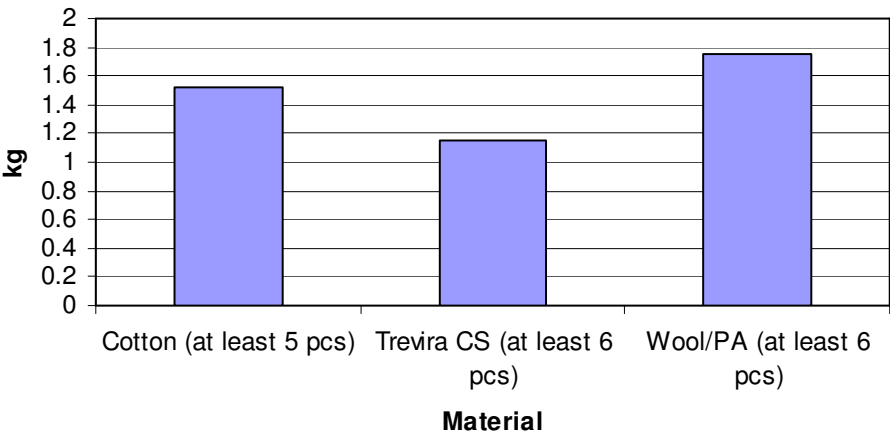
Approximately 1 812 000 tonnes of textile products, originally purchased as new, and a further 53 000 tonnes of used products entered the secondary UK textiles market in 2003. Of this quantity, a net 303 000 tonnes (16%) were collected by the secondary textile industry and 1,165k tonnes (63%) were disposed of by consumers and the industry (Ref. 234).

The balance of 397 000 tonnes, equivalent to just over 6kg per head of population per year, is unaccounted for, and is therefore presumed not to have been discarded and to be increasing the total stocks of clothing and other textiles held by householders. It is assumed that this stockpiling, or increase in the “national wardrobe”, has been occurring for a number of years, generating a potentially large quantity of latent waste (Ref. 234).

Of the net 303 000 tonnes of textiles collected in the UK in 2003, 41k tonnes of clothing were re-sold for re-use as clothing in the UK and 174 000 tonnes were exported for re-sale as clothing abroad (Ref. 234).

The amount of packaging required, used for different types of clothing, does not differ significantly, as is shown in *Figure 4.12*. Packaging material is to a large extent reused or recycled (Ref. 22).

Figure 4.12 Packaging used for cotton, polyester and wool production (Ref. 10)



- **Relevance to life cycle stage.** The stages most relevant to solid and hazardous waste include raw material acquisition, growth and production; fibre production and end of life (Ref. 1, 38 and 64). *Table 4.2* presents typical waste arisings from the production of a cotton t-shirt and a viscose blouse.

Approximately 90% of solid waste is related to consumer use and blouse disposal, not manufacturing requirements to produce the blouse. The consumer use value includes municipal wastewater treatment sludge created from the washing operation, wastes related to energy generation, detergent production and packaging wastes, and ultimately post consumer disposal of the blouses (Ref. 1). The UK industry also produces approximately 70 million tonnes of wastewater annually (Ref. 64).

Fabric production and apparel manufacture create the largest volume of solid waste from the manufacturing operations. Most of the fabric waste is from process solid waste including wastewater treatment sludges. Most of apparel manufacturing solid waste is created from packaging used in transporting the finished blouses to the retailer and consumer. Together, resin and fiber production account for less than 30% of blouse manufacturing related solid waste (Ref. 1).

Table 4.2 Waste arisings from the manufacturing of a cotton t-shirt and a viscose blouse (Ref. 64)

Type of waste	Cotton t-shirt	Viscose blouse
Making up waste (laying up, cutting and sewing)	16g (49%)	22g (74%)
Finishing waste 1 (fabric inspection and roll up on cardboard)	4g (12%)	3.4g (11%)
Finishing waste 2 (drying, final fixation setting m ² weight)	3g (9%)	2.3g (8%)
Pre-treatment (bleaching and washing waste)	2g (6%)	2g (7%)
Fabric manufacturing waste	4g (12%)	0g
Yarn manufacturing waste	4g (12%)	0g
TOTAL	32g (100%)	28.7g (100%)

- **Geographical scope of literature.** The literature focuses on waste arisings in the UK and waste from manufacturing and production processes located in various countries around the world.
- **Relevance to material.** The literature documents solid waste impacts arising from all types of clothing, suggesting that this impact is equally relevant to both non-synthetic and synthetic fibres (Ref. 64). Hazardous waste tends to be produced in the production stage (eg dyeing of materials) and is dependent on the processes that are used (Ref. 64 and 70). Packaging waste is similar for all clothing types (Ref. 64).

4.2.4 Air/Water Pollution and Toxicity

- **Impact description.** This impact includes emissions to air, water or land that may have adverse environmental or health effects. The literature presents evidence on harmful emissions from pesticide and chemicals used for cotton growing. *Table 4.3* presents data on the amounts of fertilisers, insecticides and herbicides that are used in the production of conventional cotton fibres per kg of cotton fibre. *Table*

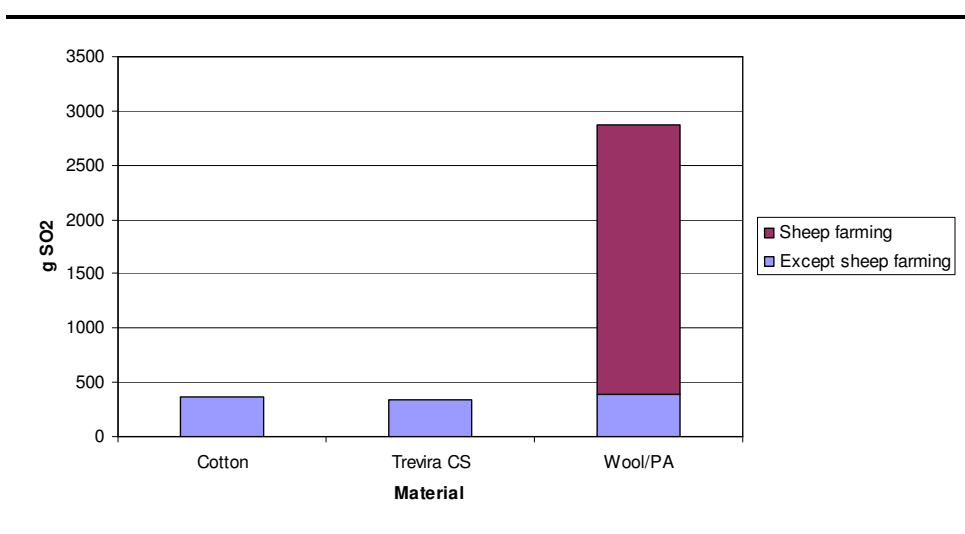
4.4 presents data on the amount of chemicals used in the production of cotton, wool, viscose, polyester and acrylic. It shows that substituting cotton with polyester results in no use of pesticides etc. However other chemicals are used to produce polyester which could be as harmful to the environment as pesticides. An LCA of the different chemicals would provide evidence on the potential toxicity impact related to shifting between cotton and polyester use.

Table 4.3 Consumption of fertilisers, insecticides and herbicides used for cotton growing (per kg output) (Ref. 22)

Material	Quantity (g)
Fertilisers	0-560
Insecticides	0.01-0.83
Herbicides	0.96-1.45

The acidification potential from the production of cotton, polyester and wool is presented in *Figure 4.13*. This data includes raw material growth/acquisition, fibre production and clothing production. Wool has the highest acidification potential due to the ammonia that is released during sheep farming. The main contributor for cotton is cultivation and for polyester it is fibre production activity (Ref. 22).

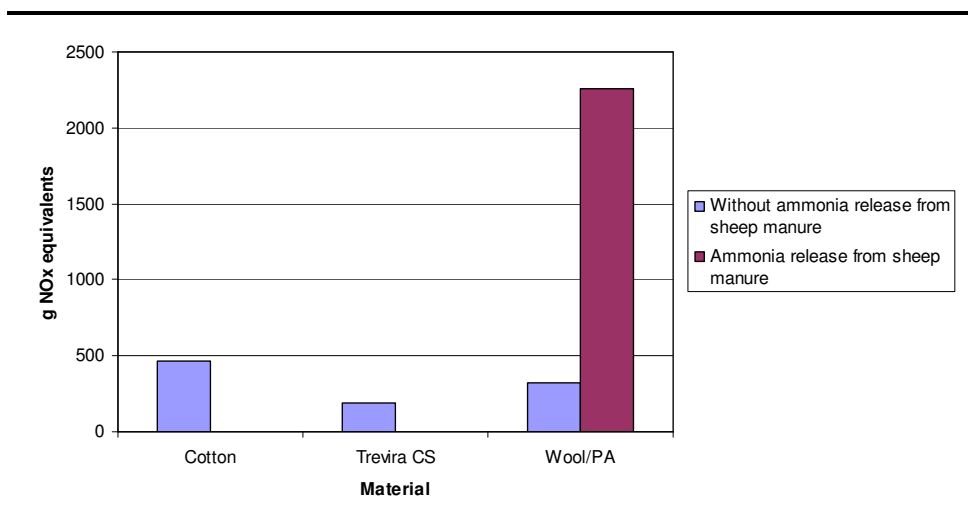
Figure 4.13 Acidification potential (Ref. 10)



The eutrophication potential from the production of cotton, polyester and wool is presented in *Figure 4.14*. This data includes raw material growth/acquisition, fibre production and clothing production. Wool has

the highest acidification potential due to the ammonia that is released during sheep farming. The main contributor for cotton is NO_x emissions from cultivation, and for polyester it is NO_x emissions from fibre production activity (Ref. 22).

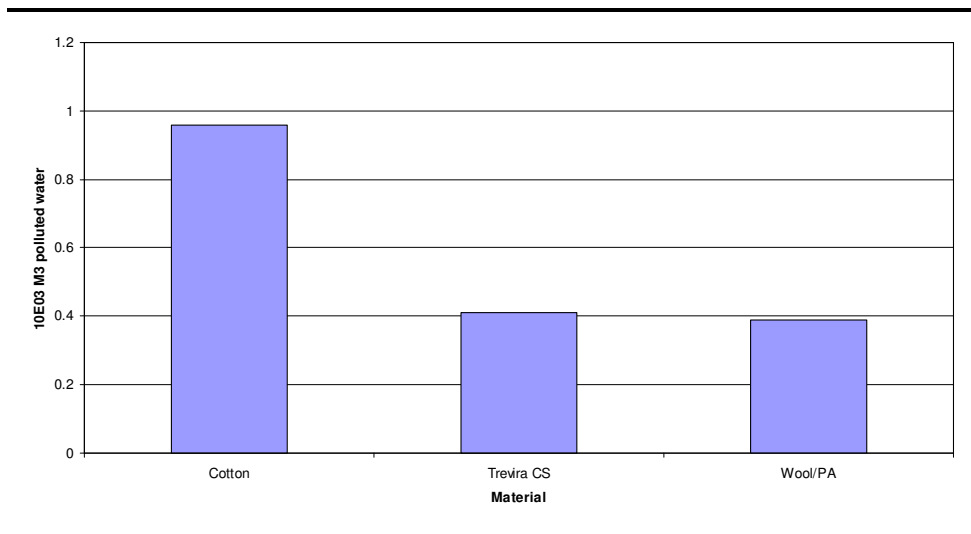
Figure 4.14 Eutrophication potential (Ref. 10)



The ecotoxicological potential from the production of cotton, polyester and wool is presented in

Figure 4.15. The cotton life cycle has the highest ecotoxicological impact, due to discharges to water in fossil energy production. Oil emissions contribute 74% of the total value for cotton (Ref. 22).

Figure 4.15 Ecotoxicological impacts potential (Ref. 10)



- **Relevance to life cycle stage.** Approximately 93% of the total toxicity impact occurs during the raw material growth/acquisition life cycle stage (Ref. 64). This is due to the pesticides and herbicides used for the growth of non-synthetic fibres. In comparison, with organic cotton, the production stage is the stage that contributes most to toxicity (Ref. 64). This is from the chemicals used in the finishing stage.

Hydrogen peroxide production (for wetting/bleaching) has significant contribution to acidification, photochemical smog and eutrophication. Waste water treatment plants are a significant contributor to eutrophication because of its emissions to water (66% contribution of the total of category) (Ref. 55).

- **Geographical scope of literature.** This impact can be far reaching, but is of most concern in the local proximity to where the impact occurs. The literature does not focus on any particular geographical area.
- **Relevance to material.** The literature presents evidence relating to acidification, eutrophication and ecotoxicological impacts for cotton, wool and polyester. This information is not available for other materials.

4.2.5 Soil Degradation/Contamination

- **Impact description.** Destruction or damage to natural landscape, which can lead to deforestation, soil erosion, water contamination and

adverse conditions for flora and fauna. This impact is often associated with air/water pollution and toxicity. Harmful pesticides and poor crop techniques as well as improper management of chemicals from clothing manufacturing and processing can lead to degradation and contamination of soil. The long-term use of fertilisers to boost production can cause local eutrophication and nitrate contamination of drinking water as well as permanent increase in soil salinity (Ref. 38).

- **Relevance to life cycle stage.** The raw material acquisition and growth stage has the largest effect on soil degradation/contamination (Ref. 12 and 39). This is due to the large amounts of chemicals that are applied to non-food crops destined for clothing.
- **Geographical scope of literature.** The geographical scope is dependent on where the impact occurs. The literature does not focus on a particular geographical area.
- **Relevance to material.** The literature reviewed only provides evidence for non-synthetic fibres, most notably cotton (Ref. 12 and 39).

Table 4.4 Inputs of chemicals (per kg of material output) (Ref. 12)

Material	Fertilisers	Insect-icides	Herbicides	Chemicals to control diseases	Detergents	Soda	C₂S	Ethylene glycol	Dimethyl terephthalate	Terephthalic acid	Antimony (III) Oxide	Titanium dioxide	Acrylonitrile
Cotton	0 – 560 g	0.01 – 0.83 g, 0.02 – 11.90 ml	0.96 – 1.45 g, 0.32 – 13.33 ml	0.007 – 0.830 g	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Wool	n/a	n/a	n/a	0.1 – 2.5 ml (sheep pesticides)	1.5 – 20 g	5 – 30 g	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Viscose	n/a	n/a	n/a	n/a	n/a	n/a	310 g	n/a	n/a	n/a	n/a	n/a	n/a
Polyester	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.35 kg	1.015 kg	0.87 kg	0.05 – 0.5 g	0.2 – 20 g	n/a
Acrylic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	850 – 910 g

4.2.6 Biodiversity/Land Use

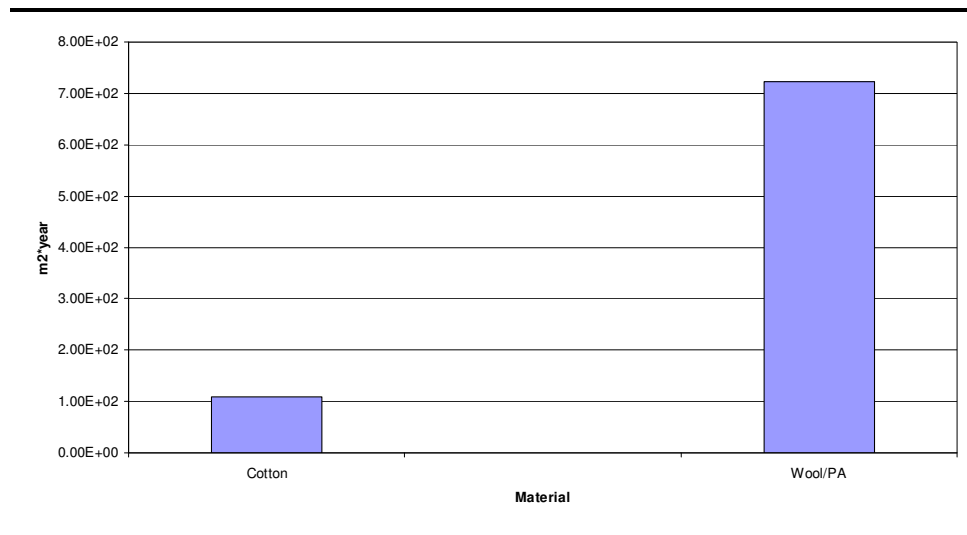
- **Impact description.** Biodiversity refers to the variety of flora and fauna that exist naturally and land use refers to the natural cover/landscape of an area. Biodiversity is negatively affected through the use of broad-spectrum pesticides, through conversion of natural habitats and through loss of land to degradation or shifting farming practices (Ref. 39). Genetically modified crops and fossil fuel extraction may also affect future land use.

An estimated 5 Mha of arable land (4% of the world total) is abandoned due to former intensive cotton cultivation with soil salinisation being the main reason (Ref. 39).

- **Relevance to life cycle stage.** There is very little evidence-based literature on loss of biodiversity (Ref. 62). The literature primarily focuses on the damage improper farming can lead to. An example is cotton production in Central Asia that has resulted in 95% of the wetlands and marshes around the Aral Sea giving way to sand deserts and more than 50 lakes, covering 60 000 ha, running dry. The mineral content of the remaining water has increased fourfold to 40 g/l, preventing the survival of most of the sea's fish and wildlife (Ref. 71).
- **Geographical scope of literature.** The literature does not focus on a particular geographical area, other than the Aral Sea, for this impact.
- **Relevance to material.** Irrigation for non-synthetic fibres can lead to a change in land use (Ref. 62 and 71). There is no evidence-based literature on biodiversity/land use in relation to synthetic fibres.

The amount of arable land required for the cultivation of cotton and sheep farming is presented in *Figure 4.16*. Sheep farming requires a significantly greater amount of arable land than cotton. Land use for sheep farming could be considered positive in some environmental respects, since grazing keeps the landscape open, as does arable land use. This could be positive for the aesthetic values and also, in some cases, for biodiversity (Ref. 22).

Figure 4.16 Use of arable land (Ref. 10)



4.3 Summary of Social Impacts

Key social impacts for the clothing sector as identified in the literature are described below.

4.3.1 Worker Rights

- **Description of impact.** This impact area is well documented in the literature and encompasses a range of issues, including, *inter alia*: bonded or forced labour; child labour and young workers; freedom of association and collective bargaining; and worker pay, hours and holidays. Trends in low-cost clothing increase pressure to produce goods at budget rates has pushed production to countries where regulation and implementation of labour standards is less stringent conditions such as low salaries, long hours and the use of child labour are more common (Ref. 157).

The industry workforce is largely made up of young women, who are 'low skilled' or 'unskilled' and may be migrants. These workers do not always know or are not able to claim their rights as an employee, leaving them vulnerable to forms of abuse. A particular problem at present is that many subcontractors deny the right of workers to form an association (or trade union) to assert their rights to appropriate working conditions, pay and training and promotion (Ref. 64).

- **Relevance to life cycle stage.** Worker rights are a concern during raw material production and growth, fibre production and clothing production and assembly, in particular in regions and countries where regulatory standards and worker rights are either not formally recognised or ineffectively applied (Ref. 158). Fair trade practices are increasing the prevalence of fair prices for growers.

Consumers at the end of the product life cycle can have an impact on the recognition and implementation of rights and working conditions in the production of textiles and clothing (Ref. 159).

- **Geographical scope of literature.** The literature studied identified the highest incidence of workers' rights abuses in India and China (Ref. 160), with further examples cited for production zones in Africa (including Zimbabwe and Ethiopia) and Central Asia (Ref. 161).
- **Relevance to material.** The majority of literature reviewed focuses on worker rights for non-synthetic materials, but is relevant for all types of materials used during clothing production and assembly. The early stages of cotton and silk fibre production provide the most frequent cases of workers' rights abuses, due in part to the geographic location of production (and associated weak labour codes), and the proliferation of small-scale, cottage-based industries (Ref. 162 and 163).

The potential for workers rights abuses associated with the extraction of oil for the production of synthetic materials is documented, eg allegations that Total used forced labour in the construction of a pipeline in Myanmar. However, this is not directly related to the textile and clothing industry (Ref. 164).

4.3.2 Worker Health and Safety

- **Description of impacts.** Health and safety impacts include: workplace accidents; stress due to shift work; continuous operation of machinery and repetitive action and noise; respiratory diseases from exposure to fibre dust; and other adverse health effects including skin irritation, poisoning and site-specific cancers from exposure to hazardous chemicals (Ref. 64, 165, 166 and 167).

In developed countries, automated processes have reduced the occurrence of many health and safety issues, including respiratory problems caused by dust from cotton and other fibres and hearing impairment (Ref. 22).

Field spraying by hand accounts for application of pesticides in 52% of the world's cotton fields. Poisoning of workers who apply the pesticides is common in developing countries (Ref. 39).

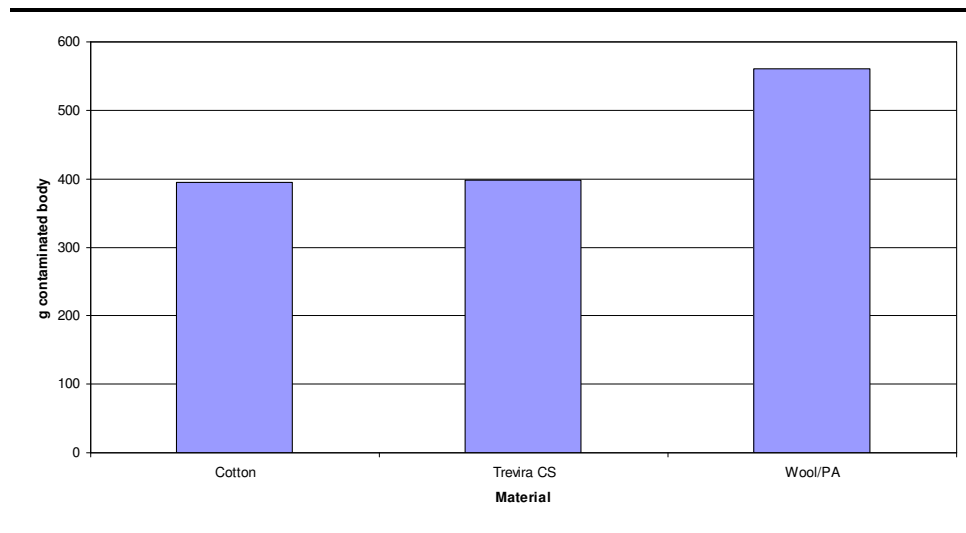
- **Relevance to life cycle stage.** The literature mainly presents worker health and safety impacts that occur during the raw material and fabric production and finishing processes (Ref. 168, 169 and 170).
- **Geographical scope of literature.** Case studies identified significant health and safety issues in India and China (Ref. 171), with additional concerns such as those raised regarding leather production in Africa (Ref. 172).
- **Relevance to material.** Health and safety impacts are relevant for both synthetic and non-synthetic materials. The use of toxic chemicals associated with leather tanning (Ref. 173), and fertilisers and pesticides used in cotton and silk production (Ref. 174), causes a significant portion of health impacts.

Dust exposure for workers involved in cotton, silk and wool production (all of which involve high speed spinning) can cause short-term and chronic respiratory illness and loss of lung capacity, as well as irritation of nasal passages, skin and eyes (Ref. 175, 176, 177 and 178).

Wool production in particular is cited as creating stress resulting from repetitive actions and high ambient noise levels (Ref. 179).

The human toxicity potential from air emissions from the production of cotton, polyester and wool is presented in *Figure 4.17*. Wool has the highest human toxicity impact potential due to the SO_x emissions from spinning and the NO_x emissions from wool scouring. NO_x from cotton cultivation is the main contributor to the human toxicity potential for cotton and SO_x from polyester fibre production is most significant for polyester (Ref. 22).

Figure 4.17 Human toxicity impact potential from air emissions (Ref. 10)



4.3.3 Poverty Alleviation

- **Description of impact.** The clothing and textile industry can be considered a catalyst for economic growth in developing countries, due to its suitability for people with limited skills and education. Despite the health risks and low income, it is often the most economically viable source of employment in areas where other occupations are either not available or do not provide sufficient income (Ref. 180). However, textile and clothing production often fails to provide social mobility for the very poor, with little opportunity for advancement, as training and skills development are not a priority at the levels of the commodity chain occupied by the very poor (Ref. 181).
- **Relevance to life cycle stage.** Raw material and fabric production are areas targeted in anti-poverty efforts for developing countries, due to the fact that they require little to no education, and much of the work is suitable for men, women or children.
- **Geographical scope of literature.** India was specifically highlighted in the literature on poverty alleviation and the textile industry (Ref. 182).
- **Relevance to material.** Sericulture, or silk production, was identified by the Indian government as part of the country's anti-poverty efforts (Ref. 183).

4.3.4 Community Health

- **Description of impact.** Community health impacts identified in relation to textiles and clothing are health concerns associated with exposure to hazardous chemicals and nuisance odours.
- **Relevance to life cycle stage.** Nuisance odour is associated with the production of polyester fibre and exposure to hazardous chemicals has been associated with the use of Teflon-coated fabrics.
- **Geographical scope of literature.** The literature on health impacts is from the UK.
- **Relevance to material.** There is not evidence that directly relates clothing materials to community health.

4.3.5 Resettlement

- **Description of impact.** Resettlement refers to any loss of land, housing economic and cultural assets, and/or loss of shared or communal resources including grazing land, water resources and recreational spaces. This impact is closely related to the environmental impact of biodiversity and land use.
- **Relevance to life cycle stage.** The production of raw materials for textiles can lead to the resettlement of communities in order to access resources; specifically oil and gas projects and timber plantations.
- **Geographical scope of literature.** Much of the information on resettlement relates to the developing world and rural communities. In addition, it is clear that where the resettlement of indigenous groups is required, the impacts are particularly significant, and must be carefully managed.
- **Relevance to material.** Resettlement impacts are particularly noted in the literature with regard to synthetic materials in relation to the exploitation of oil and gas reserves and timber plantations (Ref. 184).

4.3.6 Cultural Impacts

- **Description of impact.** The cultural impacts of the clothing and textile Industry documented in the literature include the destruction of tangible and intangible cultural heritage when land use changes occur and changes to gender roles as divisions of labour are challenged through

advances in production technology and machinery, allowing women to work in area previously restricted to men (Ref. 185).

Clothing has also resulted in cultural changes in consumer communities for example in the West, children are an important consumer group. With increased independence from parents, children cultivate their own self-image, and that of their parents. Parents are then forced to 'keep up' in an increasingly youth-oriented sector (Ref. 186).

- **Relevance to life cycle stage.** Cultural impacts occur during the production of raw-materials, fabric production, and clothing production and assembly, retail and consumer care.
- **Geographical scope of literature.** The variety of literature highlights that the cultural impact of clothing is global. The literature does not focus on one specific geographical area.
- **Relevance to material.** Cultural impacts are relevant across all materials. No literature identifies specific impacts for either synthetic or non-synthetic materials.

4.3.7 Economic Impacts

- **Description of impact.** Textile and clothing represents about 7% of world exports (Ref. 64) and supports a significant number of economies and individual incomes around the world. For example, the Asian Development Bank (ADB) reports that in some Asian countries, the textile and clothing industry has become the leading source of manufactured exports and total merchandise exports (Ref. 186):
 - over 80% in Cambodia;
 - 83% in Bangladesh;
 - 55% in Sri Lanka;
 - 51% in Nepal; and
 - 42% in Lao People's Democratic Republic.

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.

- **Relevance to life cycle stage.** Fabric production, clothing production and assembly and the retail sector may potentially have global and national economic impacts. These processes are large industries in

many countries, and have a significant affect on employment and the country's GDP.

- **Geographical scope of literature.** Literature exists for the Asian, African, (North and South) American and European continents.
- **Relevance to material.** These impacts relate to all types of clothing materials. There is a great deal of literature on cotton, as the US subsidy of its cotton farmers is a contentious issue for developing countries that also produce cotton.

4.4 Quantifying Impacts

The literature includes reports that quantify life cycle environmental impacts for specific materials, such as cotton, polyester, wool and rayon/viscose (Ref. 1, 12, 22, 25, 38, 39, 42, 54, 55, 61, 63, 64, 70, 71, 157-163 and 165-186). Several issues of note make comparing quantified evidence for the life cycle impacts of clothing difficult, including the following.

- Life cycle information is not available for all clothing materials (eg no complete life cycles on jute or flax clothing).
- Two LCAs of the same clothing product can have very different results, even if both LCAs are carried out according to the ISO standards. This can be caused by the different estimates and assumptions made in setting the system boundaries, the use of different databases, the inclusion/exclusion of life cycle stages and the interpretation of the results using different impact assessment methods.
- Quantification is presented in terms of different clothing items (eg t-shirt, blouse etc).
- Generic data is provided for the entire textiles and clothing industry
- Different definitions of clothing/textiles are used (eg some include carpet and/or footwear).

Table 4.5 identifies different estimates for environmental impacts indicating the difficulty of comparing data from three different reputable sources. The University of Cambridge study presents findings for the UK clothing and textile industry, whereas Defra and the Environment Agency (EA) present statistics for the clothing, textiles and leather industry.

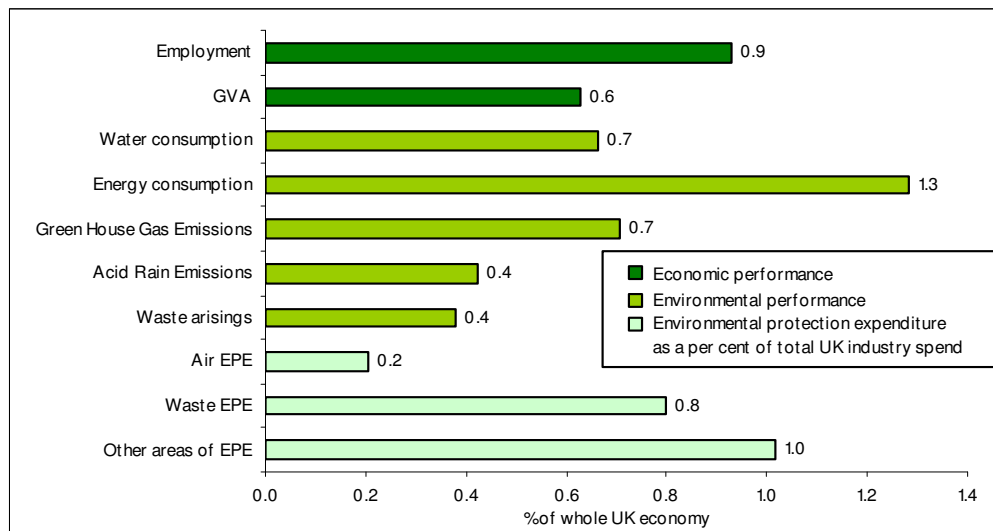
Table 4.5 Comparison of evidence on environmental impacts

Impact	University of Cambridge, 2006 (Ref. 64)	Defra Statistics, UK Textiles, Clothing and Leather Industry , 2006 (Ref. 70)	Environment Agency, 2007 (Ref. 227)
Waste	1.5 million tonnes	1.2 - 2 million tonnes	1.46 million tonnes
GHG emissions	3.1 million tonnes CO ₂ equivalent	4.6 million tonnes CO ₂ equivalent	2.87 million tonnes CO ₂ equivalent
Water consumption	90 million tonnes	90 million m ³	68 million m ³
Energy consumption	989 000 tonnes of oil equivalent	1 400 thousand tonnes of oil equivalent	850 000 tonnes of oil equivalent

Table 4.5 shows the result of the three different studies based on different assumptions and estimations. Without investigating the data and models behind the results, no conclusions can be drawn. There are discrepancies between the energy consumption and GHG emissions of the Defra study and the University of Cambridge and EA studies. In all three studies, there is consistency between the GHG and the energy consumption (normally GHG gas emissions are about a factor three higher than the energy consumption) which indicates that the difference in GHG emissions is not caused by methane and/or N₂O emissions from agriculture. The waste generation and water consumption are more or less equal in the studies.

Figure 4.18 presents Defra's statistics for the textiles, clothing and leather products sector as a proportion of the UK non-domestic sector.

Figure 4.18 The textiles, clothing and leather products sector as a proportion of the UK non-domestic sector (Ref. 70)



In comparison with the environmental data in *Figure 4.18* a recent update of the UK environmental input/output (I/O) table gives the following results (Ref. 227).

Table 4.6 The textiles clothing and leather products sector as a proportion of the UK non-domestic sector (Ref. 227)

Environmental impact	% of UK economy
Water consumption	0.32
Energy consumption	1.02
GHG	0.26
Acidification	0.18
Waste arising	0.23

The I/O results in *Table 4.6* are lower than the results in *Figure 4.18*. The reasons for this could be manifold. The way the I/O model includes environmental impacts from imported products is by assuming that imported products are produced using UK processing technology. For example, clothing and textile production in UK does not use wet processing which could explain the low water consumption and energy consumption illustrated in *Table 4.6*.

4.5 Summary of Impacts

Table 4.7 and *Table 4.8* summarise the significant environmental and social impacts, respectively, that are available in the literature in terms of the life cycle stage that is affected and the material type. This table presents:

- a brief impact description;
- the life cycle stage that is impacted (✓ impact; ✗ no impact);
- the geographic scope of the impact;
- the material type the information is for (✓ impact; ✗ no impact);
- key reports; and
- the robustness of the key reports (High (green); Medium (yellow); and Low (red)).

