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Technical report

Valuing Our Clothes: the evidence base

This report presents information on consumers' behaviour when purchasing, using, passing-on, recycling or throwing away clothing. Environmental impacts and financial implications associated with clothing design, production, purchase, use and end-of-life are estimated.

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Executive summary

Opportunities to benefit the consumer, save money and cut resource use are evident at each stage of the clothing lifecycle (Figure 1). This report presents evidence on the potential to reduce impacts and the implications of consumers' behaviour when purchasing, using, passing-on, recycling or throwing away clothing. This information can be used by retailers, designers, charities, recyclers and other stakeholders to focus action and raise consumer awareness.

Figure 1: Overview of the clothing lifecycle

Overall patterns of environmental impact are given, based on the carbon, water and waste footprints of UK clothing. Due to the complexity of the supply chain and consumer use, and limited availability of data, values are not necessarily precise. Estimates are based on the best available data.

Table 1: Environmental impacts of clothing

	Global footprint of UK consumption of clothing	Percentage of UK comparator	Footprint per household (per annum)	Household footprint equivalent (per annum)
Carbon	38 million tonnes CO_2e (WRAP, 2012a p34)	The UK part of the carbon footprint of UK clothing is 2% of the UK's total direct carbon footprint[1] (WRAP, 2012a p.34)	1.5 tonnes of CO_2e emissions[2]	Driving an average modern car 6,000 miles[3]
Water	6,300 million cubic metres of water (WRAP, 2012b p.iv)	6-8% of global water footprint of UK products and household use (WRAP, 2012b p.25)	240 cubic metres[4]	Filling over 1,000 bathtubs to capacity[5]
Waste	~1.8 million tonnes of material (WRAP, 2012d p.52)	Weight of end-of-life clothing in the UK is 5% of the weight of UK household waste collected by local authorities(WRAP, 2012d p.52)	70 kg[6]	Weight of over 100 pairs of jeans[7]

Overall, moderate actions taken across the clothing life-cycle could reduce its carbon, water and waste footprints (by 21% (WRAP, 2012a p.40), 18% (WRAP, 2012b p.32-34)[8] and 13% (WRAP, 2012d p.67) respectively) (WRAP, 2012d p.62)[9].

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[1] The total direct GHG emissions in the UK in 2009 were reported to be 566 million tonnes of CO2e (DECC, 2011). It should be noted that this total for the UK does not include GHG emissions associated with imported goods or services, or international travel– see http://www.defra.gov.uk/statistics/environment/green-economy/scptb01-ems/

[2] Calculated based on CLG household projection for 2008 – 26.3million households

[3] In 2011, average CO_2 emissions from all the licensed cars in Great Britain first registered from 2001 onwards was an average of 163 g/km. See http://www.dft.gov.uk/statistics/releases/vehicle-licensing-statistics-2011/

[4] See footnote 2

[5] The capacity of a bath is 200 litres. See: http://www.ideal-standard.co.uk/homeowner/water-saving/Article2673.aspx

[6] See footnote 2 and note 68kg is rounded.

[7] Based on average weights of men's and women's jeans (717.75g, 477.8g) from SCAP retailer data. 70kg is equivalent to 117 pairs of jeans. this has been rounded to over 100 pairs of jeans.

[8] Calculation related to actions 1 – 10 shown in Table 4.1. These are comparable to the moderate/central scenario listed in the carbon and waste footprint reports

[9] Note, cumulative reductions within and across the footprint reports may not be possible

The clothes we buy

While leaving around 1.7 billion items (30% of clothes) unworn at home (WRAP, 2012c), worth around £30 billion when purchased new[10], last year UK consumers spent £44 billion on new clothing (ONS, 2012d) – equivalent to £1,700 per household[11] and around 5% of retail spend (ONS 2012d).

The production stage (i.e. fibre production, yarn production, fabric production, garment production, distribution and retail) contributes over three-quarters of the carbon impact (WRAP, 2012a), over 90% of the water footprint (WRAP, 2012b), and one-third of the waste footprint (WRAP, 2012c). Extending the average life of clothes by a third (based on an assumed reduced need for new clothing) would reduce each of the carbon, waste and water footprints by more than 20%.

Consumer research[12] revealed a range of insights that might enable more sustainable purchasing practices:

- Many people would like to do more to buy clothes that are made to last.
- One-third of consumers would value retailer action such as a guarantee or indicator of durability.
- There is a desire for more environmental information on clothing to be provided. (WRAP, 2012c)

The survey also identified opportunities for developing alternatives to the purchase of new clothing:

- People would buy more pre-owned (or 'second-hand') clothing if greater variety was available, with better choice, more fashionable items and a wider range of sizes.
- There is interest in hiring or leasing more clothes if it was made easier, particularly designer dresses and clothes for going out and socialising.
- The idea of a retailer 'buy back' scheme attracted considerable interest, with people willing to accept a reasonable sum for returned clothes and to purchase such clothes.

The clothes we use

Almost six billion items of clothing are owned in the UK (WRAP, 2012c) – equivalent to nearly 100 items per person. The average adult washes between 274 and 343 items of clothing each year (Defra, 2009a). The annual costs associated with clothing in use in the UK are estimated as ~£3.4 billion (including electricity, water, wastewater and detergent costs) (WRAP, 2012d p.62).

In terms of the carbon footprint, in-use is the second most dominant lifecycle stage, representing just over 26% of total greenhouse gas emissions. Washing is the largest contribution (15% of the total), followed by drying (10% of the total) (WRAP, 2012a p.34).

Consumer research found laundry practices appear to be changing, with evidence of good practice but potential for further change:

- A high proportion of people wash full loads and at low temperatures, although around a third do not normally sort clothes (to facilitate more efficient washing/drying) and nearly a quarter use tumble driers in summer.
- People expressed a willingness to consider wearing clothes for longer before putting them in the laundry.

The clothes we no longer want

There are both positive and negative environmental implications for each different way of managing unwanted clothes. Around 50% of clothes are re-used at present, which is the most resource efficient strategy for managing unwanted clothing (WRAP, 2009).

Most textiles that are unsuitable for re-use – in poor condition – are still recyclable. Recycling (processing used materials into new products) has an environmental impact too, but the energy burden is insignificant in comparison with the savings made through off-setting new production.

Landfill is the most resource inefficient option for unwanted clothing. An estimated 350,000 tonnes of clothing is sent to landfill each year (WRAP, 2011a). This could be worth up to £140 million or more if recycled or re-used (WRAP, 2012e).

Consumer research found many clothes that are unworn could be brought back into use and the amount of clothing thrown away could be reduced:

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[10] Based on a population of 50 million adults. Consumer research identified 30% of clothes are unworn and the value of an adults wardrobe is on average £1783 (WRAP, 2012c).
[11] Based on 26 million households in the UK (CLG, 2008)
[12] Based on a survey of 7,950 UK adults (aged 16+) carried out in November 2011 for WRAP by Ipsos MORI.

- Clothes are most commonly unworn because they no longer fit or are in disrepair, but also due to people not regularly checking what is in their wardrobes.
- Although many people lack an ability to alter clothing or undertake more complex repairs, there is much interest in learning more about how to do so.
- People are willing to separate damaged or heavily worn clothing for recycling once aware that such items have value.

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Glossary

ATC	Agreement on Textile and Clothing
CAD	Computer aided design
CAM	Computer assisted manufacturing
CC	Conventional cotton
CDP	Carbon Disclosure Project
CERT	Carbon Emissions Reduction Target
CHP	Combined Heat and Power
CLG	Department for Communities and Local Government
CSR	Corporate social responsibility
Defra	Department for Environment, Food and Rural Affairs
DFID	Department for International Development
EA	Environment Agency
ERM	Environmental Resources Management Ltd.
ErP	Energy Related Products
ETI	Ethical Trading Initiative
EuP	Energy-Using Products
FLA	Fair Labour Association
FLO	Fairtrade Labelling Organizations
FWF	Fair Wear Foundation
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GHG	Greenhouse gases
GRI	Global Reporting Initiative
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HWRC	Household Waste Recycling Centre
IFAT	International Fair Trade Association
ILO	International Labour Organization
LCA	Life cycle assessment
MFA	Multi Fibre Agreement
MSW	Municipal Solid Waste
OC	Organic cotton
REACH	Registration, Evaluation, Authorisation and restriction of CHemicals
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
SCAP	Sustainable Clothing Action Plan
USA	United States of America
WBCSD	World Business Council for Sustainable Development
WEEE	Waste Electrical and Electronic Equipment
WRAP	Waste & Resources Action Programme
WTO	World Trade Organization

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1.0 Introduction

1.1 Purpose and scope of report

This report provides information on the potential to reduce the resource and cost impacts of clothing in the UK, and the implications of consumers' behaviour when purchasing, using and passing-on clothes. Importantly, it includes new evidence from secondary analysis to determine the carbon, water and waste footprints of UK clothing, and presents new data from large-scale consumer research. The report highlights where change will have the greatest impact and benefit.

The report focuses on clothing. Accessories, footwear and textiles more widely (e.g. curtains, tablecloths, bedding, etc.) are outside the scope of this report.

Given the complexity of the supply chain and consumer clothing use, overall patterns of impact and potential cost and resource savings are presented, but the values given are not necessarily precise. The analysis depends on a number of assumptions and approximations due to scarcity of data. Further information on the evidence base of this report is presented in the appendices.

1.2 Why does resource use for clothing matter?

1.2.1 Price and supply instability

In contrast to previous trends, the costs of buying clothes are now increasing faster than general inflation, due to rising input costs and energy prices (ONS, 2011b).

In the long term, improving the efficiency with which resources are used in the supply chain will reduce the business risks from materials price volatility and supply instability, and offset the impact of rising production costs. Commodity prices have seen a significant increase over the last decade, and price volatility is illustrated by the short-term spike in cotton prices in February 2011, an increase of 150% compared to 2010 resulting from weather patterns in producer countries (National Cotton Council for America, 2012). More than half of the water footprint of clothing bought in the UK is in countries and watersheds where there is water stress and scarcity (WRAP, 2012b). Competition for water (e.g. for cultivating food and energy crops) will increase with growth in the global population.

1.2.2 Environmental significance of clothing

The three major life-cycle stages of clothing – production, in-use and end-of-life – have big impacts. Table 1 presents the carbon, water and waste global footprints of UK clothing consumption against comparative information.

Table 1: Carbon, water and waste impacts of clothing relative to national impacts

	Global footprint of UK consumption of clothing	Percentage of UK comparator[13]	Footprint per household (per annum)	Household footprint equivalent (per annum)
Carbon	38 million tonnes CO_2e (WRAP, 2012a p.34)	The UK part of the carbon footprint of UK clothing is 2% of the UK's total direct carbon footprint[14] (WRAP, 2012a p.34)	1.5 tonnes of CO_2e emissions[15]	Driving an average modern car 6,000 miles[16]
Water	6,300 million cubic meters of water (WRAP, 2012b p.iv)	6-8% of global water footprint of UK products and household use (WRAP, 2012b p.25)	240 cubic metres[17]	Filling over 1,000 bathtubs to capacity[18]
Waste	~1.8 million tonnes of material (WRAP, 2012d p.52)	Weight of end-of-life clothing in the UK is 5% of the weight of UK household waste collected by local authorities(WRAP, 2012d p.52)	70 kg[19]	Weight of over 100 pairs of jeans[20]

As a whole, the textile and garment industry (largely based overseas) is recognised as both a major user of water and a major polluter (Fletcher, 2008). A major issue with textile waste is that natural fibres biodegrade in landfill and emit methane, a powerful greenhouse gas.

Opportunities exist at each life-cycle stage to achieve cost savings and other benefits while reducing the environmental impacts of clothing, particularly through:

- reducing the impacts of the clothing sold to consumers;
- extending the useful life of clothes;
- increasing supply and demand for pre-owned clothing;
- reducing the impacts of laundry; and
- keeping clothes out of landfill.

1.2.3 Other factors

Corporate responsibility typically entails attention to social and ethical goals, such as worker welfare, alongside environmental benefits. Clearly, any major changes in design, production, re-use and recycling to reduce resource use and environmental impacts should be assessed by businesses for any social consequences. These consequences may be positive, e.g. where inefficiencies are reduced in the clothing supply chain overall and greater donations made to charities, but the risk of local adverse impacts needs to be considered.

[13] The comparator is a measure of total UK impact, to put the impacts of clothing in perspective

[14] The total direct GHG emissions in the UK in 2009 were reported to be 566 million tonnes of CO2e (DECC, 2011). It should be noted that this total for the UK does not include GHG emissions associated with imported goods or services, or international travel– see http://www.defra.gov.uk/statistics/environment/green-economy/scptb01-ems/

[15] Calculated based on CLG household projection for 2008 – 26.3million households

[16] In 2011, average CO_2 emissions from all the licensed cars in Great Britain first registered from 2001 onwards was an average of 163 g/km. See http://www.dft.gov.uk/statistics/releases/vehicle-licensing-statistics-2011/

[17] See footnote 2

[18] The capacity of a bath is 200 litres. See: http://www.ideal-standard.co.uk/homeowner/water-saving/Article2673.aspx

[19] See footnote 2 and note 68kg is rounded.

[20] Based on average weights of men's and women's jeans (717.75g, 477.8g) from SCAP retailer data. 70kg is equivalent to 117 pairs of jeans. this has been rounded to over 100 pairs of jeans.

1.3 What is happening to address clothing resource efficiency

A wide range of organisations in the UK clothing sector, including retailers, brands, recyclers, charities, local authorities, trade bodies and Governments have come together under the Sustainable Clothing Action Plan (SCAP) to look at how to reduce the impacts of clothing while meeting consumer expectations. WRAP (Waste & Resources Action Programme) co-ordinates this activity on behalf of the UK Governments (i.e. England, Scotland, Wales and Northern Ireland). More information is available at www.wrap.org.uk/clothing.

Reducing the impacts of clothing is a policy priority in all UK nations. Defra's Review of Waste Policy in England 2011 calls for: 'the development of further collaborative voluntary actions on metrics, design and fibre selection, consumer use including cleaning, re-use and recycling, and influencing consumer behaviour'. Scotland's Zero Waste Plan aims to achieve 70% recycling rate by 2025, and landfill of biodegradable municipal waste materials such as cotton will be banned in Scotland from 2021. Reduction in ecological footprint to 'one planet' consumption levels is the primary policy goal stated in 'Towards Zero Waste' in Wales. This policy document sets a target of a 70% recycling rate by 2025, and states the need to reduce waste arisings by around 1.5% each year across all sectors in order to achieve the one planet goal for 2050. The Northern Ireland Waste Management Strategy is currently under review. Ways to reduce the impact of clothing are likely to be considered as part of that review.

2.0 Clothing production and purchase

This section provides data on purchasing behaviour, the embodied impacts of that purchasing, and consumer attitudes towards buying clothing. Based on this information, potential cost and resource savings have been identified.

2.1 How much do we buy?

In 2011, £44 billion was spent on buying 'clothing garments' (ONS, 2012d)[21]. This equates to around 5% of UK retail spend (ONS, 2012d). Per household approximately £1,700 is spent per annum on clothing[22] or £900 per adult. At the same time, almost six billion items of clothing are owned in the UK, including 1.7 billion items (around 30%) which have not been worn in the last 12 months (WRAP, 2012c).

The UK clothing market has become increasingly competitive. Inflationary pressures (particularly from food, transport and utilities) continue to outstrip wage growth and the effect of reduced purchasing power has seen consumer budgeting on the rise (Mintel, 2011a p.1).

Value retailers don't appear to be benefiting from consumers trading down. Indeed there seems to be a small but discernible migration to quality over lowest prices. (Mintel, 2011a p.5) Over half of all adults say they are spending less than they used to on clothing compared to 39% a year ago. That figure rises to nearly 60% of the C2 socio-economic group[23] which may well explain softening sales at many value retailers. (Mintel, 2011a p.7)

At present, more than a quarter of the population (28%) say they buy more clothes than they need (WRAP, 2012c).

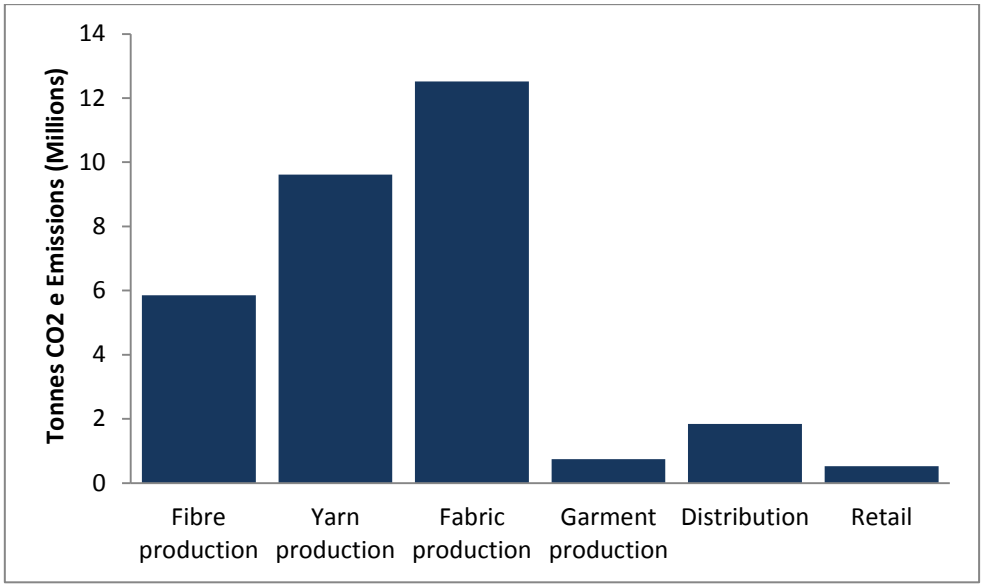
2.2 What are the production impacts?

Clothing production is a significant lifecycle stage. It contributes over three-quarters of the carbon footprint (WRAP, 2012a), over 90% of the water footprint (WRAP, 2012b) and around one-third of the waste footprint (WRAP, 2012d).

Figure 1 (WRAP, 2012a, p.4) illustrates the carbon footprint required to supply new clothes into the UK market in one year.

[21] *Consumer Trends, ONS, Q2 2011. Report published on a quarterly basis – covering Households Final Consumption Expenditure on each category of goods and services.*
[22] *Based on a household population of 26 million (CLG, 2008) and adult population (+16) 50 million(rounded) (ONS, 2010)*
[23] *The National Readership Survey (NRS) social grades are a system of demographic classification used in the United Kingdom. The distinguishing feature of social grade is that it is based on occupation. The grades are often grouped into ABC1 and C2DE and these are taken to equate to middle class and working class respectively.*

Figure 1: Carbon footprint of all new clothing in use in one year[24]



(Source: WRAP, 2012a, p.32)

The longer that clothing is used, then primarily based on an assumed requirement of less new clothing (and hence their production, distribution and retail), the lower the expected environmental footprint per annum. The length of time clothing is used for is therefore highly relevant to reducing the environmental impacts of clothing. Estimated average product lifetimes (in active use) are shown in Table 2 below. The carbon, water and waste footprint studies which are discussed throughout this report are based on these product lifetimes.