Table 4.7 Summary of significant environmental impacts

	Impact description	Relevance to life cycle stage								Geographic scope	Relevance to material type		Availability of information	Key reports
		Raw materials growth, acquisition & processing	Fibre production	Clothing production and garment assembly	Packaging	Distribution	Retail	Use	End or life management		Synthetic	Non-synthetic		
ENVIRONMENTAL IMPACTS														
Resource consumption	Use of fossil fuel for energy and water	✓	✓	✓	✗	✓	✗	✓	✗	Literature focuses on specific life cycle stages for fossil fuel and water consumption. The Aral Sea example is covered extensively in literature.	✓	✓	High	Ref. 1, 12, 22, 25, 38, 39, 42, 54, 55, 61, 63 and 64
GHG emissions	Emissions that contribute towards global warming	✓	✓	✓	✗	✓	✓	✓	✓	Literature focuses on specific life cycle stages.	✓	✓	Medium	Ref. 22, 55 and 64
Solid and hazardous waste	Production waste, unwanted clothing and processing chemicals	✓	✓	✓	✓	✗	✓	✗	✓	Literature focuses on waste clothing in the UK.	✓	✓	High	Ref. 1, 12, 22, 42, 54, 64 and 70
Air/water pollution & toxicity	Adverse emissions to air, water or land	✓	✓	✓	✗	✓	✗	✓	✗	Literature does not focus on a particular area.	✓	✓	Medium	Ref. 12, 22, 25, 38, 55 and 64
Soil degradation/contamination	Destruction or damage to natural landscape	✓	✓	✗	✗	✗	✗	✗	✗	Literature does not focus on a particular area.	✓	✓	Medium	Ref. 12, 38, 39, 64 and 71
Biodiversity/land use	Destruction or damage to flora, fauna and landscape	✓	✗	✗	✗	✗	✗	✗	✗	Literature does not focus on a particular area other than the Aral Sea.	✓	✓	Low	Ref. 12, 39 and 64

Table 4.8 Summary of significant social impacts

	Impact description	Relevance to life cycle stage								Geographic scope	Relevance to material type		Availability of information	Key reports
		Raw materials growth, acquisition & processing	Fibre production	Clothing production and garment assembly	Packaging	Distribution	Retail	Use	End or life management		Synthetic	Non-synthetic		
SOCIAL IMPACTS														
Worker rights	Bonded or forced labour, child labour, freedom of association, pay and hours	✓	✓	✓	✗	✗	✓	✗	✗	Local impact. Literature focuses on India, China and some African countries	✓	✓	High	Ref. 64 and 157 – 163
Worker health and safety	Accidents, stress, continuous/ repetitive actions, noise and adverse health effects	✓	✓	✓	✗	✗	✗	✗	✗	Local impact. Literature focuses on India, China and some African countries	✓	✓	High	Ref. 22, 39, 64 and 165 - 179
Poverty alleviation	Economic growth for an underprivileged area or group of people	✓	✓	✓	✗	✗	✗	✗	✗	Local impact. Literature mainly from India	✓	✓	Medium	Ref. 180 - 183
Community health	Nuisance odour, cancers and neurological problems	✓	✓	✓	✗	✗	✗	✗	✗	Local impact. Literature is mainly from the UK and USA	✓	✓	Medium	
Resettlement	Loss of land, housing, economic and cultural assets, or resources	✓	✗	✗	✗	✗	✗	✗	✗	Local impact. Literature relates to developing countries in general	✓	✓	Low	Ref. 184
Cultural impacts	Destruction of tangible and intangible cultural heritage	✓	✓	✓	✗	✓	✗	✓	✗	Global	✓	✓	Low	Ref. 185 and 186
Economic impacts	Gross domestic product or economical well-being	✓	✓	✓	✗	✗	✓	✗	✗	Global impact. Literature available for most countries involved in the clothing industry	✓	✓	High	Ref. 64 and 186

5 The Significance of the Findings

5.1 Introduction

The literature review identified a number of economic interventions, sector trends, technological developments and initiatives in the clothing sector (*Section 3*). The significance of these in relation to the environmental and social impacts identified in *Section 4* are summarised in this section of the report. Unless stated otherwise, the views below are those of ERM and not supported by evidence from literature. *Table 5.1* provides a summary of the significance of economic intervention and sector trends.

Specifically, the economic interventions, trends, developments and initiatives are reviewed in terms of:

1. their significance for environmental and social impacts;
2. the life cycle stage they affect;
3. the geographical location of these impacts; and
4. relevance for synthetic and non-synthetic materials.

5.2 Economic Interventions

Economic interventions have shaped the growth of the textiles and clothing industries at different stages in the life cycle and in different countries. In particular, economic interventions have restricted the growth of the Chinese clothing and textile industry. However, restrictions for some can create opportunities for others, so it is not possible to define economic interventions as positive or negative.

The end of the Multi-Fibre Agreement (MFA) has led to increased sourcing of clothing from countries with poor environmental standards. The environmental evidence related to this is not well documented. It is likely that harmful land, water and air emissions occur in countries with little or no environmental control. Worker's rights and health and safety are also of concern in some developing countries.

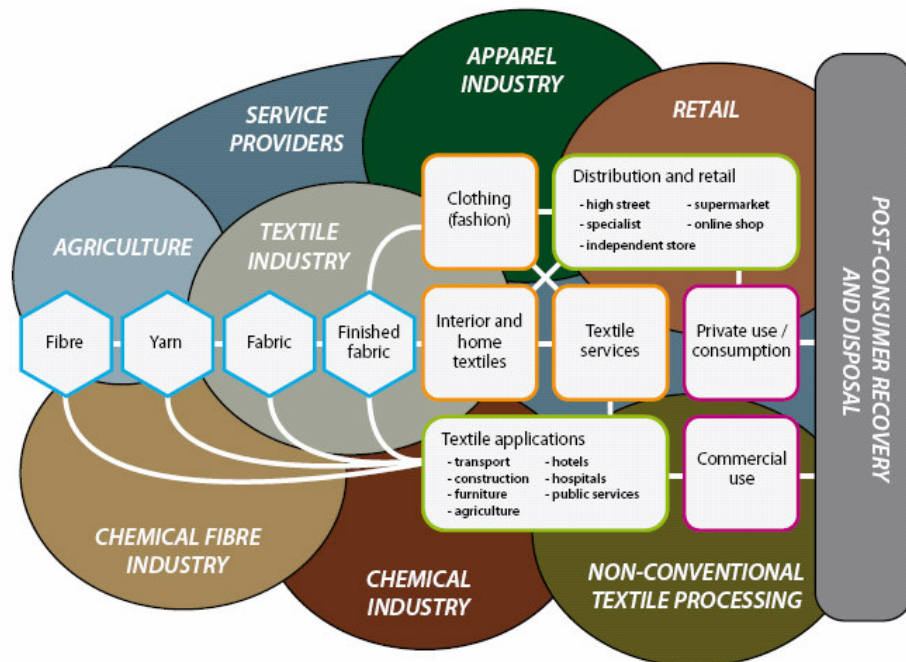
Quotas and tariffs that exist are often set to protect the clothing industry in the USA and Europe. These can limit opportunities for foreign manufacturers. Textile recycling economics are already fragile due to difficulties in end markets, both for clothing and for recycling grades (rags). These problems are forecast to intensify with the increased import penetration of very low cost Chinese-produced clothing at the cessation of the MFA, which imposes

quotas on developing country textile imports to the developed world. It will also impact on the overseas markets for second hand clothing, driving down quality and hence prices (Ref. 203).

Subsidies often make it possible to produce crops in geographic areas where the climate is not optimal for this, resulting in high energy/water/pesticides input per yield. However, subsidies can also have a positive impact on the environment (ie investments in cleaner technology). Cleaner production programmes in the clothing sector have improved working conditions (ie capacity building, introducing new technology, training of staff etc). There is no evidence in the literature that evaluates the impacts of growing cotton in areas that are not native to cotton production.

Quotas, tariffs and subsidies mainly affect the raw material growth, acquisition and processing stage of the life cycle. The impacts are felt by those who impose quotas (ie USA and Europe) and those that supply the USA and European markets (ie China and Bangladesh). Subsidies impact the USA, competing cotton producers (ie Brazil) and other countries that manufacture clothing. *Figure 5.1* presents key players in the clothing and textile industry.

Figure 5.1 Key players in the clothing and textile industry



* This figure is from European Technology Platform for the future of clothing and textiles. Euratex – A vision for 2020, Dec 2004

5.3 Sector Trends – Company Policies and Practices

The policies and practices of companies determine the location of the supply chain and the standards to which it must adhere. Market forces have been the main driver in localisation and the relocation of production to developing countries and the associated economic and employment benefits. However, company employment and labour policies and monitoring mechanisms have the potential to significantly improve labour and working conditions.

CSR policies can potentially minimise environmental and social degradation throughout the entire supply chain. The importance of considering the entire supply chain has become evident in the recent years, especially in the clothing sector. The potential economic impact of a NGO revealing an industry in the supply chain with poor working conditions, or causing environmental damage, is large. Companies such as Nike have spent significant resources restoring their image in this context. Initiatives such as GRI, AA1000 and other CSR reporting guidelines have been created to harmonise CSR reports and make it possible to compare between companies. This is very important in achieving sustainability goals and enabling stakeholders to hold companies to account.

Furthermore, the relocation of manufacturers and producers to countries with less stringent environmental practices can result in adverse environmental effects that can be both local (ie groundwater and land pollution from chemicals used in processing) and global (ie high GHG emissions).

Relocation of manufacturing and production, localisation and employment trends can have some affects on the environment. Clothing manufacturing close to the market will reduce the GHG emissions from transport and the use of skilled workers and drivers can also minimise the environmental impact through better use of manufacturing technologies and more efficient driving. However, the use of energy for transport of clothing is relatively small, so shifting the location of production has little immediate environmental impact. Shifting production to the UK has relatively little economic benefit if full employment is assumed, but taking production away from China/India would be socially damaging as the jobs lost would not be replaced (Ref. 64).

Shifting the location of production is likely to lead to a cost increase, regardless of environmental benefits, as manual operations will be moved to higher labour cost countries. This disadvantage would be offset if new production technology were available to reduce the labour content of production – as has happened in the manufacture of carpets (Ref. 64).

5.4 Sector Trends – Consumer Trends

The increased demand for discount fashion is resulting in increased production and therefore increased impacts (ie resource consumption; harmful emissions to land, water and air; solid and hazardous waste). In addition, the low quality of discount clothing is reducing the availability of suitable clothing for reuse and recycling and increasing the amount of clothing that is being thrown away. The sales value of recycling grades of material has fallen by some 71% in real terms over 15 years, largely due to the introduction of discount fashion, and may now be less than the cost of collection and sorting donated textiles (Ref. 234).

The increasing volume of clothing ranges using organic cotton will make sustainable clothing more accessible to the consumer. Although organic cotton minimises the environmental impact from using pesticides and fertilisers, the consequences of shifting all cotton produce to organic cotton may result in other significant environmental impacts. The current land used for cotton production would increase significantly, eg from organic manure production. There is a significant need for evidence comparing the environmental and social impacts of conventional and organic cotton.

Using better quality fibres for affordable clothes, which could be remanufactured at the end of life, would have a positive impact. However, this would necessitate a shift in consumer behaviour to avoid clothing being discarded as household waste. An intervention such as a take-back system where the consumer receives an amount per kg clothing when bringing it back to the retailer would encourage such behaviour. This would especially be beneficial for children's clothing that often has a very short lifetime.

There is a significant potential for consumers to play a role in reducing the environmental impacts of clothing. The effect of reducing the energy used in washing, drying and ironing cotton t-shirts dwarfs the possible effects of changing production methods or their structure. Omitting tumble-drying is by far the most important step. For cotton garments, where use phase energy consumption is dominant, a change in consumer behaviour is required (Ref. 64).

The demand for man-made fibres has doubled in the last 15 years (Ref. 64), increasing the clothing sector's reliance on fossil fuels.

We believe that consumers normally separate clothes into colours and sensitive materials (silk, wool etc) before washing and drying. The washing and drying of cotton and polyester clothes is done in one batch which indicates that the increasing demand for man made fibres, especially polyester, would further increase the environmental impacts from the life cycle (the dryer will stop running when the last piece of clothing is dry). Consumer

awareness regarding the separation of polyester, viscose etc from cotton is vital if the environmental impacts from all textile and clothing types are to be minimised.

Online sales in the clothing sector are increasing quickly. E-commerce provides energy savings in comparison to traditional high street shopping (Ref. 42). Energy savings associated with high street stores and consumer transport save approximately 1.56 kWh per pair of trousers (Ref. 42). This is off-set to a certain degree by the increased transport and packaging associated with home deliveries from a centralised depot.

The effect of moving towards more e-commerce and home deliveries would be an increased energy burden associated with retail activities, but a lower life cycle burden for clothing products (see *Figure 5.2*). In terms of the life cycle of a pair of trousers, a move to e-commerce would result in a reduction of less than 1% in the energy burden for a pair of trousers. Here it is also important to investigate if the life cycle includes the amount of clothing that is returned because it does not fit or is not as attractive as it appeared in the catalogue on the Internet.

The implications and significance of the interventions and trends are summarised in *Table 5.1*.

Figure 5.2 Energy use in a high street store compared to e-commerce (Ref. 42)

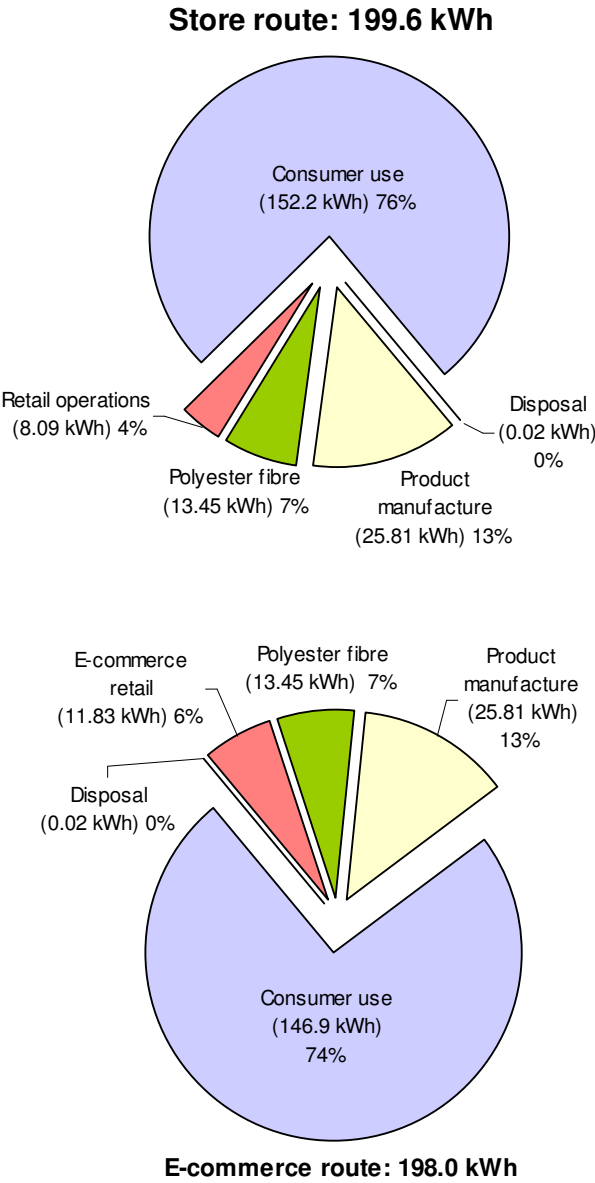


Table 5.1 Implications of economic interventions and sector trends

	Environmental impacts	Social impacts	Life cycle of impacts	Geography of impacts	Relevance to material type	
					Synthetic	Non-synthetic
ECONOMIC INTERVENTIONS						
Quotas and tariffs	Increased sourcing of clothing from countries with poor environmental standards	1) Protection of clothing industry in the USA and Europe, 2) limit of growth of Chinese clothing and textile industry and 3) potential to create opportunities for smaller clothing and textile producers to meet global demand	Fibre production, clothing production and garment assembly and distribution	Impacts those that impose quotas (eg USA and Europe) and those that supply the US and European markets (eg China and Bangladesh)	✗	✓
Subsidies	1) Environmental investments, 2) investment in energy efficiency and 3) subsidised cotton can have low yield ie high input of pesticides, energy, water etc per kg cotton output	1) Protection of US cotton growers, 2) potential limitation of growth of cotton production industry in alternative countries, specifically in the developing world, 3) subsidies resulting in new technology improving skills and motivation of staff and 4) capacity building	Fibre production, clothing production and garment assembly and distribution	Impacts the USA, competing cotton producers (ie Brazil) and other countries who manufacture clothing	✓	✓
SECTOR TRENDS - COMPANY POLICIES AND PRACTICES						
Corporate social responsibility (CSR)	1) Improved environmental standards, 2) proper management of waste and toxic chemicals, 3) improved waste management, 4) alternatives to toxic chemicals, 5) reduced GHG emissions and 6) reduced consumption of natural resources	Improved working conditions	Potential to impact all stages of the life cycle	Global	✓	✓
Relocation of production & manufacturing	1) Lack of environmental legislation in developing countries to prevent adverse environmental impacts eg hazardous materials and 2) increased environmental costs (eg GHG emissions) of air and sea transportation	1) Employment and GDP benefits for developing countries, 2) worker rights and health and safety compromised hindered by poor enforcement and 3) industry in developing world	1) Increase burden of impacts at production stage and 2) increase in transport impacts	Shift of both positive and negative impacts to developing countries	✓	✓
Localisation	1) Less impact from transport (GHG emissions) and 2) less impact from storage facilities (land use, electricity use (GHG), waste)	Promotes growth of clothing industry close to consumers, rather than in country of lowest labour cost	Distribution	Global depending on location of consumers	✓	✓
Employment	Less impact from skilled labour operating technologies and equipment efficiently	1) Decrease in employment in clothing and textiles industry in developed world, especially USA and UK and 2) increased employment in clothing and textiles industry in developing world	Has most significantly impacted clothing production and garment assembly	Increased employment in clothing and textiles in China and other developing countries	✓	✓
Integration	Improved processes that can use fewer resources and reduce waste and adverse emissions	1) Faster production and distribution of clothing and textiles and 2) reduced costs of clothing and textiles	One company may integrate several life cycle stages (eg fibre production and finishing processes)	Can reduce resource consumption and waste at production source	✓	✓
SECTOR TRENDS - CONSUMER TRENDS						
Discount fashion	1) Increase in low quality clothing and short clothing life cycle increasing solid waste from manufacturing and end-users and 2) increase demand of natural resources to produce this clothing	1) Increased production rates putting pressure on suppliers to turnaround production more quickly with implications for worker rights (eg hours, pay) and health and safety and 2) no market for low cost clothing with financial impacts for recycling and reuse companies	1) Increase demand for clothing increases burden on natural resources and raw material consumption, 2) quality of second-hand clothing decreased due to low quality clothing and 3) recycling and reuse also hampered by different fibres, coating materials and collection issues	Production is based in China, India and other developing countries and consumption is based in developed countries	✓	✓
Consumer awareness	Increased demand for clothing that is produced in a sustainable manner	1) Consumer demand for fair-trade and organic materials and 2) company reputation dependent on demonstrable good social performance	Will affect all stages in the life cycle	USA and Europe	✓	✓
Synthetic versus non-synthetic materials	The demand for more synthetic fibres (Ref. 64) increases the need for oil and gas for production	Increase demand for synthetic fibres especially polyester suggests increasing use of oil based fabrics and associated impacts	1) Will increase proportion of clothing and textiles dependent on extraction of petroleum raw materials and 2) will affect consumer care of clothing	Global	✓	✓
Online sales	Limited information available in relation to environmental or social impacts. Potential for reduced impacts from lack of retail stage. More research needed	1) Reduces need for suppliers to be close to consumers, 2) reduces need for physical retail sites and 3) children able to shop from home	1) Impacts distribution for clothing retailers – no longer need to distribute to retail sties, but to individual customers and 2) impacts retail sites as fewer are required	This will have the most impact in the West where there is increasing access to the internet, and an increasing number of families have a PC or equivalent at home	✓	✓

5.5 Significance of Technology

This section provides an analysis of environmental and social implications related to technological developments that were discussed in *Section 3*. *Table 5.2* presents a summary of the information.

5.5.1 Environmental Implications

Technology advances have improved efficiency, leading to reduced resource consumption and emissions. New production methods and the use of computer driven design have also reduced the amount of waste created from cut-offs and human error during manufacturing. Fibre surface coatings have been used to develop clothing that does not have to be washed as frequently, and can therefore reduce the harmful effects of the use stage (ie hot water for washing and tumble drying). However, there is no evidence that suggests consumers are treating these clothing materials differently. There is limited information available on the impacts of fibre surface coatings with respect to prolonging the life of clothing and how the coatings may affect recycling opportunities.

Biodegradable clothing, 'smart' fibres, RFIDs, and waterless cleaning are still in development stages. The environmental and social impacts of emerging technologies and niche market products can not be assessed for effectiveness. All technological developments must be closely monitored to identify positive and negative impacts and to address them accordingly.

5.5.2 Social Implications

The clothing sector is producing more product than ever. However, prices and employment are decreasing as new technology is implemented and vertically integrated structures support improved productivity (Ref. 64).

At the current time, the technologies discussed are expensive and used at the margins of the textiles and clothing industry in the developed world. Therefore, the social impacts of new technologies are not significant. The exception to this in the short term may be clothing recycling. In West Africa, it has been found that clothing recycling has created jobs and increased employment (Ref. 189).

More generally, all the new technologies are likely to require the development of new skills and therefore to create job opportunities. However, the expense of many of the technologies means their production and use is limited to developed countries.

There is only small scale use of the technologies at the present, and it is not clear how growth in their use would affect current trends in clothing production and garment assembly which are driven by cost and response time. If these new technologies grow, and are part of mass production, they may result in job losses and other economic impacts in developing countries.

Table 5.2 Implications of technological developments in the clothing sector

	Environmental impacts	Social impacts	Life cycle of impacts	Geography of impacts	Relevance to material type		Development status		Market	
					Synthetic	Non-synthetic	Emerging	Established*	Niche	Mainstream
Computer aided design (CAD)	Reduction of waste and improved production efficiency	1) New skills and potential job creation and 2) potential for job loss from a more automated system.	Clothing production and garment assembly	Developed countries	✓	✓	✗	✓	✗	✓
Automated systems	1) Reduction of waste and 2) reduced harmful air and water emissions (more efficient processes)	1) New skills and potential job creation and 2) potential for job loss from a more automated system.	Clothing production and garment assembly	Developed countries	✓	✓	✗	✓	✗	✓
Biodegradable clothing	1) Reduces impact at end of life, but may produce methane if landfilled 2) uses materials that would have otherwise been wasted (sometimes) and 3) potential to offset resource consumption required for cotton cultivation and fossil fuel extraction	1) Potential job creation and 2) controversy over using food crops for non-food purposes	Raw material growth and end of life management	Affects local markets where produced	✗	✓	✓	✗	✓	✗
'Smart' fibres	1) May affect end of life reuse and recycling options and 2) must be treated accordingly with the WEEE, RoHS and Battery Directives	1) New skills and potential jobs and 2) potential health and safety benefits for users	Clothing production and garment assembly, use and end of life management	Developed countries	✓	✗	✓	✗	✓	✗

	Environmental impacts	Social impacts	Life cycle of impacts	Geography of impacts	Relevance to material type		Development status		Market	
					Synthetic	Non-synthetic	Emerging	Established*	Niche	Mainstream
Fibre surface coating	1) Reduce the need for laundering, increased waste due to end of life management limitations caused by the coatings and 2) no evidence to confirm that consumers are treating clothing with coatings differently	Potential health impacts and/or perception of health impacts	Clothing production and garment assembly, use and end of life management	Global	✓	✓	✗	✓	✗	✓
RFID chips	Waste RFIDs will have to be treated accordingly with the WEEE, RoHS and Battery Directives	1) New skills and potential jobs and 2) controversy over privacy of consumers	Clothing production and garment assembly, distribution, retail and end of life management	Developed countries	✓	✓	✓	✗	✓	✗
Waterless cleaning	1) Reduces water consumption, 2) reduces need for tumble drying and 3) may be useful in areas with water shortages	1) New skills and potential jobs and 2) increase life span of clothing	Use	Developed countries	✓	✓	✓	✗	✓	✗
Non-solvent dry cleaning	Reduces use of toxic chemicals	1) New skills and potential jobs and 2) increase life span of clothing	Use	Developed countries	✓	✓	✗	✓	✓	✗
Textile colouration technologies	1) Reduces use of some toxic dyes and 2) reduced quantity required	1) New skills and potential jobs and 2) health and safety increased from using less toxic dyes	Fibre production, clothing production and garment assembly	Developed countries	✓	✓	✗	✓	✗	✓
Clothing recycling and reuse technologies	1) Increased sorting efficiency, 2) increased ease of recycling fibres and 3) energy savings	1) Job creation and 2) provides a source of affordable clothing to developing countries	Fibre production and end of life management (if recycling occurs)	Global	✓	✓	✗	✓	✓**	✓**
* Established technologies are still be further developed										
** Niche in developing countries, mainstream in developed countries										

The new technologies affect all aspects of the life cycle from clothing production to consumer care and end of life management. However a positive impact at one life cycle stage may create sustainability challenges at another. For example, the use of fibre coating may reduce clothes washing during use, but may restrict options to recycle clothing at the end of the life cycle. Therefore a careful assessment and balance of impacts is required.

5.5.3 CAD

Computerised seamless knitting machines combined with CAD allow manufacturers to provide 'mass customisation' in the clothing industry, without increasing costs and optimising the material usage thus reducing waste. CAD can also allow for production and retail to take place, which can reduce the amount transportation required. The use of CAD also reduces the occurrence of human error, which in reduces waste (Ref. 64). CAD may result in loss of employment due to the decreased need of manual labour.

5.5.4 Automated Systems

Seamless knitting, stitch-free seams, 3D weaving and 3D sewing technologies are automated systems that are relatively new in the textile and clothing sector (Ref. 64). These systems allow one machine efficiently to produce almost an entire garment, which reduces waste and also offers a potential reduction in air and water emissions.

For finishing textiles, inkjet printing can be a step closer to digitalising textile printings. Potentially, such technologies may change the cost structure of production. They may also offer other commercial benefits. Such technologies would allow production of smaller batches, including made-to-order production of individually designed and sized garments; the cost of stock-holding and the need for end-of-season price reductions would be reduced if production was fast and close to the retail outlet – as there would be no requirement for advance ordering of large batches; and production waste – from cutting parts out of flat fabric sheets – would be reduced (Ref. 64).

Automated systems rely on computers rather than human labour. Employment in the industry will decrease as more automated systems are implemented.

5.5.5 Biodegradable Clothing

Biodegradable clothing will degrade at a faster rate than synthetic clothing, at end of life. However, most waste clothing in the UK is landfilled. When

clothing biodegrades in a landfill, it produces methane, which is a significant contributor to global warming.

Biodegradable clothing is often produced using products that would otherwise be wasted or left to degrade naturally (ie banana leaves). This is currently only a niche market. However, large scale production could help reduce the requirement for natural resources such as fossil fuels and water.

Production is currently based in several developing countries and offers potential job creation in the local market. However, there has been recent media criticism of food crops being used for non-food purposes (Ref. 201 and 202). Any large scale production of biodegradable clothing would require a sustainability assessment. As with other new and emerging technologies, it presents potential job creation and the development of new skills.

5.5.6 'Smart' Fibres

It is anticipated that the production of 'smart' fibres will increase in the coming years. At US\$300 million in 2003 the overall market growth is estimated between 11% and 28% through 2008 (US\$720 million in 2008) (Ref. 108).

As more 'smart' fibres are developed, the number of applications will expand. 'Smart' fibres may also take advantage of the UK and Europe's extensive mobile phone network to communicate data with remote sensors with the integration of miniaturised GPRS transmitters (Ref. 108).

Depending on the materials used to produce 'smart' fibres, the WEEE, RoHS and Battery Directives would apply. Technology integrated with clothing may be difficult to recycle and the short life span of technological devices may also limit the life span of the garment.

These garments have many applications that could enhance health and safety of their users. Currently, the use of 'smart' fibres remains in a niche market. As with other new and emerging technologies, it presents potential job creation and the development of new skills.

In accordance with the WEEE Directive, producers of products containing WEEE are responsible for the take-back of their products. Therefore, clothing producers may be expected to implement a take-back programme for clothing with electronics.

5.5.7 Fibre Surface Coating

The UK is also developing competitiveness in novel 'nanotechnology' coatings and smart functions to be applied to textiles and clothing and in the design so

sales by volume increased by 37%. Thus, over four years, the number of garments bought per person in the UK increased by over one third (Ref. 64).

Fibre surface coatings can reduce the impact of the use stage by reducing the amount of laundering that is normally required. Coatings to clothing can repel or easily remove stains and dirt. A wrinkle resistant coating can also be applied to eliminate the need of ironing.

5.5.8 RFID Chips

There are many potential uses for RFID chips and their applications are expected to increase as the technology is further developed. RFID chips are not likely to have a significant environmental impact. Depending on the materials used to produce the chips, the WEEE, RoHS and Battery Directives may apply. Technology integrated with clothing may be difficult to recycle.

The ability of RFID chips to track movement and customer actions have raised privacy concerns. As with other new and emerging technologies, it presents a potential for job creation and the development of new skills.

In accordance with the WEEE Directive, producers of products containing WEEE are responsible for the take-back of their products. Therefore, clothing producers may be expected to implement a take-back program for clothing with electronics.

5.5.9 Waterless Cleaning

Waterless cleaning is an emerging technology that is currently only used by a niche market. There is potential to reduce resource consumption in the use stage of clothing by reducing water consumption and the need to dry clothes. Chemicals that are used for waterless cleaning must be considered to ensure that they are not toxic. This technology may also prove useful in areas with water shortages.

Waterless cleaning may also improve the life span of clothing by reducing degradation that occurs from machine washing and drying. As with other new and emerging technologies, it presents potential job creation and the development of new skills.

5.5.10 Non-Solvent Dry Cleaning

Non-solvent dry cleaning is an emerging technology that is currently only used by a niche market, but is growing. The main environmental impact this technology presents is the reduction in the use of hazardous chemicals that

are associated with traditional dry cleaning. In addition, this technology may also prove useful in areas with water shortages.

Numerous dry-cleaners provide non-solvent or 'green' dry cleaning. However, the number of traditional dry cleaners overshadows those providing this service.

As with other new and emerging technologies, it offers potential for job creation and the development of new skills.

5.5.11 Textile Colouration Technologies

New technologies such as ink-jet printing have increased efficiency in the dying phase of textile and clothing production. This allows for a reduction in the quantity of dyes used. In addition, less toxic dyes have been incorporated in textile and clothing production, which lessens the environmental impact of treating toxic wastewater and also lessens health and safety concerns amongst workers. This technology is common in the industry in developed countries, but is still under development in many areas. An ideal new technology would facilitate creation of coloured patterns directly on complex 3-dimensional shapes (Ref. 89).

5.5.12 Clothing Recycling and Reuse Technologies

Reuse and recycling of all textiles provides environmental benefits, partly due to the high resource requirements of primary material production. Technology innovations may provide a means to extract longer fibres from used textiles, although a recent innovative business for carpet recycling failed to achieve profitability (Ref. 64). New technology has also improved sorting, allowing for a more efficient recycling process.

There is a significant benefit to be achieved through recycling clothing, as the energy burden of recycling is insignificant in comparison with the savings made through off-setting new production. For every kg of new cotton clothing displaced by second hand clothing, approximately 65 kWh is saved; and for every kg of new polyester clothing displaced by second hand clothing approximately, 90 kWh is saved (Ref. 42).

Improved policy intervention to increase reuse and recycling will deliver environmental and social benefits. Current levels of re-use and recycling of clothes are low despite the excellent work of charity shops and the availability of textile banks and the economics of re-use and recycling are deteriorating (Ref. 228). Additionally, more jobs in the wider economy could be created from developing value-added markets for recycled textiles (Ref. 228).

Under the Landfill Allowance Trading Scheme, textiles are deemed to be 50% biodegradable. Therefore diverting household textiles from landfill by recycling or reuse reduces the use of landfill allowances. In 1991, the Textile Recycling Association established the Recycaltex Bonded Textile Scheme, a regulatory body designed to help local authorities, charities and other organisations that want to set up services to aid the recycling and reuse of clothes and shoes. It includes the provision of textile banks with a regular agreed collection timescale, regular payments and collections from charity shops also agreed (Ref. 228).

5.6 Significance of Initiatives

To date, the majority of initiatives are voluntary, and involve either collaboration between non-governmental groups and clothing producers, or reporting and awareness campaigns carried out by non-governmental groups that target abuses and violations in the clothing industry. While these initiatives have contributed to the higher profile of environmental and social impacts of clothing production, among both public and private stakeholders, the available literature provides only a limited indication of the comparative effectiveness of these initiatives. The significance of environmental and social impacts of initiatives is presented in *Table 5.3*.

5.6.1 Environmental Implications

Initiatives promote many different sustainable methods of clothing production that can result in numerous environmental benefits. More research is needed to determine the effectiveness of these initiatives and to identify key areas that are successful and those that are not.

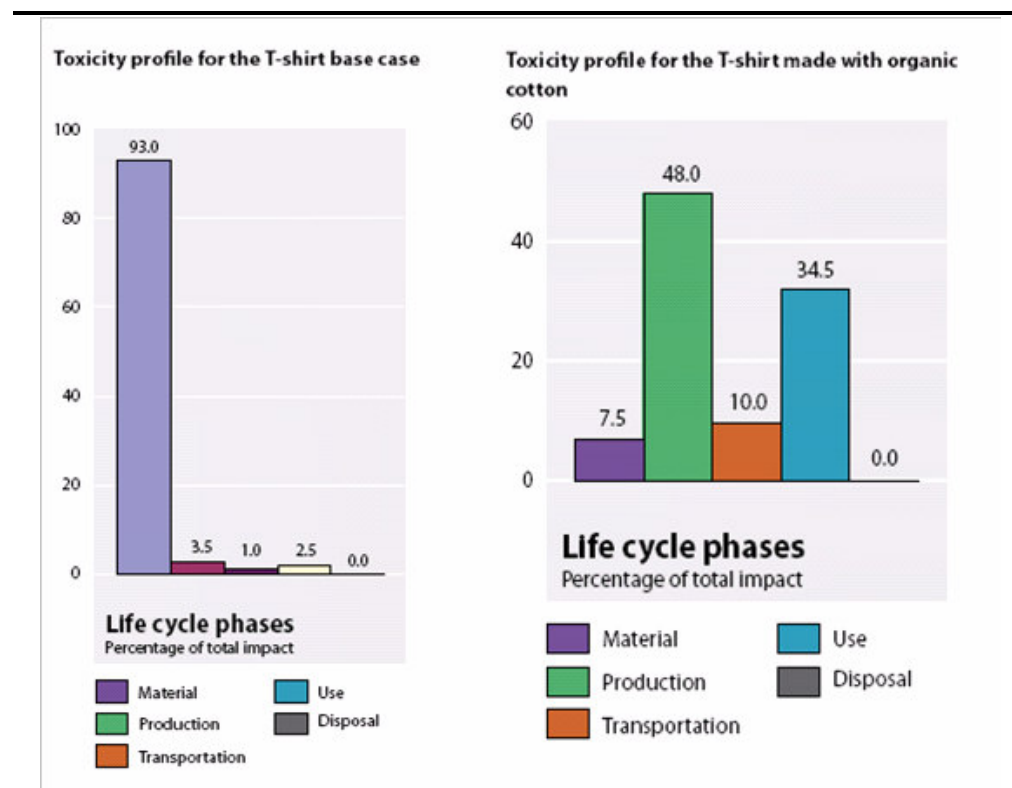
Organic Farming

Organic farming systems do not necessarily prove to be better for all environmental impacts. For example, organic production does not take water use explicitly into account. When organic growers apply improper amounts of organic/natural fertilisers or apply them when the crop does not need fertiliser, they contribute to the same unsustainable elements as high-input conventional systems. However, many organic farms rely on rain water (Ref. 39).