Table 2: Product lifetimes for clothing items

Garment Type	Active lifetime (Years)
Tops	2
Underwear, nightwear and hosiery	2
Bottoms	2
Jackets	3
Dresses	3
Suits and ensembles	3
Gloves	2
Sportswear	3
Swimwear	3
Scarves, shawls, ties etc	3

(Source: Biointelligence, 2009 Cited WRAP, 2012a, p.18)

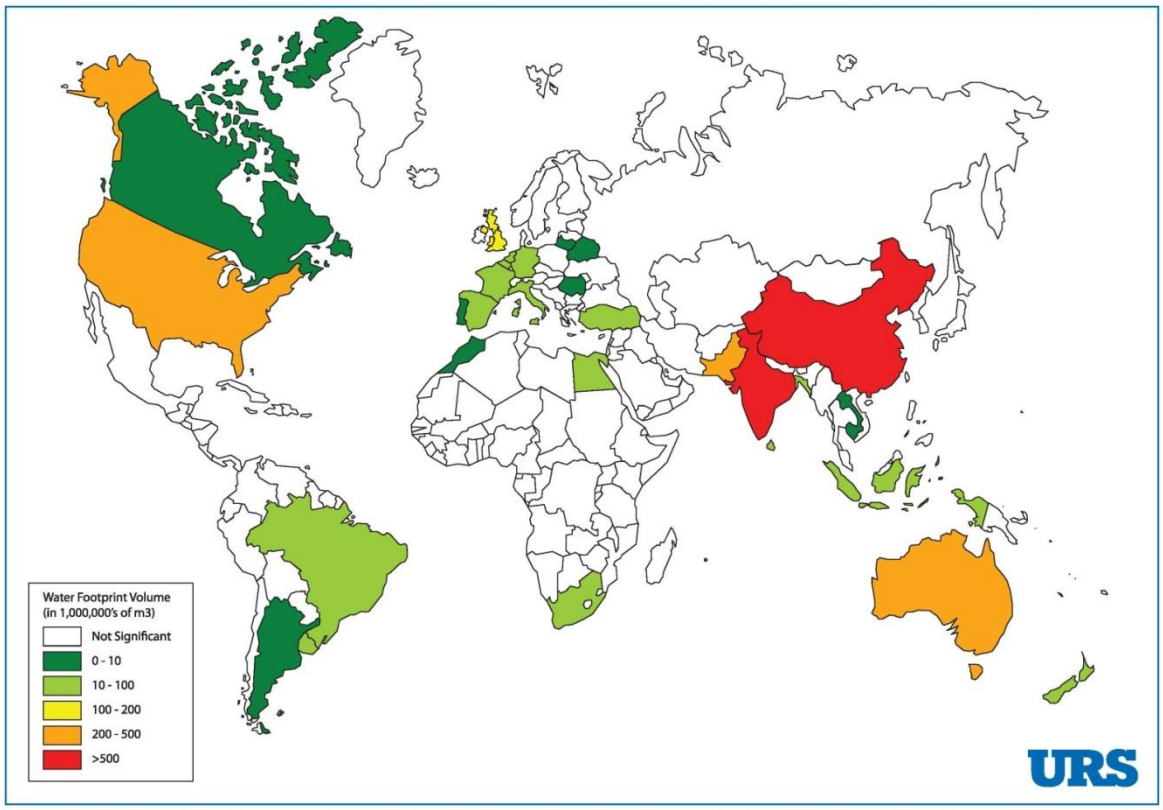
The calculated water footprint of UK clothing is 6,300 million m^3. This is equivalent to 2,500m^3 of water for every tonne of clothing in use in one year (WRAP, 2012b, p.16). However, unlike with carbon footprinting, the aim of a water footprint is not necessarily to reduce its size but to focus change in locations where water resources are already or are going to be scarce.

To identify the environmental significance of water use, the water footprint of clothing in each country has to be compared with the water resources situation in each country. The World Business Council for Sustainable Development's Global Water Tool defines a per capita availability of renewable water greater than 1700 m^3 per day as 'sufficient', while anything lower is considered a stressed or scarcity situation.

[24] *Based on UK 2009 figures. Irrespective of whether manufactured or imported to the UK*

More than half of the water associated with clothing bought in the UK comes from countries and watersheds where there is water stress or scarcity (WRAP, 2012b p.v). Any focus on water efficiency within the clothing manufacture and use life cycle needs to focus on the countries where the most water is consumed, prioritising in countries and watersheds where freshwater availability is scarce (WRAP, 2012b, p.35).

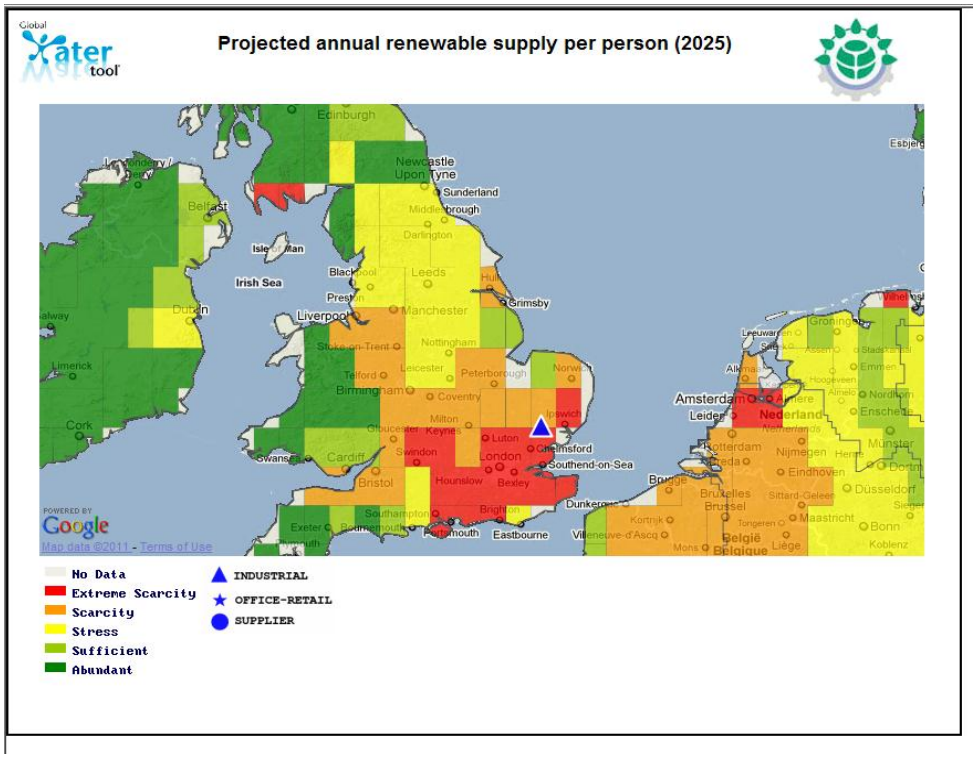
Figure 2: Water footprint per country (m^3)



(Source: WRAP, 2012d p.vi)

Water availability can vary greatly across a single country and water stress can exist at a watershed level in countries where water is classified as 'abundant' and 'sufficient' at a country level. For example, although the UK is defined as 'water sufficient' Figure 3 shows a significant proportion of the UK is predicted to be 'stressed' or 'water scarce' by 2025. (WRAP, 2012b, p.24)

Figure 3: UK projected availability of renewable freshwater resources in 2025



(Source: WRAP, 2012b p.25)

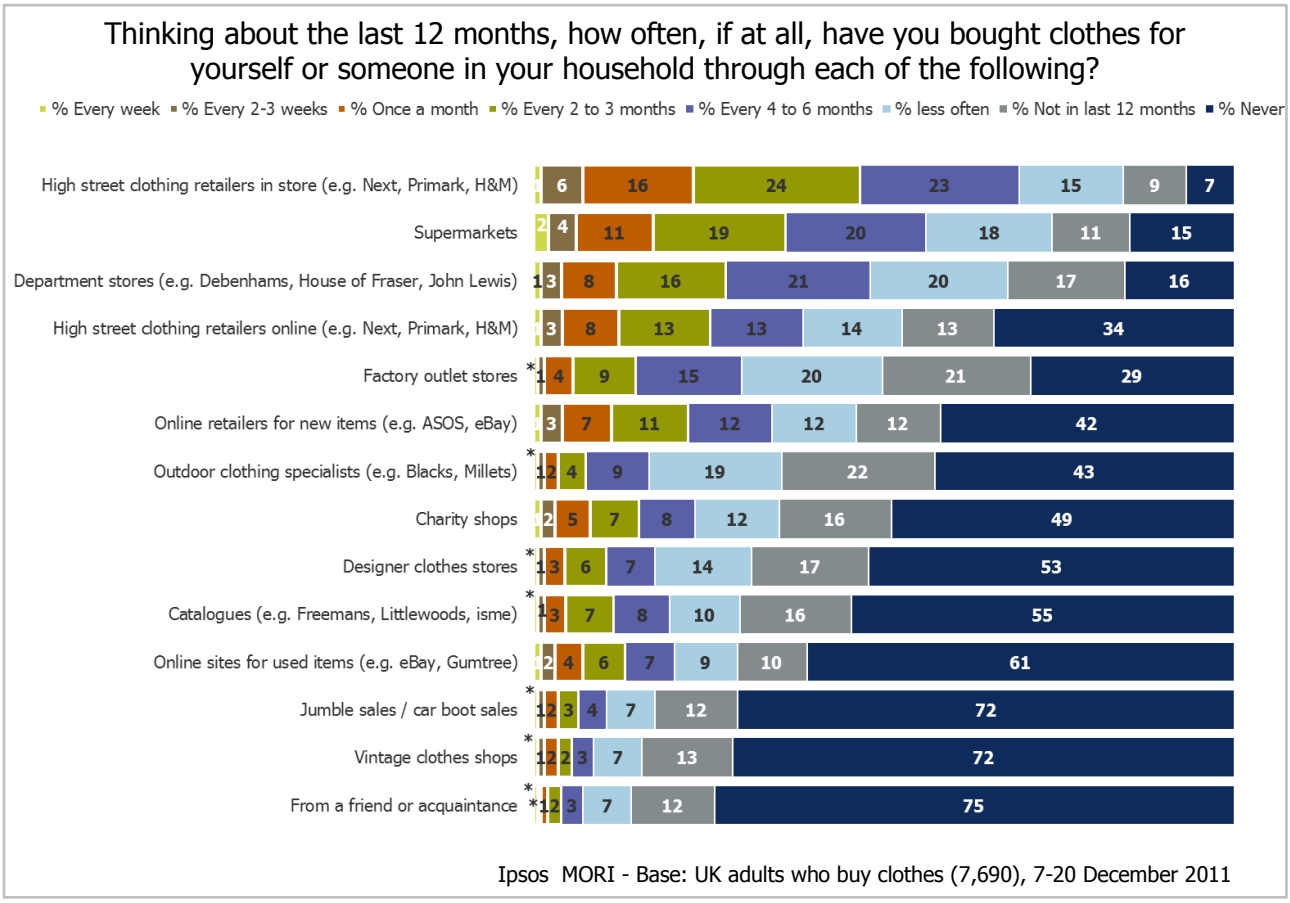
In addition to concerns about water stress or scarcity, the process of production can also have a detrimental environmental impact on water systems. Wastewater from textile production can be toxic. Emissions of volatile organic compounds mainly arise from the textile finishing, drying process and solvent use. The biochemical oxygen demand (BOD) is an indicator of the amount of organic material in a sample of water. It gives information about how much oxygen will be needed to break it down biologically or chemically. Textile wastewater tends to have a high BOD. A high BOD can lead to so much oxygen depletion in receiving waters such that near to discharges the abundance and diversity of animal life is severely reduced.

Virtually everything used creates waste throughout its lifecycle. The process wastes experienced in the production of yarn, making up and fabric production stages are significant lifecycle contributions to the waste footprint of UK clothing (representing 13%, 11% and 7% of the footprint respectively) (WRAP, 2012d p.52). The majority of clothing is manufactured outside the UK, so the majority of production waste occurs outside the UK (WRAP, 2012d p.4).

2.3 How do we behave as consumers?

People buy clothing from a range of sources, as shown in Figure 4. High street retailers, supermarkets and department stores dominate the clothing market. Over four-fifths of the adult population have bought clothes from high street retail stores at least once in the past year (84%) and nearly a quarter at least monthly (23%). (WRAP, 2012c)

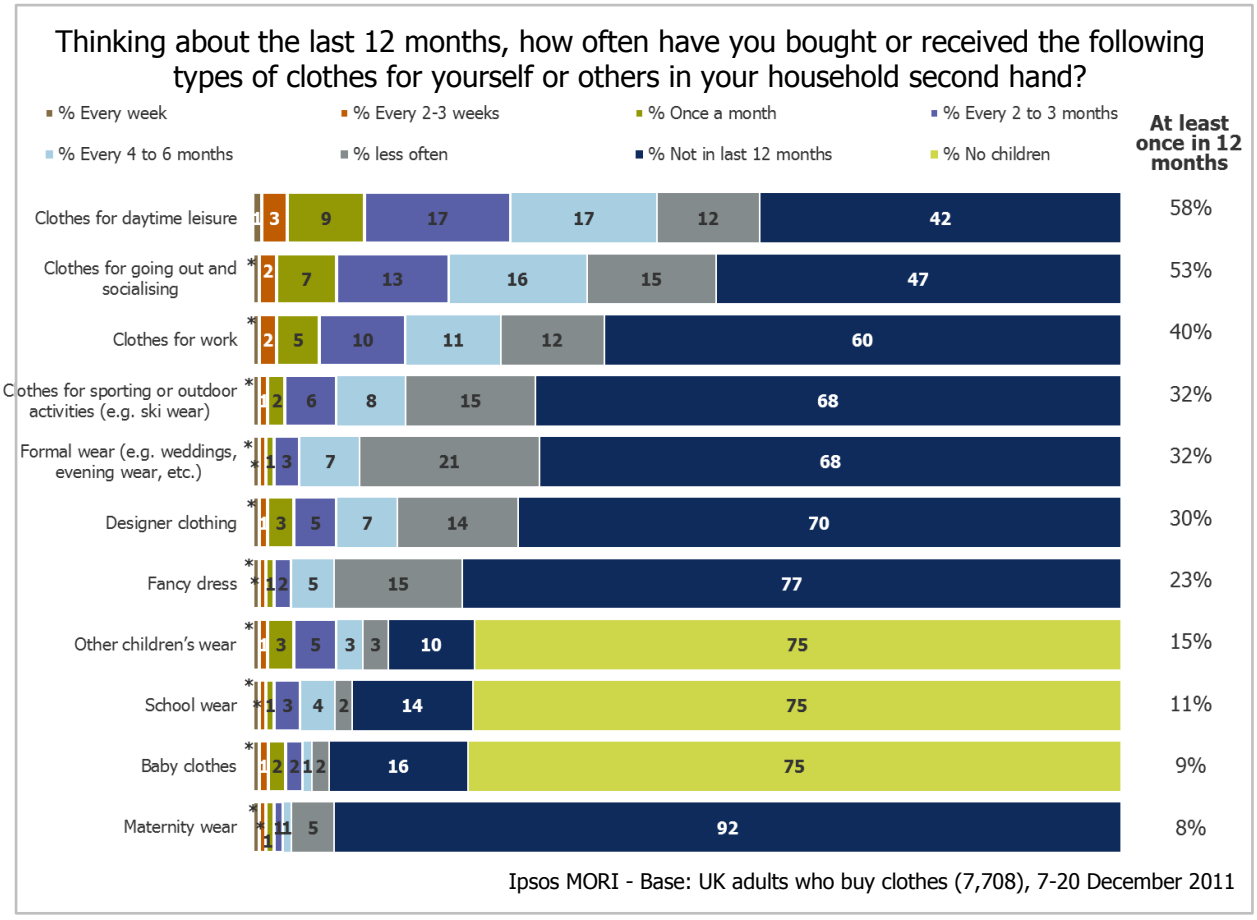
Figure 4: **Clothing purchase by outlet type**



(Source: WRAP 2012c)

There is an extensive pre-owned clothing market in the UK (see Figure 5). Over a third of the UK population have purchased clothing from a charity shop in the past year (35%) and one in 12 do so at least monthly (8%); a slight majority have done so on some previous occasion (51%). Nevertheless published data suggest some consumers feel there is a stigma attached to pre-owned purchases (Brook Lyndhurst, 2009). This is reflected by more members of the public donating clothing than those interested in wearing pre-owned clothing (WRAP, 2012c), and in the different socio-demographic profile of the donators and purchasers of pre-owned items (ACS, 2006).