The toxicological impact of a cotton t-shirt through its life cycle is dominated by chemicals used in conventional cotton agriculture (refer to *Figure 5.3*). There is a 90% reduction in toxicological impact when organic cotton is used. For the organic cotton t-shirt, the toxicity impact of the material phase no

longer dominates as the production and use phases are now more important (Ref. 64).

Figure 5.3 Toxicity of a cotton t-shirt vs. an organic cotton t-shirt (Ref. 64)



5.6.2 Social Implications

The initiatives primarily impact on worker rights and worker health and safety; focused on fabric and clothing production and garment assembly in the developing world. There is limited standardised information of the effectiveness of different initiatives. However, ETI did commission a study into the effectiveness of labour codes, which found that those are improving working conditions and worker health in many respects, although major issues remain (Ref. 190). In particular, informal workers are unable to benefit from formal labour codes, restrictions on unionisation remain, and discrimination and harassment continue.

The initiatives will not be able to mitigate social impacts alone, but provide an important driver and support to corporate policies and standards, and help raise consumer awareness.

Table 5.3 Implications of voluntary initiatives

	Environmental impacts	Social impacts	Life cycle of impacts	Geography of impacts	Relevance to material type	
					Synthetic	Non-synthetic
Fair trade	Fair trade actively encourages better environmental practices and the application of responsible methods of	Promotes poverty alleviation, gender equity, safe and healthy working environment for producers, producer	Production	Predominantly developing countries	x	✓
Labour and working conditions	N/A	Promotes improved working conditions, adherence to/ development of	Throughout life cycle	Global	✓	✓
Environmentally clean production	Promotes ecosystem management and attempts to reduce or eliminate harmful substances, especially synthetics, in agricultural production	Reduce health impacts caused by exposure to chemicals, etc. Improved sustainability of production livelihood.	Production	Global	✓	✓

6 Gap Analysis

6.1 Introduction

The gaps emerging from the literature review in relation to the clothing sector are identified as follows:

- economic indicators;
- economic interventions;
- sector trends;
- technological developments; and
- initiatives.

Gaps are then further identified in relation to:

- impacts;
- life cycle stage;
- geographic scope; and
- clothing material.

The tables in this section summarise the gaps for the issues listed above as follows:

- (✓) significant data gap exists;
- (✗) no significant gap exists;
- (n/a) not applicable; and
- the relative availability of material (High (green); Medium (yellow) and Low (red)).

6.2 Economic Indicators

There are no major gaps in the literature describing the economic status of the clothing sector. Literature that presents economic indicators, such as import and export data, GDP and employment is readily available. Sources of this information include ONS, HM Customs and Excise and the British Apparel and Textile Confederation. These are reliable sources and they are regularly updated. *Table 6.1* summarises the gap status for economic indicators.

Table 6.1 Summary of gaps for economic indicators

Impact area	Availability of literature	Life cycle gaps	Geographic gaps	Clothing material gaps	Key gaps
GDP	High	✗	✗	✗	None
Market growth	High	✗	✗	✗	None
Employment	High	✗	✗	✗	None
Imports	High	✗	✗	✗	None
Retail distribution	High	✗	✗	✗	None

6.3 Economic Interventions

There is a large selection of literature available on UK and international quotas, tariffs and subsidies; however, much of this is general information and not specific to clothing. The literature did not provide evidence on the relation of economic interventions to environmental impacts. *Table 6.2* summarises gaps for economic interventions.

Table 6.2 Summary of gaps for economic interventions

Impact area	Availability of literature	Life cycle gaps	Geographic gaps	Clothing material gaps	Key gaps
ECONOMIC INTERVENTIONS					
Quotas and tariffs	Medium	✓	✓	✓	1) Literature does not relate to UK clothing production and consumption and 2) environmental impacts are not addressed from a life cycle perspective
Subsidies	Medium	✓	✓	✓	Same as above

6.4 Sector Trends

The evidence provided information on sector trends, but not on the impacts that these trends have. *Table 6.3* summarises sector trend gaps

The key evidence gaps in our understanding of sector trends are as follows.

- **Company policies and practices.** The literature available on the relocation of production, localisation, employment trends and integration is abundant. However, these issues are often addressed in relation to the effect on sales and market relations. There is limited literature that discusses company policies and practices, with the exception to CSR policies, in relation to the life cycle of clothing and the impacts that may occur in the UK and abroad. In addition, there is limited information available on the effectiveness of CSR policies and whether goals are achieved and do provide environmental and social benefits. There is also limited evidence on supply chains, labelling and provision of information for customers.
- **Consumer trends.** The available literature on consumer trends focuses on what consumers are buying and how much they are spending. But there is no information on what drives consumer purchases. Evidence of why consumers buy clothing with organic cotton is currently unavailable. There is very limited information on how changes in consumer trends such as fashion and comfort, affect environmental and social impacts. For example, the trend of discount fashion is documented, but the impacts of this are not well researched. There is lack of evidence that discusses the impacts of the increasing amount of clothing that is being sold and purchased at supermarkets. There is also lack of information on what the drivers and incentives are that influence consumer trends and behaviour.

There is no evidence to suggest what proportions of on-line clothing sales are returned. This must be investigated before the scale of the impacts of this trend can be quantified.

- **Alternative crops.** There is literature available that presents some life cycle information on alternative crops, such as the reduced amount of toxic chemicals used for organic cotton production. However, there is limited information on whether or not promotion of organic crops have social benefits, such as improved working conditions for organic cotton farmers. There is also limited information available on who would lose out if organic crops were to be required. Some traditional cotton growing areas may not be able to produce organic cotton, due to the

natural conditions. There is also limited information on the impacts of producing hemp, flax, jute, bamboo and nettle for clothing purposes. Information on new textiles, such as Tencel is available, but is limited to product information and uses.

- **Fair trade crops.** There is limited information on the environmental benefits of fair trade crops. Literature tends to address the economic impacts associated with fairly traded goods. In addition, fair trade clothing tends to be made of cotton and therefore represents a very small percentage of the clothing industry.
- **Genetically modified (GM) crops.** GM crops are a contentious issue with numerous literature sources both for and against. The majority of this information relates to food crops. A data gap exists for GM crops used for clothing.

Table 6.3 Summary of gaps for sector trends

Impact area	Availability of literature	Life cycle gaps	Geographic gaps	Clothing material gaps	Key gaps
SECTOR TRENDS - COMPANY POLICIES AND PRACTICES					
Corporate social responsibility (CSR)	High	✓	✗	✗	1) Policies not discusses in life cycle context and 2) no evidence on the effectiveness of CSR policies
Alternative, fair trade and GM crops	Low	✓	✓	✗	Does not relate to life cycle impacts
Relocation of production & manufacturing	Medium	✓	✓	n/a	Limited literature that relates to life cycle impacts in UK
Localisation	Medium	✓	✗	n/a	Same as above
Employment	Medium	✓	✗	n/a	Same as above
Integration	Medium	✓	✗	n/a	Same as above
SECTOR TRENDS - CONSUMER TRENDS					
Discount fashion	Low	✓	✗	✓	Does not relate to life cycle impacts or how discount fashion may be changing the demands for certain materials
Consumer awareness	Low	✓	✗	✓	Same as above
Synthetic versus non-synthetic materials	High	✗	✗	✗	None
Online sales	Low	✓	✗	✗	Limited literature on the life cycle impacts of online clothing shopping

6.5 Technological Developments

The evidence for technological developments in the clothing sector focuses on technology description, development and application as well as sales. Primary gaps are as follows. *Table 6.4* summarises technological development gaps.

- **Environmental and social impacts.** There is limited information on the environmental and social impacts of technological developments such as 'smart' fibres, coatings and RFID chips. The literature states why these products are useful to the clothing sector, but does not indicate whether their will be a positive or negative impact on the environment or those involved in production. For example, are there health implications for workers who are involved with applying new surface coatings to fabrics?
- **Life cycle impacts.** There is limited literature that addresses the life cycle impacts of new technologies. For example, what are the end of life impacts for clothing with fibre surface coatings or products that contain RFID chips?
- **Effectiveness.** Several of the technologies, such as fibre surface coatings and waterless cleaning, are designed to reduce the environmental burden during the consumer use stage. However, there is no literature that indicates whether these technologies are being used effectively and actually resulting in environmental benefits.

Table 6.4 Summary of gaps for technological developments

Impact area	Availability of literature	Life cycle gaps	Geographic gaps	Clothing material gaps	Key gaps
Computer aided design (CAD)	Low	✓	✓	n/a	Limited literature on how technology is related to the life cycle of clothing and geographical scope
Automated systems	Low	✓	✓	n/a	Same as above
Biodegradable clothing	Low	✓	✓	n/a	Same as above
‘Smart’ fibres	Low	✓	✓	✗	Same as above
Fibre surface coatings	Low	✓	✓	✗	Same as above
RFID chips	Low	✓	✓	n/a	Same as above
Waterless cleaning	Low	✓	✓	n/a	Same as above
Non-solvent dry cleaning	Low	✓	✓	n/a	Same as above
Textile colouration technologies	Low	✓	✓	n/a	Same as above
Clothing recycling and reuse technologies	Medium	✗	✗	✗	None

6.6 Initiatives

There is a wealth of literature on initiatives related to the clothing and textile industry. Major gaps are as follows. *Table 6.5* summarises gaps for initiatives.

- **Life cycle perspective.** Very few reports provide information from a life cycle perspective. They generally focus on only one aspect of clothing consumption and production. For example, initiatives based

on reducing pesticide use may not address a decreased cotton yield and how that would affect cotton farmers.

- **Effectiveness.** There are limited reports that assess the effectiveness of initiatives. Often the only information available is produced by the initiative itself, and could therefore be viewed as biased.

Table 6.5 Summary of gaps for initiatives

Impact area	Availability of literature	Life cycle gaps	Geographic gaps	Clothing material gaps	Key gaps
Fair trade	Medium	✓	x	x	Literature does not address all life cycle stages
Labour and working conditions	Medium	✓	x	x	Literature does not address all life cycle stages
Environmentally clean production	High	x	x	x	None

6.7 Impacts

The major gaps for environmental and social impacts are as follows. *Table 6.6* Summarises gaps by impact.

- **Clothing material.** There is limited information on clothing materials other than cotton, polyester and wool.
- **GHG emissions.** There is abundant information on the amount of energy or fossil fuel required at different life cycle stages; however, this is not often presented in terms of GHG emissions. There are also very few reports that compare the GHG emissions from different life cycles for synthetic and non-synthetic materials to indicate where the most significant impact occurs.
- **Soil degradation and contamination.** There is limited information available on soil degradation and contamination, especially in relation to materials other than cotton. Fossil fuel extraction is necessary for the production of synthetic fibres. However, there is no evidence that relates the contamination from this practice to the clothing industry.

- **Biodiversity and land use.** There is limited information available on biodiversity and land use. Limited information is provided with regard to arable land need for crop cultivation and animal farming, but the majority of the literature is focused on cotton.
- **Resettlement.** There is limited information available on resettlement in relation to the clothing industry and whether or not this is an issue.
- **Community health.** The majority of information on the social/health impacts of the production of synthetic fibres and fabrics was based on information for the USA, Australia and the UK. However, these impacts are transferable to any context where synthetic fabrics are produced. Working standards in developing countries may differ from those in the countries where this literature is produced. Evidence is required on community health in areas that produce that majority of clothing that is imported to the UK (ie Hong Kong, China, Turkey etc).
- **Cultural impacts.** There is little information on the cultural impacts of clothing consumption and production.

Table 6.6 Summary of gaps by impact

Impact area	Availability of literature	Life cycle gaps	Geographic gaps	Clothing material gaps	Key gaps
Resource consumption	High	✗	✗	✓	All materials other than cotton, polyester and wool
GHG emissions	High	✗	✗	✓	Same as above
Solid and hazardous waste	High	✗	✗	✓	Same as above
Air/water pollution	Medium	✗	✗	✓	Same as above
Soil degradation/contamination	Medium	✓	✓	✓	Same as above
Biodiversity/land use	Medium	✓	✓	✓	Same as above
Worker rights	High	✗	✗	✗	Does not address user countries
Worker health and safety	High	✗	✗	✗	Does not address user countries
Resettlement	Medium	✓	✓	✓	Limited information in relation to clothing
Community health	Medium	✓	✓	✓	Addresses mainly producing countries
Cultural impacts	Medium	✓	✓	✓	Does not address life cycle stages
Economic impacts	High	✗	✗	✗	None

6.8 Life Cycle Stage

Major gaps in relation to life cycle stages are as follows. *Table 6.7* summarises data gaps by clothing material.

- **Complete analysis.** There are very few studies that contain complete analyses for all life cycle stages.

- **Focus on early stages.** The literature focuses primarily on raw material growth, acquisition and processing, as opposed to the later life cycle stages. The exceptions to this are for cotton, polyester and wool, where several full life cycle studies have been completed. However there are differences in what each full life cycle study includes in terms of system boundaries. For man made fibres (polyester, viscose etc.) the environmental hotspot is the raw material phase indicating that the embodied impact from the extraction of fossil fuels is included. For natural fibres, embodied energy use for production of fertilisers and pesticides as well as energy consumption for irrigation and tractors etc. is included in some of the investigated studies (eg. Ref 20)
- **Distribution.** Life cycle information is only available for cotton, polyester, rayon and wool. Although significant data gaps exist, estimates can be made for the other materials, based on their weight and the distance they must be transported for distribution.

6.9 Geographic Scope

Major gaps, geographically, are as follows.

- **User countries.** A large proportion of the literature focuses on countries where clothing is produced rather than where it is used, most notably China, India, parts of Africa, and Eastern European and South American countries often correlating with the distribution of raw materials.
- **Social and health impacts.** In contrast, the majority of information on the social/health impacts of the production of synthetic fibres and fabrics was based on information for the USA, Australia and the UK. However, these impacts are transferable to any context where synthetic fabrics are produced.
- **Country monitoring of impacts.** The environmental and social impacts vary widely, depending on each country's legislative controls that are imposed on industry and whether they are enforced. It is difficult to identify all impacts in all clothing producing countries due to lack of accessibility and monitoring.
- **Sector trends.** There is limited literature on the influence of sector trends on global and UK clothing consumption and production. The literature indicates that some countries will benefit from technology while some will not, but does not elaborate on the extent of the burdens and benefits.

6.10 Clothing Material

Major gaps for clothing materials are as follows.

- **Non-transferable information.** A number of papers contained credible and reliable research on the uses of fabrics and materials for purposes other than clothing, which deemed the research not easily transferable to this project.
- **Synthetic vs non-synthetic.** The main bodies of literature mainly focus on the environmental and social impacts for cotton and polyester clothing items. Some impacts relating to polyester production are transferable to other synthetic fibres (ie transportation, use, etc). This is also the case with cotton and some non-synthetic fibres.
- **Less common materials.** The research identified relatively few studies for clothing using hemp, flax, jute, rayon, down, leather, polypropylene, acrylic, nylon, PVC and novel fabric materials and none for silk. These materials have not been studied in great depth in the life cycles following the production stage. There is also limited information on the impacts of less common textile materials, such as Tencel. The available evidence focuses on the uses of the textiles rather than the impacts of production and use.
- **Social impacts.** The research identified a relatively few social impacts associated with wool, acrylic or novel fabric materials, and none for down, hemp, flax or jute, polypropylene, acrylic and PVC.

Table 6.7 Summary of data gaps by clothing material

Material	Availability of information	Major gaps
Non-synthetic		
Silk	Low	All life cycle stages. Distribution and transportation information transferable from other life cycles.
Wool	Medium	None
Cotton	High	None
Hemp	Medium	All life cycle stages other than production. Distribution and transportation information transferable from other life cycles.
Flax	Medium	Same as above
Jute	Medium	Same as above
Leather	Medium	All life cycle stages other than production and finishing. Distribution and transportation information transferable from other life cycles.
Synthetic		
Rayon/viscose	High	None
Polyester	High	None
Polypropylene	Low	All life cycle stages other than production. Distribution and transportation information transferable from other life cycles.
Acrylic	Low	Same as above
Nylon	Medium	Same as above
PVC	Low	Same as above
Novel fabric materials	Low	All life cycle stages. Distribution and transportation information transferable from other life cycles.

7 Recommendations for further work and recommendations for UK interventions

7.1 Existing Data

Recommendation for further work

When using existing LCA studies as a data source for building an evidence database suitable for policymaking, detailed insight into how each LCA was conducted must be taken into account, such as the estimations and assumptions made when defining the system boundaries, data requirements, and data quality, to understand the specific goal of the study. For clothing, this is especially relevant since large parts of the life cycle impacts occur in developing countries (eg in South-East Asia) where reliable data are scarce and where the LCA community so far has not been able to quantify how an emission of a substance impacts the local environment. Studies should be used using specific data from the regions where the manufacturing takes place and subsequently an interpretation using environmental impacts that are problematic in that area, such as salination, biodiversity, soil erosion etc. Using existing LCA studies conducted using European LCA data and interpreted with European impact assessment methodologies could potentially lead to erroneous conclusions. There is a clear gap in LCA studies conducted in developing countries both in terms of using data from the region and modelling the impacts as they occur in the region.

Recommendations for UK interventions

It is recommended that Defra should investigate and participate in the work currently being carried out under the UNEP/SETAC LCA initiative where LCA studies/databases/methodologies are developed for these countries.

7.2 Clothing materials and consumer behaviour

Recommendation for further work

Life cycle studies of alternative clothing materials are needed to support any evidence that polyester, viscose or cotton can be substituted with materials such as hemp, bamboo, acrylic, poly propylene. Furthermore more evidence is needed to justify the use of polyester/viscose over cotton. Environmental and social life cycle assessments should be conducted for the alternative materials where data gaps were identified. The studies should also include market information to ensure that any investment in alternative materials to substitute cotton or polyester is economically viable. It is clear that any recommendation to substitute cotton, polyester etc should not result in

significant social impacts such as job losses. Furthermore the study should include a technological assessment to ensure that alternative materials are functionally equivalent in terms of quality etc.

Although the evidence we found showed that polyester needs less intensive washing and drying, this should be supported by more research into consumer behaviour. In theory, man made fibres contribute less to the use phase of the life cycle than cotton, but only if the consumer is treating the materials separately by sorting the clothes into material type before washing and drying. If the consumer simply sorts clothes into colour, this indicates that both polyester and cotton will be washed and dried together.

Recommendations for UK interventions

Any intervention to reduce the impact of the use phase of the life cycle of clothing should build upon existing initiatives and campaigns (Wash at 30° etc). A number of technologies to support a UK intervention to reduce the environmental impact are already available:

- A+ rated washing machines;
- A rated tumble dryers;
- laundry detergent enabling 30° washing; and
- "Green" electricity.

The challenge for policy makers is therefore to encourage the use of these technologies and make it attractive for consumers to purchase green energy or energy saving products. This could be achieved by governmental subsidies but equally important campaigns and information material on how the consumer should use the technologies correctly must be made available.

7.3 Technological developments and innovations

Recommendations for further work

New technologies used in clothing applications have the potential to contribute to making clothing more sustainable. Fibre coatings, waterless cleaning and the reuse of fibres have the potential to use fewer resources and introduce environmental benefits throughout the life cycle. However, the consumer needs to be aware of these technologies and use them correctly for them to contribute to making clothing more sustainable, eg use dry cleaners with non solvent based cleaning, and not wash fibre coated clothing types as intensively as regular clothing types.

No evidence is available for the use of genetically modified (GM) crops growing for textile fibres similarly there is no evidence of environmental and social differences in the life cycle impacts of organic cotton when compared with conventional cotton. It is recommended that a full LCA comparing

organic and conventional cotton as well as further research on the use of GM crops for textile fibres, should be undertaken.

The full life cycle assessment of organic and conventional cotton should also take into account issues such as supply limitation of organic cotton which, in part, is caused by competition for land to grow edible crops. If more land is needed to supply an equivalent amount of organic cotton compared to conventional cotton it is clear that a full substitution to organic cotton is unlikely to be feasible because of the competition of land. In that case, the LCA should not compare 100% organic cotton with 100% conventional cotton but a mix of organic cotton and conventional cotton (maybe 50/50) with 100% conventional cotton.

The recyclability of SMART fibres and other technologically enhanced fibres is unknown and should be further investigated.

Recommendations for UK interventions

For any technological developments or innovations to contribute to reducing environmental or social impacts it is essential that the users of the technologies or technology enhanced products use them correctly. To ensure this, information and user guidelines must be made available through campaigning or other information channels (house delivered brochures etc).

The new RFID technologies mean that clothing would fall under the WEEE Directive, which would introduce a take back scheme at end of life. This introduces the opportunity for policy makers to setup an efficient logistic system for clothing collection and subsequent disassembly, reuse and recycling.

7.4 Consumer behaviour – shopping, maintenance and reuse/recycling

Recommendations for further work

The evidence showed a clear potential for the consumer to play a key role in reducing the impacts from their consumption of clothing either in terms of shopping patterns (fast fashion), or clothing repair and reuse/recycling of clothing.

Fast fashion is dominating the consumption pattern for clothing. However, evidence also showed a significant increase in clothing containing organic cotton. However there is no evidence to indicate why consumers buy clothing with organic cotton. It is clear that the perception of the consumer is that organic cotton is environmentally and socially better than conventional cotton but the reason for this is unknown and should be investigated further.

Fast fashion results in cheap low quality clothing that is often not suitable for repair or reuse/recycling. To enhance clothing repair, recycling of textile and reuse, via charity shops for example, a certain high level of quality is needed. The environmental and social impacts of replacing fast fashion's cheap clothing with better quality clothing are unknown and it is recommended that this is investigated further. When conducting such a study, it is essential to focus on the environmental benefits from clothing repair, recycling and reuse while considering the potential social implications of how longer lasting clothing will reduce the demand for clothing from developing countries and the subsequent consequences for the livelihoods of the people working in the textile industry in these countries.

There is no clarity on the volume of clothing going to charity shops, especially discount fashion items. The charity shops say this is increasing but the Defra Textiles study 2006 (Ref. 234) says it is decreasing.

Recommendations for UK interventions

Interventions to reduce environmental impacts must focus on longer lasting clothing through the use of better quality fibres suitable for recycling and reuse. The success of such an intervention depends on the capability to educate the consumer on the benefits related to proper end of life management of clothing such as reuse in charity shops or recycling of the fibres. Information campaigns will be needed to ensure proper education.

However, before initiating any intervention it is essential that the potential social consequences have been addressed in the entire supply chain.

It seems unavoidable that any intervention will have a negative effect somewhere in the supply chain. Weighting the consequences will be a very challenging but necessary task for policymakers.

7.5 Economic interventions and business initiatives

Recommendations for further work

Economic interventions can play a significant role in achieving more sustainable consumption of clothing in the UK. Removing subsidies from US cotton growers could favour countries such as India and China who, if they were to produce the cotton themselves, would have a more integrated production process. Since 2004, when WTO ruled that the US subsidies were unfair, a shift to producing cotton in developing countries has taken place. However no evidence of the environmental and social impacts of this transformation is available. It is recommended that this is investigated further. This investigation should focus on the environmental and social differences

between producing cotton in the US, China or India and other developing countries. Production of cotton already takes place in China and India and a further increase in production in these countries could result in less favourable situations in other countries such as Bangladesh.

Infrastructure in China is developing rapidly, and other developing countries will find it difficult to compete with China for this reason. China is constructing new coal powered power plants to supply electricity to the developing economy at an increasing rate, which indicates that shifting even more production to China could potentially have significant environmental consequences since any marginal increase in industrial activities results in an increase of fossil energy consumption

It is therefore essential that any such study should not only focus on shifting the cotton production from the US to China/India but also the knock-on effect that will take place in other developing countries (Bangladesh etc) when strengthening the industrial position of China and India. Such a study should aim to provide a better understanding of the social, environmental and trade-related issues that are particularly relevant for UK clothing consumption. Production of clothing that occurs in different country contexts, and at different points along the supply chain, merits further research in order to build a comprehensive picture of sustainable clothing.

Business has started to take responsibility for the global challenges often reflected in its CSR policies and sustainability reports. The effectiveness of CSR policies is not well known. More research is needed to identify which policies effectively reduce environmental and social burdens, and which do not. The research must also identify why certain policies are, or are not, working, and take into account UK clothing consumption and production from a life cycle perspective.

Many clothing companies have moved to locations where labour rates are more competitive. This has resulted in closure of production facilities in Europe or North America and movement of manufacturing to Asia or Latin-America. The challenge is to undertake such changes in a way that it both creates new jobs and values and mitigates the negative impacts of closure of existing manufacturing. This can be done by working with government to attract other businesses and recruit among redundant workers. Evidence of the environmental and social impacts related to this is not available and it is recommended that this is investigated further.

However, the evidence also showed that some companies (ZARA and Wal-Mart) have successfully moved their production of clothing to European countries such as Turkey and Portugal to be much closer to the European market. This has created jobs in the EU as well as reducing the need for

transport resulting in a positive environmental impact compared to transporting clothing from Asia or India.

Recommendations for UK interventions

Any intervention should use the current momentum of businesses who are taking responsibility for their environmental and social impacts throughout the supply chain. Learning from all the work that businesses have done up to now is crucial for any intervention to succeed. SustainAbility has put together a database¹ from which it is possible to compare sustainability reports and targets per sector. Analysis of this database could provide evidence on successful CSR policies that could be reflected in any political interventions coming from the UK.

¹<http://reporting.sustainability.com/sustainability/site/home.acds?context=2180057&instanceid=2180058>

Annex A1

Literature Review Tables -
Environmental Impacts

Acrylic - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Environmental Assessment of Textiles (Environmental Project No. 369)	Danish Environmental Protection Agency (DEPA) (1997)	Acrylic, cotton, wool, viscose and polyester.	Various	Resources, production, use and disposal.	Water emissions, energy consumption, toxicity and waste production.	EU	The resources used and emissions per life cycle stage (ie production of acrylic fibres) is expressed as an inventory but not assessed in terms of LCIA. The study further contains the environmental exchanges for the clothing production, use and disposal phase, but for clothing in general.	Eco-toxicity and human toxicity of chemicals.	N/A	N/A	http://qlwww.mst.dk/udgiv/publications/1997/87-7810-838-1/pdf/87-7810-838-1.PDF	High	Medium	High	Low
2	Ecolabel - textiles	European Commission (2002)	All textile materials.	Various	Fibre production only.	Residual acrylonitrile content in fibre and emissions to air of acrylonitrile during polymerisation.	EU	N/A	Toxicity of acrylonitrile.	N/A	N/A	http://ec.europa.eu/environment/ecolabel/product/pg_clothing_textiles_en.htm	High	High	High	Low
3	The path to more environmentally sound production of textiles	Laursen S E, Schmidt A and Bagh J (1999) Danish Technological Institute, Clothing and Textiles Division	Acrylic, cotton, wool, viscose and polyester.	Various	Production	Water emissions, energy consumption, toxicity and waste production.	EU	This report present a number of tools aimed at facilitating serious and structured work with the environmental and health aspects of textiles containing cotton, wool rayon, polyester or acrylic fibres. The tools are divided according to type of fibre and type of company. Major environmental and health aspects off the life cycle of the textiles are assessed, and manufacturers can obtain good advice on an environmentally sound production process.	High noise level, waste generation and wastewater output.	Production	N/A	http://qlwww.mst.dk/udgiv/publikationer/2000/87-7944-183-1/pdf/87-7944-104-1.pdf	High	Medium	High	Medium

Cotton - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Well Dressed? The Present and Future Sustainability of Clothing and Textiles in the United Kingdom	University of Cambridge Institute for Manufacturing (2006)	Cotton, viscose and information on alternative fibres.	T-shirt, blouse and carpet.	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water; and solid waste. Social issues are also discussed.	UK; Reference to numerous countries where textiles are manufactured and cotton is produced.	About 0.6kg of oil equivalent primary energy is used in the industry per kg of output (about 0.4% of the UK total). About two kilograms of CO2 equivalent is emitted to air per kg output (about 0.4% of the UK total). Approximately 60kg of water is used (about 0.5%of UK total) and about 45kg of waste water is discharged per kg of output. The difference is lost as evaporation during textile wet processes (eg dyeing). About one kg of solid waste arises per kg of output (about 0.5% of UK total).	The sector's contribution to climate change is dominated by the requirement for burning fossil fuel to create electricity for heating water and air in laundering. Other major energy uses arise in providing fuel for agricultural machinery and electricity for production. Water consumption – especially the extensive use of water in cotton crop cultivation – can also be a major environmental issue as seen dramatically in the Aral Sea region.	For conventional cotton products, the requirement for energy is driven by laundry, but the use of toxic chemicals is driven by agriculture. In contrast, for viscose, energy use is dominated by production.	Volume of UK expenditure for clothing and market trends were addressed. Alternative materials and 'smart functions' were also discussed.	http://www.ifm.eng.cam.ac.uk/sustainability/projects/mass/UK_textiles.pdf	High	High	High	High
2	Methodological Issues in the LCA Procedure for the Textile Sector A case study concerning fabric for a sofa	Environmental Systems Analysis. Chalmers University of Technology, Göteborg, Sweden. Lisbeth Dahllof (2004)	Cotton, polyester and wool.	Sofa fabric	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water; and solid waste.	Sweden	This report lists numerous quantitative measures for significant impacts.	For cotton the most significant impact was cultivation and wet treatment of the fabric (the processes includes dyeing). For polyester, there most significant impact was polyester production. For wool production, the most significant impact was sheep farming, ring spinning and nylon fiber production, wool scouring.	Production		http://www.esa.chalmers.se/Publications/PDF-files/TR/ESAreport20047.pdf	High	High	High	High
3	Environmental Indicators of Textile Products for the ISO (Type III) Environmental Project Declaration	Eija Nieminen-Kalliala (2003)	Cotton	Woven fabrics for bed sheets, printed interior fabrics, knitwear, T-shirts, women's tights and terry cloth. Industrial fabrics used for the manufacturing of work clothing, and of bed sheets for hotels and hospitals, were also examined.	Manufacturing	A proposal has been developed for the formulation of technical environmental indicators of different types of textile products.	Finland	Not addressed directly.	Not addressed directly.	Not addressed directly.	Volume of Finnish expenditure on clothing and market trends were addressed.	Tampere University of Technology, Institute of Fibre Materials Science PO Box 589, 33101 Tampere, Finland. AUTEX Research Journal Vol. 3, No4, December 2003 © AUTEX (http://www.autexj.org/No4-2003/0056.PDF)	High	High	High	Low
4	Report 3: Textile Processing Techniques	British Textile Technology Group (1999)	Cotton, polyester and others.	Various	Production and manufacturing.	Toxic chemicals, waste and effluent.	Global	There is quantitative data for toxic chemicals, waste and effluent.	Waste	The paper addressed production and manufacturing.		http://www.e4s.org.uk/textilesonline/content/pdfs/report3.pdf	High	Medium	High	High
5	Report 4: Textile Mass Balance and Product Life Cycles	British Textile Technology Group (1999)	Cotton/polyester blend (and a number of other combinations).	Bed sheets	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water/pesticides; and solid waste.	UK	0.28 GJ of energy and 7.36 m3 of water are consumed in the life cycle of a set of sheets. After three years the sheet (0.80kg) would probably be either torn up and used as rags or immediately thrown into the dustbin. It is unlikely that it would be recycled.	N/A - This paper provided mass balance data.	This paper addressed the issue that the whole concept of product life-time, design, fashion and the responsibility for re-use have to be reassessed. A culture built on the idea of wastage needs to be dismantled and a new way introduced.	Volume of UK expenditure for clothing and market trends were addressed.	http://www.e4s.org.uk/textilesonline/content/pdfs/report4.pdf	High	Medium	High	Medium
6	Environmental Impacts of Different Cotton Growing Regimes	Tobler M I and Schaerer S (2001) Swiss Federal Institute of Technology Zurich	Cotton	N/A	Production/ agricultural practices	Water use, use of toxic chemicals and soil conservation.	Texas, USA	Water consumption, pesticide use and soil erosion can be significant concerns depending on which method of cotton growing method is used.	Water consumption, soil erosion, and pesticide use.	Improvements could be achieved by three main activities: selection of best practices, regulations and incentives, as well as education for sustainability.	Some technology used during cotton growing is discussed.	Institute for Manufacturing Automation Sustainable Textile Production ETH Center, CH 8092 Zurich Address: CLA F 23 Tel. ++411 632 21 98 / Fax ++411 632 13 18 marion.tobler@produktion.bepi.ethz.ch (http://cost628.texma.org/assets/009_ToblerSchaerer.pdf)	High	High	High	High
7	Life Cycle Assessment: Environmental Profile of Cotton and Polyester- Cotton Fabrics	Kalliala E M and Nousiainen P (1999)	Cotton and cotton/polyester	Bed sheets	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use, water consumption and use of toxic chemicals.	Finland	Water consumption due to irrigation is between 7 m3/kg to 29 m3/kg compared to the approximately 17 l/kg of water consumption in polyester fibre production. The use of fossil resources as raw-materials and in energy production causes high CO2 emissions into the air, which rapidly increases the global warming potential.	Energy use and water consumption.	Cotton fibre production consumes about 40% less energy than polyester fibre production. Cotton growing requires, however, huge amounts of water: irrigated amounts vary from 7 to 29 tons per kg of raw cotton fibres. Pesticides and fertilizers used in traditional cotton cultivation have ecotoxic effects in contrast to organic cotton cultivation, where natural alternatives to agrochemicals are used. It could also be concluded that 50/50 CO/PES sheets in hotel use have fewer environmental impacts than 100% CO sheets. This is due to the higher durability as well as lower laundering energy requirements of 50/50 CO/PES sheets.	N/A	Eija M.Kalliala, and Pertti Nousiainen, Tampere University of Technology, PO Box 527, 33101 Tampere, Finland, Europe http://www.leeds.ac.uk/autex/v1n1/2264_99.pdf	High	High	High	High