Figure 5: Pre-owned clothing purchase



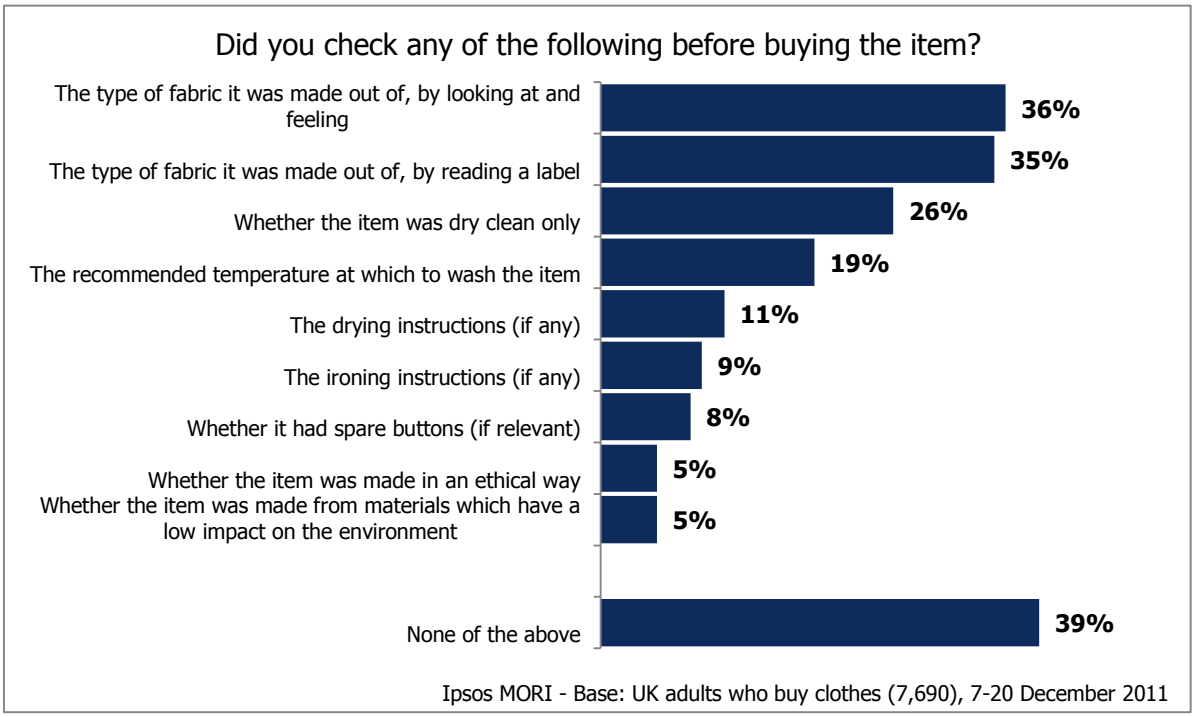
(Source: WRAP, 2012c)

Criteria for purchasing clothes (whether new or pre-owned) deemed most important relate to functional attributes such as value for money (82%), a comfortable fit (78%) and the feel of the material (77%). Next important are those relating to laundry, such as being suited to washing at a low temperature (41%). Whether the item is of a recognised brand, ethically produced or has a low environmental impact is considered less important. The criteria 'made to last and look good for longer' is more often deemed important than 'fashionable' (61% agreed with the former, 46% with the latter)[25]. (WRAP, 2012c)

Prior to purchase, the characteristic of items that is checked most often is the fabric (36%). Figure 6 shows only a very small proportion of the population will check whether the item has been produced in an ethical way or from materials with a low environmental impact (5% for both). (WRAP, 2012c)

[25] *Note, this is based on the UK adult population only (16 years and older)*

Figure 6: Consideration we make prior to purchasing new clothing



(Source: WRAP, 2012c)

Consumer research asked respondents a range of statements regarding their pre-purchasing behaviour. Firstly about the last item which they bought (see Figure 7) and secondly, about more general purchasing (see Figure 8). Responses to both sets of questions were very similar. The most important feature when purchasing both the most recent item and in general was value for money. A 'net importance' score was calculated for each feature (% 'important' minus % 'not important') and value for money scored +79 for the most recent item and +83 for purchasing in general, clearly a very important feature for most people. (WRAP, 2012c)

Durability of the clothing was more important than fashion with 'look and feel of the material' scoring +72 and +73 respectively and 'made to last and look good for longer' scoring +59 and +66 but the item being 'fashionable' scored only +23 and +30. Choosing a recognised brand was, on balance, considered unimportant scoring -26 and -17, indicating that more people think of it as 'not important' than 'important'. (WRAP, 2012c)

Slightly more thought that it was important for the item to be 'machine washable at a low temperature' than thought it not important, scoring +14 and +11. Again, whether the item was ethically produced and whether its manufacture had a low environmental impact were considered to be the least important features. Almost half of the adult population rate these as 'not important' when purchasing clothing. (WRAP, 2012c)

Figure 7: The importance of factors in determining our last clothing purchase

How important in hindsight were each of the following when you bought it?

	Level of importance (1 no importance and 5 extreme importance)					Net importance
	1	2	3	4	5	
	% across					
Value for money	1	2	15	37	44	+79
Look and feel of the material	2	3	18	45	32	+72
Something that you/recipient would wear frequently	3	3	17	42	35	+71
The right fit/provided room to grow	4	3	15	37	41	+71
Made to last and look good for longer	4	5	22	39	29	+59
Fashionable	12	11	31	32	14	+23
Machine washable at a low temperature	14	14	31	27	15	+14
Non-iron	23	17	31	18	10	-12
Quick drying	23	19	32	19	8	-14
Recognised brand	29	20	28	16	7	-26
Ethically produced	24	22	35	13	5	-29
Low environmental impact	25	23	35	12	5	-32

Ipsos MORI - Base: UK adults who buy clothes (7,690), 7-20 December 2011

(Source: WRAP, 2012c)

Figure 8: The importance of factors in determining our clothes purchases, in general

IN GENERAL, how important, if at all, is each of the following to you when deciding which clothes to buy for yourself or others in your household?

	Level of importance (1 no importance and 5 extreme importance)					Net importance
	1	2	3	4	5	
	% across					
Value for money	1	1	12	39	46	+83
Something that you/recipient would wear frequently	1	2	15	46	35	+78
The right fit/provided room to grow	2	2	14	39	43	+77
Look and feel of the material	2	2	19	47	30	+73
Made to last and look good for longer	3	4	21	43	30	+66
Fashionable	9	10	32	35	14	+30
Machine washable at a low temperature	11	15	37	26	12	+11
Quick drying	17	19	38	19	7	-10
Non-iron	18	19	37	18	8	-11
Recognised brand	22	21	33	19	6	-17
Ethically produced	21	23	38	13	5	-27
Low environmental impact	22	23	39	12	4	-29

Ipsos MORI - Base: UK adults who buy clothes (7,690), 7-20 December 2011

(Source: WRAP, 2012c)

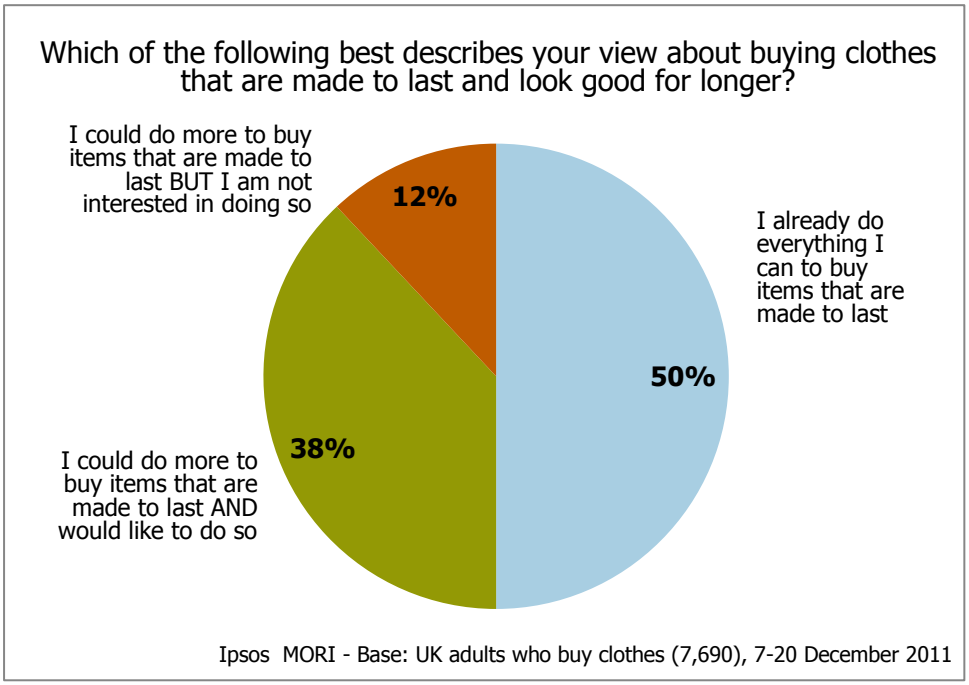
Nearly one in five adults report they are not in a position to think about either ethical or environmental issues due their current financial position; being greener is seen as a 'nice to do' rather than 'need to do' aspect of their lifestyles (Mintel, 2009 p.68). Even before the recession, price premiums were a barrier to more widespread take-up of green and ethical products and the evidence of altered priorities is that 12% of adults stated that they could no longer afford price premiums for green or ethical products. (Mintel, 2009 p.15)

2.4 Where and what is the potential for savings?

Extending the lifetime of clothing is likely to have the greatest impact on reducing the carbon, water and waste footprint. This is based on the assumption that fewer new garments will be needed when more use is made of existing ones. Extending the average life of clothes by a third could reduce the carbon, water and waste footprints (by 8% (WRAP, 2012a p.40), 10% (WRAP, 2012b p.32) and 9% (WRAP, 2012d p.67) respectively) and result in savings of around £2 billion in the direct cost of waste associated[26] with UK clothing; not including potential opportunity costs (WRAP, 2012d p.75). This is the single most significant intervention of those evaluated.

Consumer research found a considerable proportion of the population would like to purchase clothes that are 'made to last', and brand reputation or lengthier guarantees could encourage them to do so. (Extending the lifetime of clothing through repair is discussed further in Section 5.0). Figure 9 illustrates that almost four in ten adults who could do more to buy clothes that are made to last and look good for longer would like to do so (38%) (WRAP, 2012c). Recent retail sales analysis does suggest a small but discernible migration to quality over lowest prices is occurring (Mintel, 2011 p.35).

Figure 9: Views about buying clothes that are made to last



(Source: WRAP, 2012c)

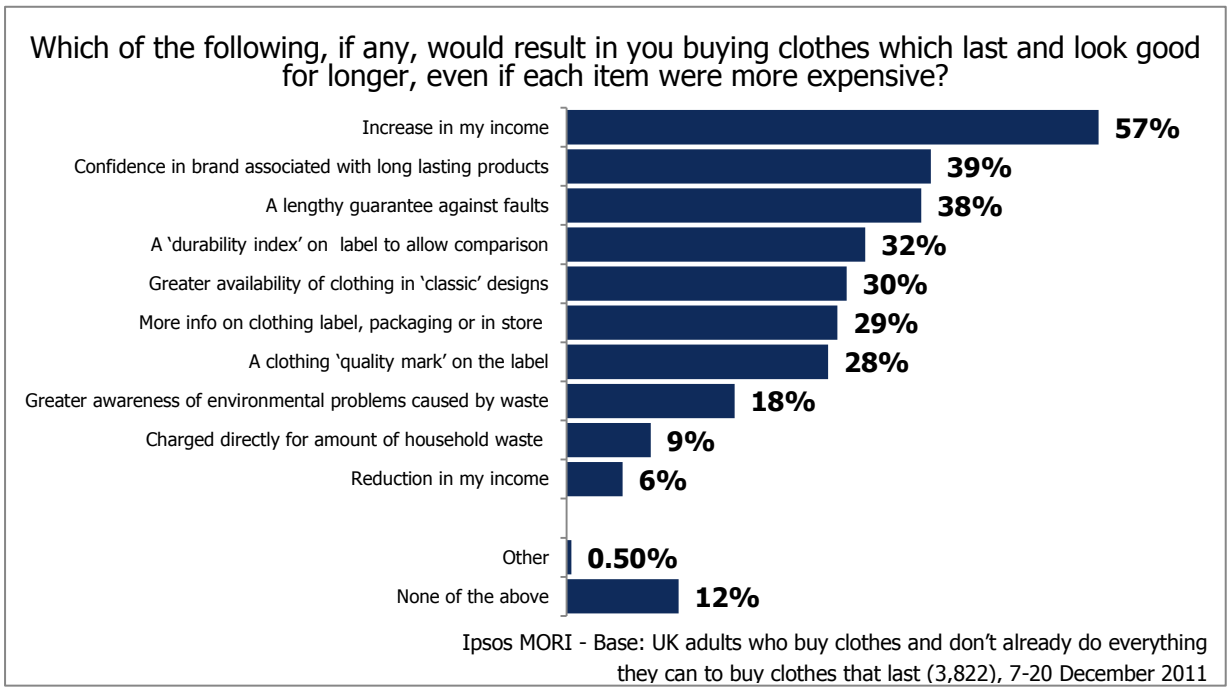
An increase in income would make more than half of the population likely to invest in clothes that are made to last and look good for longer (57%). However, other factors such as recognising a brand associated with long-lasting products or having a lengthy guarantee against faults would each persuade almost four in ten to buy these items (39% and 38% respectively). (WRAP, 2012c)

There was interest for more information to be made available (Figure 10); around three in ten would like to see a 'durability index' on the label to allow comparison between garments (32%), more information in

[26] *Opportunity costs have not been considered*

general on the clothing, packaging or in store (29%) and a clothing 'quality mark' on the label (28%). Almost one in five thought that they would buy clothes which last and look good for longer if they were more aware of environmental problems caused by waste (18%). (WRAP, 2012c)

Figure 10: Drivers for buying clothes which last and look good for longer



(Source: WRAP, 2012c)

Most customers do not currently check the environmental and ethical details of their purchases and, indeed, nearly half rate these factors as not important. However, nearly four in ten adults believe that there is too little information on the environmental impact of items of clothing available (38%) (WRAP, 2012c), which might imply garment labelling and/or better provision of information on the overall environmental performance of the brand or retailer may be of interest to consumers. Information provision has been proven to successfully change environmental behaviours in certain sections of the population (see for example, Giesen, 2008; Allwood et, al. 2006). Other research has identified a 'knowledge action gap' in general across the population (e.g. Forum for the Future, 2010 p.18).

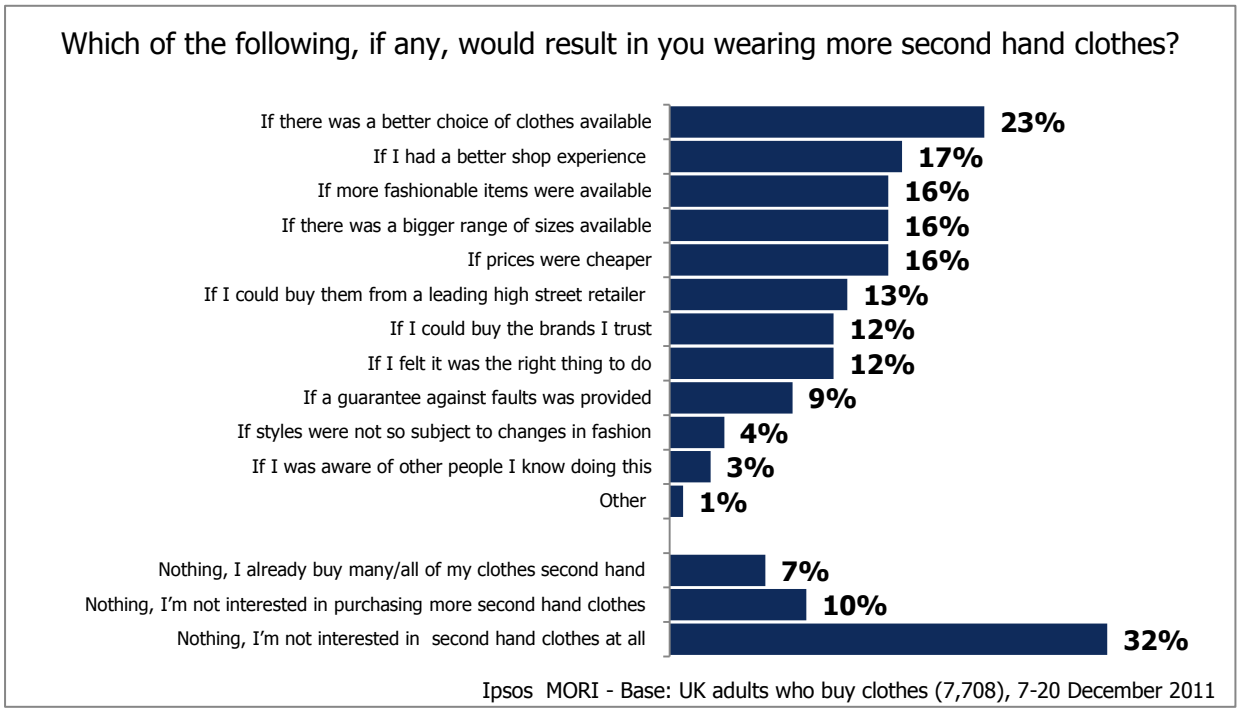
Eco labels (such as the examples shown in Figure 11) can provide a wide variety of information relating to clothing sustainability, and can cover design, development, in-use and recycling information.

Figure 11: Example of eco labelling

(Source: www.rapanuiclothing.com)

The pre-owned clothing market is well established, but a better choice of second hand clothes (23%) and a better shop experience (17%) would encourage people to wear more second hand clothes (see Figure 12). People would also be encouraged by the availability of more fashionable items, the availability of a greater range of sizes, and by a lower price (16% each). (WRAP, 2012c)

Figure 12: Drivers to buy more second-hand clothing

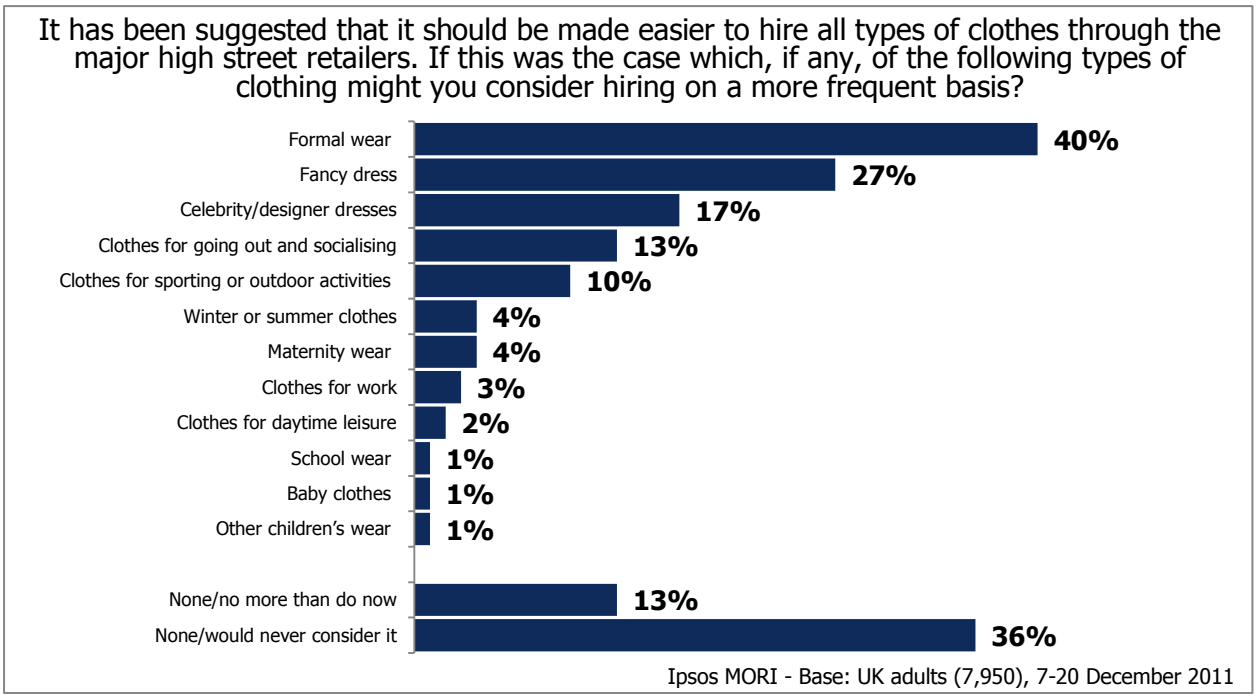


(Source: WRAP, 2012c)

Just over one in ten would consider wearing more pre-owned clothes if they could buy them from a high street retailer (13%) and if they could buy the brands that they trust (12%) (WRAP, 2012c).