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8	Life Cycle Assessment of Cotton/Polyester Fabric in B05 Company	Sára B, Di Giovannantonio S and Tarantini M (2003) FEBE EcoLogic/ENEA	Cotton	N/A	Production and manufacturing.	Energy use, water consumption and use of toxic chemicals.	Belgium	The product system requires 49 litre of water for 1 kg of product. Production of electricity is not a significant issue. Hydrogene peroxide production (for wetting/bleaching) has significant contribution to acidification, human toxicity, photochemical smog and eutrophication.	Water consumption and use of toxic chemicals.	The processing/manufacturing stages of the life cycle are responsible for the significant impacts.	N/A	Studio As sociato di Con s ulenza e Formazione Ambientale "Sára Balázs & Associati" Via Canalazzo, 44 48100 Ravenna - Italia Tel. & Fax. +39-0544-465722 www.febe-ecologic.it info@febe-ecologic.it http://spring.bologna.enea.it/to wefo/results_public_area/D20 %20LCA/D20%20LCA_B05.pdf	High	High	High	High
9	Life Cycle Assessment in the Supply Chain: A Review and Case Study	Michael Browne Transport Studies Group, University of Westminster, London, UK; Christophe Rizet NRETS, Arcueil, France; Stephen Anderson Transport Studies Group, University of Westminster, London, UK; Julian Allen A1, Basile Kelta, B2K Consultants L Hay – Les Roses, France. 2005.	Cotton	Jeans	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use	UK, France		Energy use	Location from which cotton is sourced can have a major impact on the total energy used in commercial transport in the jeans supply chain. However, overall, this has a limited impact on the total energy used in producing and supplying jeans. This is because the vast majority of total energy used in the supply chain is consumed during cotton cultivation, denim production and jeans manufacture. The work also demonstrates that the amount of energy used by consumers transporting jeans to their homes by car can be greater than the total commercial transport energy used in the supply chain (per kg of jeans transported).	Unknown	http://taylorandfrancis.metapress.com/rzrm22q4oxcouf3hz4.pwr245/app/home/contribution.asp?referrer=parent&backto=searcharticlesresults,1.959:or-http://www.ingentaconnect.com/content/routledg/itr/2005/00000025/00000006/art00007	High	Unknown	High	Unknown
10	Streamlined Life Cycle Assessment of Two Marks & Spencer plc Apparel Products	Marks and Spencer (2002) Prepared by ERM	Cotton and polyester	Polyester pants and men's cotton briefs	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use	UK	The total extracted energy consumption associated with the lifetime of a three pack of men's briefs has been calculated to be 107 kWh. The total extracted energy consumption associated with the lifetime of a pair of trousers has been calculated to be 200 kWh.	Energy use	79.4% of the energy use is from the consumer.	N/A	Environmental Resources Management Eaton House, Wallbrook Court, North Hinksey Lane Oxford OX2 0QS Telephone 01865 384800 Facsimile 01865 384848 Email post@ermuk.com http://www.ermuk.com http://forum.europa.eu.int/Public/irc/env/waste_strat/library?l=latest/eurocommerce_spencerpdf/2/ EN_1.0_&a=d	High	High	High	High
11	Four Alternatives Compared: Table Cloths	Danish Textile Service Association (2004)	Cotton, polyester, cotton/polyester mix and paper.	Table cloths	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use	EU	Not listed in abstract.	Energy use	The majority of energy use was in the consumer use stage. The conclusion of this study was that paper table cloths have the least impact.	N/A	http://www.lca-center.com/site.asp?p=4025	High	High	High	Low
12	Life Cycle Assessment of Disposable and Reusable Nappies in the UK	Environment Agency (2005) Prepared by ERM	Cotton	Nappies	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Global warming; ozone depletion; summer smog formation (photo-oxidant formation); depletion of non-renewable reserves (depletion of abiotic resources); nutrient water pollution (eutrophication); acidification; human toxicity; and aquatic and terrestrial toxicity measures.	UK	Global warming and non-renewable resource depletion impacts, over the 2.5 years for which a child is assumed to be using nappies, are comparable with driving a car between 1300 and 2200 miles.	N/A	N/A	N/A	http://publications.environment-agency.gov.uk/epages/eapublications.storefront/458aabc00168114c273fc0a8029606af/Product/View/SCHO0505BJCW&2DE&2DE#	High	High	High	Medium
13	Life Cycle Analysis of Cotton Towels: Impact of Domestic Laundering and Recommendations for Extending Periods Between Washing	Blackburn R and Payne J (2004) Green Chem., 2004, 6, G59 - G61, DOI: 10.1039/b407628a	Cotton	Towels	Use	Energy, water, and chemical consumption	Unknown	It was found that any process or treatment that could reduce the washing frequency of that product would be likely to effect a significant reduction in energy, water and chemical consumption over a given time for that product, hence providing a greener life cycle for the product; one recommendation to achieve this, by reducing washing frequency, is through the use of anti-microbial finishes such as poly (hexamethylenebiguanide).	Laundering	Use	N/A	http://www.rsc.org/publishing/journals/GC/article.asp?doi=b407628a	High	Unknown	High	Unknown
14	Texpert's from Fibers to Finish	Cognis (2001)	Cotton and others	N/A	Production	Chemical use	Global	N/A - this report gives details on what chemicals are used in the production of textiles.	N/A	Production	N/A	http://www.cognis.com/textiles/pdfs/0_B0b004_Lz.pdf	High	High	High	Medium

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15	The Travels of a T-Shirt in the Global Economy: An Economist Examines the Markets, Power, and Politics of World Trade	Pietra Rivoli (2005)	Cotton	T-shirt	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Social impacts	Global	Unknown - this book examines the global impact of the production, manufacturing, consumption, waste of a t-shirt.	Unknown	Unknown	Unknown	http://www.amazon.com/Travels-T-Shirt-Global-Economy-Economist/dp/0471648493	Low	Medium	Medium	Medium
16	An Analysis of Energy Use and Input Costs for Cotton Production in Turkey	Yilmaz I, Akcaoz H and Ozkan B (2004) Faculty of Agriculture, Department of Agricultural Economics, University of Akdeniz, Antalya, Turkey	Cotton	N/A	Production	Energy use	Turkey	The results revealed that cotton production consumed a total of 49.73 GJ/ha-1 of which diesel energy consumption was 31.1% followed by fertilizer and machinery energy. Output-input energy ratio and energy productivity were 0.74 and 0.06 kg of cotton MJ-1, respectively. Cost analysis showed that net return per kilogram of seed cotton was insufficient to cover costs of production in the research area. The most important cost items were labour, machinery costs, land rent and pesticide costs.	Only energy was addressed.	Only production was addressed.	N/A	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V4S-4D0Y35P-1&_coverDate=02%2F28%2F2005&_alid=527339384&_rdoc=1&_fmi=&_orig=search&_qd=1&_cdl=5766&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=f62b6571484fc27cdd914d8f9b640c1b	High	High	High	High
17	RUSLE Estimates of Soil Erosion in Cotton Production Systems in North Alabama	Nayakatawa E Z, Reddy K C and Lemunyon, J L (2001)	Cotton	N/A	Production	Soil erosion	USA	Quantitative data on soil erosion is provided in this report.	Only soil erosion was addressed.	Only soil erosion was addressed.	Only soil erosion was addressed.	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V4S-4D0Y35P-1&_coverDate=02%2F28%2F2005&_alid=527339384&_rdoc=1&_fmi=&_orig=search&_qd=1&_cdl=5766&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=f62b6571484fc27cdd914d8f9b640c1b	High	High	High	Low
18	The Sustainability of Cotton: Consequences for Man and Environment	Kooistra K and Termorshuizen A (2006) Biological Farming Systems, Wageningen University	Cotton	N/A	Production	Water use, human and environmental toxicity, global warming, eutrophication, acidification, erosion, land use, biodiversity and salinisation.	Global	Quantitative data on water use, toxicity and other key impacts are provided in this report.	Water use and pesticide use	Production	Social and trade issues were addressed.	http://www.wur.nl/NR/rdonlyres/C01C6409-28A3-4FEF-BABE-747020DDC25E/21267/Rapport223binnenWEB.pdf	High	High	High	Medium
19	Life Cycle Analysis of Hand-Drying Systems: Cotton versus Paper Towels	European Textile Services Association (2006)	Cotton	Continuous towels	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use, water use, waste, global warming potential, potential acidification of soil and water, nutrient enrichment of soil and water, and potential creation of photochemical ozone (summer smog)	EU	Data is provided on all impacts that are addressed.	Energy, greenhouse gases, and waste.	Production	N/A	http://www.etsa-europe.org/Etsa-Europe.org/news/documents/ETSA_LCA_Brochure_cotton_roll_towels_July06_EN.pdf	High	High	High	Medium
20	Life Cycle Assessment of Reusable Surgical Gowns	European Textile Services Association (2001)	Cotton (reusable vs disposable gowns)	Surgical gowns	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy consumption, global warming, acidification, eutrophication and post consumer waste.	EU	Data is provided on all impacts that are addressed.	N/A	N/A	N/A	http://www.epe.be/visionlab/workshops/march8/presentations/long.pdf	High	High	High	Medium
21	Environmental Assessment of Textiles (Environmental Project No. 369)	Danish Environmental Protection Agency (DEPA) (1997)	Acrylic, cotton, wool, viscose and polyester.	Various	Resources, production, use and disposal.	Water emissions, energy consumption, toxicity and waste production.	EU	The resources used and emissions per life cycle stage (ie production of acrylic fibres) is expressed as an inventory but not assessed in terms of LCIA. The study further contains the environmental exchanges for the clothing production, use and disposal phase, but for clothing in general.	Eco-toxicity and human toxicity of chemicals.	N/A	N/A	http://qlwww.mst.dk/udgiv/publications/1997/87-7810-838-1/pdf/87-7810-838-1.PDF	High	Medium	High	Low

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22	The Path to More Environmentally Sound Production of Textiles	Laursen S E, Schmidt A and Bagh J (1999) Danish Technological Institute, Clothing and Textiles Division	Acrylic, cotton, wool, viscose and polyester.	Various	Production	Water emissions, energy consumption, toxicity and waste production.	EU	This report present a number of tools aimed at facilitating serious and structured work with the environmental and health aspects of textiles containing cotton, wool rayon, polyester or acrylic fibres. The tools are divided according to type of fibre and type of company. Major environmental and health aspects off the life cycle of the textiles are assessed, and manufacturers can obtain good advice on an environmentally sound production process.	High noise level, waste generation and wastewater output.	Production	N/A	http://ghwww.mst.dk/udgiv/publikationer/2000/87-7944-183-1/pdf/87-7944-104-1.pdf	High	Medium	High	Medium
23	The Deadly Chemical in Cotton	Environmental Justice Foundation in Collaboration with the Pesticide Action Network UK (date unknown)	Cotton	Various	Production	Health and land, water and air toxicity	West Africa, Uzbekistan and India	Quantification of where cotton is produced and consumed and how many chemicals are needed	Production	Production	N/A	www.pan-uk.org	High	Medium	High	High
24	My sustainable t-shirt	Pesticide Action Network UK (date unknown)	Cotton	Various	Production, processing and manufacturing	N/A	UK	N/A - this report describes the production of fair trade and organic clothing	N/A	N/A	N/A	www.pan-uk.org	High	Medium	High	Medium

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Down - Environmental Impacts

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			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Goose Production - Chapter 10. Feather and Down Production	Food and Agriculture Organization of the United Nations (FAO) (2002)	Down	Various	Production	N/A	EU	N/A - This article outlines how goose down is produced.	N/A	N/A	Ethical treatment of animals.	http://www.fao.org/DOCREP/005/Y4359E/y4359e0c.htm	High	Low	High	Low

Flax - Environmental Impacts

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			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Report 3: Textile Processing Techniques	British Textile Technology Group (1999)	Flax and others	Various	Production and manufacturing.	Toxic chemicals, waste and effluent.	Global	There is some quantitative data on production and manufacturing of flax.	Waste	The paper addressed production and manufacturing.	N/A	http://www.e4s.org.uk/textilesonline/content/pdfs/report3.pdf	High	Medium	High	Medium
2	Engineering Flax and Hemp for an Alternative to Cotton	Ebskamp M J M (2002) Plant Research International. Wageningen, The Netherlands	Hemp, Flax	N/A	Production	Unknown	Unknown	Unknown	Unknown	Unknown	N/A	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TCW-45R7651-1&_coverDate=06%2F01%2F2002&_alid=512029050&_rdoc=1&_fmt=&_orig=search&_qd=1&_cdi=5181&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=8b72b6f55234b1a30c4a542a9cd9d406	High	Unknown	High	Unknown
3	Comparative Life Cycle Assessment of Three Insulation Materials	Schmidt A (date unknown) dk-Teknik Energy & Environment	N/A - this study was regarding the use of flax for insulation. Some growing and production information is relevant for textiles.	N/A	Production, manufacturing, collection, transport, and sorting, use and waste/recovery.	Global warming, acidification, generation of solid and hazardous wastes, and energy and water consumption.	Denmark	Flax insulation has the largest impacts of the three materials in most of the impact categories examined in the study.	N/A	N/A	N/A	http://www.p2pays.org/ref/37/36362.pdf	High	High	High	Low
4	Flax	Interactive European Network for Industrial Crops and their Applications (2002)	Flax	N/A	Production	N/A	Europe	N/A - Background information on the amount of flax produced in the EU.	N/A	N/A	N/A	http://www.ienica.net/crops/flax.pdf	High	High	High	Low
5	Cultivation and Processing Systems for the Cost Efficient Recovery of Fibres from Flax for Use as a Staple Textile	Rudkin S (2006) Industrial Crop Partnership Ltd UK	Flax	N/A	Production	Unknown	Europe	Unknown	Unknown	Unknown	Unknown	Steve Rudkin General Manager Industrial Crop Partnership Ltd Halstead Lodge, Swithland Lane Rothley Leics LE7 7SJ UNITED KINGDOM Telephone: 44 116 230 2341 Fax: 44 116 230 2341 http://www.biomatnet.org/secure/Fair/S904.htm	High	Unknown	High	Low
6	Annual Report of the Government-Industry Forum on Non-Food Uses of Crops	Defra (2002)	Flax and hemp	N/A	Production	Unknown	UK	This report outlines some of the non-food crops produced in the UK.	N/A	N/A	N/A	http://www.defra.gov.uk/farm/crops/industrial/pdf/forum-ann-rep-02.pdf	High	High	High	Low

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7	UK Flax and Hemp Production: The Impact of Changes in Support Measures on the Competitiveness and Future Potential of UK Fibre Production and Industrial Use	Defra (2005) Prepared by ADAS	Flax and hemp	N/A	Production	Toxicity	UK	The production of hemp and flax requires less fertilisers, herbicides and insecticides than that of other textiles.	N/A	N/A	N/A	http://www.defra.gov.uk/farm/crops/industrial/pdf/flaxhemp-report.pdf	High	High	High	Low

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Hemp - Environmental Impacts

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			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Life Cycle Analysis of Field Production of Fibre Hemp, the Effect of Production Practices on Environmental Impacts	Werf Hayo (January 2004) Euphytica, Volume 140, Numbers 1-2, January 2004, pp. 13-23(11) Publisher: Springer	Hemp	N/A	Production	Eutrophication, climate change, acidification and energy use.	France	The production of 1 ha of hemp yielded a eutrophication potential of 20.5 kg PO4-equivalents, a global warming potential of 2330 kg CO2-equivalents, an acidification potential of 9.8 kg SO2-equivalents, a terrestrial ecotoxicity potential of 2.3 kg 1,4-dichlorobenzene-equivalents, an energy use of 11.4 GJ, and a land use of 1.02 ha.year. A comparison of hemp (low impacts), wheat (intermediate impacts) and sugar beet (high impacts) revealed that the crops were similar for the relative contributions of emitted substances and resources used to impacts, and for the relative contribution of processes to impacts.	Eutrophication and the reduction of climate change.	Production	N/A	http://www.ingentaconnect.com/content/klu/euph/2004/00000140/F0020001/00004750	High	High	High	Unknown
2	Engineering Flax and Hemp for an Alternative to Cotton	Ebskamp M J M (2002) Plant Research International. Wageningen, The Netherlands	Hemp, Flax	N/A	Production	Unknown	Unknown	Unknown	Unknown	Unknown	N/A	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TCW-45R7651-1&_coverDate=06%2F01%2F2002&_alid=512029050&_rdoc=1&_fml=&_orig=search&_qd=1&_cdi=5181&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=8b72b6f55234b1a30c4a542a9cd9d406	High	Unknown	High	Unknown
3	Feasibility of Hemp Textile Production in the UK	BioRegional Development Group (2004)	Hemp	N/A	Production	Energy consumption	UK	This report summarises the ecological footprint vis-à-vis a series of tables. There are potential energy savings, in comparison with cotton, during the cultivation and fibre production stages.	N/A	Production		http://www.bioregional.com/programme_projects/pap_fibres_proq/hemp%20textiles/Feasibility_UK_hemp_textile_production.pdf	High	Medium	High	Medium
4	Annual Report of the Government-Industry Forum on Non-Food Uses of Crops	Defra (2002)	Flax and hemp	N/A	Production	Unknown	UK	This report provides detail on what non-food crops are produced in the UK.	Unknown	Unknown	Unknown	http://www.defra.gov.uk/farm/crops/industrial/pdf/forum-ann-rep-02.pdf	High	Low	High	Low
5	UK Flax and Hemp Production: The Impact of Changes in Support Measures on the Competitiveness and Future Potential of UK Fibre Production and Industrial Use	Defra (2005) Prepared by ADAS	Flax and hemp	N/A	Production	Toxicity	UK	The production of hemp and flax requires less fertilisers, herbicides and insecticides than that of other textiles.	N/A	N/A	N/A	http://www.defra.gov.uk/farm/crops/industrial/pdf/flaxhemp-report.pdf	High	High	High	Low
6	NF0307 - Hemp for Europe Manufacturing and Production Systems	Ministry of Agriculture, Fisheries and Food (date unknown)	Hemp	N/A	Production	N/A	UK	Report details production requirements.	N/A	N/A	N/A	http://www.defra.gov.uk/farm/crops/industrial/research/reports/rdrep12.pdf	High	High	High	Low
7	Hemp	Interactive European Network for Industrial Crops and their Applications (2002)	Hemp	N/A	Production	N/A	Europe	N/A - Background information on the amount of hemp produced in the EU.	N/A	N/A	N/A	http://www.ienica.net/crops/hemp.pdf	High	High	High	Low
8	A Supply Chain Assessment and Development for Hemp Bast Fibre in the Non-Woven and Technical Textile Industries. (NF0616)	Garrood J (2006) Springdale Crop Synergies Ltd. Sponsored by Defra	Hemp	N/A	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy inputs; air, water, and land emissions.	UK, Global	Unknown	Unknown	Unknown		http://www.nnfcc.co.uk/research/results.cfm	High	High	High	Low

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Jute - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - Is the evidence from a credible source?	(2) Reliability - Is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - Is the evidence free from bias?	(4) Transferability - Is the evidence usable for policy making?
1	LCA of PP-HDPE Woven Sacks vis-a-vis Jute and Paper Bags	Indian Centre for Plastics in the Environment (date unknown)	Jute	Bags	Resource consumption and recovery.	Emissions to air, water and land.	India	The consumption of energy is 333 Thousand GJ/MMT of packed product for jute sacks. Energy consumption related to transportation of bulk goods shows that transportation in jute sacks requires significantly excess amount of energy, being about 2036 GJ/MMT of packed product in case of jute sacks. The production of jute sacks requires utilization of chemicals in the amount of 258 ton/MMT of packed product.	Energy consumption and emissions.	Production and transportation.	Human toxicity	http://www.envis-icpe.com/lifecycle.html#LCA	Unknown	High	Medium	Medium
2	Life Cycle Analysis Study of Synthetic, Jute and Paper Woven Sacks	Indian Institute of Technology (2002) Sponsored by Indian Centre for Plastics in the Environment (ICPE)	Jute	Bags	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Water, energy and chemical consumption.	India	333,000 GJ of energy are required to grow and produce 12,290 tonnes of jute sacks. 21,7000 litres of water are needed to produce 12,290 tonnes of jute sacks. 258.5 tonnes of chemicals are needed for the production of the same amount.	Energy and water consumption.	Production	None	Not completed yet.	High	Unknown	Unknown	Unknown
3	Report 3: Textile Processing Techniques	British Textile Technology Group (1999)	Jute and others	Various	Production and manufacturing.	Toxic chemicals, waste and effluent.	Global	There is no significant quantitative data for jute.	Waste	The paper only addressed production and manufacturing.	N/A	http://www.e4s.org.uk/textilesonline/content/pdfs/report3.pdf	High	Low	High	Medium
4	Feasibility of Jute Products with a View to Develop Ecolabel Criteria through LCA and Stakeholder Consultation	Jute Manufacturers Development Council, Ministry of Textiles, Government of India (date estimated to be 2005) Prepared by PwC	Jute	Various	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Global warming, acidification, eutrophication, natural resource depletion, solid waste, smog, and air quality.	India, EU, USA	N/A - quantitative information is on imports and exports.	N/A	N/A	Human toxicity	http://www.jute.com/ecolable/dossier_annex%20II.4.ppt#324.3.Preamble http://www.jute.com/ecolable/dossier_annex%20II.4.ppt	High	Medium	High	Medium

Leather - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Use of LCA in the Procedure of the Establishment of Environmental Criteria in the Catalon Eco-label of Leather	Canals M I et al (2002)	Leather - chrome-tanned leather (mainly used in shoes)	Clothing and shoes	Cradle to gate - agriculture for feedstuff, dairy farm and calf growing (only 7.7% allocation to leather, based on economic value) Calf Growing - Slaughterhouse - Storage - Chrome Tannery - Also included are fertilizer production, salt production (storage) and chromium sulphate production.	Standard impact categories were chosen, as well as separate impact indicators.	Catalonia (except for fertilizer and chromium sulphate production)	Life cycle figures available are for the tanning of 1000 kg of salted hide.	Toxicity and GWP from the are identified as significant impacts.	Agriculture (Fossil Energy Use & Aquatic EcoTox) - cattle raising (GWG, smog, Acid, &N) and tannery (GWP, Htox, TerTox) is the most significant hot spots in terms of most impact categories	N/A	International Journal of LCA 7 (1) 2002	High	High	High	High
2	IPPC Ref Doc on BAT Tanning Hides and Skins	European Commission (2003)	Leather	Clothing and shoes	Tanning - from rawhide to leather which can be used in clothing or shoe manufacture (manufacturing and finishing)	Emissions to water and air	EU	Descriptive document - provides industry stats, used techniques, mass balance, chemicals used (given ID of tanning as being a hotspot in the Catalonian study - the information on the chemicals could be used for further detail)	N/A	N/A	N/A	BREF - JRC (Joint Research Centre) http://www.epa.ie/Licensing/IPPC/Licensing/BREFDocuments/	High	High	High	High
3	Environment Report 2003	Italian Tanning Industry (2003)	Leather hides (not life cycle based - yet provides inputs and outputs for a given unit of leather - see inputs and outputs)	Clothing and shoes	Tanning	Emissions to water and air	Italy	Environmental report - reports on emissions, effluent and waste in terms of m2 of leather produced for shoe or clothing manufactures - The Italian report is available from the European Leather Association (www.euroleather.com)	N/A	N/A	N/A	European Leather Association www.euroleather.com	Medium	Medium	Medium	Medium
4	Application of LCA to footwear	Mila (1998)	Leather shoes	Shoes	Cradle to grave	GWP, AP,EP, HTP, water consumption, non renewable resources depletion	Catalonia	Life cycle figures available are for the life cycle of 1000 hours of leather ladies footwear.	GWP, Acidification, Eutrophication and toxicity	GWP, EP and AP - agricultural stage (especially as only 7.69% of the total impact has been allocated to leather hides) EP and HTP for tanning process, HTPS, AP and resource depletion for manufacture and GWP for waste management	N/A	N/A	High	High	High	Medium

Nylon - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Ecoprofiles	Beaustead (2002)	Nylon	N/A	Raw material production	LCI only	EU	N/A	N/A	N/A	N/A	APME (European Plastics Association)	High	High	High	Low
2	Ecolabel - textiles	European Commission (2002)	All textile materials	N/A	Raw material production for polyamide only - even though the actual label refer to the manufacture of all textiles, includes washing (use) criteria and end of life criteria	Global warming	EU	Nitrous oxide emissions	Emission of Nitrous oxide for raw material production	Raw material production (it does not address any other issue for nylon)	N/A	http://ec.europa.eu/environment/ecolabel/product/pg_clothing_textiles_en.htm	High	High	High	Low

Polyester - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Well Dressed? The Present and Future Sustainability of Clothing and Textiles in the United Kingdom	University of Cambridge Institute for Manufacturing. 2006.	Cotton, viscose and information on alternative fibres.	T-shirt, blouse and carpet.	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water; and solid waste. Social issues are also discussed.	UK; Reference to numerous countries where textiles are manufactured and cotton is produced.	About 0.6kg of oil equivalent primary energy is used in the industry per kg of output (about 0.4% of the UK total). About two kilograms of CO2 equivalent is emitted to air per kg output (about 0.4% of the UK total). Approximately 60kg of water is used (about 0.5%of UK total) and about 45kg of waste water is discharged per kg of output. The difference is lost as evaporation during textile wet processes (e.g.dyeing). About one kg of solid waste arises per kg of output (about 0.5% of UK total).	The sector's contribution to climate change is dominated by the requirement for burning fossil fuel to create electricity for heating water and air in laundering. Other major energy uses arise in providing fuel for agricultural machinery and electricity for production. Water consumption – especially the extensive use of water in cotton crop cultivation – can also be a major environmental issue as seen dramatically in the Aral Sea region.	For polyester products, the requirement for energy is driven by crude oil production and laundry.	Volume of UK expenditure for clothing and market trends were addressed. Alternative materials and 'smart functions' were also discussed.	http://www.ifm.eng.cam.ac.uk/sustainability/projects/mass/UK_textiles.pdf	High	High	High	High
2	Methodological Issues in the LCA Procedure for the Textile Sector A case study concerning fabric for a sofa	Environmental Systems Analysis. Chalmers University of Technology. Göteborg, Sweden. Lisbeth Dahllof (2004)	Cotton, polyester and wool.	Sofa fabric	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water; and solid waste.	Sweden	This report lists numerous quantitative measures for significant impacts.	For cotton the most significant impact was cultivation and wet treatment of the fabric (the processes includes dyeing). For polyester, there most significant impact was polyester production. For wool production, the most significant impact was sheep farming, ring spinning and nylon fiber production, wool scouring.	Production		http://www.esa.chalmers.se/Publications/PDF-files/TR/ESAreport20047.pdf	High	High	High	High
3	Report 3: Textile Processing Techniques	British Textile Technology Group (1999)	Cotton, polyester and others.	Various	Production and manufacturing.	Toxic chemicals, waste and effluent.	Global	There is quantitative data for toxic chemicals, waste and effluent.	Waste	The paper addressed production and manufacturing.		http://www.e4s.org.uk/textilesonline/content/pdfs/report3.pdf	High	Medium	High	High
4	Report 4: Textile Mass Balance and Product Life Cycles	British Textile Technology Group (1999)	Cotton/polyester blend (and a number of other combinations).	Bed sheets	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water/pesticides; and solid waste.	UK	0.28 GJ of energy and 7.36 m3 of water are consumed in the life cycle of a set of sheets. After three years the sheet (0.80kg) would probably be either torn up and used as rags or immediately thrown into the dustbin. It is unlikely that it would be recycled.	N/A - This paper provided mass balance data.	This paper addressed the issue that the whole concept of product life-time, design, fashion and the responsibility for re-use have to be reassessed. A culture built on the idea of wastage needs to be dismantled and a new way introduced.	Volume of UK expenditure for clothing and market trends were addressed.	http://www.e4s.org.uk/textilesonline/content/pdfs/report4.pdf	High	Medium	High	Medium
5	Life Cycle Assessment: Environmental Profile of Cotton and Polyester-Cotton Fabrics	Kalliala E M and Nousiainen P (1999)	Cotton and cotton/polyester	Bed sheets	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use, water consumption and use of toxic chemicals.	Finland	Water consumption due to irrigation is between 7 m3/kg to 29 m3/kg compared to the approximately 17 l/kg of water consumption in polyester fibre production. The use of fossil resources as raw-materials and in energy production causes high CO2 emissions into the air, which rapidly increases the global warming potential.	Energy use and water consumption.	Cotton fibre production consumes about 40% less energy than polyester fibre production. Cotton growing requires, however, huge amounts of water: irrigated amounts vary from 7 to 29 tons per kg of raw cotton fibres. Pesticides and fertilizers used in traditional cotton cultivation have ecotoxic effects in contrast to organic cotton cultivation, where natural alternatives to agrochemicals are used. It could also be concluded that 50/50 CO/PES sheets in hotel use have fewer environmental impacts than 100% CO sheets. This is due to the higher durability as well as lower laundering energy requirements of 50/50 CO/PES sheets.	N/A	Eija M.Kalliala, and Pertti Nousiainen, Tampere University of Technology, PO Box 527, 33101 Tampere, Finland, Europe http://www.leeds.ac.uk/autex/v1n1/2264_99.pdf	High	High	High	High
6	Resource and Environmental Profile Analysis of a Manufactured Apparel Product Life Cycle Analysis (LCA): Woman's Knit Polyester Blouse - Final Report	American Fiber Manufacturers (1993) Prepared by Franklin Associates	Polyester	Blouse	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use, water consumption and use of toxic chemicals.	USA	Significant impacts on energy and solid waste in the consumer use stage.	Energy use and solid waste.	The consumer use corresponds to 86% of the life cycle energy needs. Cold wash with line drying reduces laundering energy by more than 90%. Air emissions and solid waste are also very dominant in the consumer phase.	N/A	http://www.fibersource.com/f-tutor/LCA-Page.htm#EXECUTIVE%20SUMMARY	High	High	High	High

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
7	Streamlined Life Cycle Assessment of Two Marks & Spencer plc Apparel Products	Marks and Spencer (2002) Prepared by ERM	Cotton and polyester	Polyester pants and men's cotton briefs	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use	UK	The total extracted energy consumption associated with the lifetime of a three pack of men's briefs has been calculated to be 107 kWh. The total extracted energy consumption associated with the lifetime of a pair of trousers has been calculated to be 200 kWh.	Energy use	79.4% of the energy use is from the consumer.	N/A	Environmental Resources Management Eaton House, Wallbrook Court, North Hinksey Lane Oxford OX2 0QS Telephone 01865 384800 Facsimile 01865 384848 Email post@ermuk.com http://www.ermuk.com http://www2.marksandspencer.com/thecompany/ourcommitmenttosociety/environment/pdfs/Final_LCA_report.pdf	High	High	High	High
8	Four Alternatives Compared: Table Cloths	Danish Textile Service Association (2004)	Cotton, polyester, cotton/polyester mix and paper.	Table cloths	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use	EU	Not listed in abstract.	Energy use	The majority of energy use was in the consumer use stage. The conclusion of this study was that paper table cloths have the least impact.	N/A	http://www.lca-center.com/site.asp?p=4025	High	High	High	Low
9	Life Cycle Analysis of a Polyester Garment	American Fiber Manufacturers (1995)	Polyester	Unknown	Unknown	Pollutant emission and waste treatment .	Unknown	Unknown	Unknown	Unknown	N/A	Resources, conservation and recycling (Resour. conserv. recycl.) ISSN 0921-3449 Source / Source Life cycle management 1995, vol. 14, no 3-4 (dissem.), pp. 233-249 http://cat.inist.fr/?aModele=afficheN&cpsidt=2890590	High	Unknown	High	Unknown
10	Environmental Assessment of Textiles (Environmental Project No. 369)	Danish Environmental Protection Agency (DEPA) (1997)	Acrylic, cotton, wool, viscose and polyester.	Various	Resources, production, use and disposal.	Water emissions, energy consumption, toxicity and waste production.	EU	The resources used and emissions per life cycle stage (ie production of acrylic fibres) is expressed as an inventory but not assessed in terms of LCIA. The study further contains the environmental exchanges for the clothing production, use and disposal phase, but for clothing in general.	Eco-toxicity and human toxicity of chemicals.	N/A	N/A	http://glwww.mst.dk/udgiv/publications/1997/87-7810-838-1/pdf/87-7810-838-1.PDF	High	Medium	High	Low
11	The path to more environmentally sound production of textiles	Laursen S E, Schmidt A and Bagh J (1999) Danish Technological Institute, Clothing and Textiles Division	Acrylic, cotton, wool, viscose and polyester.	Various	Production	Water emissions, energy consumption, toxicity and waste production.	EU	This report present a number of tools aimed at facilitating serious and structured work with the environmental and health aspects of textiles containing cotton, wool rayon, polyester or acrylic fibres. The tools are divided according to type of fibre and type of company. Major environmental and health aspects off the life cycle of the textiles are assessed, and manufacturers can obtain good advice on an environmentally sound production process.	High noise level, waste generation and wastewater output.	Production	N/A	http://glwww.mst.dk/udgiv/publikationer/2000/87-7944-183-1/pdf/87-7944-104-1.pdf	High	Medium	High	Medium

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Polypropylene - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Ecolabel Textiles (EC)	European Commission (2002)	Polypropylene	N/A	Fabric production	Lead based pigments cannot be used	EU	N/A	Toxicity of lead	Use phase	N/A	http://ec.europa.eu/environment/ecolabel/product/pg_clothing_textiles_en.htm	High	High	High	Low
2	Eco profile PP	Beaustead (2005)	Polypropylene	N/A	Raw material production	LCI only	EU	N/A	N/A	N/A	N/A	APME (European Plastics Association)	High	High	High	Low
3	Ecoinvent	Ecoinvent (2006)	Polypropylene	N/A	Waste management (landfill and incineration)	LCI only	EU	N/A	N/A	N/A	N/A	www.ecoinvent.ch	High	High	High	Medium