There is also interest in hiring or leasing more clothes if such practices were to be made more available, particularly designer clothing and clothes for going out and socialising (see Figure 13). Around half of respondents indicate that they would consider hiring clothes more frequently if made easier through major high street retailers (51%). Four in ten would consider hiring formal wear on a more frequent basis (40%) and over a quarter would consider hiring fancy dress (27%). (WRAP, 2012c)

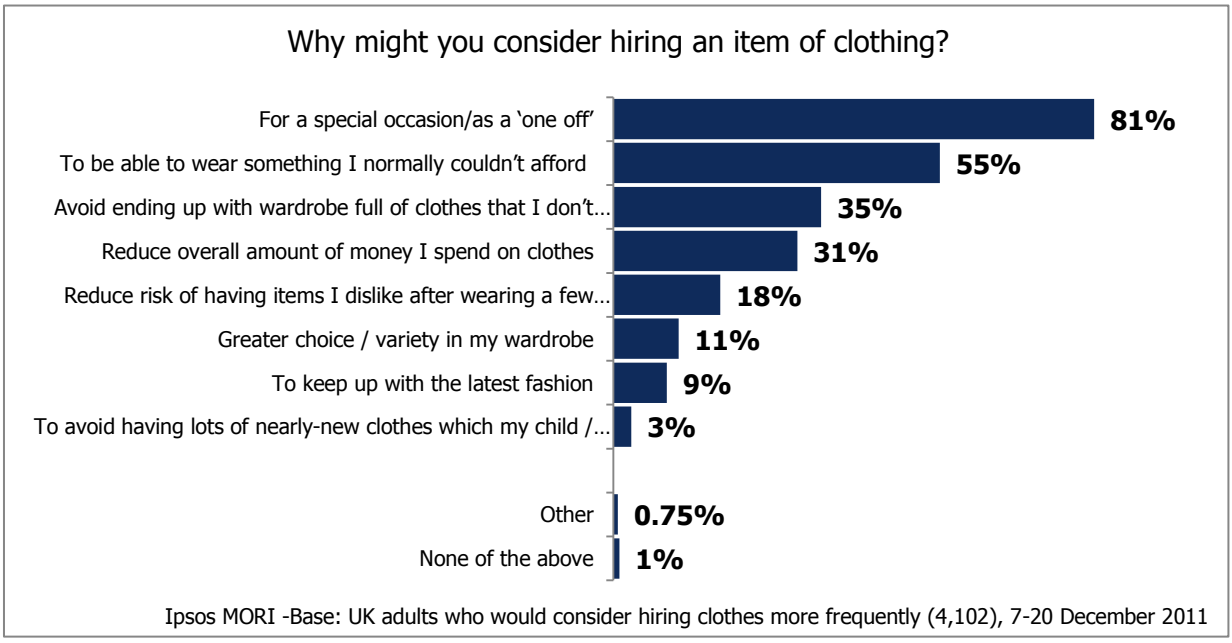
Figure 13: Interest in hiring different types of clothing



(Source: WRAP, 2012c)

Figure 14 shows that among those willing to consider hiring clothes more often, the greatest motivation is to wear it for a special occasion or as a 'one-off' (81%), or to be able to wear something that one could not usually afford (55%). (WRAP, 2012c)

Figure 14: Reasons to consider clothing hire



(Source: WRAP, 2012c)

The possibility of a retailer 'buy-back' scheme attracted considerable interest, especially with regard to clothes for going out and socialising, designer clothing and seasonal clothing. More than half of people would be at least fairly likely to use a buy-back scheme were it to be introduced; definitely (8%), very likely (15%) and fairly likely (29%). People appear willing to accept a reasonable sum for returned clothes and many expressed interest in purchasing discounted returned clothes through such a scheme (this is discussed further in Section 5.0). (WRAP, 2012c)

3.0 Clothing ownership

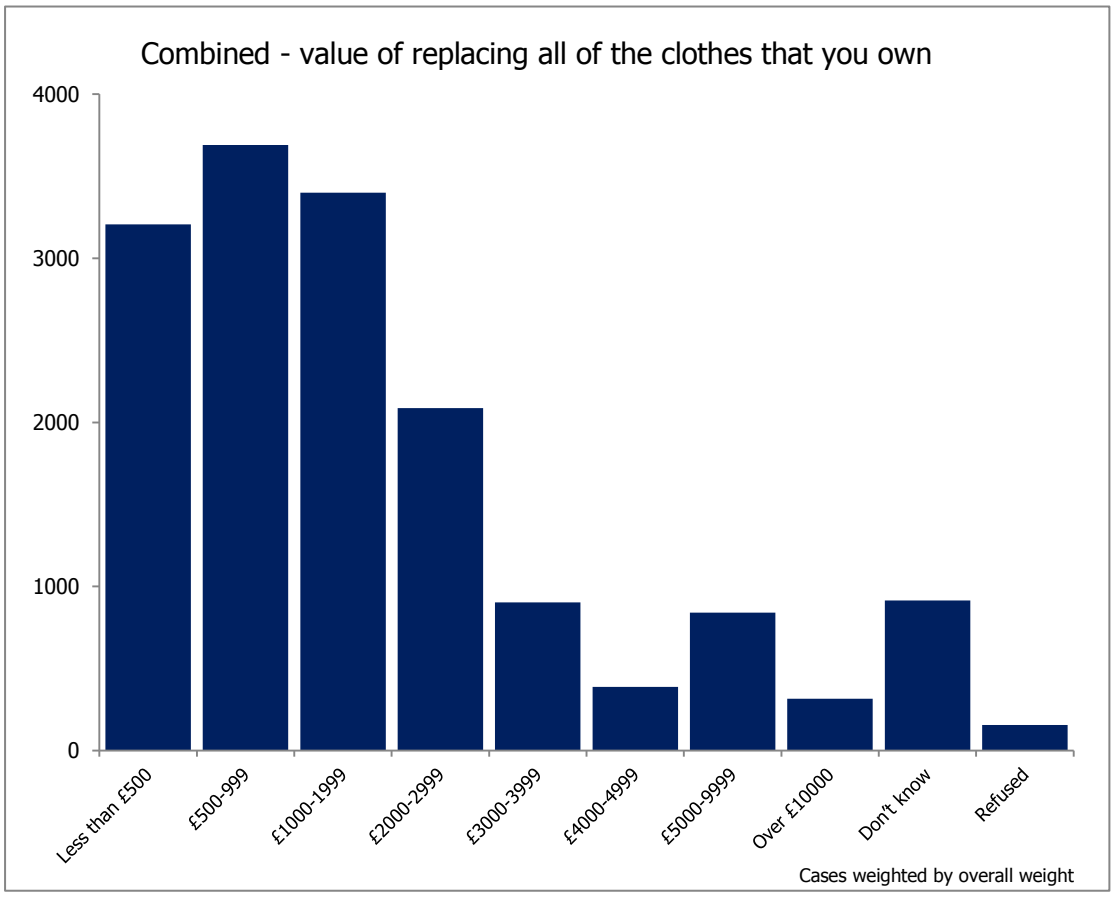
This section provides data on clothing ownership, and associated attitudes and behaviour. Based on this information, potential cost and resource savings have been identified. The results from consumer research should be treated as indicative only, as methodological issues are highlighted below.

3.1 How much do we own?

Adults in the UK (those aged 16+) estimate that they own a total of almost six billion items of clothing between them (5,744,000,000). The mean average number of clothing items owned is 115 (WRAP, 2012c).

Survey respondents were asked to estimate the replacement value of all of the clothing that they owned. In the cases where the respondent refused or couldn't estimate, a list of possible ranges was presented to them and they were asked to estimate using those bands. People typically estimated the value of their wardrobe, including items stored in their home or elsewhere, at £1,783 (based on the mean). At a national level, this equates to around £89 billion worth of adult clothing in UK homes[27]. (WRAP, 2012c)

Figure 15: Estimated average value of clothing per person



(Source: WRAP, 2012c)

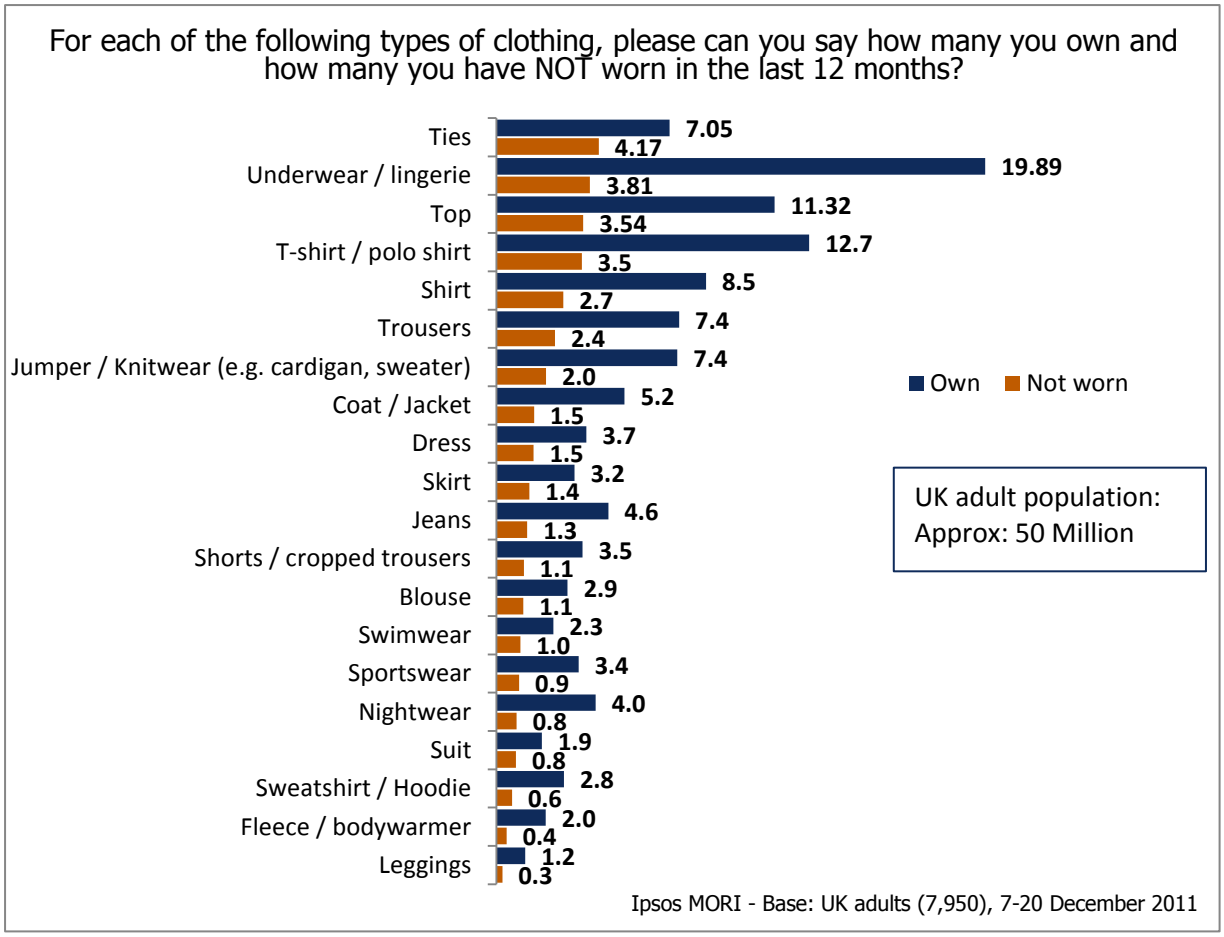
The histogram above (Figure 15) shows the estimated average value of clothing per person. This shows, on the one hand, that more people think they own less than £1,000 than any other £1,000 bracket. On the other hand, more people think they own more than £1,000 of clothing than less than £1,000.

[27] *Based on UK adult population only – 50 million*

3.2 How do we behave as consumers?

Survey respondents were asked how many items they owned of each particular type and how many of those they had not worn in the last 12 months. Some items are mainly for men (e.g. ties) and some mainly for women (e.g. blouses) but Figure 16 below shows the average number for each person living in the UK (i.e. the data are good for showing the percentage, and therefore the number, of unworn items but the typical number owned will vary by gender).

Figure 16: Clothing ownership and unworn garments by type



(Source: WRAP, 2012c)

Over four out of every five adults owns at least one item of clothing that they have not worn in the last 12 months (82%). On average, each adult in the UK owns 3.5 tops that they have not worn, for example. When extrapolated to the full UK population, this equates to approximately 175 million tops (see Figure 30) (WRAP, 2012c)

Since Table 1 shows the average number of each item a person living in the UK owns (or hasn't worn), we can calculate how many items are owned and not worn in the UK by multiplying the average number by the UK population. For example, if every adult in the UK owns an average of 7.05 ties (no matter whether they are male or female), the number of ties owned by the UK adult population is 7.05 x 50 million (the approximate number of adults living in the UK). As with any survey, there are margins for error here and the numbers in Table 3 should be treated as being approximate. It presents data calculated on the basis of how many items of clothing UK adults' report that they own, and of these how many they have worn in the last year.

Table 3: Estimated number of clothing items worn and unworn in the UK

	Estimated number of items in the UK (owned) (millions)	Estimated number of owned items in the UK not worn in the last 12 months (millions)	Estimated number of items in the UK worn in the last 12 months (millions)
Leggings	59.0	12.5	46.5
Suit	93.0	40.0	53.0
Swimwear	116.0	49.0	67.0
Fleece/bodywarmer	100.5	21.0	79.5
Blouse	145.0	55.0	90.0
Skirt	159.5	67.5	92.0
Sweatshirt/hoodie	137.5	32.0	105.5
Dress	183.0	76.0	107.0
Shorts/cropped trousers	175.5	56.0	119.5
Sportswear	167.5	46.5	121.0
Ties	352.5	208.5	144.0
Nightwear	202.0	41.5	160.5
Jeans	228.0	63.0	165.0
Coat/jacket	261.0	77.0	184.0
Trousers	372.0	119.5	252.5
Jumper/Knitwear	368.5	101.0	267.5
Shirt	426.5	136.5	290.0
Top	566.0	177.0	389.0
T-shire/polo shirt	636.5	174.0	462.5
Underwear/lingerie	994.5	190.5	804.0
Total	**5,744.0**	**1,744.0**	**4,000.0**

(Source: WRAP, 2012c)

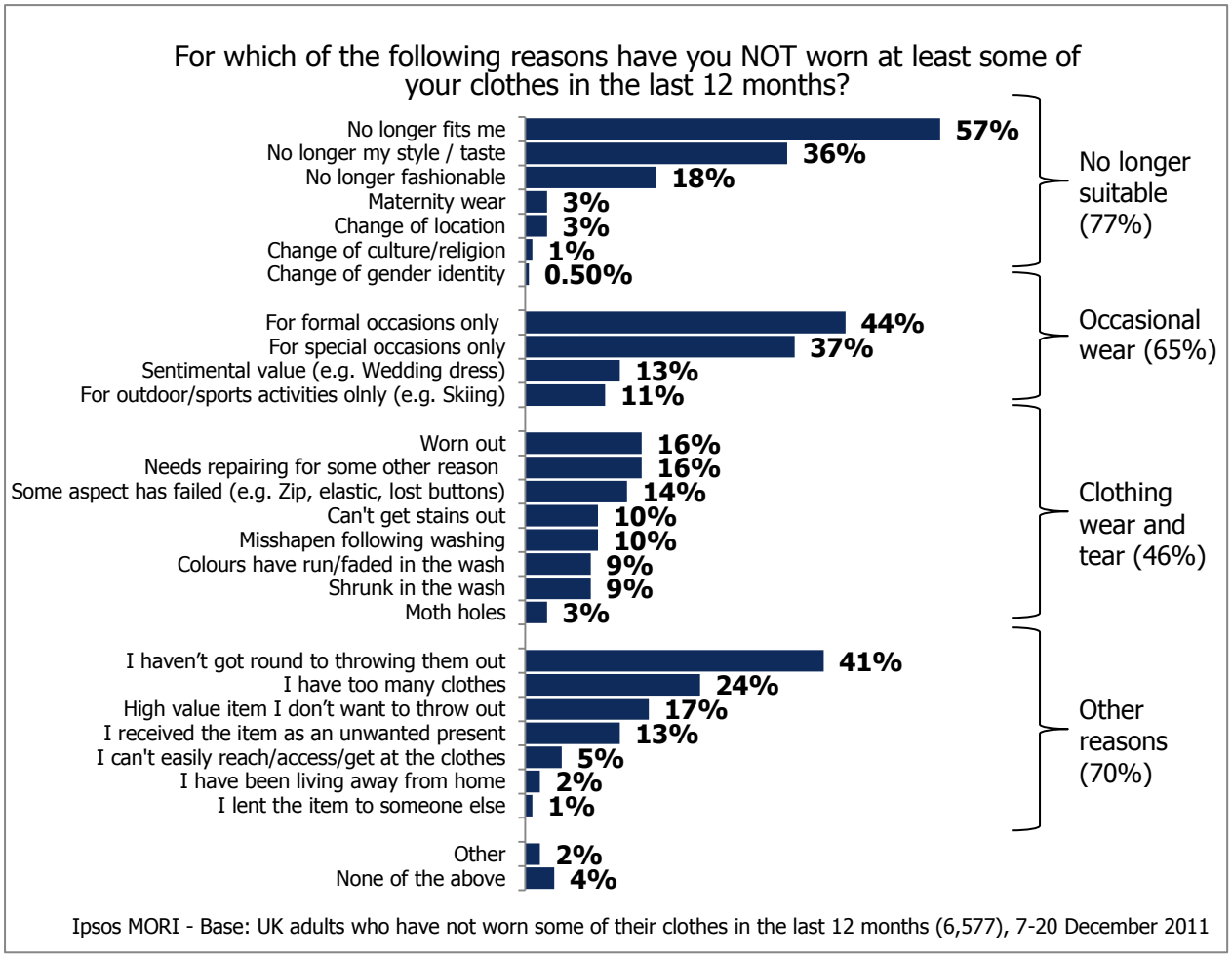
Reasons people do not wear some of the clothing they own are presented in Figure 17. The most likely reason for an item of clothing not to have been worn in the last 12 months is that it is no longer suitable, with over three-quarters of those who own some clothes that they haven't worn citing this as a reason (77%). Over half own clothes that no longer fit them (57%), over a third say that the item(s) no longer suits their style or taste (36%) and almost one in five don't wear clothes that are 'no longer fashionable' (18%). (WRAP, 2012c)

Two-thirds have not worn items of clothing in the last year because the garments are designed just to be 'occasional wear' (65%), either for formal occasions (44%) or for special occasions such as weddings or funerals (37%). (WRAP, 2012c)

Almost half own at least one item of clothing which they have not worn because of wear and tear (46%). This includes items which have been worn out (16%), those that need repairing (also 16%) and those where some other aspect has failed, such as the zip or elastic (14%). One in ten has not worn an item because of the following washing issues; can't get stains out (10%), misshapen during washing (10%), colours have run/faded (9%) or the item has shrunk (9%). (WRAP, 2012c)

Other reasons include not having got round to throwing them out (41%), they just have too many clothes (24%) and because the item is of high value and they don't want to just throw it out (17%). More than one in ten people own an item that has not been worn in the last 12 months because it was an unwanted gift (13%). (WRAP, 2012c)