PVC - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	LCA of PVC and Competing Materials	PE Europe (2004) Commissioned by the EC	PVC (not textiles)	N/A - Note: It does mention PVC share in mass for clothing - which is very small for those mentioned	Raw materials, production, used and disposal	Resource depletion, GWP, acification, stratospheric ozone depletion, toxicity and troposperic ozone creation	EU	Depends on the application of PVC, and clothing is not assessed.	N/A	The studies show that within the PVC chain, the production of intermediates, particularly the processes from the resource extraction of crude oil and rock salt up to the VCM production, plays a major role for the environmental impacts.	A more promising optimisation potential exists for clothing, possibly due to the lack of existing studies. The mass flows in the fashion sector are large and unpredictable. PVC does not currently play a major role in this market.	http://ec.europa.eu/enterprise/chemicals/sustdev/pvc-final_report_lca.pdf	High	Medium	Medium	Low
2	Ecoinvent	Ecoinvent (2006)	PVC	N/A	End of life (landfill and incineration)	LCI only	EU	N/A	N/A	N/A	N/A	www.ecoinvent.ch	High	High	High	Medium

Rayon/Viscose - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Well Dressed? The Present and Future Sustainability of Clothing and Textiles in the United Kingdom	University of Cambridge Institute for Manufacturing (2006)	Cotton, viscose and information on alternative fibres.	T-shirt, blouse and carpet.	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water; and solid waste. Social issues are also discussed.	UK; Reference to numerous countries where textiles are manufactured and cotton is produced.	About 0.6kg of oil equivalent primary energy is used in the industry per kg of output (about 0.4% of the UK total). About two kilograms of CO2 equivalent is emitted to air per kg output (about 0.4% of the UK total). Approximately 60kg of water is used (about 0.5%of UK total) and about 45kg of waste water is discharged per kg of output. The difference is lost as evaporation during textile wet processes (e.g.dyeing). About one kg of solid waste arises per kg of output (about 0.5% of UK total).	The sector's contribution to climate change is dominated by the requirement for burning fossil fuel to create electricity for heating water and air in laundering. Other major energy uses arise in providing fuel for agricultural machinery and electricity for production. Water consumption – especially the extensive use of water in cotton crop cultivation – can also be a major environmental issue as seen dramatically in the Aral Sea region.	For conventional cotton products, the requirement for energy is driven by laundry, but the use of toxic chemicals is driven by agriculture. In contrast, for viscose, energy use is dominated by production.	Volume of UK expenditure for clothing and market trends were addressed. Alternative materials and 'smart functions' were also discussed.	http://www.ifm.eng.cam.ac.uk/sustainability/projects/mass/UK_textiles.pdf	High	High	High	High
2	Rayon Fibre	Fibre source (2007)	Rayon	N/A	Production	N/A	N/A	N/A - This article refers to the specific processes involved in making rayon.	N/A	N/A	N/A	http://www.fibersource.com/f-tutor/rayon.htm	High	Low	Medium	Low
3	Life cycle inventory analysis of bleached kraft cellulose production from pinewood and eucalyptus in Chile	Environmental Sciences Centre, University of Concepcion, Chile and Imperial College, UK (1998)	Cellulose - the main component of rayon	N/A	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Natural resources, chemicals, energy. Release of liquid, gas and solid waste.	Chile	Unknown - only abstract	Unknown - only abstract	Unknown - only abstract	Unknown - only abstract	http://library.witpress.com/pages/PaperInfo.asp?PaperID=7165	High	Unknown	High	Unknown
4	Rayon—The Multi-Faceted Fiber	Smith J A (2002) Ohio State University	Rayon	N/A	Use	N/A	N/A	This act sheet describes how rayon must be cared for (dry clean only).	N/A	N/A		http://ohioline.osu.edu/hyg-fact/5000/pdf/5538.pdf	High	Low	High	Low
5	Report 3: Textile Processing Techniques	British Textile Technology Group (1999)	Viscose and others	Various	Production and manufacturing.	Toxic chemicals, waste and effluent.	Global	There is a number of quantitative data.	Waste	The paper only addressed production and manufacturing.		http://www.e4s.org.uk/textilesonline/content/pdfs/report3.pdf	High	Medium	High	Medium
6	Making Rayon Fiber	Textile Science, University of Tennessee (1999)	Rayon	N/A	Production	N/A	USA	Only contains information on the production process.	N/A	N/A	N/A	http://www.mindfully.org/Plastic/Cellulose/Rayon-Fiber.htm	High	High	High	Low
7	Environmental Assessment of Textiles (Environmental Project No. 369)	Danish Environmental Protection Agency (DEPA) (1997)	Acrylic, cotton, wool, viscose and polyester.	Various	Resources, production, use and disposal.	Water emissions, energy consumption, toxicity and waste production.	EU	The resources used and emissions per life cycle stage (ie production of acrylic fibres) is expressed as an inventory but not assessed in terms of LCIA. The study further contains the environmental exchanges for the clothing production, use and disposal phase, but for clothing in general.	Eco-toxicity and human toxicity of chemicals.	N/A	N/A	http://glwww.mst.dk/udgiv/publications/1997/87-7810-838-1/pdf/87-7810-838-1.PDF	High	Medium	High	Low
8	The path to more environmentally sound production of textiles	Laursen S E, Schmidt A and Bagh J (1999) Danish Technological Institute, Clothing and Textiles Division	Acrylic, cotton, wool, viscose and polyester.	Various	Production	Water emissions, energy consumption, toxicity and waste production.	EU	This report present a number of tools aimed at facilitating serious and structured work with the environmental and health aspects of textiles containing cotton, wool rayon, polyester or acrylic fibres. The tools are divided according to type of fibre and type of company. Major environmental and health aspects off the life cycle of the textiles are assessed, and manufacturers can obtain good advice on an environmentally sound production process.	High noise level, waste generation and wastewater output.	Production	N/A	http://glwww.mst.dk/udgiv/publikationer/2000/87-7944-183-1/pdf/87-7944-104-1.pdf	High	Medium	High	Medium

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Silk - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Report 3: Textile Processing Techniques	British Textile Technology Group (1999)	Silk and others	N/A	Production and manufacturing.	Toxic chemicals, waste and effluent.	Global	There is some quantitative data on production and manufacturing.	Waste	The paper only addressed production and manufacturing.	N/A	http://www.e4s.org.uk/textilesonline/content/pdfs/report3.pdf	High	Medium	High	Medium
2	Bangladesh-Silk Development Pilot Project	Government of Bangladesh (GOB). Bangladesh Silk Foundation (BSF). World Bank Funded (2002)	Silk	N/A	Production	Soil conservation	Bangladesh	An environmental assessment has been undertaken and is under review (unable to locate this document).	None	The paper only addressed production.	Silk production, a highly labor intensive activity, has strong potential to increase such opportunities for the poor, particularly women.	http://wbln0018.worldbank.org/lo%20web%20sites/bangladesh%20web.nsf/0704a4348e105b2e462566720023975f170a63b802c62de2b4625671b001f8ff7?OpenDocument	High	Unknown	High	Low

Pale blue shading represents that the article/paper must be purchased.

Wool - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - Is the evidence from a credible source?	(2) Reliability - Is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - Is the evidence free from bias?	(4) Transferability - Is the evidence usable for policy making?
1	Methodological Issues in the LCA Procedure for the Textile Sector A case study concerning fabric for a sofa	Environmental Systems Analysis. Chalmers University of Technology. Göteborg, Sweden. Lisbeth Dahllöf (2004)	Cotton, polyester and wool.	Sofa fabric	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water; and solid waste.	Sweden	This report lists numerous quantitative measures for significant impacts.	For cotton the most significant impact was cultivation and wet treatment of the fabric (the processes includes dyeing). For polyester, there most significant impact was polyester production. For wool production, the most significant impact was sheep farming, ring spinning and nylon fiber production, wool scouring.	Production		http://www.esa.chalmers.se/Publications/PDF-files/TR/ESAreport20047.pdf	High	High	High	High
2	Life Cycle Assessment: The New Zealand Merino Industry - Merino Wool Total Energy Use	The AgriBusiness Group (2006)	Wool	N/A	Production	Energy Use	New Zealand	Producing New Zealand Merino wool fibre uses significantly less energy resource than it takes to manufacture fossil fuel dependent man-made fibres. For example, nylon manufacture uses over 5 times more energy, acrylic 3.8 times, polyester 2.7 times.	Energy consumption is lower in the production of wool than other textiles.	Production	N/A	http://www.merinoinc.co.nz/Reports/LCA_summary.pdf	Currently under peer review.	High	Medium	High
3	Report 3: Textile Processing Techniques	British Textile Technology Group (1999)	Cotton, polyester and others.	Various	Production and manufacturing.	Toxic chemicals, waste and effluent.	Global	There is quantitative data for toxic chemicals, waste and effluent.	Waste	The paper addressed production and manufacturing.	N/A	http://www.e4s.org.uk/textilesonline/content/pdfs/report3.pdf	High	Medium	High	High
4	Report 4: Textile Mass Balance and Product Life Cycles	British Textile Technology Group (1999)	Cotton/polyester blend (and a number of other combinations).	Bed sheets	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy use; use of toxic chemicals; release of chemicals in waste water/pesticides; and solid waste.	UK	0.28 GJ of energy and 7.36 m3 of water are consumed in the life cycle of a set of sheets. After three years the sheet (0.80kg) would probably be either torn up and used as rags or immediately thrown into the dustbin. It is unlikely that it would be recycled.	N/A - This paper provided mass balance data.	This paper addressed the issue that the whole concept of product life-time, design, fashion and the responsibility for re-use have to be reassessed. A culture built on the idea of wastage needs to be dismantled and a new way introduced.	Volume of UK expenditure for clothing and market trends were addressed.	http://www.e4s.org.uk/textilesonline/content/pdfs/report4.pdf	High	Medium	High	Medium
5	Environmental Assessment of Textiles (Environmental Project No. 369)	Danish Environmental Protection Agency (DEPA) (1997)	Acrylic, cotton, wool, viscose and polyester.	Various	Resources, production, use and disposal.	Water emissions, energy consumption, toxicity and waste production.	EU	The resources used and emissions per life cycle stage (ie production of acrylic fibres) is expressed as an inventory but not assessed in terms of LCIA. The study further contains the environmental exchanges for the clothing production, use and disposal phase, but for clothing in general.	Eco-toxicity and human toxicity of chemicals.	N/A	N/A	http://www.mst.dk/udgiv/publications/1997/87-7810-838-1/pdf/87-7810-838-1.PDF	High	Medium	High	Low
6	The path to more environmentally sound production of textiles	Laursen S E, Schmidt A and Bagh J (1999) Danish Technological Institute, Clothing and Textiles Division	Acrylic, cotton, wool, viscose and polyester.	Various	Production	Water emissions, energy consumption, toxicity and waste production.	EU	This report present a number of tools aimed at facilitating serious and structured work with the environmental and health aspects of textiles containing cotton, wool rayon, polyester or acrylic fibres. The tools are divided according to type of fibre and type of company. Major environmental and health aspects off the life cycle of the textiles are assessed, and manufacturers can obtain good advice on an environmentally sound production process.	High noise level, waste generation and wastewater output.	Production	N/A	http://www.mst.dk/udgiv/publikationer/2000/87-7944-183-1/pdf/87-7944-104-1.pdf	High	Medium	High	Medium

Various Materials - Environmental Impacts

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Streamlined Life Cycle Assessment of Textile Recycling	Salvation Army (2002) Prepared by ERM	Various	Various	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Energy consumption	UK	The study of recycling operations found that the collection, processing and distribution of post consumer clothing consume 1.7 Kwh of extracted energy per kg of second hand clothing recycled. This is insignificant in comparison with the energy associated with the production of new clothing. This study showed that for every kg of new cotton clothing displaced by post consumer clothing approximately 65 kwh is saved. 90 kwh for every kg of polyester displaced.	Transport	Internal transportation of post consumer clothing.	N/A	http://www.satradngco.org/Reports/LCA.pdf	High	High	High	High
2	Life Cycle Assessment (LCA) Applied in the Textile Sector: the Usefulness, Limitations and Methodological Problems – A Literature Review	Environmental Systems Analysis Chalmers Tekniska Högskola Göteborg (2003)	Various	N/A	Includes a review of LCA that have been completed.	N/A	Global	This report reviews other LCA's that have been completed.	It notes that an important problem for the textile sector is assessing land use and the fate of chemicals as well as working health problems.	N/A	N/A	http://www.esa.chalmers.se/Publications/PDF-files/TR/ESA20039.pdf	High	Medium	High	Medium
3	LCA Methodology Issues for Textile Products	Dahllof L (2004) Environmental Systems Analysis. Chalmers University of Technology. Göteborg, Sweden	Various	N/A	Includes a review of LCA's that have been completed.	N/A	Global	The most important problems were: 1) to find inventory data in general, 2) to assess land use for cotton and wool production, 3) to assess emissions of chemicals to the environment and 4) to assess irrigation water use for cotton cultivation. Two problems that are potentially important but the significance of which is not evaluated are 1) the work environment and 2) the use of genetically engineered cotton.	Chemical use, cleaning of clothes	Production	N/A	http://www.esa.chalmers.se/Publications/PDF-files/Lic/ESA20048.pdf	High	Low	High	Medium
4	Clothing Care in the Sustainable Household	Vezzoli C (1998) CIR.IS Politecnico di Milano	Various	Various	Use	Energy consumption	EU	Energy use during use phase is significant. Quantitative data is provided.	Energy and water consumption	Use	N/A	http://www.sushouse.tudelft.nl/wijziggen/publicaties/clothing/GOI98.rtf	High	High	High	High
5	Environmental Assessment of Future-Scenario's in the Sushouse Project: Illustrated for Clothing Care	Remke M, Bras-Klapwijk J and Marjolijn C (date unknown) Knot Delft University of Technology, Technology Assessment Group	Various	Various	Use	Energy and water consumption, emissions, waste, transport.	EU	Consumption is responsible for the largest part of the savings in energy use, materials use and water use. The decrease in consumption was reached through higher quality materials and clothes, reparation and less washing, which lead to a longer use life, and through limited and flexible wardrobes, sharing clothes and leasing clothes, which lead to a higher use-intensity. The decrease in the laundry quantity, due to the use of anti-dirt materials, dirt-indicators, stain removers and disposable underwear, also yields savings in energy-use, water use and detergents use. Furthermore the up scaling of the laundry process in the Outsourcing and the Eternally Yours DOS reduces the water and detergents use in the clothing care function.	Energy and water consumption	Use	N/A	http://www.sushouse.tudelft.nl/nol/frames.htm	High	Medium	High	Medium
6	Design Orienting Scenario and System Innovation for Sustainable Clothing Care	Vezzoli C (2000) CIR.IS Politecnico di Milano, Dip. DI Tec.	Various	Various	Use	N/A	EU	Not too much quantitative data. However there is good information on system boundaries.	N/A	Use	N/A	http://www.sushouse.tudelft.nl/nol/frames.htm	High	Medium	High	Medium
7	Life Cycle Assessment as a tool for water management optimization in textile finishing industry	Tarantini M, Scalbi S, Misceo M and Verità S (2004) The International Society for Optical Engineering	Cotton, silk, polyester, acetate, and viscose	Textiles used for water reuse scenarios	All stages	Unknown	Belgium, Italy	Unknown	Unknown	N/A	N/A	http://www.woodheadpublishing.com/en/book.aspx?bookID=548	High	Unknown	High	Low
8	Environmental impact of textiles: Production, processes and protection	Slater K (2003) University of Guelph, Canada. Published in association with The Textile Institute	Various	N/A	All stages	Unknown	Unknown	Unknown	Unknown	Unknown	N/A	http://www.woodheadpublishing.com/en/book.aspx?bookID=548	High	Unknown	Unknown	Unknown
9	Sustainable Textile Production	Tobler M (2005) Swiss Federal Institute of Technology Zurich	Various	N/A	Production, manufacturing, consumption, collection, transport, and sorting, use and waste/recovery.	Unknown	Global	Unknown	Unknown	Unknown	Marketing issues are addressed.	http://www.emsc.ch/Deutsch/pdf/Manual-AD.pdf	High	High	High	High
10	Danida Cleaner Textile Project	National Cleaner Production Centre (2005)	Various	N/A	Production and manufacturing		South Africa		The main environmental impact is the use of electricity in the regeneration process.			http://www.ncpc.co.za/cto/cotton_growing.asp	High	Medium	High	Medium
11	2nd Draft of the "Domestic Washing of Clothes" Case Report	Leiden University (1999) CHAINET	Various	Various	Use	Energy and water consumption, emissions, waste, transport.	EU	Not too much quantitative data. However there is good information on consumer use.	N/A	Use	N/A	http://www.leidenuniv.nl/interfac/cmi/ssp/projects/chainet/drtwash2.pdf	High	Medium	High	Medium
12	European Eco-label. Revision of Eco-label Criteria for Laundry Detergents. Final Report	DHI Water & Environment dk-TEKNIK ENERGY & ENVIRONMENT (2003)	Various	Various	Use	Use of detergents	EU	Good data on chemicals in detergents and the amounts used.	N/A	Use	N/A	http://ec.europa.eu/environment/ecolabel/pdf/laundry_detergents/finalreport_0503.pdf	High	High	High	Medium

	Title	Author and Age	Scope of Study					Scale of Impacts	Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
13	Report on current shortcomings of the existing dyes and changes required to improve it, and create the next generation dyes (standards, market, cost).	Novel Sustainable Bioprocesses for European Colour Industries (2004) Project co-funded by the European Commission within the Sixth Framework Programme	Textiles and leather.	N/A	Manufacturing (dyeing)	Raw material, energy, chemical use	EU	N/A	The adverse effects of dye processing on the human work-force, users and environment at large have been highlighted. The legislations regarding the different sectors have been studied as a benchmark for new dyes. The bottlenecks in the present dye producing and users industries have been investigated and requirement of dyes of the future with desirable attributes have been identified. This study led to the selection of 5 problematic "existing dyes" (based on criteria such as: cost, production time, energy consumption, worker friendliness, environmental friendliness) as targets for the replacement of their synthesis by biotechnological methods.	N/A	Social issues were addressed.	http://www.biomatnet.org/publications/1883rep.pdf	High	Medium	High	Medium
14	EcoTopTen – Innovations for Sustainable Consumption	Graulich K (2006) Oeko-Institut e.V., Institute for Applied Ecology, Germany	Full range of textiles (organic & fair-trade standards) and clothing washers and tumble dryers	N/A	Production, manufacturing, use and waste/recovery.	N/A	EU	N/A	Energy consumption	Use	N/A	http://www.ecotopten.de/download/EEDAL_EcoTopTen-paper.pdf	High	High	High	High
15	Environment Direct Evidence Base for Clothing, Washing and Tumble Drying	Defra (2006)	Various	N/A	Production, manufacturing, use and waste/recovery.	Employment levels, Gross Value Added, water consumption, energy consumption, greenhouse gas emissions, acid rain emissions, waste arisings and environmental protection expenditure (EPE) on air, waste and other media.	UK	Over 260,000 people are employed in this industry, which produces over 2 million tonnes of waste and consumes around 90 million cubic metres of water annually. Greenhouse gas emissions from the textile, clothing and leather industry have declined between 1990 and 2004 and are currently 22 per cent lower than in 1990. 99 per cent of these emissions are CO2, 0.4 per cent is nitrous oxide and 0.3 per cent is hydro fluorocarbons. Energy use by the textile, clothing and leather industry saw a peak in 2001 at over 5.5 million tonnes of oil equivalent and now lays at 11 per cent higher than in 1990, at 4.7 million tonnes of oil equivalent. The majority of textiles, clothing and footwear in the UK are exported from overseas. A large proportion (92 per cent) of the total UK consumption of textiles, clothing and footwear comes from imported goods. This is the import penetration. The value of UK manufacturer sales in 2005 was about £1.1 billion. Household spend on textiles, clothing and footwear in 2004 exceeded £54 billion, and accounted for around 7 per cent of all household expenditure that year.	N/A	N/A	N/A	Contact Defra	High	High	High	High
16	Fashioning Sustainability: A Review of the Sustainability Impacts of the Clothing Industry	Forum for the Future (2007)	Various	N/A	All stages	Pesticide use in growing cotton, GM, water use, fair conditions and prices for growers, animal welfare, use of oil in synthetics, disposal, use of toxic chemicals, water and energy use, untreated waste, pesticide use, working conditions, human rights, boycotts, supplier audit and fatigue, subsidies and quotas, price pressures, fair play along the supply chain, energy use, CO2 emissions, global complex supply chains, poor transport planning, unsustainable consumption and design for the environment.	UK and global	Numerous statistics. Refer to report for detail.	There are significant impacts in all stages of the clothing production and consumption.	Production and end of life	N/A	www.forumforthefuture.org.uk/publications/fashion2_page542.aspx .	High	High	High	High

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Annex A2

Literature Review Tables - Social Impacts

Industry - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4)Transferability - is it usable for policy making?
1	The Apparel and Textile Industries after 2005: Prospects and Choices	Frederick H. Abernathy, Anthony Volpe, David Weil (2004)	N/A	N/A	Fabric production; finishing processes; distribution and retail	Labour issues and global communities	Global (US-focus, but widely applicable)	Supply Chain Dynamics (prioritized); also labour, material, shipping, tariff and quota costs	These affect sourcing decisions in the global apparel market (from where to purchase clothing products)	Changing role of manufacturer has raised profile of supply chain dynamics in sourcing decisions (ie the closer the manufacturer, the more responsive to retailer demands, based on customer demands)	Harvard Center for Textile and Apparel Research, 23 December 2004 http://www.proexport.com.co/vbecontent/library/documents/DocNewsNo5667DocumentNo4738.PDF ;	High	Low	Medium	High
2	Cleaner Production in the Textile Industry - Lessons from the Danish Experience	George Wynne, Dhiraj Maharaj, Chris Buckley (2001)	N/A	N/A	All (focus on cotton growing and textile manufacturing)	Resource consumption; greenhouse gas emissions; land use; hazardous waste; air pollution; water pollution; soil degradation; soil contamination; biodiversity and toxicity.	Denmark, South Africa (applying Danish model to SA)	Studies the potential benefits of applying Danish model of Cleaner Production in the South African textile industry (eg mitigate cost vs controlling pollution through end-of-pipe means)	Retailers (such as Woolworths) apply pressure through environmental codes of practice for suppliers of textiles	Because CP combines financial cost savings and environmental improvements, it has been recognized by UNCED Agenda 21 as one of the best ways of reconciling industrial growth w/ environmental protection	Danish Cooperation for Environment and Development (DANCED), 2001 http://www.nu.ac.za/cleanerproduction/pdfs/Paper_Natcon_final.pdf ;	Unknown	High	Low - document supports organization's activities	Medium
3	Lessons from Corporate Social Responsibility Initiatives in the Apparel and Textile Industries: submission to National Roundtables on Corporate Social Responsibility	Ethical Trading Action Group (2006)	N/A	N/A	Fabric Production; Finishing processes	Labour issues; global communities	Global (Canada focus, but widely applicable)	Looks at gaps in the application of effective labour standards, caused by: 1) a lack of common standards and agreed upon rules; 2) competition from non-branded discount goods; 3) ineffective auditing	1) Governments can create pressure to strengthen capacity of local organizations, governments and workers in developing countries; 2) local nongovernmental and labour orgs must be active in verifying conditions and participate in corrective action; 3) Capacity of local governments must be increased so they can be main enforcement of laws/ regulations; 4) Gov't should encourage greater public scrutiny of voluntary labour and environmental standards monitoring	Voluntary codes of conduct, with varying standards of monitoring and verification requirements and procedures, have met with varying levels of success; also, these have created confusion for local suppliers, workers and governments, as well as consumers	Ethical Trading Action Group; 606 Shaw St; Toronto, ON; M6G 3L6; www.maquillasolidarity.org; 12 September 2006 http://www.maquillasolidarity.org/campaigns/disclosure/ETAG%20submission.pdf ;	Unknown	Low	Low - document supports organization's activities	High
4	Producing, Providing, Trading: Manufacturing Industry and Sustainable Cities	Robbins N and Kumar R (1999)	Industry in general (examples use leather, cotton)	N/A	All Environmental and social (more environmental focus)	(Environmental) Resource consumption; hazardous waste; air pollution; water pollution; soil contamination; toxicity. (Social) Labour issues, global and local communities	Global	1) In advanced economies, environmental costs associated with manufacturing occur beyond manufacturing stage - generated during sourcing, consumption and disposal of products; 2) 'industrial ecology' - philosophy wherein wastes/emissions of one process serve as raw material for another; 3) Make producers responsible for end of life waste generated by their product 4) Need to cut environmental costs of freight transport - increase proximity between production and consumption	1) Looks at role of industry in contributing to sustainable development in cities; 2) industry must become responsible for socio-environmental performance of its own production activities, the sourcing of raw material inputs "upstream", and for emissions and wastes products generate "downstream" 3) go beyond reliance on purchasing power of informed (wealthy) minority to focus on new service economy where manufacturing companies provide services rather than products (eg. 'lease' of carpet until it wears out and is then replaced); 4) Retailers face customer pressure to be driving force for change in social/ environmental codes down supply chain	1) Ex. 1996 Closed Substance Cycle and Waste Management Act (Germany) determined that whoever produces, markets, consumes goods is responsible for avoidance, recycling, re-use, ecological disposal of waste; 2) Ex. Initiatives to shift cotton production to more sustainable basis using organic and integrated pest management, pans of harmful dyes, introduction of cases of conduct	Environment and Urbanization, Vol. 11 No. 2 (October 1999) http://eau.sagepub.com/cgi/reprint/11/2/75.pdf ;	Yes	Yes	Fairly objective (no evident bias)	Yes
5	International Trade and Industrial Upgrading in the Apparel Commodity Chain	Gary Gerffi (1999)	N/A	N/A	Raw material production - retail	Social trends, business practices	Global (Asian, US and Mexican case studies, among others)	1) Buyer-driven commodity chains refer to industries where large retailers, branded marketers/ manufacturers play pivotal role in setting up decentralized production networks in variety of exporting countries (typically - developing world); 2) Buyer-driven commodity chains are characterized by highly competitive, locally owned, globally dispersed production systems; profits derived from combinations of research, design, sales, marketing and financial services (linking overseas factories with evolving product niches) 3) Growing retailer concentration (away from independent clothing retailers) creates shift in power from manufacturers to retailers and marketers; creates tendency to augment global sourcing;	1) the main leverage in buyer-driven chains is exercised by retailers, marketers, manufacturers through their ability to shape mass consumption via strong brand names and their reliance on global sourcing strategies to meeting the demand; 2) leader firms use entry barriers to generate different kinds of "rents": <i>relational rents</i> - several families of inter-firm relationships that link large assemblers with small-med enterprises, strategic alliances and clusters of small firms; <i>trade-policy rents</i> - scarcity value created by protectionist trade policies; <i>brand name rents</i> - product differentiating techniques;	Entry barriers for most garment factories are low, but become progressively higher as one moves upstream	Journal of International Economics 48 (1999) http://www.uni-leipzig.de/~afrika/documents/Carlos/Gerffi.pdf ;	High	High	Medium	High
							4) branded marketers address influx of competition in overseas production by altering content/ scope of global sourcing network: discontinuing certain support functions; reducing purchase and redistribution activities; shrinking supply chains; adopting stricter vendor certification to improve performance; shifting sourcing from Asia to W. Hemisphere; 5) Branded apparel manufacturers responding to competition from overseas production by: joining ranks of importers (small-/mid-sized apparel firms); engaging in international subcontracting at different levels in foreign production (large firms); deemphasizing production activities to build up marketing side of operations, capitalizing on brand names and retail outlets; 6) Strengthening of brand names has led to new focus on "concept stores" (eg. Disney, Nike) - direct link between manufacturer and consumer	3) As each type of organizational buyer in commodity chain becomes more active in offshore sourcing, competition between retailers, marketers and manufacturers intensifies, blurring traditional boundaries between firms & realignment of interests within chain; 4) process of filling distribution pipeline leads retailers to develop strong ties with global (pref. cheap) suppliers; 5) many retailers now compete directly with brand names (producers and marketers) by expanding "private labels"; 6) emergence of "manufacturers without companies" (eg Nike) whose sourcing has always been done overseas - provided overseas suppliers with knowledge necessary to upgrade position in apparel chain							

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4)Transferability - is it usable for policy making?
6	Establishing an International Network Position: findings from an exploratory survey of UK textile suppliers	Rhonda E. Johnsen (2000)	N/A	N/A	Distribution, retail	Small business; business trends	UK companies	1) UK suppliers forced to internationalize quickly by developing their own int'l supply relationships, or by breaking into new international networks; 2) Small suppliers must establish new network position w/ new customers in other countries and compete w/ suppliers in several countries; 3) Small textile suppliers offer flexible manufacture and design - responding effectively to fashion cycle;	1) Small suppliers are in relationship with large customers, who have power & influence and wealth of suppliers to choose from - can often dictate conditions for continuation of relationship to weaker suppliers; 2) recent trends indicate that UK retail buyers are more focussed on international suppliers, are not prepared to support uncompetitive domestic suppliers	Paper examines how SMEs in UK textile industry can overcome lack of knowledge to establish new relationships and reposition in int'l networks. Levels of power and dependency were key in ability to do so - when balance heavily in favour of UK retailers, suppliers less able to internationalize	Business School, Bournemouth University; Bournemouth, Dorset; http://imprgroup.org/uploads/papers/73.pdf ;	High	High	Medium	Unknown
7	Globalization in the Apparel and Textile Industries: What is New and What is Not?	Frederick H. Abernathy, John T. Dunlop, Janice H. Hammond, David Weil (2002)	N/A	N/A	Distribution, retail, finishing processes	Business/ Industry trends; globalization; distribution and sources (indirectly, economics and jobs)	American focus (US, Mexico, Caribbean), global application	1) Dealing with variability in demand has become crucial to suppliers competing in lean retailing world; 2) More of the risk from holding the wrong product at the wrong time is shifted backward onto the supply chain; 3) A sudden drop in the demand for a line of goods means that a supplier faces liquidating several weeks of product, if they carry advance supplies; 4) If the cost of capital rises, inventory becomes more expensive and the most profitable position shifts toward local production/ If the cycle time difference between the plants in the two locations decreases, then the most profitable allocation shifts toward the offshore plant; 5) The ability to ship via land of only short distances by sea potentially implies more direct (and simpler) infrastructure connections relative to sourcing more distant countries (like Asia)	1) a manufacturer providing goods to the US market must balance the benefits of more proximate but costly sources that offer short-cycle local production against lower-cost offshore operations that require longer lead times; 2) The more variability added to the shipment process through underdeveloped and/or constrained transportation networks, fragmented administrative processes for trade, political instability, or weather-related problems, the more risk facing the supplier and consequent need to hold larger buffer inventories;	1) Spread of new form of retail distribution - lean retailing and product proliferation - change problems faced by suppliers; 2) It will be difficult for nations with inadequate infrastructure, distant locations from major consumer markets, or political (or climactic) instability, will be at a disadvantage, even if they have low wage rates; 3) for types of apparel where replenishment is not a major factor in sourcing, the presence of a large number of countries with extensive apparel capacity means more intense competition for a smaller market of non-replenishment products; 4) Nations wanting to use textiles to develop will need comprehensive policies in place and advantageous geographic location to succeed	Harvard Center for Textile and Apparel Research, 20 March 2002 http://www.hctar.org/pdfs/GS07.pdf ;	High	High	Medium	Low
8	Women encounter technology: Changing Patterns of Employment in the Third World - Ch. 5 Emerging Issues	Swasti Mitter, Sheila Rowbotham (1995)	N/A	N/A	Fabric production, Finishing processes	Skills development, gender issues, business development	Indonesia, Bangladesh, Thailand	1) The technology gap between industrialized and developing countries is increasing in importance; 2) technological innovation has the potential to provide new employment opportunities for women; 3) Skills development should be an immediate concern because of long gestation period for investment in human resources; 4) In some countries, there is perception of women's inability to carry out tasks associated with higher level skills and responsibility	1) Demand factors such as quality, variety, and just-in-time response are equal to cost in determining competitiveness; 2) Governments will have to initiate, coordinate, and share costs of R&D and training schemes; 3) also, business community should recognize benefit in participating in the design and execution of human resource development; 4) As complexity/speed of technological change increase, formal education must be complemented by specialized training and R&D that are more relevant to production system; 5) Cross-cultural impact of foreign enterprises can create change in the perception of women as industrial workers;	1) Emerging trend points to shift from mass production of standard products, using narrowly-skilled workers, toward more specialized products using more broadly-skilled workforce and multi-purpose machines;	The United Nations University; INTEC - Institute for New Technologies http://www.unu.edu/unupress/unupbooks/uu37we/uu37we0d.htm	High	Low	Medium	High
9	New Consumers? The Social and Cultural Significance of Children's Fashion Consumption	Sharon Boden, Christopher Pole, Jane Pilcher, Tim Edwards (2004)	N/A	N/A	Consumption	Social trends, family dynamics, Consumer agency/ influence	UK	1) Children's consumption is becoming increasingly socially and culturally significant; 2) Media interest in children and consumption also increased, especially in area of fashion and rise of "teenager"; 3) child consumers are an important sector of the commercial marketplace; 4) selection of clothes plays role in construction of identity; Children are inevitably influenced by fashion marketing, contemporary trends, esp re logo culture and consumption of image; 5) with increased autonomy and independence from parents, children cultivate notions of what 'suits' them and what will successfully signify their self-image; 6) Children's displays of femininity or masculinity relate to their age and the process of growing up; 7) like adults, children's identity formation is rational - that is, structured to varying extents in varying contexts by the opinion and conduct of others;	1) The market of childrenswear is growing strongly, retail competition intense with both designer labels/ low-price retailers; 2) Children are becoming a "target group" of active, purposeful consumers; 3) Child consumers are i) a primary market in their own right; ii) an influential market given their influence on parental household purchases; iii) a market for the future of all nations; iv) a particular demographic segment; v) a specific lifestyle segment according to the same criteria as their parents; vi) a benefit segment such as educational benefits; 4) clothing industry, alongside popular culture, are implicit in production of fashion for children - skew choices available and how choices are used to construct the body; 6) Especially for girls, "dressing up" is a highly gendered activity, specific to a particular part of lifecourse - is perhaps why girls work so hard to distance selves from it later on;		Cultures of Consumption Working Paper Series, Working Paper 16 https://ira.le.ac.uk/bitstream/2381/47/1/Boden+Working+Paper2.doc?	High	Medium	Unclear	Unknown
								8) kids associate certain shops, brands, styles with superior quality/ with keeping abreast of new trends; 9) Kids actively shape attitudes to consuming within the household - affecting power relations between themselves, siblings, parents; 10) "Peer pressure" exerted against other kids, also against parents to consume as directed by children; 11) Kids' increasing engagement with consumer culture is changing relationships with parents and family life itself;	7) kids are affected by a sense of fashion do's/ don'ts that are dependent on context and rules of particular environment/ culture; 8) Kids are able to independently appraise fashion marketplace, implicating potential social dangers or purchasing poor quality, unfashionable clothes; 9) across all age groups, kids use clothing consumption as a negotiating tool with parental figures to demonstrate a growing autonomy from them; 10) pressure affects how parents dress, also taps into issues of how kids symbolise parental material capital; 11) Kids assume authority to modernise parents' tastes and behaviour of parents being compromised by pressure on them to consume as urged by kids;						
10	Impact of WTO on the Patterns of Trade in Textile & Clothing	Syed Kashif Rafi (2005)	N/A (some examples of cotton used)	N/A	Distribution, trade patterns	Import/ Export, commodity chains, end of quotas	Worldwide	1) textile and clothing industries/trade have long been catalyst for economic growth (in 2001, accounted for over USD450 billion); 2) From 2005 all WTO quotas on textile and clothing will be abolished; 3) US and Caribbean textile producers fear competition from flood of low-priced Chinese goods when US phases out import quotas; 4) To protect selves from uneven competition, US textile industry enters into joint venture with Asian textile producers; 5) financial facility is important in export trade, to facilitate export trading; 6) international trade does not follow trade favouritism/ trade restrictions regulations;	1) is especially important for developing countries, and more so for LDCs; 2) Efforts to liberalize the sector continue w/in ongoing negotiations (Doha) re many remaining trade restrictions; 3) biggest competition: Chinese gov't owned companies that have low wages and don't have to make profit; 4) US shifts manufacturing units to Asian countries to reduce cost - leads to inflow of direct investment to Asia; 5) if a country has surplus savings, it can provide refinancing and lending facilities to exporters; 6) business and profit motives determine ultimate trade patterns	1) In EU alone, sector directly employs over 2.1 million people; annual sales worth €200 billion, exports €45 billion; 2) the impact of WTO on China textile and clothing industry depends on reduction of tariffs and elimination of quotas, as well as non-tariff barriers imposed on China	Journal of Management and Social Sciences, Vol. 1 No. 2 (Autumn 2005) http://www.biztek.edu.pk/downloads/rasearch/jmss_v1_n2/v1n2_204-226.pdf ;	High	High	Medium	High