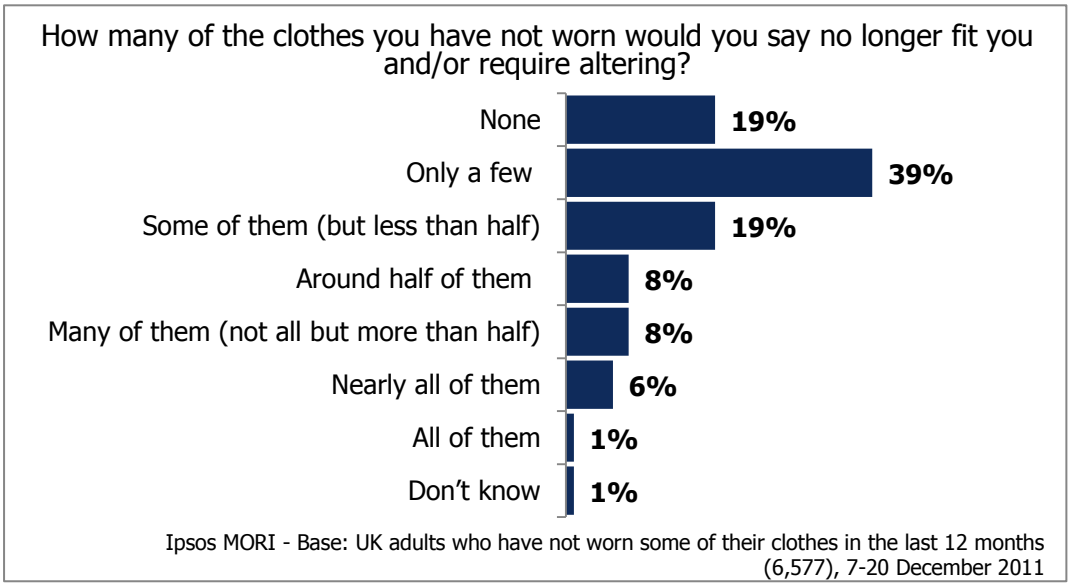
Figure 17: Reasons for unworn clothing



(Source: WRAP, 2012c)

Figure 18 shows four out of every five adults who have not worn some clothes in the last 12 months own items that they no longer wear because they no longer fit and/or require altering (80%). (WRAP, 2012c)

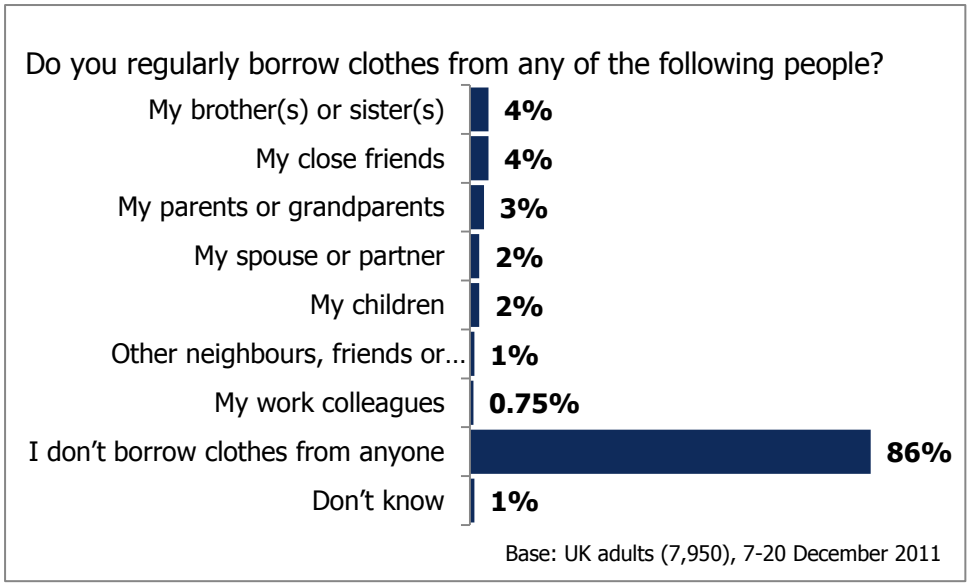
Figure 18: Clothes not worn which no longer fit and/or require altering



(WRAP, 2012c)

Overall, barely one in ten of the population wear borrowed clothing regularly. Typically people borrow from siblings or close friends. (WRAP, 2012c)

Figure 19: Clothes borrowing



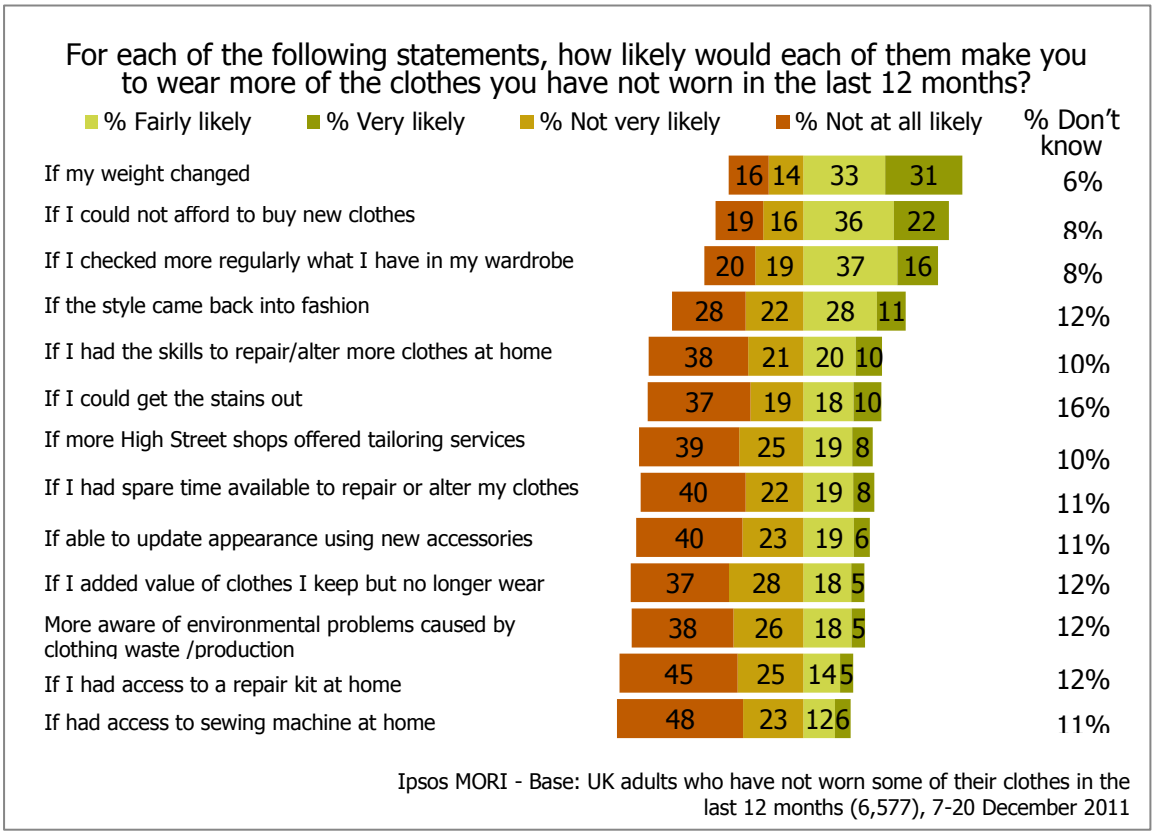
(WRAP, 2012c)

3.3 Where and what is the potential for savings?

A substantial proportion of the clothes that people own are unworn, mainly because they no longer fit or are in disrepair but also due to people not regularly checking their wardrobes. Addressing these issues could help to reduce the costs and resource implications of UK clothing, through maximising the use of clothing.

Figure 20 illustrates things that might need to happen for people to wear more of the clothes that they have not worn in the last 12 months. The most common thing that would need to happen was if their weight changed (64% thought this was 'fairly likely' or 'very likely' to make them wear more), if they could not afford to buy new clothes (57%) and if they simply checked more often what they actually have in their wardrobe (53%). (WRAP, 2012c)

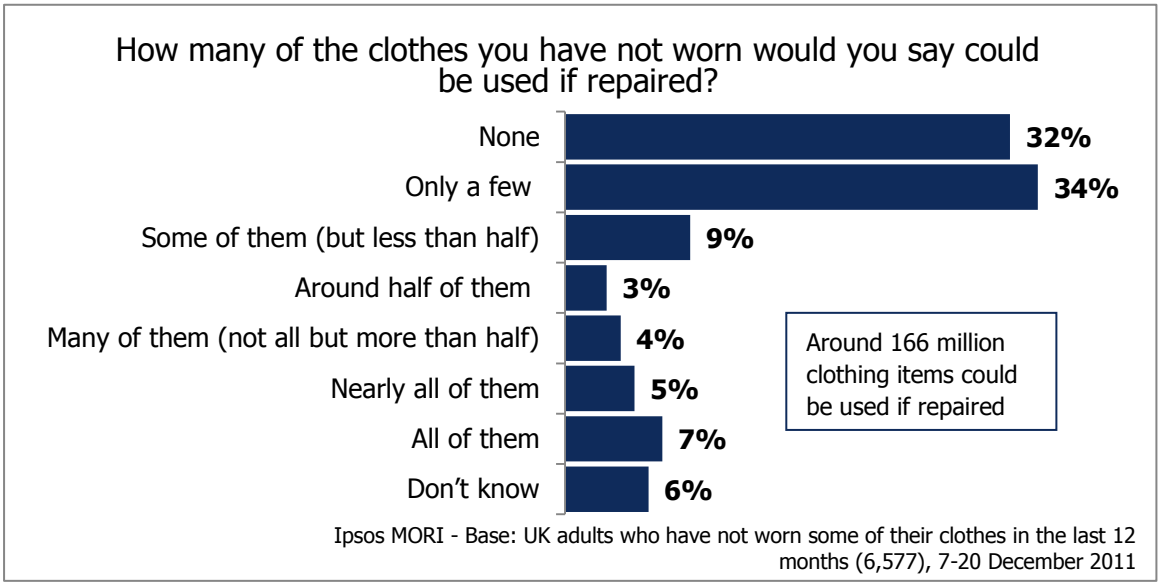
Figure 20: Drivers to wear unworn clothing



(Source: WRAP, 2012c)

Nearly one-third of the population would bring more unused clothing back into use if they had the necessary skills or time to repair or alter clothes. Nearly one in five people could use over half of their unworn clothes if they were repaired (19%), this equates to around 166 million clothing items Figure 21 shows the proportion of unworn clothes that could be used if they were repaired (WRAP, 2012c).

Figure 21: Opportunity for clothing repair

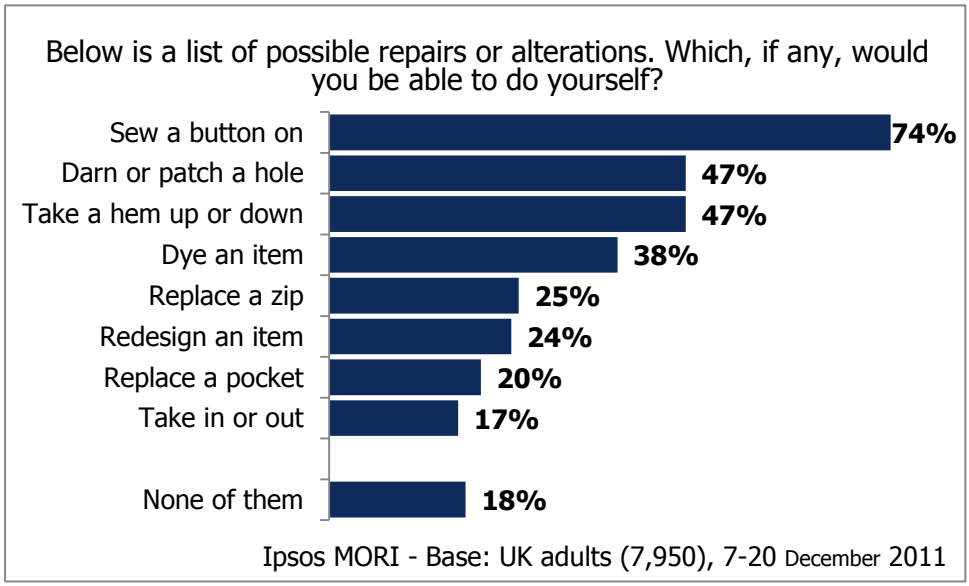


(WRAP, 2012c)

Based on the amount of clothes adults report that they have left unworn that could be used if repaired, it is calculated that potentially around 166 million clothing items could be brought back into use if repaired. (WRAP, 2012c)

Figure 22 shows most people (74%) are able to sew on a button, and nearly half can darn or patch a hole, and take a hem up and down (47% respectively for both skills). However, people are less able to undertake more complex alteration tasks (e.g. less than a quarter can adjust the size of a garment (17%). (WRAP, 2012c)

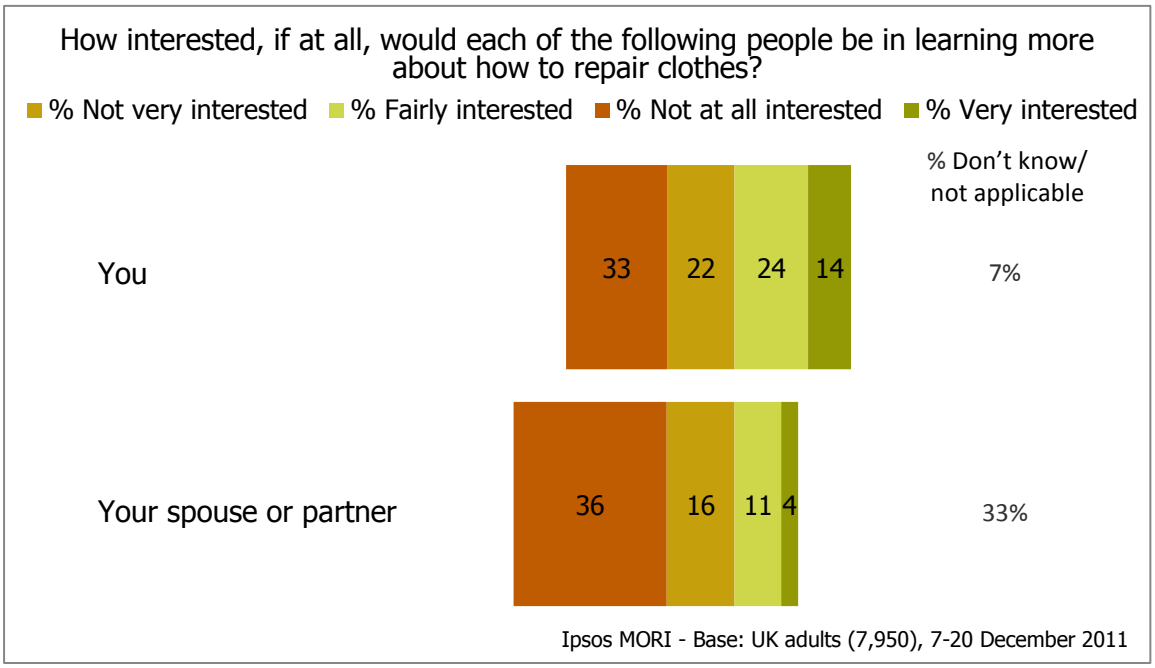
Figure 22: Possession of clothing repair skills



(WRAP, 2012c)

Over a third of the population are interested in learning more about how to repair clothes (37%), with one in seven describing themself as being 'very interested' (14%), see Figure 23 below (WRAP, 2012c).

Figure 23: Appetite to learn about clothing repair



(WRAP, 2012c)

4.0 Clothes cleaning and preparation

This section provides data on the clothing cleaning and preparation undertaken, and the embodied impacts of laundering behaviour. Based on this information, potential cost and resource savings are reported. The data imply good practice is already fairly prevalent.

4.1 How much clothing cleaning and preparation do we undertake?

Most adults have responsibility for washing clothing (WRAP, 2012c) and will on average wash between 274 and 343 items of clothing each year (Defra, 2009a). Washing machines are now seen as an essential part of life in the UK, and the vast majority of people have a washing machine in their home[28] (ONS, 2010b p2).

The majority of people do their washing two or three times a week, irrespective of how this is done. Around a third of households do their washing less than once a week, and one in five do laundry at least once a day. (Mintel, 2010b)

In comparison to washing machines, ownership of tumble dryers is more discretionary. Nearly half of all UK homes (46%) own a tumble dryer. Whether or not people have a garden or access to outdoor space does not decrease the likelihood that they will own a tumble dryer[29] (Mintel, 2011b). Of those who own a tumble dryer, almost two-thirds use it at least half the time during the winter (63%), however, over two in five never use it during the summer (44%) (WRAP, 2012c).

Alternative ways to dry clothes such as hanging them out in the garden, on the balcony or inside the house, are for many people satisfactory alternatives. Over two-thirds of adults have an outside clothes line, two thirds have a clothes rack and nearly a half have an airing cupboard. (WRAP, 2012c)

Practices and opinions on ironing vary. Almost two-thirds of all adults consider it important that clothes are ironed (63%), with nearly a third considering it very important (30%). Over a third of people do not consider it important to iron their clothes (36%), with over one in ten believing it is not at all important (12%). (WRAP, 2012c)

If and when the need for replacing a washing machine, tumble dryer or iron arises, consumers are now more likely to consider the associated costs of laundry. High electricity costs are making consumers more aware of the advantages in buying more energy-efficient appliances. (Mintel, 2011b) This in turn, could influence the amount of clothes cleaning and preparation undertaken.

4.2 What are the impacts?

Clothes laundry has big environmental impacts. A significant amount of energy is consumed and GHG emissions produced from domestic washing and drying of clothing. In terms of the carbon footprint this is the second most dominant lifecycle stage, representing a quarter of total lifecycle GHG impacts. (WRAP, 2012a p.34)

Table 4: Carbon footprint of clothes laundry (tCO_2e)

	Washing	Drying	Ironing	TOTAL
Carbon footprint (tCO_2e)	5,765,441	3,809,464	243,098	9,818,003

(Source: WRAP, 2012a p32)

[28] *In 2010, 96% of UK households owned a washing machine (ONS, 2010 p2)*
[29] *But people with no garden (17.2%) are more likely to own a washer dryer than average (13.5%)*

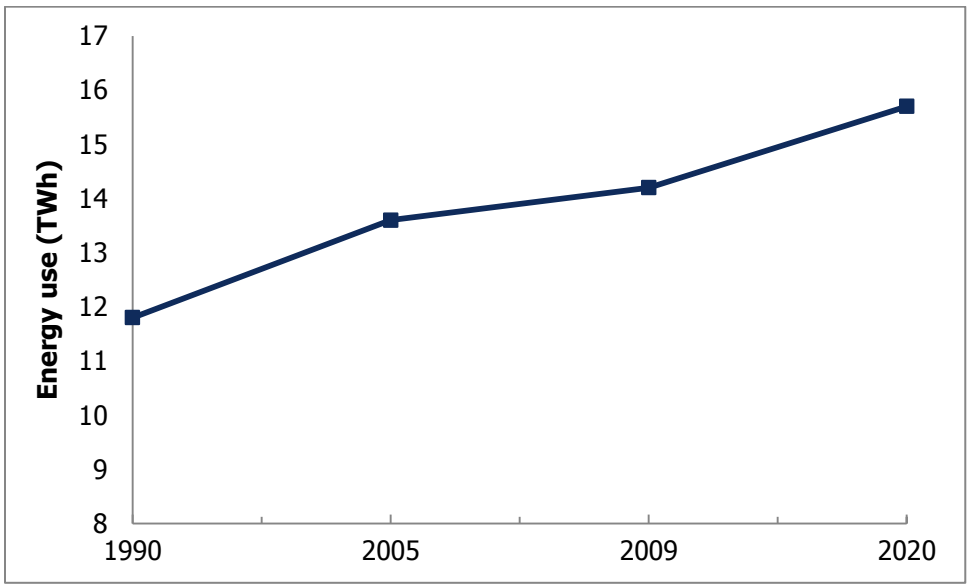
Table 4 displays the baseline carbon footprint results of all clothing in use in the UK in 2009, whether manufactured in or imported to the UK. The data do not differentiate the "in-use" carbon footprint by fibre type – which may under-estimate the carbon footprint of water-retaining fibres, notably cotton.