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4)Transferability - is it usable for policy making?
11								7) (simulation analysis) China, HK, Italy will be net losers under new rules - US, Canada, UK, Spain will be net winners; 8) Endogenous production of raw material will continue to play favourable role in competitiveness, but weaker; 9) size of the economy, availability of financial resources, import and domestic production of basic and intermediate products = determinant of textile/ clothing exports; 10) textile and clothing producing countries are dependant on one another; 11) textile/ clothing exporting countries are not concentrated on regional basis	7) China's sustainable competitiveness will decrease w/out entry to WTO, will increase w/ entry to WTO; 8) Expected: concentration in textile and clothing trade will be reduced, trade will be based on two-way transactions; 9) no evidence of significant relation between preferential treatment of importing countries and trade volume of exporting countries, or between restrictions imposed by importing countries re. quota and tariff and trade volume of exporting countries; 10) exporting countries import the intermediate products, then convert them into finished goods and re-export; 11) the top 24 countries are distributed across European, American and Asian continents						
12	The Seeds of Sustainable Consumption Patterns	Edgar Hertwich (2003)	N/A	N/A	Consumer care, end of life management	Sustainable consumption, social trends/ habits, Initiatives towards cleaner consumption	Developed countries	1) The environmental and social impacts of consumption are largely determined through infrastructure, available goods and services, and habits; 2) Washright campaign to convince people to change their laundry habits; 3) Average European wash temperatures have dropped over last decade from 65-48C; 4) Funserve campaign to improve access to high-efficiency white goods - offer customers the services they need instead of products that provide services; 5) a 10% market share of appliances would reduce the energy consumption by about 7TWh - 3 mill CO2 emissions/ year; 6) through changing daily, consciously made choices, we can only impact small fraction of the direct/ indirect impacts caused by households	1) Sustainable consumption research should focus more on how to shape habits and how to improve the availability/ acceptance of sustainable solutions; 2) campaign attempts to reduce wash temperatures, encourage fully-loaded machine, reduce detergent consumption and packaging material; 3) Lower temps enabled by better detergents and easy-care fabrics like synthetics;4) Lease highly efficient appliances to customers, remove initial cost barrier and spread cost out over use phase, where they are compensated by lower electricity costs; 5) also with Funserve, 50 million m3 water and 26,000 tons detergent could be saved each year; 6) level of impact largely predetermined by factors the consumer has not control over (avail. infrastructure, nature of the energy system, properties of products and services available) or through habits, social expectations, long-term decisions (where to live, etc);	1) Continuation in trend toward lower temps, with increase in laundry machine efficiency, can substantially lower electricity required for washing	International Institute for Applied Systems Analysis (IIASA), <i>Proceedings 1st International Workshop on Sustainable Consumption in Japan (19-20 May 2003)</i> < http://www.tev.rttu.no/edgar.hertwich/download/SeedsSC_Tokyo.pdf >	High	High	Unclear (based on source, probably represents a bias toward sustainable consumption)	High
13	Elimination of Child Labour from the Garment Sector of Bangladesh	Bangladesh Garment Manufacturers and Exporters Association Date not known	All	Shirts, Trousers, Jackets, T-shirts, sweaters	Manufacturing of clothing	Child Labour	Bangladesh	Monitoring of implementation of child labour MoU; education of displaced workers; Health and safety in factories	Manufacturing of ready made garments		http://www.bomea.com/pro.htm	High	Medium	Low	High
14	One dead after Bangladesh protest	BBC 23 May 2006	All	All	Manufacturing of clothing	Worker wages	Bangladesh	Low worker wages	Manufacturing of ready made garments		http://news.bbc.co.uk/2/hi/south_asia/5007252.stm	High	Medium	Unknown	Medium
15	Well Dressed	J Allwood; S Ellebaek Laursen; C Malvido de Rodriguez; N M P Bocken 2006	All	All	All	sustainability of the industry	UK	High waste volumes from 'fast fashion'; labour codes of practice; low wages and little opportunity to develop skills; suppression of collective bargaining.	manufacture; retail	Consumer Choices that will affect changes in the sector; trade relationships; gender issues;	University of Cambridge Institute for Manufacturing	High	High	High	High
16	The impact of the second hand clothing trade on developing countries	S Baden and C Barber 2005	All	All	end of life management	increased employment; low cost; negative impacts on local textile and garment industries; impacts on export country jobs.		maximising economic benefit, job creation, and supply chain development associated with SHC		cultural change in consumer clothing preferences	S Baden, C Barber September 2005 'The impact of the second-hand clothing trade on developing countries' Oxfam	High	High	High	High
17	Historical Perspectives on textiles and clothing in Asian Development	Asian Development Bank 2006	All	All	Fabric Production and Clothing Manufacture	Economic growth ; employment for women	Asia	Dependency of Asian economies on clothing and textiles in industrialisation	Fibre and fabric production, finishing processes, clothing manufacture		http://www.adb.org/Documents/Books/ADO/2006/part010402.asp	High	High	Medium	Medium
18	Fashion Victims - The true cost of cheap clothes at Primark, ASDA and Tesco	War on Want (2006)	Cotton and others	N/A	Production and manufacturing	Worker rights: hours, pay and gender issues	Bangladesh and China	1) Long working hours are common - up to 80 hours/week; 2) low pay is common - 5p/hour; 3) gender issues - women are treated poorly; and 4) workers' fundamental rights to join a trade unions is not met.	Production and manufacturing	N/A	www.waronwant.org	High	Medium	High	Medium
19	India, manufacturing and labour laws	Welford R (2007) <i>CSR Asia Weekly</i> Volume 3 Week 9	All	N/A	Manufacturing of clothing	Labour laws	India	India's archaic labour laws	Production and manufacturing	N/A	www.csr-asia.com	High	Medium	High	Medium
20	FIT5: Improving factories in the supply chain	Frost S (2006) <i>CSR Asia Weekly</i> Volume 2 Week 50	All	N/A	Manufacturing of clothing	Supply chains	Global and China	Supply chain improvements: worker rights, health and safety and codes of conduct	Production and manufacturing	N/A	www.csr-asia.com	High	Low	High	Medium

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			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
21	The supply chain talks back	Frost S (2006) <i>CSR Asia Weekly</i> Volume 2 Week 48	All	N/A	Manufacturing of clothing	Supply chains	Global and China	Suppliers are trying to accommodate consumer demands of both lower prices and social improvements	Production and manufacturing	N/A	www.csr-asia.com	High	Low	High	Medium
22	Top apparel brands fail China test	Frost S (2007) <i>CSR Asia Weekly</i> Volume 3 Week 4	All	N/A	Manufacturing of clothing	Supply chains	China	Poor manufacturing quality	Production and manufacturing	N/A	www.csr-asia.com	High	Medium	High	Medium
23	The Global Textile and Clothing Industry post the Agreement on Textiles and Clothing	Nordas H K (2004) WTO	All	N/A	Supply chains	Impacts from the General Agreement on Tariffs and Trade	Global - numerous countries addressed	Source of imports, market shares and employment	Production, distribution and retail	N/A	www.wto.org	High	High	High	High

Hemp - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographi c Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?

No information was found.

Wool - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Moving Towards Social Responsibility in the Textile and Fibre Industry: a Diachronic Approach	Christel Baldia (2001)	Cotton, silk, wool, polyester, nylon, rayon, lyocell	N/A	Raw material production (incl. dye process); consumer care	Health and safety, labour issues, hazardous waste; water pollution	US	1) Dust exposure can cause pulmonary disease - workers chronically exposed risk developing chronic airflow obstruction or byssinosis as with asbestos	1) Through pressure from agencies (like OSHA), cotton standard passed 1978 - reduced "brown lung" from cotton dust from 12000 workers to 700 (1978-2000); 2) 1986 - OSHA est. instance-by-instance penalties on companies violating H&S standards	Author conducted content analysis of trade journal <i>The Journal of Textile Chemists and Colorists (AATCC)</i> from 1975-2000 to study changes in industry focus on social/ environmental concerns	Ancient Textiles; 1 June 2001; http://home.Columbus.rr.com/ancienttextiles/Social%20Responsibility%20Textile%Industry.htm	Unknown	High	Medium	Low
2	Encyclopedia of Occupational Health and Safety 4th Ed: Wool Industry	D.A. Hargrave (2001)	Wool	N/A	raw material production	Health and Safety	global	1) The industrial disease usually associated with wool textiles is anthrax; 2) the spores of the fungus <i>Coccidioides immitis</i> can be found in wool, especially from the SW US; 3) Chemicals used for degreasing & dyeing create risk of: gassing, poisoning and irritations	1) Anthrax was once a great danger to wool sorters, but has mostly been eradicated; 2) the fungus can cause the disease coccidioidomycosis, which usually has a poor prognosis; 3) Prevention of chemical risks involve substitution of a less dangerous chemicals	1) in weaving sheds, noise control presents a serious problem on which much work remains to be done. 2) in many developed areas, mills are being abandoned in favour of new plants in developing countries and areas where cheaper labour is readily available	International Labour Organization http://www.ilo.org/encyclopedia/?d&nd=857200478&prevDoc=857200478&spack=011intelsearch%3Dwool%26listid%3D01000000200%26listpos%3D0%26lsz%3D54%26w1%3Don%26whereselectsw%3D1%26c=wool#l0	High	High	Medium	High
3								7) larger enterprises are able to invest in new technological developments, many smaller and older mills continue to operate in old plants with out-dated but still functioning equipment; 8) Economic imperatives dictate less rather than greater attention to health	5) many mills operate around the clock, shift work is frequently required; to meet production quotas, machines operate continuously, with each worker being "tied" to one or more pieces of equipment and unable to leave it for bathroom or rest breaks until production allows it						
4	Factors Underlying Fabric Perception	Wendy Moody, Roger Morgan, Patricia Dillon, Chris Baber, Alan Wing	Fleece (100% polyester), Lycra, Sheepskin, Silk, Corduroy (100% cotton), leather, velvet (100% viscose), Irish linen, Denim, Lace, Tweed	N/A	Consumption	Consumption patterns, influences	Assume developed world (West)	1) clothes shopping represents a building and development of the 'self'; 2) Fleece, Tweed = "Sedate warmth"; Satin, silk, lace = "Faded Familiarity"; Corduroy, leather = "Male"; Lycra, Denim = "Energized"; Velvet, Irish linen = "Opulent Poise"	1) Decisions and motivations are based on anticipated reality of preference, personality, emotion and moods; 2) The characteristic "feel" of a given fabric depends on a particular combination of ceratin variables	Subjects were given touch and feel tests of various textile fabrics and asked to classify	Eurohaptics 2001 Conference Proceedings, Educational Technology Paper http://www.eurohaptics.vision.ee.ethz.ch/2001/moody.pdf	High	High (supported by case study)	Unknown (depends on bias of subjects, how they were studied...)	High

Cotton - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Environmental and Social Benchmarking for Industrial Processes in Developing Countries: a pilot project for the textile industry in India, Indonesia and Zimbabwe	Marc Diebäcker (2000)	Cotton	N/A	Fabric Production	(Environmental) Resource consumption; hazardous waste; air pollution; water pollution; soil contamination; toxicity. (Social) Labour issues (occupational H&S, wages, training/ education, non-discrimination, work environment, hours)	Developing countries. Case studies from India, Indonesia and Zimbabwe	Identifies the pressure faced by industry to meet emerging international social and environmental norms and standards. Looks at ways to help small- and medium-scale enterprises in developing countries meet these standards	1) For export oriented firms, the corporate codes of ethics of large int'l buyers is more important than int'l guidelines in inciting improvements in social and environmental performance. 2) In many countries, the non-existence of policy incentives and p	1) UNIDO describes a methodology to enable industry in developing countries to compare themselves against global norms and to meet emerging social and environmental standards: benchmarking, life cycle analysis, social auditing. 2) Improvements in environment	UNIDO Vienna International Centre, Austria; 2000 http://www.envindia.com/pmac/images/uploads/benchmarking.pdf	High	High	Medium	High
2	Producing, Providing, Trading: Manufacturing Industry and Sustainable Cities	Nick Robbins, Ritu Kumar (1999)	Industry in general (examples use leather, cotton)	N/A	All Environmental and social (more environmental focus)	(Environmental) Resource consumption; hazardous waste; air pollution; water pollution; soil contamination; toxicity. (Social) Labour issues, global and local communities	Global	1) In advanced economies, environmental costs associated with manufacturing occur beyond manufacturing stage - generated during sourcing, consumption and disposal of products; 2) 'industrial ecology' - philosophy wherein wastes/emissions of one process act as input to another product system	1) Looks at role of industry in contributing to sustainable development in cities; 2) industry must become responsible for socio-environmental performance of its own production activities, the sourcing of raw material inputs "upstream", and for emissions	1) Ex. 1996 Closed Substance Cycle and Waste Management Act (Germany) determined that whoever produces, markets, consumes goods is responsible for avoidance, recycling, re-use, ecological disposal of waste; 2) Ex. Initiatives to shift cotton production to	Environment and Urbanization, Vol. 11 No. 2 (October 1999) http://eau.sagepub.com/cgi/reprint/11/2/75.pdf	High	High	Medium	High
3	Moving Towards Social Responsibility in the Textile and Fibre Industry: a Diachronic Approach	Christel Baldia (2001)	Cotton, silk, wool, polyester, nylon, rayon, lyocell	N/A	Raw material production (incl. dye process); consumer care	Health and safety, labour issues, hazardous waste; water pollution	US	1) Cotton dust exposure can cause pulmonary disease - workers chronically exposed risk developing chronic airflow obstruction or byssinosis as with asbestos	1) Through pressure from agencies (like OSHA), cotton standard passed 1978 - reduced "brown lung" from cotton dust from 12000 workers to 700 (1978-2000); 2) 1986 - OSHA est. instance-by-instance penalties on companies violating H&S standards; 3) in 1978,	Author conducted content analysis of trade journal <i>The Journal of Textile Chemists and Colorists (AATCC)</i> from 1975-2000 to study changes in industry focus on social/ environmental concerns	Ancient Textiles; 1 June 2001; http://home.columbus.rr.com/ancienttextiles/Social%20Responsibility%20Textile%Industry.htm	Unknown	High	Medium	Low
4	Bonded Labour in India: Its Incidence and Pattern	Ravi S. Srivastava (2005)	Silk, Cotton (some leather)	N/A	Raw material production, fabric production	Labour issues, gender?	India	1) Bonded child labour found to be prevalent in India's silk and cotton industries; 2) Social element: most bonded workers from SC/ST or are Muslim - predominantly girls; 3) System of heavy advances used to secure labour, as well as other methods	1) Bonded labour found in occupations including rearing of silk cocoons, production of silk sarees, leather products, in hybrid cotton seed farms, in cotton fields, weaving; 2) Silk - master weavers pay advances to weavers, who employ children as helpers:	No real indication of what is being done to prevent/ stop this/ whether it's perceived as bad, etc.	International Labor Office, Special Action Programme to Combat Forced Labour http://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=1026&context=child	High	Medium - Number provided for prevalence of bonded labour	Medium	Low

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5	Labour Laws and Employment Practices, Affecting Children, In Central Asia	IOM (2004)	Cotton	N/A	Raw material production	Labour issues	Central Asia	1) Use of child labour more widespread since end of Soviet Union; 2) Children used in irrigating, weeding, harvesting work; 3) Students in fields exposed to risks associated with heavy work and use of chemicals	1) Up to 3 months spent out of school (often don't go back)- education levels suffer significantly	40-50% of region's cotton annually picked by school children and students	International Organization for Migration < http://www.tcc.iom.int/iom/images/uploads/Labour%20Laws%20and%20Employment%20Practices%20Affecting%20Children%20in%20Central%20Asia_1105710320.pdf >	High	High	Medium	Unknown
6	Cotton Mill Dust May Be Carrier as Well as Culprit in Respiratory Ills	Courtney Humphries (2003)	Cotton	N/A	Raw material production, fabric production	Health	China	1) Long-term exposure to cotton dust can leave mill workers with severe respiratory illness; 2) Cotton dust contains endotoxins; 3) workers exposed to endotoxins experience acute drops in lung volume, capacity over course of shift.	1) Dust is created when cotton is blown open and further cleaned, carded, combed, and spun into threads; 2) Endotoxins are now associated with long-term symptoms: chronic lung function loss, more so than cumulative dust exposure	1) Still unclear whether respiratory function continues to worsen or eventually improves; 2) Endotoxin portion of dust, and not dust itself, is harmful to workers (implications beyond textile mill); 3) Methods to measure endotoxin levels are currently inappropriate	Focus: Harvard Medical, Dental and Public Health Schools < http://focus.hms.harvard.edu/2003/March21_2003/occupational_health.html >	High	Low	Medium	High
7	Impact of WTO on the Patterns of Trade in Textile & Clothing	Syed Kashif Rafi (2005)	N/A (some examples of cotton used)	N/A	Distribution, trade patterns	Import/ Export, commodity chains, end of quotas	Worldwide	1) textile and clothing industries/trade have long been catalyst for economic growth (in 2001, accounted for over USD450 billion); 2) From 2005 all WTO quotas on textile and clothing will be abolished; 3) US and Caribbean textile producers fear competition from developing countries	1) is especially important for developing countries, and more so for LDCs; 2) Efforts to liberalize the sector continue w/in ongoing negotiations (Doha) re many remaining trade restrictions.	1) In EU alone, sector directly employs over 2.1 million people; annual sales worth €200 billion, exports €45 billion; 2) the impact of WTO on China textile and clothing industry depends on reduction of tariffs and elimination of quotas.	Journal of Management and Social Sciences, Vol. 1 No. 2 (Autumn 2005) < http://www.biztek.edu.pk/downloads/research/imss_v1_n2/v1n2_204-226.pdf >	High	High	Medium	High
8	Trends and Patterns of Denim Demand in India	Nayak Paramanand a (2005)	Denim	Clothes	Retail, Distribution	Consumer trends, Market trends	India	1) Indian consumers spend approx. 9% of disposable income on clothing and footwear (compared with 5% in US); 2) Indian consumers typically more loyal to stores than brands; 3) The fall in prices of cotton has had significant effect on prices of denim	1) Indian market for branded products like jeans, trousers, shirts, etc estimated at 40 million consumers; 2) Brand is second most important factor (price most important in East); 3) Production of denim depends on cost of cotton - principle raw material	1) Nearly 72% of Indian population lives in rural areas; 2) rural market in India growing approx. twice as fast as urban market; 3) due to expanded production capacity, it's estimated that supply will increase by 8% while demand will increase by only 5-6%	Institute for Economic and Social Change < http://www.arts.cornell.edu/poverty/kanbur/KarnatakaConfPapersAndCall.pdf >	High	High (no sources, though)	Medium	Unknown
9	Factors Underlying Fabric Perception	Wendy Moody, Roger Morgan, Patricia Dillon, Chris Baber, Alan Wing	Fleece (100% polyester), Lycra, Sheepskin, Silk, Corduroy (100% cotton), leather, velvet (100% viscose), Irish linen, Denim, Lace, Tweed	N/A	Consumption	Consumption patterns, influences	Assume developed world (West)	1) clothes shopping represents a building and development of the 'self'; 2) Fleece, Tweed = "Sedate warmth"; Satin, silk, lace = "Faded Familiarity"; Corduroy, leather = "Male"; Lycra, Denim = "Energized"; Velvet, Irish linen = "Opulent Poise"	1) Decisions and motivations are based on anticipated reality of preference, personality, emotion and moods; 2) The characteristic "feel" of a given fabric depends on a particular combination of variables	Subjects were given touch and feel tests of various textile fabrics and asked to classify them	Eurohaptics 2001 Conference Proceedings, Educational Technology Paper < http://www.eurohaptics.vision.ee.ethz.ch/2001/moody.pdf >	High	High (Supported by case study findings)	Unknown (depends on bias of subjects, how they were studied...)	High

Silk - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Sensitization to Silk and Childhood Asthma in Rural China	Juan C. Celedon, Lyle J. Palmer, Xiping Xu, Binyang Wang, Zhian Fang, Scott T. Weiss (2001)	Silk	Includes filled clothes (eg. Coats, blankets)	Raw material production, fabric production, finishing processes, end of life management (eg. Use of waste products)	Health	China (some mention of India, Japan, Central Asia)	1) Silk is an aeroallergen that is ubiquitous in Chinese society; 2) Sensitization to silk is a predictor of childhood asthma; 3) Because of the importance of sericulture in some countries (China, India, Japan), sensitization to silk may influence human toxicity	1) Sensitization to mulberry can be attributable to allergens in the silk cocoon, silkworm pupae, and unprocessed silk threads; 2) Silk workers involved in sorting/boiling cocoons and in reeling, rearranging, degumming threads can be sensitized to silk.	1) the final products of silk are usually nonallergenic; 2) given pervasiveness of silk products in Chinese culture, avoidance of exposure to silk waste is difficult unless its use is greatly reduced; 3) Additional research needed to see if sensitization more human toxicity impacts	Pediatrics Vol. 107 No. 5 (1 May 2001) < http://pediatrics.aappublications.org/cgi/reprint/107/5/e80 >	High	High	Medium	Unknown (no)
2	Silk: A Tradition with a Future?	Antero Hyvarinen (1999)	Silk	N/A	Raw material production, fabric production, distribution, retail	Social trends, competition from other textiles, regional economic impacts on silk	Global	1) Silk industry is at crossroads; 2) Traditional producers cutting back on labour intensive silk production; 3) Silk producers in Asia (eg India, Thailand) remain significant consumers; 4) Overall regional consumption of silk/ silk product is down.	1) New sandwashed silk brought wider affordability during 90s, but competition from other synthetics has decreased market share; 2) urban industries lure farmers from business in which incomes dropped radically in recent years; 3) Japan is the largest consumer of silk	1) Silk is almost entirely made of proteins and is close in composition to human skin, making it comfortable to wear; 2) If farmers stop sericulture, industry cannot easily recover because working with silkworms requires particular discipline.	International Trade Forum - Issue 1/1999 < http://www.tradeforum.org/news/printpage.php/aid/94/Silk:_A_Tradition_with_a_Future_.html >	High	High	Low - Seems to be biased towards support of silk industry	Medium
3	New Consumers? The Social and Cultural Significance of Children's Fashion Consumption	Sharon Boden, Christopher Pole, Jane Pilcher, Tim Edwards (2004)	N/A	N/A	Consumption	Social trends, family dynamics, Consumer agency/ influence	UK	1) Children's consumption is becoming increasingly socially and culturally significant; 2) Media interest in children and consumption also increased, especially in area of fashion and rise of "tweenager"; 3) child consumers are an important sector of the fashion industry	1) The market of childrenswear is growing strongly, retail competition intense with both designer labels/ low-price retailers; 2) Children are becoming a "target group" of active, purposeful consumers.		Cultures of Consumption Working Paper Series, Working Paper 16 < https://ira.le.ac.uk/bitstream/2381/47/1/Boden+Working+Paper2.doc? >	High	Medium	Unclear	Unknown
4								8) kids associate certain shops, brands, styles with superior quality/ with keeping abreast of new trends; 9) Kids actively shape attitudes to consuming within the household - affecting power relations between themselves, siblings, parents.	7) kids are affected by a sense of fashion do's/ don'ts that are dependent on context and rules of particular environment/ culture; 8) Kids are able to independently appraise fashion marketplace, implicating potential social dangers or purchasing poor quality clothing						

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
5	Impact of WTO on the Patterns of Trade in Textile & Clothing	Syed Kashif Rafi (2005)	N/A (some examples of cotton used)	N/A	Distribution, trade patterns	Import/ Export, commodity chains, end of quotas	Worldwide	1) textile and clothing industries/trade have long been catalyst for economic growth (in 2001, accounted for over USD450 billion); 2) From 2005 all WTO quotas on textile and clothing will be abolished; 3) US and Caribbean textile producers fear competition.	1) is especially important for developing countries, and more so for LDCs; 2) Efforts to liberalize the sector continue w/in ongoing negotiations (Doha) re many rmainig trade restrictions.	1) In EU alone, sector directly employs over 2.1 million people; annual sales worth €200 billion, exports €45 billion; 2) the impact of WTO on China textile and clothing industry depends on reduction of tariffs and elimination of quotas.	Journal of Management and Social Sciences, Vol. 1 No. 2 (Autumn 2005) < http://www.biztek.edu.pk/downloads/research/imss_v1_n2/v1n2_204-226.pdf >	High	High	Medium	High
6								7) (simulation analysis) China, HK, Italy will be net losers under new rules - US, Canada, UK, Spain will be net winners; 8) Endogenous production of raw material will continue to play favourable role in competitiveness, but weaker; 9) size of the economy	7) China's sustainable competitiveness will decrease w/out entry to WTO, will increase w/ entry to WTO; 8) Expected: concentration in textile and clothing trade will be reduced, trade will be based on two-way transactions.						
7	Social Mobility in the Context of Occupational Health: The Case of Silk Reeling	Anand Inbanathan (2005)	Silk	N/A	Raw material production	Poverty reduction, Health and safety, social mobility	India	1) Sericulture has been seen as part of anti-poverty effort in India by state and central governments; 2) Sericulture also causes significant health problems for workers	1) Sericulture is a set of activities which, as currently organized, is suitable for people with limited skills and almost no education; 2) Silk-reeling is considered most problematic activity, but dying and silkworm reeling may also have health impacts.	1) In India, with significant absolute poverty, there is a need to develop income generating options for the poor (considering limited education/ skills); 2) There are few details about the chemicals used in dyeing, or their effects on the workers who use the technologies	Institute for Social and Economic Change, Bangalore < http://www.isec.ac.in/Karnataka_Inbanathan16.5.05_aligned.pdf >	High	High (case study)	Medium	High (from industrial perspective)
8	Encyclopedia of Occupational Health and Safety 4th Ed: Silk Industry	J. Kubota (1998)	Silk	N/A	Raw material production, fabric production	Health and safety	global	1) Carbon monoxide toxicity reported, esp. in Japan; 2) Dermatitis of the hands of female workers reeling raw silk (skin lesions on fingers, wrists and forearms); 3) Allergic skin reactions to raw silk (facial swelling and ocular inflammation)	1) Attributed to use of charcoal fires in poorly ventilated sericulture rearing rooms; 2) Initially attributed to decomposition products of the dead chrysalis and cocoon parasite - now often associated with temperature of reeling baths	(re. dermatitis) Since introduction of new installations with lower bath temperatures, incidence of dermatitis have decreased among reel workers; (re. tonsillitis) Disinfection and frequent replacement of reel bath water, along with exhaust ventilation should take place frequently.	International Labor Organization http://www.ilo.org/encyclopaedia/?d&nd=857200479&prevDoc=857200479&spack=111intelsearch%3Dsilk%26listid%3D010000000200%26listpos%3D1%26lsz%3D35%26w1%3Don%26whereselectsw%3D1%26&c=silk#10	High	Medium	Medium	High
9								11) Silk reeling as a means of social mobility has significant limitations; 12) Little income is left for education of children	8) Ovens are now more efficient on fuel, and save on amount of fuel needed, however, they have the same drawbacks as before (still use biomass fuel); 9) Steam from open ovens, along with serecin from cocoons, causes allergic reactions in many workers						

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
10	Environmental Issues in Non-Wood Pulp Production - Fundamentals, Problems and Opportunities	Paula Paananen (2004)	Jute, hemp	N/A	Raw material production	Water pollution, waste recovery	Asia	1) non-wood pulping mills typically small in size with insufficient chemical recovery and effluent treatment	1) Many small mills lack a recovery unit and instead discharge chemicals directly into receiving water body			Unknown	Low	Unknown	Low

Flax - Social Impacts

	Title	Author and Age	Scope of Study				Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope				(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?

No information was found.

Jute - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Environmental Issues in Non-Wood Pulp Production - Fundamentals, Problems and Opportunities	Paula Paananen (2004)	Jute, hemp	N/A	Raw material production	Water pollution, waste recovery	Asia	1) non-wood pulping mills typically small in size with insufficient chemical recovery and effluent treatment	1) Many small mills lack a recovery unit and instead discharge chemicals directly into receiving water body	N/A		Unknown	Low	Unknown	Low

Rayon/Viscose - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Public Health Assessment: American Bemberg Plant; Environmental Contamination and other Hazards	1999 - Superfund Site Assessment Branch; Division for Health Assessment and Consultation; ATSDR	Rayon/Viscose	All	Production	Environmental Contamination and Public and Worker Health	Elizabethton, Carter County, Tennessee	Worker Health	Production		http://www.atsdr.cdc.gov/hac/pha/ambem/abp_p2.html _ Agency for Toxic Substances and Disease Registry (ATSDR)	High	High	Unknown	High
2	Ohio State University - FactSheet: Rayon - The Multi-Faceted Fibre	Joyce A Smith	Rayon/Viscose	All	Consumer Care	Confusion in cleaning needs	USA	cost of care	consumer care	Processing of rayon requires high water and energy use and has contributed to air and water pollution		High	High	Unknown	Low
3	sustainable textile standard	Institute for Market Transformation to Sustainability	All	All	All	Public Health and Environment; Labour and working conditions		community health; energy use; sustainable re-use	All	sustainable agriculture	Institute of Market Transformation to Sustainability	Medium	High	Medium	Medium
4	Electron Treatment of woodpulp for the viscose process	T m Stepanik; D E Ewing; R Whitehouse 2000	Rayon/Viscose	All	raw material production	worker and public health and safety		potential for water and air emissions	fabric production		Radiation physics and chemistry Volume 57 Issues 3-6	High	High	High	Low
5	Rayon	answers.com date unknown	Rayon/Viscose	All	raw material production	water and air pollution	Global	water and air emissions	raw material production		http://www.answers.com/topic/rayon	Medium	Medium	Unknown	Medium
6	Mitigating Environmental and Social Impacts of Intensive Plantation Forestry	K Heaton 2006	Rayon/Viscose	All	raw material production	loss of forest habitat and biodiversity; soil and water quality; loss of recreational opportunities; resettlement; low economic benefit;	Global	loss of forest habitat and biodiversity; soil and water quality; loss of recreational opportunities; resettlement; low economic benefit;	raw material production		Journal of Sustainable Forestry Volume 21 Issue 4	High	High	High	High

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
7	Ecological and social impacts of fast growing timber plantations and genetically engineered trees	N Carman; O Langelie; A Perry; A Peterman; D Smith B. Tokar	Rayon/Viscose	All	raw material production	decrease in water availability; encroachment on to indigenous communities, agriculture and forests;	Global	decrease in water availability; encroachment on to indigenous communities, agriculture and forests;	raw material production		http://www.forestethics.org/downloads/GEtrereport.pdf	High	Low	Low - campaign organisation	Medium

Down - Social Impacts

[illegible]

No information found

Leather - Social Impacts

	Title	Author and Age	Scope of Study				Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence				
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed					Geographic Scope	(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Producing, Providing, Trading: Manufacturing Industry and Sustainable Cities	Nick Robbins, Ritu Kumar (1999)	Industry in general (examples use leather, cotton)	N/A	All Environmental and social (more environmental focus)	(Environmental) Resource consumption; hazardous waste; air pollution; water pollution; soil contamination; toxicity. (Social) Labour issues, global and local communities	Global	1) In advanced economies, environmental costs associated with manufacturing occur beyond manufacturing stage - generated during sourcing, consumption and disposal of products; 2) 'industrial ecology' - philosophy wherein wastes/emissions of one process is an input to another product system	1) Looks at role of industry in contributing to sustainable development in cities; 2) industry must become responsible for socio-environmental performance of its own production activities, the sourcing of raw material inputs "upstream", and for the emissions occurring in the supply chain	1) Ex. 1996 Closed Substance Cycle and Waste Management Act (Germany) determined that whoever produces, markets, consumes goods is responsible for avoidance, recycling, re-use, ecological disposal of waste.	Environment and Urbanization, Vol. 11 No. 2 (October 1999) http://eau.sagepub.com/cgi/reprint/11/2/75.pdf	High	High	Medium	High
2	(excerpt) Cleaner Leather Production: The Changing Environmental Image of African Tanneries	UNIDO (2001)	Leather	N/A	Raw material production, fabric production	Hazardous Waste, resource consumption, toxicity	Africa (Ethiopia, Zimbabwe)	1) Leather is a significant source of income for African countries, also major source of industrial pollution and target for public scrutiny and gov't regulation;	1) Industry aware that new technology would reduce costs, improve environmental performance, expand range of products; 2) Encouraging of technology options aimed at reducing water consumption, optimizing dosage and fixation of chemicals & minimizing organic chemicals such as solvents	1) Eastern/Southern Africa - most tanneries have effluent treatment plants, some are experimenting with various means of reducing solid waste;	UNIDO http://www.unido.org/doc/4580	High	Low	Medium	Low
3	The Leather Global Value Chain and the World Leather Footwear Market	World Leather Market (2000)	Leather	Footwear, other apparel	Raw material production, fabric production, finishing processes, distribution, retail	Evolution in commodity chain, environmental impacts, skills/ capacity development	global	1) Buyer-driven commodity chain characterizes labour-intensive industries like footwear and garments; 2) two markets, the local and the export market: the latter is usually managed within the rules of a buyer-driven commodity chain/supply chain	1) Buyer-driven chain: marketing and manufacturing agents set up global production networks (usually in dev'ing countries), which produce finished goods under contract specifications, guidelines and technical advice from purchasing agents.	1) the polluting situation in developing countries started to change and by the early 90s the tanners were under pressure to invest in effluent treatment facilities	World Leather Market http://www.factbook.net/leather_evolution.php	High	High	Medium	High
5								6) There is concern about the availability, price and quality of hides and skins and the need to conform to environmental specifications during processing; 7) Opportunities for upgrading depend on the quality of information provided to the manufacturer	5) reverse in flow of international trade in raw materials & the relocation of leather production from developed to developing countries (1960-80) transferred the most highly polluting wet processing away from the OECD countries when environmental concerns were added to the agenda						

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
6	Encyclopedia of Occupational Health and Safety 4th Ed: Health Effects and Disease Patterns	Frank B. Stern (2001)	Leather	N/A	Raw material production, fabric production	Health and Safety	global	1) Employment in the leather and leather manufacturing products industry has been associated with various diseases caused by biological, toxicological and carcinogenic agents; 2) Skin disorders such as eczema and contact (allergic) dermatitis have also been reported	1) specific disease associated with exposure in the leather industry depends upon the extent to which the worker is exposed to the agent(s), which is dependent upon the occupation and work area within the industry	1) Benzene has largely been eliminated from the footwear industry	International Labour Organization < http://www.ilo.org/encyclopedia/?print&nd=857200646 >	High	High	Medium	High
7	Factors Underlying Fabric Perception	Wendy Moody, Roger Morgan, Patricia Dillon, Chris Baber, Alan Wing	Fleece (100% polyester), Lycra, Sheepskin, Silk, Corduroy (100% cotton), leather, velvet (100% viscose), Irish linen, Denim, Lace, Tweed	N/A	Consumption	Consumption patterns, influences	Assume developed world (West)	1) clothes shopping represents a building and development of the 'self'; 2) Fleece, Tweed = "Sedate warmth"; Satin, silk, lace = "Faded Familiarity"; Corduroy, leather = "Male"; Lycra, Denim = "Energized"; Velvet, Irish linen = "Opulent Poise"	1) Decisions and motivations are based on anticipated reality of preference, personality, emotion and moods; 2) The characteristic "feel" of a given fabric depends on a particular combination of variables involving fabric surface	Subjects were given touch and feel tests of various textile fabrics and asked to classify them	Eurohaptics 2001 Conference Proceedings, Educational Technology Paper < http://www.eurohaptics.vision.ee.ethz.ch/2001/moody.pdf >	High	High (Supported by case study findings)	Unknown (depends on bias of subjects, how they were studied...)	High

Polyester - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Textile Fibres and Terminology	E4S Environmental Teaching Resources Date unknown	Polyester	All	fabric production and finishing processes	Odour and Health; Air pollution	UK	Odour - local authorities are insisting that abatement systems are installed to remove fumes.	Production; dyeing; setting of Synthetics;	Carcinogens of polyester dyes; High energy consumption ; emissions	http://www.e4s.org.uk/textilesonline/content/6library/report1/textile_fibres/polyester.htm	High	High	Unknown	High
2	Well Dressed	J Allwood; S Ellebaek Laursen; C Malvido de Rodriguez; N M P Bocken 2006	All	All	All	sustainability of the industry	UK	High waste volumes from 'fast fashion'; labour codes of practice; low wages and little opportunity to develop skills; suppression of collective bargaining.	manufacture; retail	Consumer Choices that will affect changes in the sector's trade relationships; gender issues;	University of Cambridge Institute for Manufacturing	High	High	High	High
3	Nylon; The story of a fashion revolution Book Reviews	John K Smith	Nylon; acrylic; polyester	All	Retail and Consumer Care	fashion; political statement; women's liberation in the west	USA; Europe; Japan	Rebellion; practicality	retail and consumer care		Technology and Culture volume 43 Number 2 pp.446-448 http://eh.net/bookreviews/library/0312	Medium	Medium	Medium	Medium
4	sustainable textile standard	Institute for Market Transformation to Sustainability	All	All	All	Public Health and Environment; Labour and working conditions		community health; energy use; sustainable re-use	All	sustainable agriculture	Institute of Market Transformation to Sustainability	Medium	High	Medium	Medium
5	Managing the social impacts of oil and gas operations	Shell 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	Global	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	raw material production		http://www.shell.com/home/Framework?siteId=envandsoc-en&FC2=envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communities/zzz_lhn.html&FC3=envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communit	High	High	High	Medium
6	Social impact Assessment in the Oil and Gas Industry	IPIECA 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	Global	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	raw material production		http://www.ipieca.org/downloads/social/SIA_Document_Final.pdf	High	High	High	High
7	Quick Start: Design for Sustainability	Government Victoria, Australia	All	All	All	Health	Australia	Health impacts on humans from emissions		environmental	www.sustainability.vic.gov.au/resources/documents/PE_011_Quickstart_06_FA.pdf	High	Medium	High	High
8	BTC Pipeline EIA Review		Oil based Synthetics	All	raw material production	Cultural resources; resettlement; consultation	Asia	Resettlement; cultural heritage	raw material production		http://www.foe.co.uk/resource/reports/btc_eia_review.pdf	Medium	Medium	Low	Medium
9	Best practices in mainstreaming environmental and social safeguards into gas pipeline projects	World Bank	Oil based Synthetics	All	raw material production	cultural resources; indigenous people;	Bolivia and brazil	cultural resources, indigenous people, stakeholder engagement,	raw material production		http://wbln0018.worldbank.org/esmap/site.nsf/files/322-06+(Quintero)For+Web.pdf/\$FILE/322-06+(Quintero)For+Web.pdf	High	Medium	Medium	Medium

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
10	Moving Towards Social Responsibility in the Textile and Fibre Industry: a Diachronic Approach	Christel Baldia (2001)	Cotton, silk, wool, polyester, nylon, rayon, lyocell	N/A	Raw material production (incl. dye process); consumer care	Health and safety, labour issues, hazardous waste; water pollution	US	1) Dust exposure can cause pulmonary disease - workers chronically exposed risk developing chronic airflow obstruction or byssinosis as with asbestos;	1) Through pressure from agencies (like OSHA), cotton standard passed 1978 - reduced "brown lung" from cotton dust from 12000 workers to 700 (1978-2000); 2) 1986 - OSHA est. instance-by-instance penalties on companies violating H&S standards;	Author conducted content analysis of trade journal <i>The Journal of Textile Chemists and Colorists (AATCC)</i> from 1975-2000 to study changes in industry focus on social/ environmental concerns	Ancient Textiles; 1 June 2001; http://home.Columbus.rr.com/ancienttextiles/Social%20Responsibility%20Textile%Industry.htm	Unknown	High	Medium	Low
11	Factors Underlying Fabric Perception	Wendy Moody, Roger Morgan, Patricia Dillon, Chris Baber, Alan Wing	Fleece (100% polyester), Lycra, Sheepskin, Silk, Corduroy (100% cotton), leather, velvet (100% viscose), Irish linen, Denim, Lace, Tweed	N/A	Consumption	Consumption patterns, influences	Assume developed world (West)	1) clothes shopping represents a building and development of the 'self'; 2) Fleece, Tweed = "Sedate warmth"; Satin, silk, lace = "Faded Familiarity"; Corduroy, leather = "Male"; Lycra, Denim = "Energized"; Velvet, Irish linen = "Opulent Poise"	1) Decisions and motivations are based on anticipated reality of preference, personality, emotion and moods; 2) The characteristic "feel" of a given fabric depends on a particular combination of variables involving fabric surface	Subjects were given touch and feel tests of various textile fabrics and asked to classify them	Eurohaptics 2001 Conference Proceedings, Educational Technology Paper http://www.eurohaptics.vision.ee.ethz.ch/2001/moody.pdf	High	High (Supported by case study findings)	Unknown (depends on bias of subjects, how they were studied...)	High

Polypropylene - Social Impacts

	Title	Author and Age	Scope of Study				Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence				
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed					Geographic Scope	(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Well Dressed	J Allwood; S Ellebaek Laursen; C Malvido de Rodriguez; N M P Bocken 2006	All	All	All	sustainability of the industry	UK	High waste volumes from 'fast fashion'; labour codes of practice; low wages and little opportunity to develop skills; suppression of collective bargaining.	manufacture; retail	Consumer Choices that will affect changes in the sector's trade relationships; gender issues;	University of Cambridge Institute for Manufacturing	High	High	High	High
2	sustainable textile standard	Institute for Market Transformation to Sustainability	All	All	All	Public Health and Environment; Labour and working conditions		community health; energy use; sustainable re-use	All	sustainable agriculture	Institute of Market Transformation to Sustainability	Medium	High	Medium	Medium
3	Managing the social impacts of oil and gas operations	Shell 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	Global	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	raw material production		http://www.shell.com/home/Framework?siteId=envandsoc-en&FC2=/envandsoc-en/html/iwqen/key_issues_and_topics/our_neighbours/interacting_with_communities/zzz_lhn.html&FC3=/envandsoc-en/html/iwqen/key_issues_and_topics/our_neighbours/interacting_with_communities	High	Medium	Medium	Medium
4	Social impact Assessment in the Oil and Gas Industry	IPIECA 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	Global	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	raw material production		http://www.ipieca.org/downloads/social/SIA_Document_Final.pdf	High	High	High	High
5	Quick Start: Design for Sustainability	Government Victoria, Australia	All	All	All	Health	Australia	Health impacts on humans from emissions		environmental	www.sustainability.vic.gov.au/resources/documents/PE_011_Quickstart_06_FA.pdf	High	Medium	High	High
6	BTC Pipeline EIA Review		Oil based Synthetics	All	raw material production	Cultural resources; resettlement; consultation	Asia	Resettlement; cultural heritage	raw material production		http://www.foe.co.uk/resource/reports/btc_eia_review.pdf	Medium	Medium	Low	Medium
7	Best practices in mainstreaming environmental and social safeguards into gas pipeline projects	World Bank	Oil based Synthetics	All	raw material production	cultural resources; indigenous people;	Bolivia and brazil	cultural resources, indigenous people, stakeholder engagement,	raw material production		http://wbln0018.worldbank.org/esmap/site.nsf/files/322-06+(Quintero)For+Web.pdf/\$FILE/322-06+(Quintero)For+Web.pdf	High	Medium	Medium	Medium

Acrylic - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Well Dressed	J Allwood; S Ellebaek Laursen; C Malvido de Rodriguez; N M P Bocken 2006	All	All	All	sustainability of the industry	UK	High waste volumes from 'fast fashion'; labour codes of practice; low wages and little opportunity to develop skills; suppression of collective bargaining.	manufacture; retail	Consumer Choices that will affect changes in the sector's trade relationships; gender issues;	University of Cambridge Institute for Manufacturing	High	High	High	High
2	sustainable textile standard	Institute for Market Transformation to Sustainability	All	All	All	Public Health and Environment; Labour and working conditions		community health; energy use; sustainable re-use	All	sustainable agriculture	Institute of Market Transformation to Sustainability	Medium	High	Medium	Medium
3	Managing the social impacts of oil and gas operations	Shell 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	Global	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	raw material production		http://www.shell.com/home/Framework?siteId=envandsoc-en&FC2=/envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communities/zzz_lhn.html&FC3=/envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communit	High	Medium	Medium	Medium
4	Social impact Assessment in the Oil and Gas Industry	IPIECA 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	Global	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	raw material production		http://www.ipieca.org/downloads/social/SIA_Document_Final.pdf	High	High	High	High
5	Quick Start: Design for Sustainability	Government Victoria, Australia	All	All	All	Health	Australia	Health impacts on humans from emissions		environmental	www.sustainability.vic.gov.au/resources/documents/PE_011_Quickstart_06_FA.pdf	High	Medium	High	High
6	BTC Pipeline EIA Review		Oil based Synthetics	All	raw material production	Cultural resources; resettlement; consultation	Asia	Resettlement; cultural heritage	raw material production		http://www.foe.co.uk/resource/reports/btc_eia_review.pdf	Medium	Medium	Low	Medium
7	Best practices in mainstreaming environmental and social safeguards into gas pipeline projects	World Bank	Oil based Synthetics	All	raw material production	cultural resources; indigenous people;	Bolivia and Brazil	cultural resources, indigenous people, stakeholder engagement,	raw material production		http://wbIn0018.worldbank.org/esmap/site.nsf/files/322-06+(Quintero)For+Web.pdf/\$FILE/322-06+(Quintero)For+Web.pdf	High	Medium	Medium	Medium

Nylon - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Well Dressed	J Allwood; S Ellebaek Laursen; C Malvido de Rodriguez; N M P Bocken 2006	All	All	All	sustainability of the industry	UK	High waste volumes from 'fast fashion'; labour codes of practice; low wages and little opportunity to develop skills; suppression of collective bargaining.	manufacture; retail	Consumer Choices that will affect changes in the sector's trade relationships; gender issues;	University of Cambridge Institute for Manufacturing	High	High	High	High
2	Nylon; The story of a fashion revolution Book Reviews	John K Smith	Nylon; acrylic; polyester	All	Retail and Consumer Care	fashion; political statement; women's liberation in the west	USA; Europe; Japan	Rebellion; practicality	retail and consumer care		Technology and Culture volume 43 Number 2 pp.446-448 http://eh.net/bookreviews/library/0312	Medium	Medium	Medium	Medium
3	sustainable textile standard	Institute for Market Transformation to Sustainability	All	All	All	Public Health and Environment; Labour and working conditions		community health; energy use; sustainable re-use	All	sustainable agriculture	Institute of Market Transformation to Sustainability	Medium	High	Medium	Medium
4	Managing the social impacts of oil and gas operations	Shell 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	Global	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	raw material production		http://www.shell.com/home/Framework?siteId=envandsoc-en&FC2=/envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communities/zz_z_lhn.html&FC3=/envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communit	High	Medium	Medium	Medium
5	Social impact Assessment in the Oil and Gas Industry	IPIECA 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	Global	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	raw material production		http://www.ipieca.org/downloads/social/SIA_Document_Final.pdf	High	High	High	High
6	Quick Start: Design for Sustainability	Government Victoria, Australia	All	All	All	Health	Australia	Health impacts on humans from emissions	fabric production	environmental	www.sustainability.vic.gov.au/resources/documents/PE_011_Quickstart_06_FA.pdf	High	Medium	High	High
7	BTC Pipeline EIA Review		Oil based Synthetics	All	raw material production	Cultural resources; resettlement; consultation	Asia	Resettlement; cultural heritage	raw material production		http://www.foe.co.uk/resource/reports/btc_eia_review.pdf	Medium	Medium	Low	Medium

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
8	Best practices in mainstreaming environmental and social safeguards into gas pipeline projects	World Bank	Oil based Synthetics	All	raw material production	cultural resources; indigenous people;	Bolivia and brazil	cultural resources, indigenous people, stakeholder engagement,	raw material production		http://wbln0018.worldbank.org/esmap/site.nsf/files/322-06+(Quintero)For+Web.pdf/\$FILE/322-06+(Quintero)For+Web.pdf	High	Medium	Medium	Medium
9	Moving Towards Social Responsibility in the Textile and Fibre Industry: a Diachronic Approach	Christel Baldia (2001)	Cotton, silk, wool, polyester, nylon, rayon, lyocell	N/A	Raw material production (incl. dye process); consumer care	Health and safety, labour issues, hazardous waste; water pollution	US	1) Dust exposure can cause pulmonary disease workers chronically exposed risk developing chronic airflow obstruction or byssinosis as with asbestos	1) Through pressure from agencies (like OSHA), cotton standard passed 1978 - reduced "brown lung" from cotton dust from 12000 workers to 700 (1978-2000); 2) 1986 - OSHA est. instance-by-instance penalties on companies violating H&S standards.	Author conducted content analysis of trade journal <i>The Journal of Textile Chemists and Colorists (AATCC)</i> from 1975-2000 to study changes in industry focus on social/ environmental concerns	Ancient Textiles; 1 June 2001; < http://home.columbus.rr.com/ancienttextiles/Social%20Responsibility%20Textile%Industry.htm >	Unknown	High	Medium	Low

PVC - Social Impacts

	Title	Author and Age	Scope of Study				Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence				
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed					Geographic Scope	(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Well Dressed	J Allwood; S Ellebaek Laursen; C Malvido de Rodriguez; N M P Bocken 2006	All	All	All	sustainability of the industry	UK	High waste volumes from 'fast fashion'; labour codes of practice; low wages and little opportunity to develop skills; suppression of collective bargaining.	manufacture; retail	Consumer Choices that will affect changes in the sector's trade relationships; gender issues;	University of Cambridge Institute for Manufacturing	High	High	High	High
2	Nylon; The story of a fashion revolution Book Reviews	John K Smith	Nylon; acrylic; polyester	All	Retail and Consumer Care	fashion; political statement; women's liberation in the west	USA; Europe; Japan	Rebellion; practicality	retail and consumer care		Technology and Culture volume 43 Number 2 pp.446-448 http://eh.net/bookreviews/library/0312	Medium	Medium	Medium	Medium
3	sustainable textile standard	Institute for Market Transformation to Sustainability	All	All	All	Public Health and Environment; Labour and working conditions		community health; energy use; sustainable re-use	All	sustainable agriculture	Institute of Market Transformation to Sustainability	Medium	High	Medium	Medium
4	Managing the social impacts of oil and gas operations	Shell 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	Global	livelihood impacts; health impacts; safety impacts; cultural and community lifestyle impacts; security and conflict; economic impacts;	raw material production		http://www.shell.com/home/Framework?siteId=envandsoc-en&FC2=/envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communities/zz_z_lhn.html&FC3=/envandsoc-en/html/iwgen/key_issues_and_topics/our_neighbours/interacting_with_communit	High	Medium	Medium	Medium
5	Social impact Assessment in the Oil and Gas Industry	IPIECA 2004	Polyester, Polypropylene; Acrylic; Nylon; PVC	All	raw material production	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	Global	demographics; socio-economic; health; social infrastructure; resources; psychological and community aspects; cultural property; social equity.	raw material production		http://www.ipieca.org/downloads/social/SIA_Document_Final.pdf	High	High	High	High
6	BTC Pipeline EIA Review		Oil based Synthetics	All	raw material production	Cultural resources; resettlement; consultation	Asia	Resettlement; cultural heritage	raw material production		http://www.foe.co.uk/resource/reports/btc_eia_review.pdf	Medium	Medium	Low	Medium

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
7	Best practices in mainstreaming environmental and social safeguards into gas pipeline projects	World Bank	Oil based Synthetics	All	raw material production	cultural resources; indigenous people;	Bolivia and brazil	cultural resources, indigenous people, stakeholder engagement,	raw material production		http://wbln0018.worldbank.org/esmap/site.nsf/files/322-06+(Quintero)For+Web.pdf/\$FILE/322-06+(Quintero)For+Web.pdf	High	Medium	Medium	Medium

Novel Fabric Materials - Social Impacts

	Title	Author and Age	Scope of Study					Which Impacts/Issues were Identified as Significant	Which Life Cycle Stages/Activities or Consumer Choices were Identified as Making a Significant Contribution to These?	Other Relevant Issues	Source/contact details:	Robustness of Evidence			
			Textile Materials	Clothing Products	Life Cycle Stages	Impacts Identified/ Addressed	Geographic Scope					(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias ?	(4) Transferability - is it usable for policy making?
1	Well Dressed	J Allwood; S Ellebaek Laursen; C Malvido de Rodriguez; N M P Bocken 2006	All	All	All	sustainability of the industry	UK	High waste volumes from 'fast fashion'; labour codes of practice; low wages and little opportunity to develop skills; suppression of collective bargaining.	manufacture; retail	Consumer Choices that will affect changes in the sector;p trade relationships; gender issues;	University of Cambridge Institute for Manufacturing	High	High	High	High
2	sustainable textile standard	Institute for Market Transformation to Sustainability	All	All	All	Public Health and Environment; Labour and working conditions		community health; energy use; sustainable re-use	All	sustainable agriculture	Institute of Market Transformation to Sustainability	Medium	High	Medium	Medium
3	EWG Assessment of EPA Draft Human Health Risk Assessment for the Teflon Chemical PFOA	Environmental Working Group 2005	Teflon	Gore-tex	consumer care	Health	USA	Cancer, Immune System Damage, Pituitary gland damage	Consumer care		http://www.ewg.org/issues/PFCs/20050112/scienceanalysis.php	High	Medium	Low	Low
4	Check the labels in school clothes for toxic chemicals	WWF Cymru	Teflon	Children's school clothes	Retail and Consumer Care	Health	UK	Cancer	purchase of durable children's clothes		http://www.wwf.org.uk/core/about/cymru_000001330.asp	Medium	Medium	Medium	High

Annex B

Technological Developments

Literature Summary Technological Developments

	Title	Author and Age	Geographic Scope	Description of Publication	Source/contact details:	Robustness of Evidence			
						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
1	Technical Textile Markets	Textile Intelligence (2006)	Global	This report presents information regarding changes and developments in the industrial and technical textile industry, by providing important information, data and expert analysis on the different sectors within the whole industry.	http://www.textilesintelligence.com/tilproducts/sendbrochure.cfm?repid=TISTTM	High	High	High	High
2	Performance Apparel Markets	Textile Intelligence (2006)	Global	This report presents major developments in the global performance apparel market, focusing on new products, new technologies, new fibres and key players. Contents include information on: moisture management; temperature regulation; stretch; high strength; reflective wear; support wear; UV protection; windproof, waterproof and water-resistant technologies; flame retardancy and smart textiles.	http://www.textilesintelligence.com/tilproducts/sendbrochure.cfm?repid=TISPAM	High	High	High	High
3	The Impact of New Technology in the Clothing Industry: Outlook to 2000	Byrne C (2000) Produced for the International Labour Office in Geneva	Global	This paper describes the current state and major directions of research and technology development into clothing and examines the social dimension of some of the changes that may result. It goes on to describe in greater detail the current state of the art in areas such as CAD/CAM, manufacturing, management, organisation and information technology systems, as well as the 'enabling' technologies which facilitate many of these changes. It also examines the extent to which manufacturing systems are likely to need, and be able, to respond to the demands of individual consumers as opposed to retailers and institutional customers. Finally, the human resource implications of these trends are considered.	http://davidrigbyassociates.co.uk/DRA%20WEBSITE%2003/assets/Impact%20Clothing%20Technology.pdf	Medium	Low	Medium	High

	Title	Author and Age	Geographic Scope	Description of Publication	Source/contact details:	Robustness of Evidence			
						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
4	Study on Water Vapour Transfer Rate of Waterproof Breathable Fabrics with Different Water Content and Condensation	Hua L and Weiyuan Z (date unknown)	China	This paper reports on the influence of water content and condensation on water vapour transfer rate (WVTR) of waterproof breathable fabrics.	Abstract No. 41: http://www.tiwc2007.org/frmset9.htm	Unknown	Unknown	Unknown	Low
5	Spacer Fabrics with Anti-Microbial and Water Repellent Characteristics	Bagherzadeh R, Latif M and Mintazer M (date unknown)	Iran	This paper describes the results of testing spacer fabrics with anti-microbial and water repellent characteristics.	Abstract No. 87: http://www.tiwc2007.org/frmset9.htm	Unknown	Unknown	Unknown	Low
6	Application of Nanolignin for UV Blocking of Linen Fabrics	Zimniewska M, Kozlowski R and Batog J (date unknown)	Poland	This paper reports the finding from applications to linen and hemp fabrics to supply them with a high Sun Protection Factor (SPF).	Abstract No. 89: http://www.tiwc2007.org/frmset9.htm	Unknown	Unknown	Unknown	Low
7	Intelligent Textiles for Smart Applications	Chidambaram G, Chidambaram R and Dandapani S (date unknown)	India	This report reviews intelligent textiles, including: phase change materials, shape memory materials, chromic materials, conductive materials and interactive electronics with textiles.	Abstract No. 119: http://www.tiwc2007.org/frmset9.htm	Unknown	Unknown	Unknown	Medium
8	Engineering the Performance and Functional Properties of Technical Textiles	Engineering and Physical Sciences Research Council (EPSRC) (2006) Prepared by the University of Manchester	UK	This paper presents the results of a study that created geometric and mechanical models to predict the structural performance of technical textiles fabrics under specified load conditions; investigate porosity on fluid flow; measure and model moisture vapour transmission through fabrics; establish the effect of fabric coating on the functionality and performance of technical textiles fabrics; investigate new porous coatings.	http://www.hw.ac.uk/sbc/RIFileX/document/appendix1uom.pdf	High	High	High	Low
9	Smart Fibres, Fabrics and Clothing	Tao X (2001) Woodhead Publishing	Global	This book provides an overview and review of the fundamentals and latest developments in smart technology for textiles and clothing.	http://www.knovel.com/knovel2/Toc.jsp?BookID=819	High	High	High	High
10	European Technology Platform for the Future of Textiles and Clothing: A Vision for 2020	Euratex (2004)	UK	This report outlines a vision for the European textile industry with ways to compete in a changing market.	http://www.textile-platform.org/documents/Key%20Documents/Basic/A%20Vision%20for%202020.pdf	High	High	High	High

	Title	Author and Age	Geographic Scope	Description of Publication	Source/contact details:	Robustness of Evidence			
						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
11	Well Dressed? The Present and Future Sustainability of Clothing and Textiles in the United Kingdom	University of Cambridge Institute for Manufacturing (2006)	UK; Reference to numerous countries where textiles are manufactured and cotton is produced.	This report reviews new technology and smart functions.	http://www.ifm.eng.cam.ac.uk/sustainability/projects/mass/UK_textiles.pdf	High	High	High	High
12	Environmental Consequences of Using Flame-Retardant Textiles: A Simple Life Cycle Analytical Model	Horrocks A R, Hall M E and Roberts D (1997)	UK	This paper extends earlier work which explored the possibility of undertaking a life cycle analysis of flame-retardant cotton and polyester textiles and consequently enabled semi-quantitative estimations of their relative environmental impacts to be made. This model is extended to undertake full environmental audits of a range of flame-retardant textiles and requires full consideration of each stage from fibre/raw material production to eventual disposal. The results show that each of the eleven generic fibres analysed yield environmental index values within a range 32-51% where 100% denotes the worst environmental position possible. This relatively low range of values suggests that current production and processes which attempt to maximize economic viability also tend to reduce environmental impact.	http://cat.inist.fr/?aModele=afficheN&cpsidt=2129960	High	Unknown	High	Low
13	Electronic Intelligence Development for Wearable Applications (Elektroninen)	Hännikäinen J (2006)	Sweden	Not provided	http://www.ele.tut.fi/research/personalelectronics/publications_1.htm	High	Unknown	High	Medium
14	The Changing Global Geography of Low-Technology, Labor-Intensive Industry: Clothing, Footwear, and Furniture	Allen J S (2006)	USA; global	This paper presents a geographic investigation of low-technology, labor-intensive industries by invoking notions of industrial organization, locational agglomeration and spatial divisions of labor.	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VC6-4KJDX41-1&_user=10&_coverDate=09%2F30%2F2006&_ali_d=541213520&_rdoc=2&_fmt=summary&_orig=searh&_cdi=5946&_sort=d&_docanchor=&view=c&_ct=36&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=ee4178b30d9fbf82f83ec492c9b8dc69	High	Unknown	High	Medium
15	Improving the Appearance of all Textile Products from Clothing to Home Textile using Laser Technology	Ziynet O, Oktay P, Ece N O and Arif O (2004) Ege University, Bornova-Izmir/Turkey	Global	This study compared and contrasted manual and laser techniques to create denim trousers.	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V4H-4F1J8NC-1&_user=10&_coverDate=11%2F30%2F2005&_ali_d=541213520&_rdoc=5&_fmt=summary&_orig=searh&_cdi=5759&_sort=d&_docanchor=&view=c&_ct=36&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=72a755d029c0aad0137c45fc5d9bfc4a	High	Unknown	High	Medium

	Title	Author and Age	Geographic Scope	Description of Publication	Source/contact details:	Robustness of Evidence			
						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
16	Globalisation and the Environment: The Long-Term Effects of Technology on the International Division of Labour and Energy Demand	Miozzo M, Dewick P and Green K (2005) Manchester School of Management, UMIST, University of Manchester	Global	This paper examines the effect of the structural changes arising from the globalisation of production and innovation and from technological changes on the environment. Two industries are chosen: clothing and footwear and chemical.	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V65-4FBWHD3-3&_user=10&_coverDate=08%2F31%2F2005&_ali_d=541213520&_rdoc=6&_fmt=summary&_orig=searh&_cdi=5805&_sort=d&_docanchor=&view=c&_ct=36&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=9303e9d5be7b934f9a3a6889af4e2de6	High	Unknown	High	High
17	Textiles Gain Intelligence	Gould P (2004)	Global	This article outlines technical textiles.	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6X1J-49KRMTY-10&_user=10&_coverDate=10%2F31%2F2003&_ali_d=541213520&_rdoc=12&_fmt=summary&_orig=search&_cdi=7244&_sort=d&_docanchor=&view=c&_ct=36&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=ab2891153c5053a665730d9ac5a469fd	Medium	Low	Medium	Low
18	Fabric Area Network – A New Wireless Communications Infrastructure to Enable Ubiquitous Networking and Sensing on Intelligent Clothing	Hum A P J (2001) Starlab Research Laboratories	Belgium	This paper presents the working prototypes and the research work in progress regarding wireless communications in clothing.	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VRG-429952V-4&_user=10&_coverDate=03%2F31%2F2001&_ali_d=541213520&_rdoc=15&_fmt=summary&_orig=search&_cdi=6234&_sort=d&_docanchor=&view=c&_ct=36&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=b008ab758a22fe9c7db7137c60b72e3c	Medium	Low	Medium	Low
20	International Journal of Clothing Science and Technology	Various	Global	There are numerous articles in this journal that provide information on technological developments in the clothing industry.	http://www.emeraldinsight.com/Insight/viewContainer.do?containerType=Journal&containerId=10729	High	High	High	High
21	Staying Healthy by Dressing Smart	Information Society Technologies (date unknown) The Wearable Health Care System	Global	This article reviews the use of smart technology in clothing for health purposes.	Rita Paradiso Via Pistoiese,755 D I-59100 Prato Italy Tel: +39-050-754350 Email: rita@smartex.it http://istresults.cordis.lu/index.cfm/section/news/Tpl/article/BrowsingType/Long%20Feature/ID/74748	Medium	Medium	Medium	Medium
22	Tech Jacket Makes iPod sing in the Rain	T3 (2006)	Global	This article reviews the use of iPods in jackets.	http://www.t3.co.uk/news/247/entertainment/mp3_player/hi-tech_jackets_have_ipod_singing_in_the_rain	Medium	Medium	Medium	Medium
23	iPod Snow Jacket	Tech Digest (2006)	Global	This article reviews the use of iPods in jackets.	http://www.techdigest.tv/2005/04/ipod_snow_jacket.html	Medium	Medium	Medium	Medium
24	Sloping Off	GadgetCandy.com	Global	This article reviews the use of iPods and mobile phones in jackets.	http://www.gadgetcandy.com/archives/2007/01/zegna_ijacket.php	Medium	Medium	Medium	Medium

	Title	Author and Age	Geographic Scope	Description of Publication	Source/contact details:	Robustness of Evidence			
						(1) Credibility - is the evidence from a credible source?	(2) Reliability - is the evidence supported by quantitative data or analytical methods?	(3) Objectivity - is the evidence free from bias?	(4) Transferability - is the evidence usable for policy making?
25	Kenpo iPod jacket - control your iPod via your sleeve	ShinyShiny.tv	Global	This article reviews the use of iPods in jackets.	http://www.shinyshiny.tv/2007/01/kenpo_ipod_jack.html	Medium	Medium	Medium	Medium
26	Kenpo's high fashion iPod coat	GadgetCandy.com	Global	This article reviews the use of iPods in jackets.	http://www.gadgetcandy.com/archives/2005/10/kenpoas_high_fa.php	Medium	Medium	Medium	Medium
27	Know Where jacket phones home with GPS data	Perton M (2006) Engadget	Global	This article reviews the use of GPS in clothing.	http://www.engadget.com/2006/03/08/know-where-jacket-phones-home-with-gps-data/	Medium	Medium	Medium	Medium
28	RFIDs and Waste Management	Coggins C (date unknown) WAMTECH	UK and Global	This paper reviews the use of RFIDs in products and packaging, legislative background and use in waste management applications.	Dr. Chris Coggins (contact via Defra)	High	Low	High	Medium

Pale blue shading represents that the article/paper must be purchased.