Tumble dryers are much more energy-hungry than washing machines: new tumble dryers consume 3KWh per use, compared to 0.8KWh for a typical new washing machine[29] (Energy Saving Trust, 2011 p22). Approximately nearly four times the energy is used to dry clothes than used to wash them. However, the footprint of drying is lower because use is not universal. Not everyone irons either, but the environmental impact in energy terms of ironing is lower than washing and drying.

The annual water footprint of all the clothes washed in the UK in one year is 36.3 million m^3 water. This equates to 0.58 m^3 water per person. (WRAP, 2012b p.23). The water footprint of clothes cleaning measures the net 'consumption' of water lost to the system (e.g. water evaporated during drying), and excludes water returned via the drain to the water catchment area. The volume of water supplied for washing is higher, and has particular significance for parts of the UK when facing summer drought.

The environmental impact of clothes laundry in the UK is expected to rise. Figure 24 shows the energy demand profile of washing in 1990, 2005 & 2009[11], and the prediction for energy demand in 2020.

Figure 24: Energy demand profile of washing



(Energy Saving Trust, 2011 p.17)

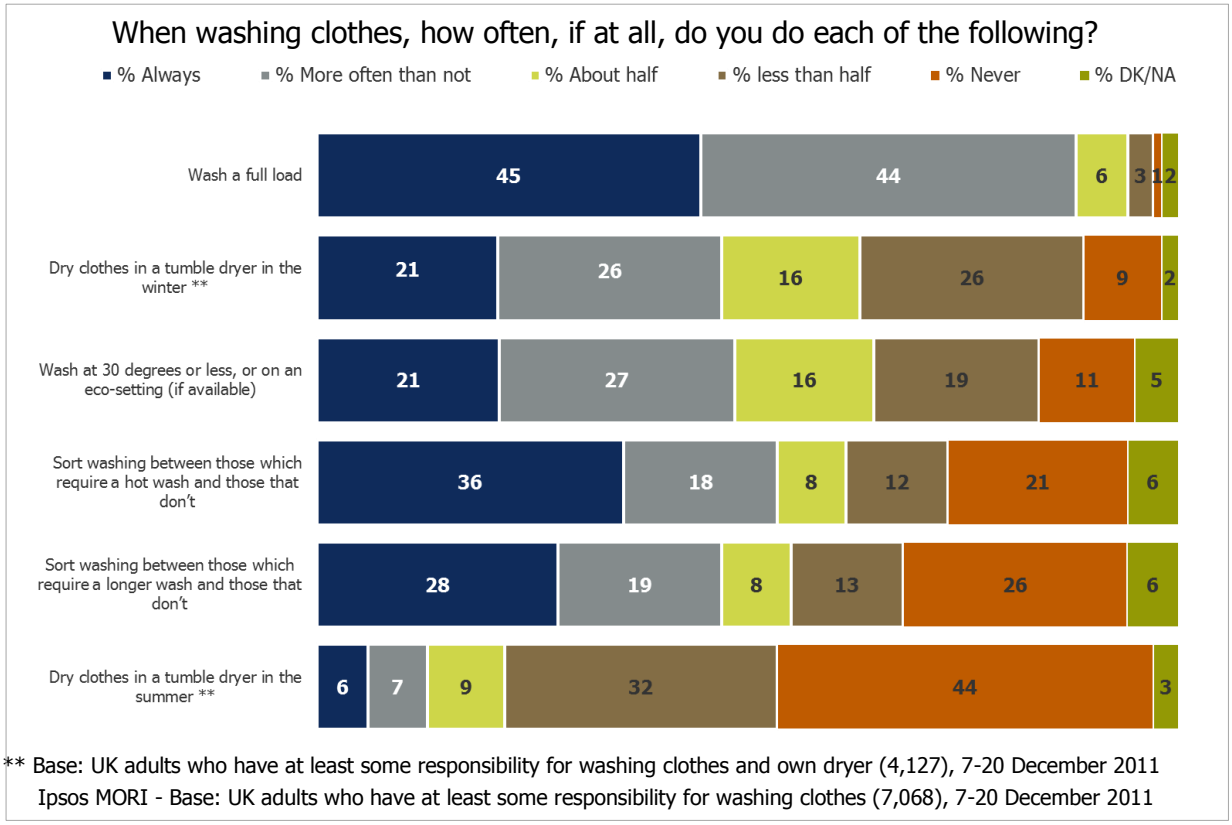
In the UK, 29% of CO_2e emissions come from the home. In 2009, energy consumption by washing and drying appliances had risen to 14.2 TWh – an increase of around 4% in five years. Given the trends and existing policies, this figure is now expected to reach 15.7 TWh by 2020[27]. (Energy Saving Trust, 2011 p23). However, in carbon terms the impact is likely to reduce in future years as a result of moving towards a generating mix with lower carbon emissions per TWh.

During the use phase, it is assumed that ironing, shrinkage or abrasion from washing results in fibre damage of 0.1%. Based on an assumed 10 washes per year, it is calculated that approximately 1% of clothing per annum is damaged irreparably as a consequence of cleaning. (WRAP, 2012d p.46)

4.3 How do we behave as consumers?

Figure 25 provides an overview of clothes washing behaviour. Most people wash at a full load at least half of the time (95%), and almost two-thirds of adults wash their clothes at 30 degrees or less, or on an eco-setting, at least half the time (64%). Three in five people regularly sort their washing between those which require a hot wash and those that don't (61%), and over half sort their washing between those that require a longer wash and those that don't (55%). Of those who own a tumble dryer, almost two-thirds use it at least half the time during the winter (63%), however, over two in five never use it during the summer (44%). (WRAP, 2012c)

Figure 25: Clothes washing behaviour

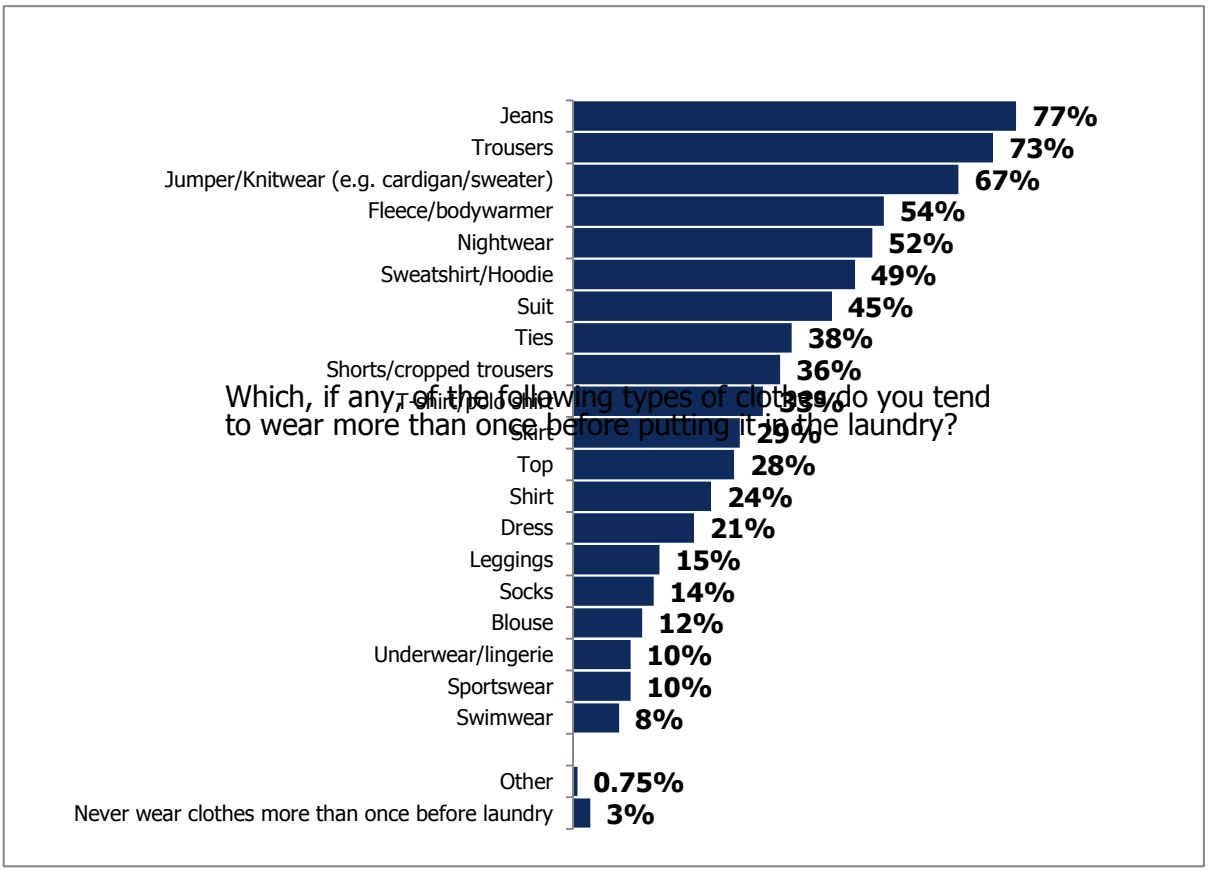


** Base: UK adults who have at least some responsibility for washing clothes and own dryer (4,127), 7-20 December 2011
Ipsos MORI - Base: UK adults who have at least some responsibility for washing clothes (7,068), 7-20 December 2011

(Source: WRAP, 2012c)

The majority of adults will wear at least some clothes more than once before putting them in the laundry (97%), leaving a small proportion who will wash all of their clothes after just one wear (3%). (WRAP, 2012c) Figure **26** shows the frequency in which clothes are worn prior to washing. While some garments are washed after wearing just once, others are worn more frequently before washing. Two-thirds of adults wash a t-shirt/polo shirt after only wearing it once (67%), and three quarters will wear a shirt only once before washing it (76%). Only 3% of the population will never wear anything more than once. (WRAP, 2012c)

Figure 26: Frequency of clothes wear prior to washing



(Source, WRAP, 2012c)

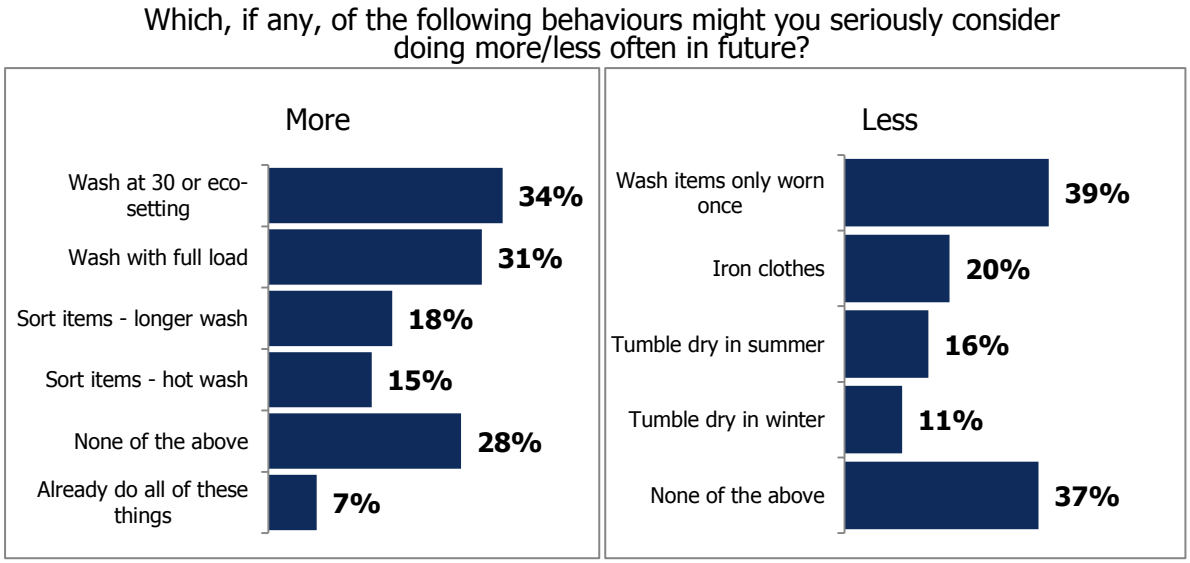
Within this question, it must be noted that the figures presented here are the average for the UK population so, while some items might be gender specific the percentage quoted within Figure 26 is the average across both genders.

4.4 Where and what is the potential for savings?

Laundry practices appear to be in transition. There is evidence of positive practice, in that a high proportion of people wash full loads and at low temperatures, but there are also many people who do not normally sort clothes (facilitating more efficient washing and drying) and some who use tumble driers routinely. The behavioural change in which the greatest proportion of people expressed an interest is wearing clothes for longer before putting them in the laundry. (WRAP, 2012c)

A summary of people's willingness to change clothes laundry behaviour is illustrated in Figure 27. Most people would seriously consider changing an element of their laundry behaviour, with only one-third not willing to consider changing behaviour at all (32%). (WRAP, 2012c)

Figure 27: Willingness to change clothes laundry behaviour



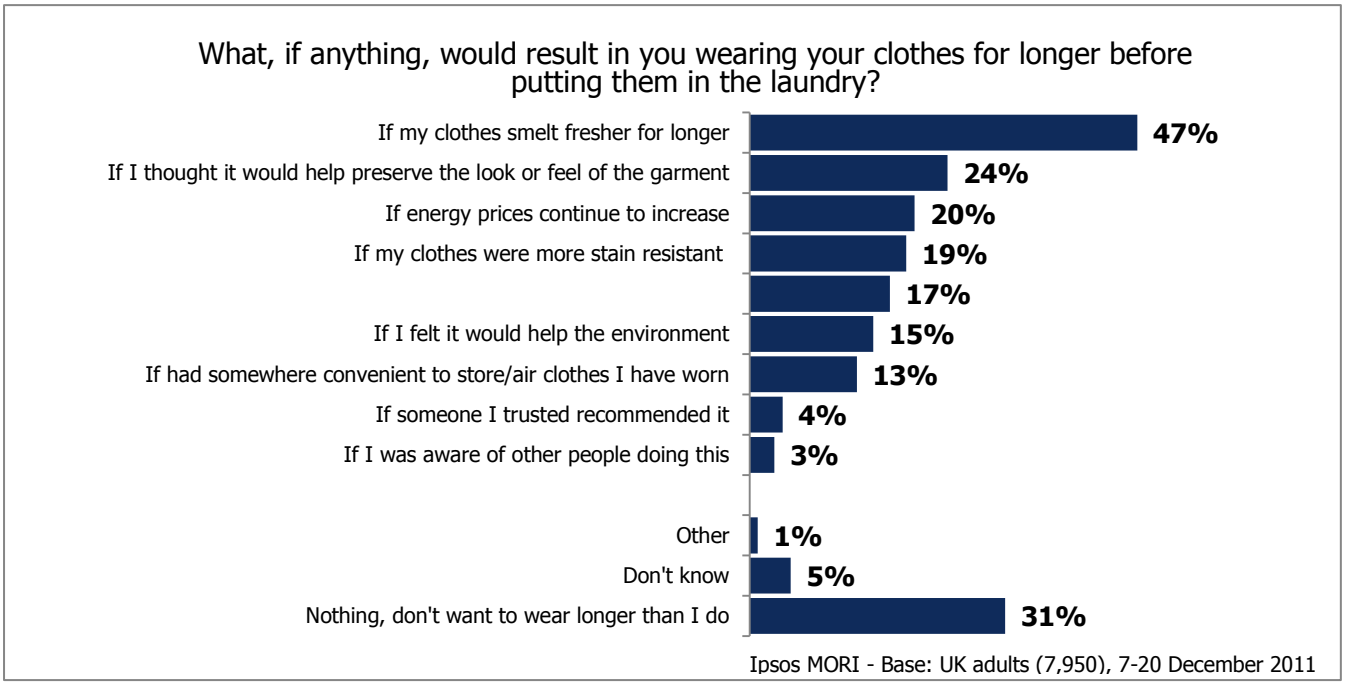
Ipsos MORI - Base: UK adults who have at least some responsibility for washing clothes (7,068), 7-20 December 2011

(Source, WRAP, 2012c)

Almost two in five people with some responsibility for washing clothes would consider washing items that have only been worn once less often (39%), over a third would consider washing their clothes at 30 degrees or on an eco-setting more often in the future (34%) and nearly a third would consider waiting for a full load more often (31%). One in five would consider ironing their clothes less (20%), and fewer than one in five would consider sorting items into those which require a longer wash more often (18%) or a hotter wash (15%) and tumble drying less often in the summer (16%) or winter (11%). (WRAP, 2012c)

Reducing the number of washing machine cycles would have the biggest impact on reducing the environmental impact of clothing in-use. If everybody washed their clothes 10% less each year, the carbon footprint would reduce by 2.6%. This is a consequence of the use phase representing such a large proportion of total lifecycle emissions, and the fact that both drying and ironing are reduced by 10% when you reduce the number of washes. (WRAP, 2012a p.41)

Figure 28: Drivers for wearing clothes for longer prior to washing

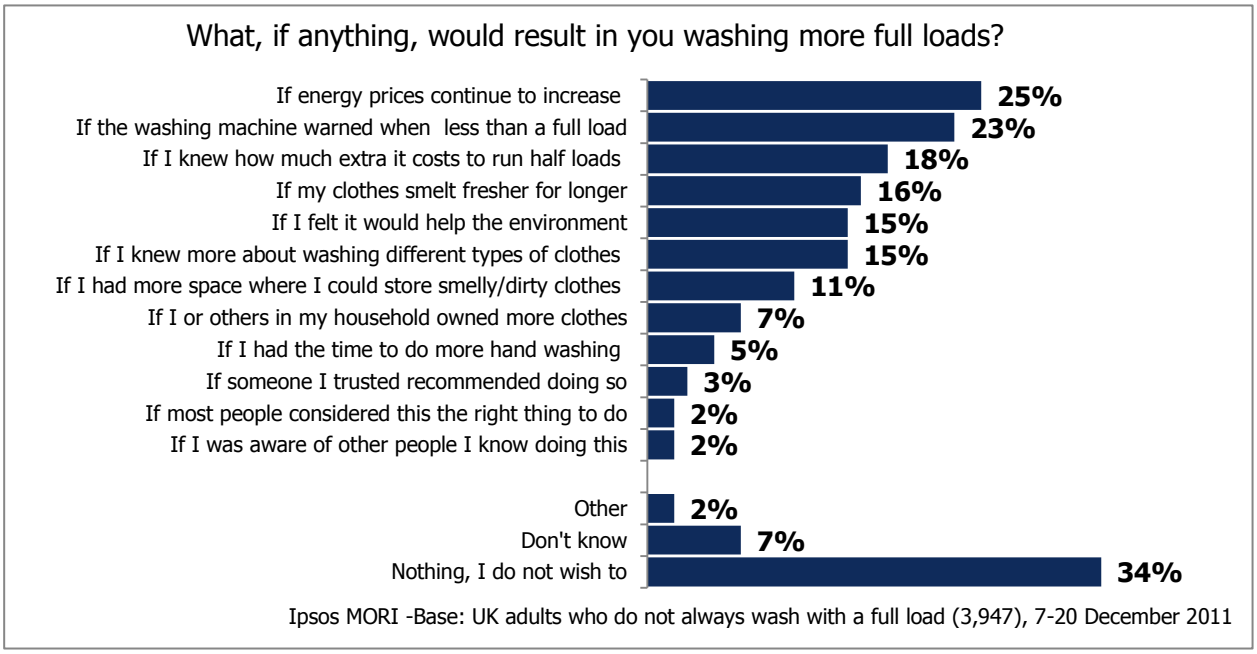


(Source, WRAP, 2012c)

Figure 28 shows almost half of all adults would delay putting their clothes in the laundry if their clothes smelt fresher for longer (47%), nearly a quarter would do so if they felt it would help to preserve the look or feel of the garment (24%), and one in five would do so as a result of energy prices continuing to rise (20%). Between one in ten and two in ten would do so if their clothes were more stain resistant (19%), if they knew how much money they would save by running the washing machine less often (17%), if they felt it would help the environment (15%) or if they had somewhere convenient to store/air clothes once worn (13%). (WRAP, 2012c)

Three in five UK adults who do not always wash with a full load would consider doing so more often in the future (59%) (WRAP, 2012c). This would mean that washing machines would be run less frequently, therefore creating energy savings. An increase in washing and drying load size from 3.4kg to 3.7kg is estimated to result in a carbon reduction of 1.4% (WRAP, 2012a p.42).