Annex C

Initiatives

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Clean Clothes Campaign	Europe	To improve working conditions in the garment and sportswear industries	The campaigns work autonomously at the national level, and come together to work jointly at the European level. This European campaign network is backed up by a broader, international network that includes trade unions, NGOs, and individuals in countries where garments are produced, i.e. Asia, Africa, Eastern Europe, and Central America. The CCC also cooperates with similar campaigns in the United States, Canada, and Australia.	<p>Key focus of the campaign is on consumer awareness and dialogue with companies</p> <p>CCC has developed a code of conduct that is based on ILO conventions. The 'Model Code' applies to companies producing and selling garments and foot wear</p> <p>Other activities:</p> <ul style="list-style-type: none"> • pressure companies to take responsibility to ensure that their products are made in decent working conditions • Solidarity work to support workers, trade unions & NGOs • Raising awareness among and mobilizing citizens who buy clothes • Exploring legal possibilities for improving working conditions • 	www.cleanclothes.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Fairtrade Labelling Organizations (FLO) International	Global (20 countries)	<p>Strategic Intent:</p> <ul style="list-style-type: none"> • to work with marginalized producers & workers to help them move from vulnerability to security & economic self-sufficiency • To empower producers & workers as stakeholders in their own organizations • to play a wider role in the global arena to achieve greater equity in international trade 	<p>A worldwide network of Fair Trade organizations actively involved in supporting producers, awareness raising, campaigning for changes in rules and practices of conventional international trade</p> <p>There are 20 Labelling Initiatives under Fair Trade Labelling Organization (FLO) in Europe, Canada, US, Japan, Australia, NZ</p>	<p>The main tasks and responsibilities of FLO are:</p> <ul style="list-style-type: none"> • Setting international Fairtrade standards (Fairtrade Standards and Policies are approved by autonomous Standards and Policy Committee within FLO) • Facilitating and developing Fairtrade business (matching supply and demand; liaising with Fairtrade-certified producers to strengthen organizations and improve production and market access) • Making the case for trade justice (working with other Fair Trade organizations – IFAT, NEWS, EFTA – FLO have created common Platform to promote case for trade justice in debates on trade and development) 	www.fairtrade.net
Fair Labor Association (FLA)	Global (based in US, Switzerland)	<p>To combine the efforts of industry, civil society organizations, colleges & universities to protect workers' rights & improve working conditions worldwide by promoting adherence to international labour standards</p>	<p>The FLA represents a multi-stakeholder coalition of companies, universities and NGOs. There are currently 20 leading brand-name companies participating in the FLA</p>	<p>Conducts independent monitoring and verification to ensure that the FLA's Workplace Standards are upheld where FLA company products are produced. Through public reporting, the FLA provides consumers and shareholders with credible information to make responsible buying decisions.</p>	www.fairlabor.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Ethical Trading Initiative (ETI)	UK	To ensure that the working conditions of workers producing for the UK market meet or exceed international labour standards	<p>An alliance of companies, NGOs and trade union organisations, set up in 1998, that exists to promote and improve the implementation of corporate codes of practice which cover supply chain working conditions.</p> <p>Funded by a combination of membership fees (currently comprising approximately 60% of our funding base) & a grant from DfID (40% of funding). Members also contribute in-kind (eg, staff time, travel expenses, meeting facilities).</p>	<ul style="list-style-type: none"> • <u>Experimental Projects</u>: provide corporate, trade union & NGO members opportunity to work together to identify/promote good practice in specific aspects of code implementation, often in collaboration with their suppliers and partners. • <u>Research Projects</u>: occasionally commission research to identify existing knowledge about priority issues, or to generate new knowledge where there are gaps in understanding • <u>Monitoring corporate performance</u>: regular monitoring of the progress of our members in implementing the ETI Base Code, through a rigorous annual reporting and review process. • <u>Building Capacity</u>: build the capacity of relevant organisations to implement codes effectively. To date, have supported organisations in three supplier countries to develop the skills & resources to monitor/improve labour conditions at a local level • <u>Training</u>: In conjunction with capacity building work, developing a training programme which focusses on improving the skills of our corporate members, their suppliers & other stakeholders in supplier countries in implementing the ETI Base Code • <u>Working with Others</u>: ETI collaborative activities, including the Multistakeholders Initiatives Project ("Joint Initiative"). 	www.ethicaltrade.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Fair Wear Foundation (FWF)	Netherlands	To promote humane labour conditions in the garment industry	<p>Founded in 1999, FWF is an initiative of business associations in the garment sector, trade unions, and NGOs.</p> <p>FWF is active in every country in which member companies source their garments. At present, these are the following countries:</p> <ul style="list-style-type: none"> • Bangladesh • China • India • Indonesia • Macedonia • Poland • Rumania • Turkey • Tunisia 	<p>FWF works with the Code of Labour Practices for the Garment Industry. Member companies endorse this code & commit themselves to auditing labour conditions in their factories against the provisions of the code and to implementing improvements, where necessary.</p> <p>The code contains eight internationally respected labour standards; these need to be implemented in the factories step-by-step. The factories are mostly located in Asia, Eastern Europe, and North Africa.</p> <p>The Fair Wear Foundation verifies whether member companies actually implement the code of labour practices. For this purpose, the FWF uses a set of four instruments:</p> <ul style="list-style-type: none"> • Complaints procedure for employees • "External" factory audits • Contacts with local organisations • Audit of the management system of the member 	en.fairwear.nl

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Worldwide Responsible Apparel Production (WRAP)	USA	To promote humane, ethical, and lawful conditions and practices in manufacturing facilities all over the world.	<p>The WRAP was created by the American Apparel Manufacturer's Association (AAMA) as part of its commitment to responsible business practices and to ensure that apparel is produced under lawful, humane and ethical conditions.</p> <p>The first stage in this process was the development of the Worldwide Responsible Apparel Production Principles -- basic standards that address labor practices, factory conditions, and environmental and customs compliance. The WRAP Principles received the public endorsement of the AAMA Board of Directors in 1998. More recently, the Principles have been endorsed by groups representing apparel manufacturers from 18 countries around the world</p>	<p>Independently monitors & certifies compliance with the following standards; WRAP also monitors the factory for compliance with detailed practices and procedures implied by adherence to these standards:</p> <ul style="list-style-type: none"> • Compliance with Laws and Workplace Regulations • Prohibition of Forced Labor • Prohibition of Child Labor • Prohibition of Harassment or Abuse • Compensation and Benefits • Hours of Work • Prohibition of Discrimination • Health and Safety • Freedom of Association & Collective Bargaining • Environment • Customs Compliance • Security <p>Also, various training programs educate workers, factory managers, government inspectors, and others about issues related to global supply chains and their workers.</p>	www.wrapapparel.org
Workers' Rights Consortium	USA	To assist in the enforcement of manufacturing Codes of Conduct adopted by colleges & universities; these Codes are designed to ensure that factories producing clothing & other goods bearing college/ university names respect the basic rights of workers.	<ul style="list-style-type: none"> • An independent labor rights monitoring organization, conducting investigations of working conditions in factories around the globe. • 167 affiliated universities and colleges • Roughly 40% of the WRC's funds come from college and university affiliation fees. The remaining 60% is raised through grants from philanthropic foundations and the federal government 	<p>The WRC works with labor rights experts in the United States and around the world to investigate factory conditions.</p> <ul style="list-style-type: none"> • Report findings to colleges and universities & the general public. • Where violations are uncovered, the WRC works with colleges & universities, U.S.-based retail corporations & local workers/organizations to correct the problem & improve conditions. <p>The WRC is also developing a mechanism to ensure that workers producing collegiate goods can lodge complaints about Code of Conduct violations, safely and confidentially, by contacting local non-governmental organizations and the WRC.</p>	www.workersrights.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Organic Exchange		<p>To expand organic agriculture, with a specific focus on increasing the production/ use of organically grown fibres like cotton</p> <p>10 year goal: to secure commitments from leading retailers/ brands to use organic cotton in amounts equalling 10% of global cotton production</p>	<p>Developed a set of Organic Exchange (OE) guidelines to address increasing customer awareness re production in the cotton industry. Most of the world's cotton is grown using significant amounts of pesticides & synthetic fertilizers.</p> <p>To be eligible for certifications, textile companies must meet the OE guidelines. Members of the OE include: Coop, Cutter & Buck, Hess Natur, Marks & Spencer, Mountain Equipment Cooperative, Nike, Norm Thompson, Otto Versand, Patagonia and Timberland</p>	<ul style="list-style-type: none"> • Brand Outreach: We work with brands and retailers to develop and implement short-, medium- and long-term goals to transition some or all of their cotton use to organic cotton. Our staff and dedicated external consultant base have expertise in all areas of farming, supply chain management, product development, marketing, metrics development and reporting. • Farm Development: We work with existing organic farming projects, as well as new producer groups, to help secure contracts for their existing cotton and rotation crop production and develop sound and supportable expansion plans. A new focus is increasing the visibility of farmers worldwide. Regional farming coordinators are currently located in Africa, India and South America. • Tool Development: We support businesses in the development and implementation of an organic cotton program with information, tools and consulting. Our tools include our quarterly newsletter, website, on-line tracking service, sourcing directory, annual conference and marketplace and regional trainings. 	www.organicexchange.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
China Labor Watch	China	<p>CLW seeks to initiate programs that:</p> <ul style="list-style-type: none"> • Educate workers in China about the labor movement & social justice issues; • Promote increased international attention to/ understanding of the labor situation in China ; • Encourage corporations to take social responsibility/ compliance commitments seriously; • Influence labor-related lawmaking in China through activities like public issuance of research reports; • Support workers fighting for their rights in the Chinese courts. 	<p>In accord with the principles of the International Labor Organization (ILO), China Labor Watch's fundamental beliefs are:</p> <ul style="list-style-type: none"> • Social and economic justice is essential to universal, lasting peace; • Freedom of expression and association are essential to sustainable progress; • Poverty anywhere constitutes a threat to prosperity everywhere; • All workers have a right to be represented by the organization of their choosing; • Workers are entitled to dignity, respect and a living wage. 	<p>Through press releases, frequent updates of labor news on its website, in-depth labor reports, communications with the media & other labor/ human rights organizations, CLW presents the international community with an accurate picture of the labor situation in China. It has produced over 100 press releases & 20+ in-depth reports on a wide range of topics, including conditions in shoe and garment factories; child labor and work injuries; lay-offs and unemployment; and issues facing women employees.</p> <p>Recently, CLW has begun to focus on worker education. It organizes free legal classes held in neighborhood settings where workers feel comfortable. These classes cover, for example, how to bring grievances to local labor boards. In addition, the organization has published thousands of booklets that explain in clear, accessible terms the hours, wages and benefits workers are entitled to by law.</p>	www.chinalaborwatch.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Child Labor Watch		<p>To influence public policy on child labor issues through better understanding of the impact on child health, the quality of life, ability to work effectively as adults,</p> <ul style="list-style-type: none"> •To strengthen protections, guard youth from excessive, inappropriate, & hazardous labor; •advocate for better enforcement of child labor laws, ensure compliance; •educate the public, business, govts to broaden awareness/ understanding re the nature of child labor exploitation in US/ other countries •urge US Congress to ratify/ enforce ILO & UN Conventions that affect child labor. 	<p>Exists to serve as a national network for the exchange of information about child labor; provide a forum & a unified voice on protecting working minors and ending child labor exploitation; develop informational & educational outreach to the public/ private sectors to combat child labor abuses & promote progressive initiatives and legislation.</p>	<ul style="list-style-type: none"> • testifying before state and federal legislatures and agencies on child labor • presenting comments in response to regulatory initiatives • hosting conferences, forums, and briefings • creating and distributing educational and public awareness materials • initiating research • conducting campaigns and media events 	www.stopchildlabor.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Maquila Solidarity Network (MSN)	Canada	To promote and defend the rights of workers in sweatshops, factories and export processing zones.	<p>MSN is a labour and women's rights advocacy organization promoting solidarity with grassroots groups in Mexico, Central America, and Asia working to improve conditions in maquiladora factories and export processing zones. We believe retailers must be accountable for the conditions under which their products are made.</p> <p>Since 1995, we have supported garment workers' efforts to improve working conditions through policy advocacy, corporate campaigning and engagement, participation in multi-stakeholder initiatives to promote corporate accountability, and local labour rights capacity building.</p>	<ul style="list-style-type: none"> • Campaigned for the protection of workers' rights and promotes new strategies to use codes of conduct, monitoring & verification systems to achieve greater respect for workers' rights. • Promotes alliances & solidarity among organizations & social movements working to improve the lives of garment workers. • The basic approach is to establish long-standing working relationships with locally-based labour, women's, human and worker rights, and independent monitoring organizations in producer countries. • Has strong links with groups in Latin America and the Caribbean and is strengthening ties with groups in Asia and Africa 	www.maquilasolidarity.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
The National Labor Committee	US	To help defend the human rights of workers in the global economy	<p>The NLC is helping to catalyze popular campaigns based on our original research to promote worker rights and pressure companies to end human and labor abuses. With a database of over 22,000 organizations and individuals, we serve as an information center, distributing our literature and videos. In just the last few years the NLC has:</p> <ul style="list-style-type: none"> • Helped bring massive, widespread media coverage to worker, human rights issues, raising them to nat'l level of public debate; • Established groundbreaking models for independent monitoring of factories by local human rights/religious groups; • Successfully pressured dozens of companies - incl Gap, Kathie Lee Gifford/Wal-Mart, Walt Disney Company - to improve conditions in supplier plants, to respect human & worker rights. 	<ul style="list-style-type: none"> • Investigates and exposes human/ labor rights abuses committed by U.S. companies producing goods in the developing world. • Undertake public education, research, popular campaigns that empower U.S. citizens to support the efforts of workers to learn & defend their rights. • Work to provide international visibility and backing for their efforts-- to press for international legal frameworks with effective enforcement mechanisms that will help create a space where fundamental internationally recognized worker rights can be assured. 	www.nlcnet.org/
MADE-BY					www.made-by.nl

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Sustainable Cotton Project (SCP)	US	To pioneer markets for certified organically grown and sustainable cotton	Formed in 1994, SCP joined with Community Alliance with Family Farmers (CAFF) in 2003 to strengthen operation, reach into farm/ consumer audiences. CAFF & SCP are collaborating to provide growers with information about biological farming techniques and to educate the public about the importance of reducing chemical use in food and fibre production.	<p>SCP has developed programs in 3 primary areas to stimulate the transition to supply & demand of the organic and sustainable cotton industry:</p> <ul style="list-style-type: none"> • BASIC The BASIC program focuses directly on farm issues. BASIC's goal is to develop a working knowledge of chemical reduction techniques that can be successfully and economically applied to cotton. BASIC offers strategies to save farmers money while reducing and eliminating certain farm chemicals, such as insecticides, miticides and fertilizers, and water consumption. • Cleaner Cotton The Cleaner Cotton Campaign has a simple goal: to educate manufacturers about proven business models and strategies to incorporate organic and sustainable cotton fibers into existing products. Bolstering manufacturer demand is essential to increase the market opportunities for farmer's growing sustainable and organic cotton. • Care What You Wear This initiative was created to partner with other organizations to educate consumers about issues in conventional cotton production and the availability and importance of purchasing organic and sustainable cotton products. By partnering with consumer groups and students activists, we are helping to spread the demand for organic and sustainable farming practices by encouraging the purchasing sustainable products. 	www.sustainablecotton.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Pesticide Action Network		<ul style="list-style-type: none"> • Eliminate hazardous pesticides from the market, replace them with sustainable solutions • Resist development & introduction/ use of genetic engineering of agricultural production • Empower grassroots movements/ citizens to fight agrochemical, seed corps, challenge corp globalization • Increase public investment, devt, adoption, implemtn of non-chemical pest control 	Pesticide Action Network (PAN) is a network of over 600 participating NGOs, institutions & individuals in over 90 countries working to replace the use of hazardous pesticides with ecologically sound alternatives. Its projects and campaigns are coordinated by five autonomous Regional Centers (N. America, Latin America, Europe, Africa, Asia & the Pacific)	<p>5 specific goals have been defined as priorities, and a working group has been set up to coordinate and integrate a global initiative dealing with each of this priorities. The working groups and their plans are:</p> <ul style="list-style-type: none"> • Eliminating the worst pesticides (PAN North America) • Genetic engineering and pesticides (PAN Latin America) • People's food sovereignty and corporate power (PAN Asia Pacific) • Sustainable alternatives to pesticides (PAN Germany) • Advisory group on community based monitoring (PAN Africa) 	www.pan-international.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Organic Consumers Association: Clothes for a Change Campaign	USA	To raise awareness about the negative health & environmental effects of conventional & genetically engineered cotton & the institutionalized exploitation of clothing sweatshops	By uniting organic consumers, anti-genetic engineering activists, trade unionists, religious social justice advocates, progressives in the fashion & apparel industry, and the Fair Trade / anti-sweatshop communities into a potent force we can change the dynamics of the marketplace and fundamentally alter public policy	<p>Demand that major clothing manufacturers & retailers:</p> <ul style="list-style-type: none"> • Stop using genetically engineered cotton; • Start blending in certified organic or “transition to organic” cotton in their clothing • Guarantee that they meet independently verified Fair Labor standards • Eliminate all production & export cotton subsidies in the US & convert to Green subsidies for organic & transition to organic cotton production <p>In addition, we will enlist public interest groups to support the campaign by:</p> <ul style="list-style-type: none"> • Committing to procure non-sweatshop, environmentally sound products • Signing on in support of the core demands of the Clothes for a Change campaign 	www.organicconsumers.org
Helvetas	Switzerland	Helvetas is committed to bringing together farmers, traders, the textile industry & the retail trade to realise joint projects in organic cotton farming	Since 1997 Helvetas has been committed to supporting environmental-friendly & socially acceptable cotton production. In 2002 the first farmers in the Helvetas project in Mali started to produce organic cotton, & organic cotton certification was achieved in 2003. In 2004 Helvetas began to transfer the successful approach to Kyrgyzstan, Burkina Faso & Senegal	<p>Projects operate in Mali, Burkina Faso, Senegal & Kyrgyzstan. Efforts include:</p> <ul style="list-style-type: none"> • Feasibility studies to assess the prospects of organic cotton cultivation • Pilot projects with interested producers, mostly small farmers • Support producers in setting up producers' organisation 	www.helvetas.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Asia Monitor Resource Center	Hong Kong/ Asia	Support for a democratic & independent labour movement, promoting the principles of labour rights, gender consciousness, & active workers' participation	<p>Founded in 1976, AMRC provides services to the following:</p> <ul style="list-style-type: none"> • grassroots NGOs concerned with women workers, labour issues & development; • activists within the labour movement; • labour organisations specialising in areas such as education & training, health & safety, labour rights; • NGOs in developed countries, international organisations concerned with labour rights & labour standards in Asia; • organisations requesting information on specific countries or industries to raise public awareness of labour issues in Asia; • NGOs seeking North-South or South-South collaboration on research projects, monitoring, information exchange, & analysis/ sharing of experiences. 	<p>To help workers become empowered, AMRC engages in the following:</p> <ul style="list-style-type: none"> • providing workers with access to information, tools, and skills • promoting men & women working together as equal partners • strengthening international solidarity among workers through the exchange of experiences & ideas • engaging in strategies to help organise workers in a changing society <p>In particular, AMRC supports the ILO's core labour standards covering freedom of association, the right to collective bargaining, the elimination of forced labour & child labour, and abolition of discrimination at work. AMRC sustains its work through monitoring, research, and training programmes</p>	www.amrc.org.hk
Institute of Contemporary Observation					www.ico-china.org
Sweatshop Watch	USA (California)	We are committed to eliminating the exploitation that occurs in and the illegal and inhumane conditions that characterize sweatshops.	Sweatshop Watch is a coalition of labor, community, civil rights, immigrant rights, women's, religious and student organizations, and individuals that serves low wage workers, with a focus on garment workers, primarily in the state of California, but also nationally and globally	<p>Sweatshop Watch's Corporate Accountability work aims to hold retailers and garment manufacturers accountable for the conditions of workers who sew their clothes. Our strategies include:</p> <ul style="list-style-type: none"> • Advocating for stronger worker protections and increased enforcement of labor laws; • Supporting garment worker organizing by educating garment workers about their rights; and • Mobilizing the public to support worker-led corporate accountability campaigns. 	www.sweatshopwatch.org/

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Child Workers in Asia (CWA)	Thailand (Asia)	<ul style="list-style-type: none"> •promote the rights of working children as per UN Convention on the Rights of the Child & the ILO Conventions re to child labour; •raise awareness & influence public opinion re child labour exploitation; •facilitate communication & sharing of info, materials, experiences & resources among people & orgs involved in child labour issues at various levels; •co-ordinate action between NGOs in the region; •assist, facilitate support groups for child workers at the country level; •seek new ways to protect child workers & prevent child labour exploitation. 	<p>Child Workers in Asia (CWA) was established in 1985 as a support group for child workers in Asia & the NGOs working with them. Today, it brings together over 70 groups/organizations working on child labour in 14 countries. It facilitates sharing of expertise and experiences between NGOs & strengthens their collaboration to jointly respond to the exploitation of working children in the region.</p>	<p>Focused interventions (through sub-regional and regional Task Forces)</p> <ul style="list-style-type: none"> • Child Domestic Workers • Bonded Labour in South Asia • Children Migrant Workers and Trafficked Children <p>Capacity Building for NGOs</p> <ul style="list-style-type: none"> • Participatory research with children • Advocacy and social mobilization • Children's Participation <p>Promotion of Children's Participation</p> <ul style="list-style-type: none"> • National Leadership Trainings for Child Workers • Regional Leadership Training of Child Workers • Facilitators' Training at National Levels • Develop Manuals to Promote Children's Participation <p>Research, Documentation, Information Dissemination</p> <ul style="list-style-type: none"> • CWA Newsletter - NGO & children's perspectives and experiences • Research – children & education, children in agriculture, child labour policies, girl labourers • Reports on Child Labour <p>Advocacy and Lobbying</p> <ul style="list-style-type: none"> • Participation regional & international advocacy actions for children • Regional workshops to discuss international instruments & their use for local campaigns & lobby • Building working relationships with regional & international policy & program formulating bodies. 	www.cwa.tnet.co.th

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Coop America	USA	To harness economic power—the strength of consumers, investors, businesses, and the marketplace—to create a socially just and environmentally sustainable society.	<p>Founded in 1982, Co-op America is a national nonprofit organization that operates as a collaborative and participatory workplace, where staff members reach consensus through democratic decision-making processes on key strategic issues for the organization</p> <p>What Makes Co-op America Unique</p> <ul style="list-style-type: none"> • Focus on economic strategies—action to solve social & environmental problems. • Mobilize people in their economic roles—as consumers, investors, workers, business leaders. • Empower people to take personal <i>and</i> collective action • Work on issues of social justice <i>and</i> environmental responsibility. We see these issues as linked in the quest for a sustainable world • Work to stop abusive practices <i>and</i> to create healthy, just & sustainable practices. 	<p>Co-op America’s work combines four powerful strategies:</p> <ul style="list-style-type: none"> • Empowering individuals to make purchasing and investing choices that promote social justice and environmental sustainability; • Demanding an end to corporate irresponsibility through collective economic action • Promoting green and fair trade business principles while building the market for businesses adhering to these principles; • Building sustainable communities in the US and abroad. <p>Programs areas include:</p> <ul style="list-style-type: none"> • Fair Trade • Responsible Shopper - alerts the public about the social and environmental impact of major corporations, and provides opportunities for consumers and investors to vote with their dollars for change • Boycotts • Sweatshops - provides consumers with information to help stop sweatshop labor & promote fair treatment of workers • Shop & Unshop – provides consumers with information and strategies to make green purchasing decisions 	www.coopamerica.org

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Social Accountability International (SAI)	USA (country offices in Italy, Netherlands, Vietnam)	To promote human rights for workers around the world as a standards organization, ethical supply chain resource, and programs developer.	<p>SAI is a non-governmental, international, multi-stakeholder organization dedicated to improving workplaces & communities by developing and implementing socially responsible standards.</p> <p>In 1997, SAI launched SA8000 (Social Accountability 8000) – a voluntary standard for workplaces, based on ILO and UN conventions – which is currently used by businesses and governments around the world and is recognized as one of the strongest workplace standards.</p> <p>SA8000 certified facilities are located in 57 countries and across 71 industries</p>	<p>SAI Activities:</p> <ul style="list-style-type: none"> • Convenes key stakeholders to build and continually refine consensus-based ethical workplace standards • Accredits qualified organizations to verify compliance with these standards • Promotes the understanding and implementation of social performance standards worldwide <p>Features of SAI's Work:</p> <ul style="list-style-type: none"> • Collaboration with companies, NGOs, labor & trade unions (such as Gap Ltd, Timberland; various trade unions that represent over 15M workers in their ranks; NGO's that include Amnesty International, CARE) • Partnership with a global network of auditing groups ("certification bodies") which certify companies & production facilities to the SA8000 standard • Global presence– SAI has offices in China, Italy, Holland & Central America 	www.sa-intl.org

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Fair Labor Association	USA	To combine the efforts of industry, civil society organizations, colleges and universities to protect workers' rights and improve working conditions worldwide by promoting adherence to international labour standards	<p>The FLA is designed to complement international and national efforts to promote respect for labor rights. The FLA represents a multi-stakeholder coalition of companies, universities and NGOs.</p> <ul style="list-style-type: none"> • There are currently 20 leading brand-name companies participating in the FLA (including Adidas, Asics, Eddie Bauer, Gildan Activewear, H&M, Liz Claiborne, MEC, Nordstrom, Nike, Patagonia, PUMA, Reebok, and others) • Colleges and universities join the FLA to promote fair and decent conditions in the production of goods bearing their logo. (there are over 194 colleges and universities affiliated with the FLA.) These schools require their licensees to participate in the FLA licensee program. • The NGO Advisory Council of the FLA, facilitates the involvement of local and international NGOs to help ensure that the implementation of Codes of Conduct ultimately results in worker empowerment and the meaningful protection of workers' rights. 	<p>Methodology involves participating companies adopting the FLA Code of Conduct and implementing a comprehensive compliance program, including internal monitoring, throughout their supply chain. The FLA then contracts with accredited monitors to conduct independent monitoring of each company's high risk facilities, works with companies to remediate problems identified in their facilities and independently verifies and accounts for company internal compliance programs</p> <p>The process involves:</p> <ul style="list-style-type: none"> • code of conduct implementation • internal monitoring • independent, external monitoring • remediation verification • public reporting 	www.fairlabor.org

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Ethical Trading Initiative (ETI)	UK	To identify, develop and promote good practice with respect to implementing codes of labour practice	<ul style="list-style-type: none"> • ETI set up in 1998 to combine the knowledge & influence of relevant NGOs and the international trade union movement with food/ clothing companies to identify & promote good practice in code implementation. • Funded by a combination of membership fees (approx 60%) and a grant from the Department for International Development (40%) • Corporate membership (37 in 2004) includes Debenhams Retail, Gap Inc, Marks & Spencer, Monsoon Accessorize, New Look Retailers, Next Retail and others 	<p>Improve working conditions in two main ways:</p> <ul style="list-style-type: none"> • NGO, trade union & corporate members collaborate to identify “good practice” in code implementation, and then promote and share this good practice. We do this mainly through our experimental projects and research, and we share this through publications, seminars and conferences, presentations at 3rd party events, and our Website. • We encourage companies to adopt the ETI Base Code and implement it in their supply chains. We aim to influence corporate behaviour in this regard by: <ul style="list-style-type: none"> · Getting new companies to join ETI. · Requiring all corporate members to submit annual progress reports on their code implementation activities. · Evoking, where necessary, our procedure for disengaging poor performers. 	www.ethicaltrade.org

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Joint Initiative on Corporate Accountability and Workers Rights	Turkey/ UK	<p>The aims of the Joint Initiative are:</p> <ul style="list-style-type: none"> • to maximise the effectiveness and impact of multistakeholder approaches to the implementation and enforcement of codes of conduct, by ensuring that resources are directed as efficiently as possible to improving the lives of workers and their families; • to explore possibilities for closer co-operation between the organizations; • to share learning on the manner in which voluntary codes of labour practice contribute to better workplace conditions in global supply chains. 	<p>Brands and retailers are faced with multiple industry standards and suppliers are confused by the numerous codes and initiatives. Better co-ordination and co-operation is needed. It is also important to develop a shared understanding of the ways in which voluntary codes of conduct contribute to better working conditions.</p> <p>The Joint Initiative brings together different aspects of code implementation and/or enforcement in a programme of collaborative work. These are: Clean Clothes Campaign, Ethical Trading Initiative, Fair Labour Association, Fair Wear Foundation, Social Accountability International and Workers Rights Consortium ("the organizations").</p>	<p>Representative members met in 2003/04 and agreed the broad outline of a 'trial project' which would pose and test various aspects of the overall collaborative effort (the 'Joint Initiative'). They elaborated concrete, measurable objectives in an initial Project Design (2004), spanning over 30 months and two "phases" of testing.</p> <p>Turkey was chosen as the site for the Trial Project. Organizations involved in the Joint Initiative intend to build on the results of the Turkey Trial Project, elaborating on the models of collaboration developed and the lessons learned there, in other countries. The project is expected to run until the end of 2007.</p> <p>Seven multinational buyers joined the initiative, each belonging to one or more of the MSI's with member companies, for the purpose of conducting the trial project in Turkey. These are Adidas, Gap Inc., Hess Natur, Marks and Spencer, Nike, Patagonia and Puma. A limited number of facilities in Turkey, which supply these multinational brands, have participated in the trial project as well as trade unions, NGOs, industry and employers associations and other interested parties-national and international</p>	www.jo-in.org

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Nordic Swan	Denmark, Finland, Iceland, Norway and Sweden	The Swan's mission is to contribute to reducing the consumer burden on the environment and to encourage manufacturers to develop environmentally-friendly products and services.	The Swan is the official Nordic Eco-label, introduced by the Nordic Council of Ministers. The Swan logo demonstrates that a product is a good environmental choice.	The Swan is the official Nordic ecolabel, introduced by the Nordic Council of Ministers. The Swan logo demonstrates that a product is a good environmental choice. The green symbol is available for around 60 product groups for which it is felt that ecolabelling is needed and will be beneficial. These days, everything from washing-up liquid to furniture and hotels can carry the Swan label. The Swan checks that products fulfil certain criteria using methods such as samples from independent laboratories, certificates and control visits.	http://www.svanen.nu/Eng/about/
Öko-Tex	Global	Accredited textiles require the following: <ul style="list-style-type: none"> •No carcinogenic dyes •No release of heavy metals •No formaldehyde (or just trace amounts) •Skin friendly pH •No chloro-organic carriers •No biologically active finishes 	Öko-tex is an accreditation scheme set up by the textile industry. The Öko-Tex Standard 100 encompasses the industries established testing criteria for textile products and also addresses quality assurance and test procedures.	Global accreditation scheme that has set standards for four categories: products for babies, products with direct contact to skin, products with indirect contact to skin and decoration materials. There are institutes in 39 countries that are full members of the International Association for Research and Testing in the field of Textile Ecology (Öko-Tex).	http://www.oeko-tex.com/en/main.html

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
European Commission Ecolabel	EU	<p>Limit use of substances harmful to the environment</p> <p>Limit substances harmful to health</p> <p>Reduce water and air pollution</p> <p>Textile shrink resistance during washing and drying</p> <p>Colour resistance to perspiration, washing, wet and dry rubbing and light exposure</p>	<p>The EC's Eco-label scheme is part of the wider Integrated Product Policy. It is the "The official EU mark for Greener Products". The Eco-label (for any product) is established by a Commission Decision, establishing the ecological criteria for the award of the Community Eco-label.</p>	<p>The EC Ecolabel flower logo on products indicates that they are a reliable guide to easily identify the good environmental performers available on the market.</p> <p>The logo can be awarded to all kind of textile clothing and accessories, interior textiles, and fibres, yarn and fabric.</p>	<p>http://europa.eu.int/com/m/environment/ecolabel/product/pg_clothing_textiles_en.htm</p>
ICCO	Global	<p>ICCO's mission is to work towards a world where poverty and injustice are no longer present.</p>	<p>ICCO provides knowledge, expertise and financial support to initiatives that contribute to significant sustaining social and environmental change in the supply chain of cotton and clothing.</p>	<ul style="list-style-type: none"> • Brings suppliers and buyers of sustainable cotton into contact with each other. • Helps cotton farmers strengthen their position within the supply chain and gain direct access to international markets. • Support companies that want to produce in a sustainable manner. • Draws attention to the position of workers and their working conditions; • Exerts a positive influence on public opinion relating to sustainable cotton. • Contributes to the development of universal certification systems for organic and fair trade clothing. • Protests against the subsidised overproduction of cotton from the European Union and the United States. 	<p>http://www.icco.nl/documents/pdf/Katoen%20-%20Engels.%20Time%20for%20change%20in%20the%20world%20of%20cotton.pdf</p>

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Better Factories Cambodia	Cambodia	To improve working conditions in Cambodia's export garment factories.	<p>Better Factories Cambodia is a unique programme of the International Labour Organization. It benefits workers, employers and their organizations. It benefits consumers in Western countries and helps reduce poverty in one of the poorest nations of the world.</p> <p>It does this by monitoring and reporting on working conditions in Cambodian garment factories according to national and international standards, by helping factories to improve working conditions and productivity, and by working with the Government and international buyers to ensure a rigorous and transparent cycle of improvement.</p>	<ul style="list-style-type: none"> • Monitor factories • Provide better access to information • Provide training opportunities 	http://www.betterfactories.org/
Recyclatex	UK	Recyclatex is the only body which can effectively offer National Organisations, including charities and local authorities, exclusive service collection contracts throughout the entire United Kingdom.	Recyclatex is a trading group made up of a select number of TRA members who can offer Charities and Local Authorities Textile collection contracts Nationwide with the comfort of a bonded protection scheme.	<p>All members of Recyclatex are required to place an agreed substantial sum of money with The Recycling Association as a bond. In the event of any member failing to operate the scheme correctly or ceasing to trade, sufficient funding is immediately available for another member company to maintain the contract until a new contract can be agreed.</p> <p>This funding also allows The Textiles Recycling Association to appoint approved contractors, on a temporary basis as necessary, and to clear and re-establish a regular collection pattern for the body concerned.</p>	http://www.textile-recycling.org.uk/recyclatex.htm

INITIATIVE	COUNTRY/ REGION	OBJECTIVE	BACKGROUND	DESCRIPTION OF ACTIVITIES	ADDITIONAL INFORMATION
Organic Label (Soil Association)	UK	The only certification body linked to a committed charity, promoting organic food and farming to your customers.	The Soil Association offers organic certification for farmers, growers, food processors and packers, retailers, caterers, textile producers, health and beauty manufacturers and importers, in the UK and internationally.	<ul style="list-style-type: none"> • SA Certification is the UK's largest organic certification body • Established in 1973, SA certifies 80% of all organic products sold in the UK • SA Certification provides organic certification of the highest integrity to all sectors of the organic market (food, farms, textiles, health and beauty care, restaurants and even timber) • SA currently certifies over 4,000 organic farms and businesses of all shapes and sizes • SA are a fully owned trading company of the Soil Association charity • SA are the only certification body linked to a charity devoted to promoting organic food and farming • Once certified (licensed) with SA Certification, 'licensees' can use the Soil Association symbol (above) - consumers recognise the symbol as the ultimate mark of organic integrity. 	http://www.soilassociation.org/certification

Annex D

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