Figure 29: Drivers for washing with more full loads

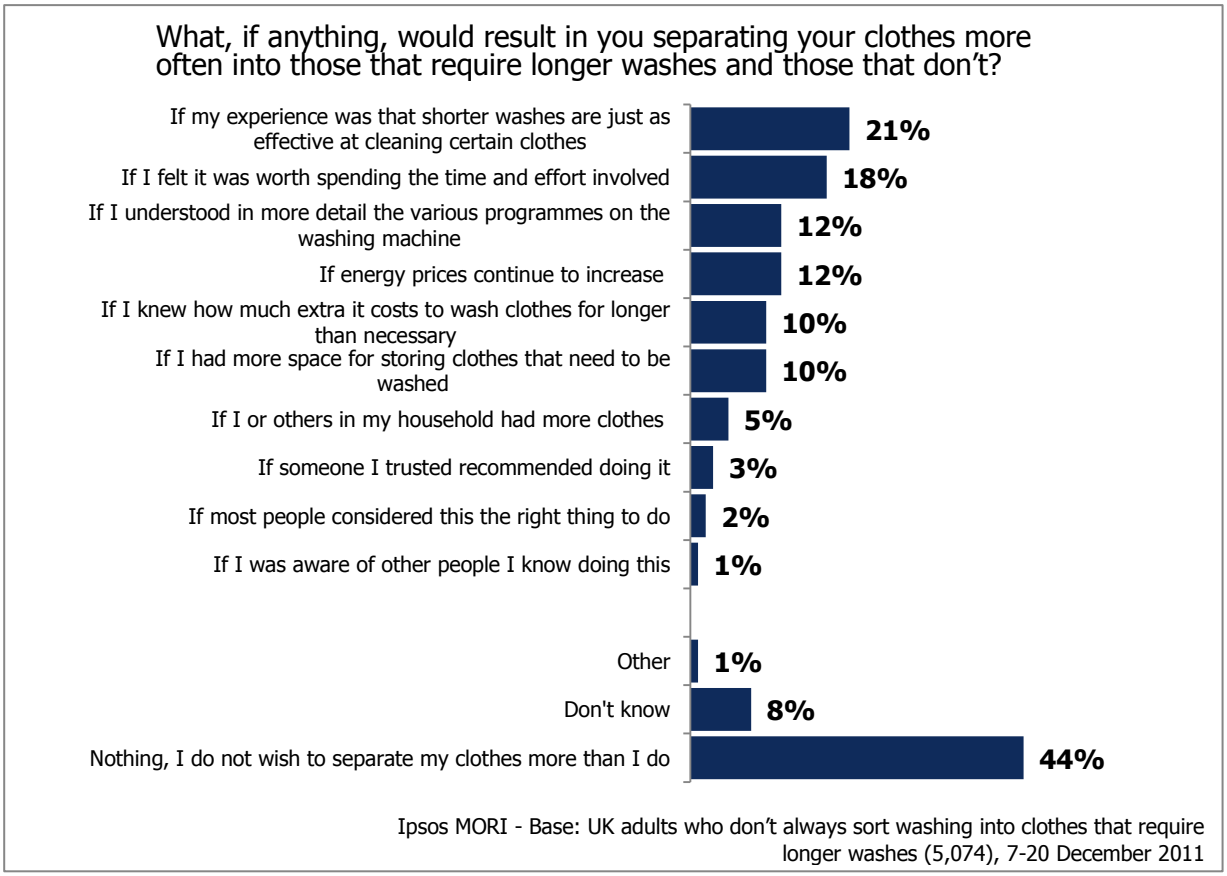


(Source, WRAP, 2012c)

Figure 29 presents drivers which would make people more inclined to wash more full loads. A quarter of adults would wash with a full load more often if energy prices continue to increase (25%) and just under a quarter would be encouraged to do so if their washing machine warned them when they had less than a full load (23%). Almost one in five would do more full loads if they knew how much more it cost them to run half loads (18%) and around one in six adults would do more if their clothes smelt fresher for longer (16%), if they felt it would help the environment (15%), or if they were more informed about washing different types of clothes (15%). (WRAP, 2012c)

Separating clothes into those that require longer washes and those that do not has the potential to create resource savings. However, this is only if it does not come at the expense of washing full loads. Just under half who do not always sort laundry between longer and shorter washing would consider doing it more often in the future (48%). Factors which would encourage more separation of clothing for washing are shown in Figure 30.

Figure 30: Drivers for separation of clothing prior to washing



(Source, WRAP, 2012c)

Around one in five would be encouraged to do so if their experience of shorter washes were just as effective as longer washes (21%), or if they felt it was worth spending the time and effort involved (18%). Around one in ten would be persuaded by a greater understanding of the various programmes on their washing machine (12%), if energy prices continue to increase (12%), if they knew how much extra it costs (10%) or if they had more space for storing clothes that need to be washed (10%). (WRAP, 2012c) Any concerted effort to encourage clothing separation for washing should be mindful that it could lead to less full load washing.

Sales of larger washing machines, with load capacity of 7kg and over, are increasing. Bigger drum sizes and higher overall energy-efficiency ratings could help to reduce the energy used in washing clothes – if people respond by washing larger loads, less frequently. The danger is that better efficiency could be undermined by machines running with small loads in them just as often as the previous smaller machines. (Energy Saving Trust, 2011 p.22)

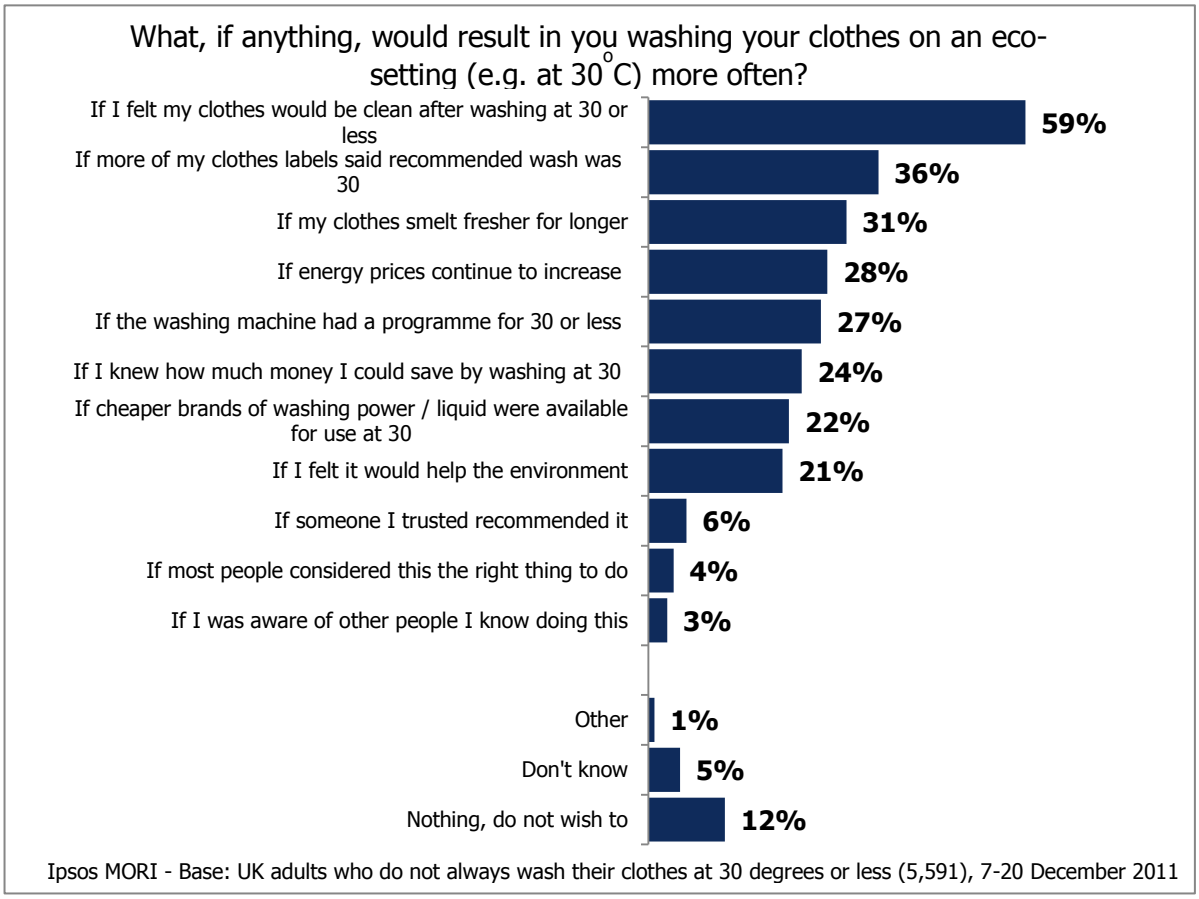
Raising water temperature is very energy consuming (Cotton, 2007). Washing at lower temperatures can use up to 40% less energy[30] than high temperatures. (Energy Saving Trust, 2011 p.22) Over a third of adults with responsibility for washing clothes, would consider washing their clothes at 30°C or on an eco-setting more often in the future (34%). Washing at 30°C instead of higher temperature would reduce the environmental impact of clothing, and could save around £10 a year. (Energy Saving Trust, 2011 p.32) This equates to a saving of around £55 million per annum at a national level[30].

More than eight in ten adults who don't always wash at an eco-setting would consider doing so more often in the future (83%). Around three in five adults would be encouraged to do so if they were confident that their clothes would definitely be clean (59%). Over a third would wash their clothes at an eco-setting if more of

[30] *Calculated by multiplying £10 by 11% of the adult population (50 million) who report they never wash at 30°C or lower (WRAP, 2012c)*

their clothes labels recommended it (36%), and around a third would consider it if their clothes smelt fresher for longer as a result (31%). (WRAP, 2012c)

Figure 31: Drivers to wash clothes on an eco-setting more often



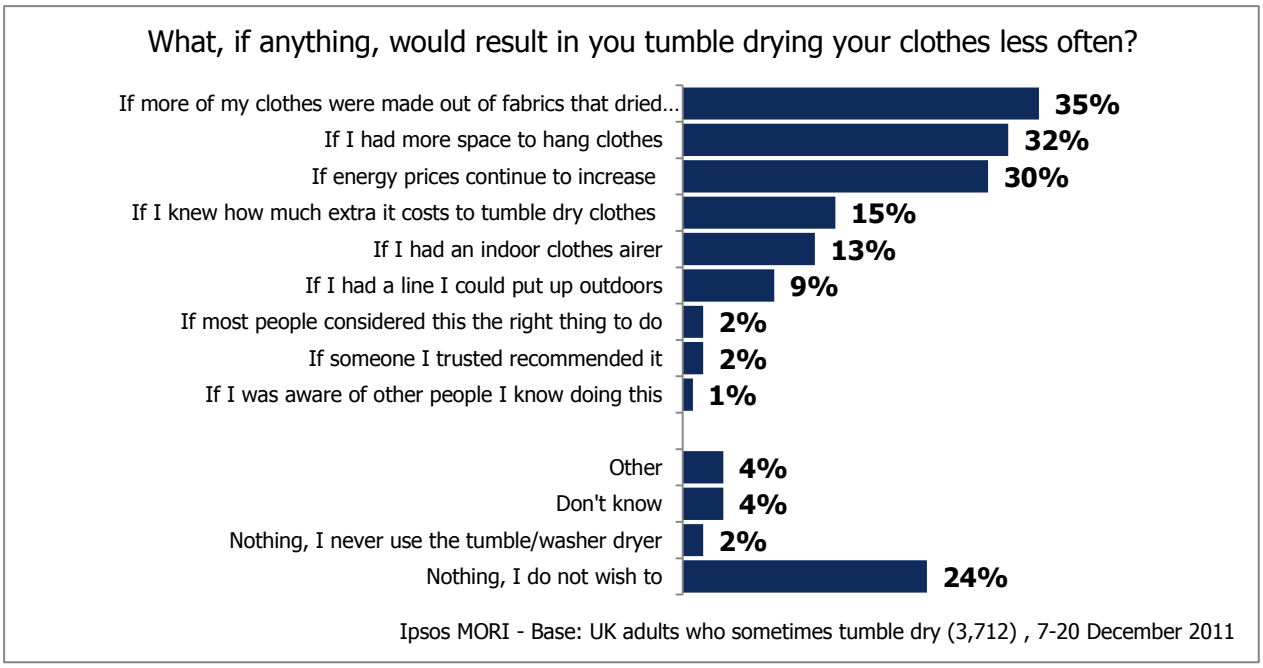
(Source, WRAP, 2012c)

Around a quarter would be persuaded if energy prices continue to increase (28%), if their washing machine had an appropriate setting (27%), if they knew how much money they could save (24%), if cheaper brands were available for use at 30 degrees (22%) or if they felt that it would help the environment (21%). (WRAP, 2012c)

Achieving further uptake of lower temperature washing would require co-ordination across appliance manufacturers (producing washing machines that can wash at lower temperatures), detergent manufacturers (producing detergents that are effective at cleaning clothes at lower temperatures) and retailers and brand owners (providing information and education to consumers around the viability and benefits of low temperature washing). (Carbon Trust, 2011 p.15)

Seven in ten adults who currently tumble dry their clothes would consider doing it less (70%); reasons for doing so are shown in Figure 32. Around a third would tumble dry less often if their clothes were made from fabrics that dried quicker (35%), if they had more space to hang their clothes (32%), or if energy prices continue to increase (30%). (WRAP, 2012c)

Figure 32: Drivers to tumble dry less often



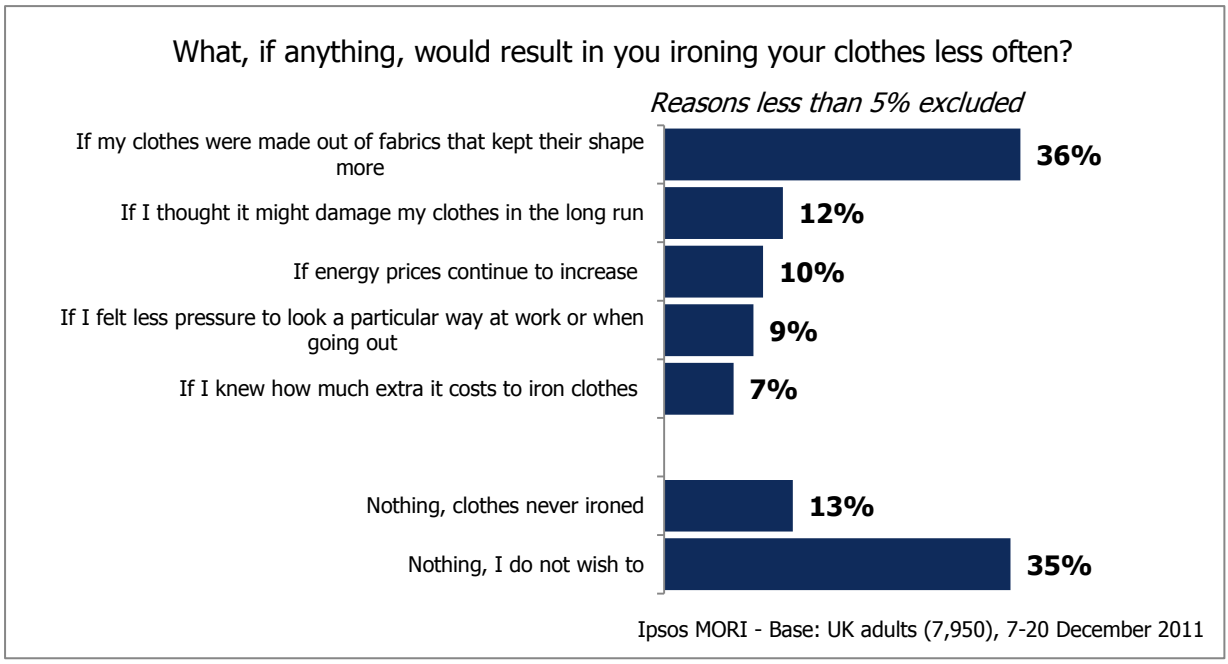
(Source, WRAP, 2012c)

Although machine drying is very energy-intensive and represents a significant proportion of total lifecycle carbon impact, machine dryer use in the UK is already quite low (around 32%) and therefore a reduction in use does not translate into an equal absolute reduction in use. However, reduced tumble drying could increase the lifetime of a garment through less shrinkage or other damage to clothing while machine drying. (WRAP, 2012a p.42)

A possible negative indirect consequence of drying clothing indoors on radiators is that increased ventilation (e.g. opening windows) to remove moisture could lead to loss of heat from the home (Defra, 2009a). The resource and cost implications of this are not known, but thought to be insignificant.

Just under a half of all adults in the UK would consider ironing less than they currently do (47%). Over a third would iron less often if their clothes were made from fabrics that held their shape more (36%) (WRAP, 2012c) The environmental impact of ironing is relatively low, but ironing also costs in terms of time (it is estimated it takes three minutes to iron the average item (WRAP, 2012a p.24)).

Figure 33: Drivers to ironing clothing less



(Source, WRAP, 2012c)

Qualitative studies seeking to understand laundry behaviour have found that everyday practices are influenced by habits, routines and concepts of cleanliness which may outweigh views on sustainability. While people may be aware of the kinds of clothing habits that are good from a sustainability point of view, people do not necessarily act on this knowledge; research involving a diary task and wardrobe audit did demonstrate that gaining awareness of the issues influenced the behaviour of some people (Defra, 2008a).

In May 2010, the European Parliament approved the revised Energy Labelling Framework Directive. Since the scheme was first introduced, energy efficiency for some appliances has improved even more, so that, while an A-rating is still good, it can be bettered. The new layout allows three extra classes (A+, A++ and A+++) so in future labels will still show seven grades but for some products these will be A+++ to D, for others A++ to E and so on. For example, Energy Saving-recommended washing machines in the scheme can be eg AAA – ie A for energy, A for wash quality and A for spin (Mintel, 2010c p.22).

Advances in technology also present opportunities for resource and cost savings in terms of laundry. Examples include:

- Fibre surface coatings that can be applied to textiles to protect against stains and spills and make the garment water resistant, flame retardant or antimicrobial. These materials can be washed less frequently (Defra, 2007c p88)
- Tumble dryers that use mechanical steam compression, heat pump technology and variations on solar power; some of these require only half the energy of a conventional dryer. However, they are more expensive, and are currently a niche product. (Energy Saving Trust, 2011 p.22)
- A wrinkle resistant textile coating that can be applied to eliminate the need for ironing (Defra, 2007c p88).

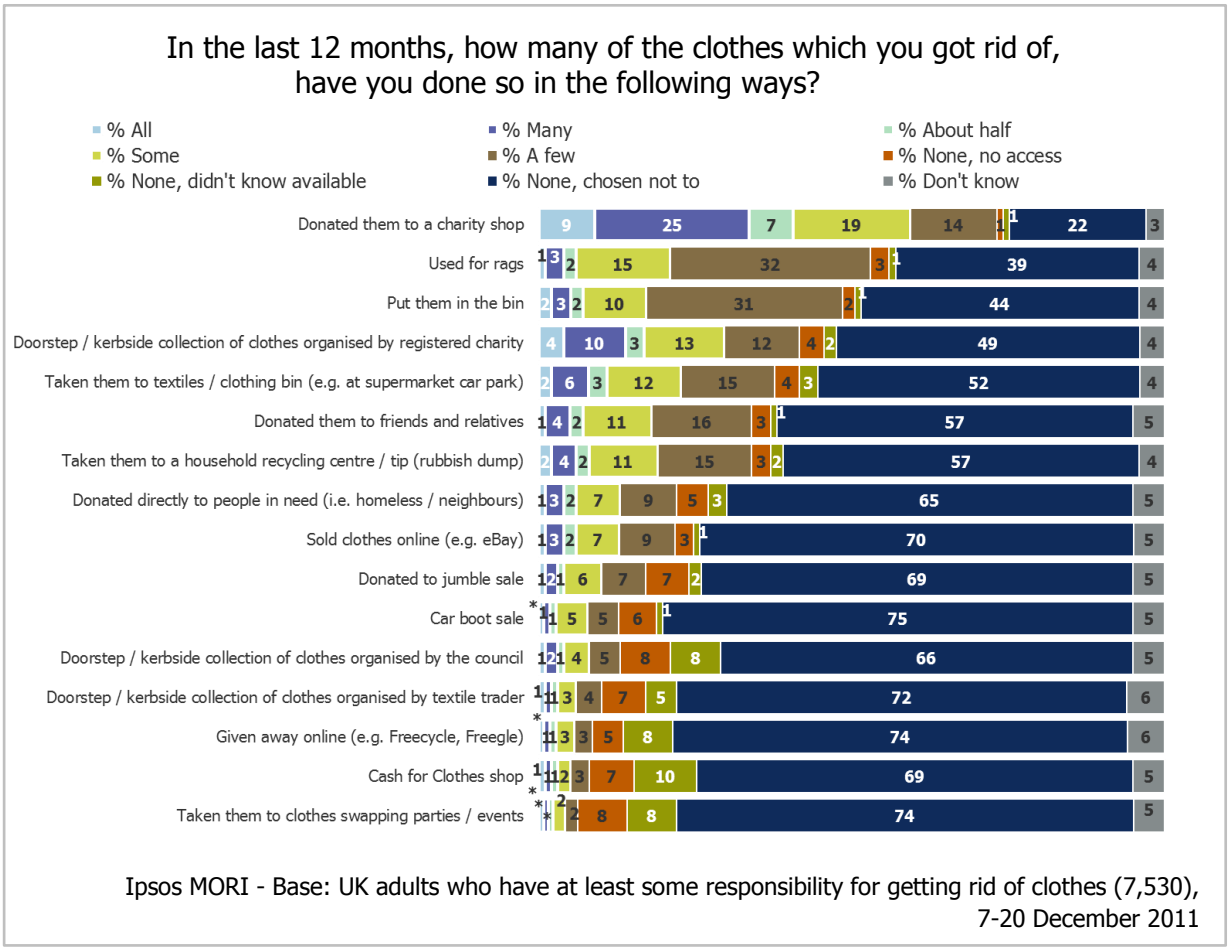
5.0 Clothing end-of-life

This section provides data on how UK adults treat unwanted clothing and the embodied impacts of their behaviour. Based on this information and consumer attitudes, potential cost and resource savings have been identified.

5.1 How much unwanted clothing do we get rid of and how?

Each year, an estimated 1.1 million tonnes of end-of-life clothing is passed-on by UK consumers either for re-use, recycling, incineration or landfill (WRAP, 2012d p.5). Nearly all adults take at least some responsibility for getting rid of unwanted clothes (94%). More than seven in ten people have donated at least some of their clothes to a charity shop in the last 12 months (73%), with four in ten donating at least half of their unwanted clothes here (41%). Over half of people used at least some of their discarded clothes for rags (53%), and almost half of people put at least some of their clothes in the bin as rubbish (48%). (WRAP, 2012c)

Figure 34: How consumers get rid of unwanted clothing



Ipsos MORI - Base: UK adults who have at least some responsibility for getting rid of clothes (7,530), 7-20 December 2011

(Source, WRAP, 2012c)

Other popular ways of getting rid of clothes in the last 12 months have been doorstep or kerbside collection by a registered charity (42%), by taking them to a textiles bin (37%), donating them to friends or relatives (35%), and taking them to a household recycling centre (33%). Fewer than three in four use other methods, such as donating directly to people in need (22%), selling clothes online (21%), and donating to a jumble sale (16%). (WRAP, 2012c)

Most textiles are considered re-usable or recyclable but at present, nearly one-third of unwanted clothing ends up in landfill. Table 5 provides a breakdown of the overall fate of clothing waste in the UK.

Table 5: Fate of clothing waste in the UK

Fate of Waste	Proportion to this Route	Tonnes
Re-use (UK and abroad)	47.6%	540kt
Recycling (closed loop[31])	0.0%	0
Recycled (open loop[32])	14.5%	160kt
Incineration	7.2%	80kt
Landfill	30.7%	350kt

(Source: WRAP 2011a p.10)

This analysis excludes any net change in the quantity of clothes being kept in the wardrobe each year (Source: WRAP 2012d p.37).

5.2 What are the impacts?

For each end-of-life fate for clothing that is chosen, there are both positive and negative environmental implications. For example, GHG emissions result from activities such as transportation, sorting, re-using/recycling, the operation of an incinerator or from the decomposition of waste in landfill. Offsetting these impacts somewhat are activities that displace the need to produce equivalent items elsewhere in the economy and for this a benefit is given. For example, reusing clothing can displace the need to buy new clothing; incinerating clothing generates electricity, which displaces the need to generate electricity from conventional means; and recycling clothing displaces the need to produce fibres. In some cases, the benefit of the displaced product outweighs the burdens associated with the waste management and therefore a net benefit is evident. (WRAP, 2012a p.30) For this reason, the most resource-efficient strategy for getting rid of unwanted clothing is re-use.

If cotton t-shirts are considered for example, around 120 million t-shirts are re-used (ca 30,000 tonnes) in some form each year. This is about 50% of all the t-shirts reaching the end of their life[33]. The potential benefits associated with this re-use activity include:

- avoidance of 450,000 tonnes CO_2e per year[34];
- over £1 net revenue to re-use organisations / Government in combination (discounting wider costs or losses to householders, offices or businesses), per t-shirt re-used;
- over £170 million per year to households as a result of sale of items through re-use, exchange and avoiding purchase of (more expensive) new items; and
- 500 jobs – as a net employment benefit of dealing with all t-shirts that reach the end of their life (WRAP, 2011a p.3.).

Recycling uses much less energy than producing new materials from scratch. The energy burden of recycling is insignificant in comparison with the savings made through off-setting new production, approximately 65 kWh is saved; and for every kg of new polyester clothing displaced by pre-owned clothing approximately, 90kWh is saved (Marks and Spencer, 2002. Cited Defra, 2007c p.89). This means less fossil fuel is burnt and less greenhouse gas is emitted.

Putting unwanted clothes into landfill has significant environmental impacts and is costly. Not only do landfill sites take up a lot of space which could be used for other purposes, but non-man-made materials also release methane when deposited in these environments and can potentially contribute to increased GHG emissions

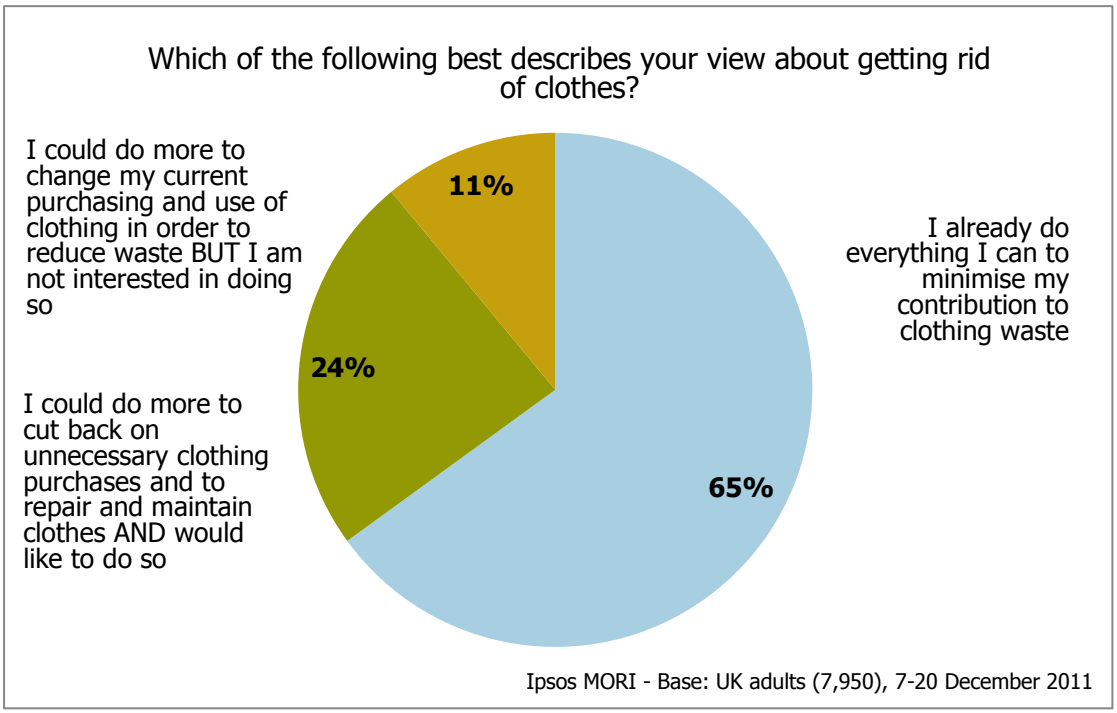
[31] *Closed loop recycling occurs when a material is substituted for the same primary material in a similar application*
[32] *Open loop recycling occurs when a material is recycled into other product systems and the material undergoes a change to its inherent properties*
[33] *The other 50% go to recycling, energy recovery or landfill*
[34] *Current levels of re-use of T-shirts*

(Defra, 2007 p.vii). It currently costs a council £64[35] in tax alone for each tonne of waste buried (plus local operation costs which vary).

5.3 How do we behave as consumers?

Almost two-thirds of people claim that they already do everything they can to minimise their contribution to clothing waste (65%), as shown in Figure 35. Around one quarter of the population state that that they could do more to cut back on unnecessary clothing purchases and to repair and maintain clothes, and would like to do so (WRAP, 2012c).

Figure 35: Views about getting rid of clothing

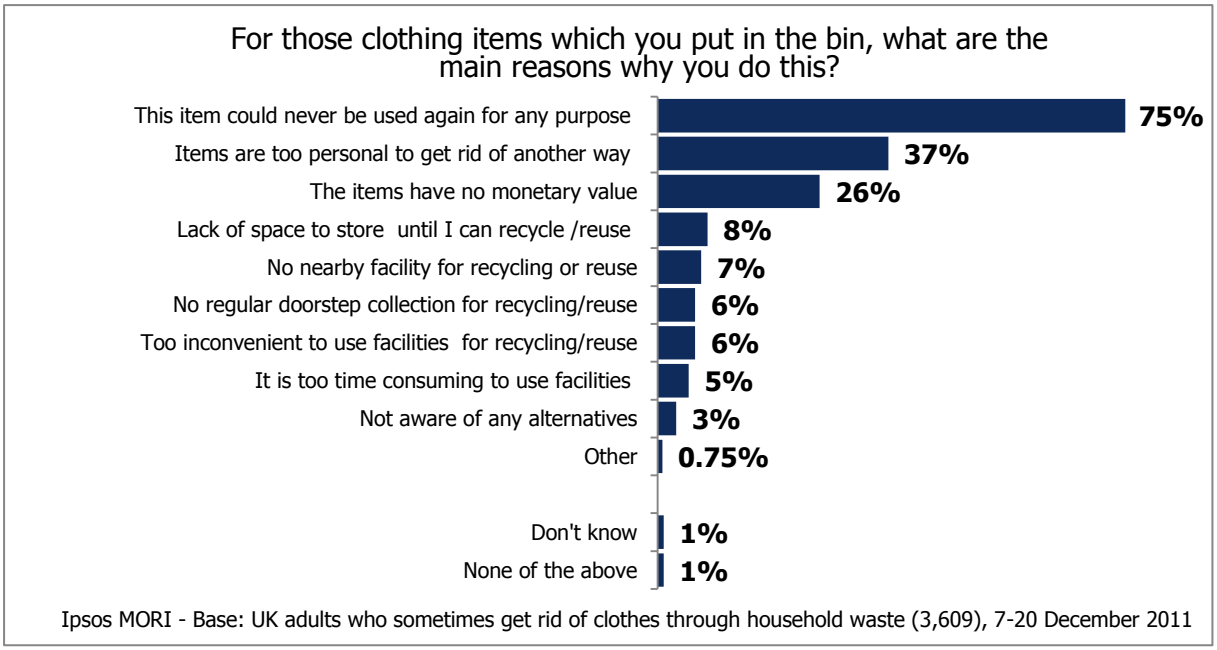


(Source, WRAP, 2012c)

[35] *The standard landfill rate is £64 per tonne from 1 April 2012 to 31 March 2013 and will increase to: £72 per tonne on 1 April 2013; and £80 per tonne on 1 April 2014.*

Figure 36 presents the main reasons clothing is put in general household waste**.** Three-quarters of those who sometimes get rid of clothes by putting them in the bin state that these clothes could never be used again for any purpose (75%), by far the most common response. More than one in three think that the items they throw away are too personal to get rid of in any other way (37%) and around a quarter do not think that their old clothes have any monetary value (26%).

Figure 36: Reasons for putting clothing in general household waste



(Source, WRAP, 2012c)

As noted in Section 4 clothing sales volumes are now falling, as clothing prices begin to rise. These trends could have possible implications for clothing waste. The following could be experienced:

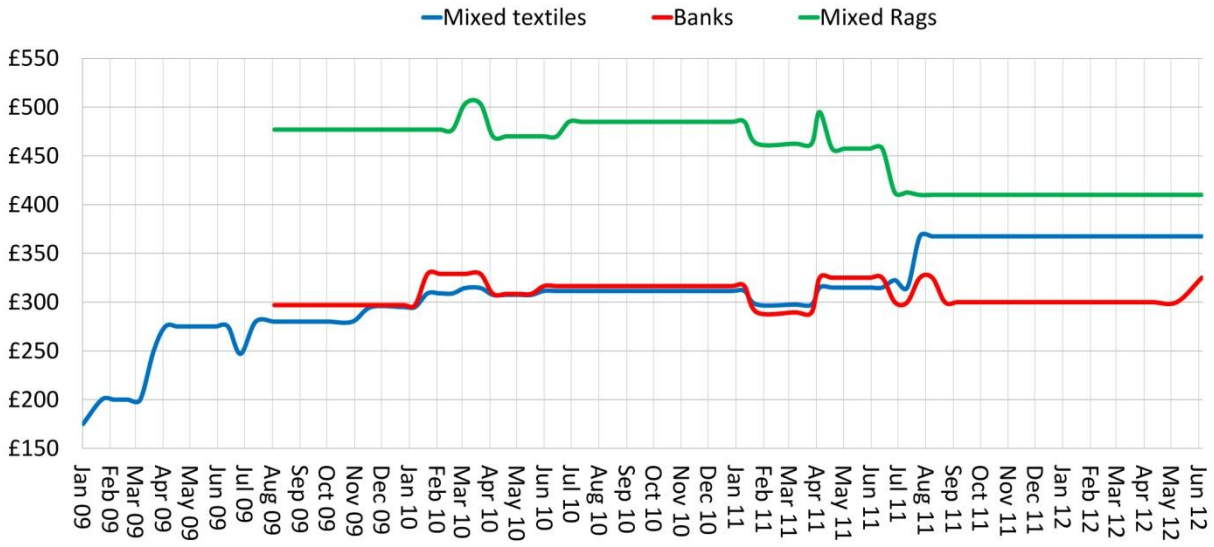
- a fall in arisings in the short term as consumers firstly buy less and secondly are perhaps more encouraged to hold on to clothes;
- greater consumer awareness of the costs associated with clothes which in turn might create a more favourable backdrop for waste minimisation behaviour change, in particular behaviour change that can be shown to deliver savings.

5.4 Where and what is the potential for savings?

Much unwanted clothing is donated to charity shops or discarded using other appropriate routes, but clothing is often binned because people consider it too damaged or heavily worn. People would be most likely to separate more clothing for re-use or recycling if made aware that such items have value. At present around 30% of end-of-life garments are sent to landfill, most of which would have a commercial value as textiles, at least.

Figure 37 presents trends in the value of recovered textiles.

Figure 37: Value of textiles (£ per tonne)

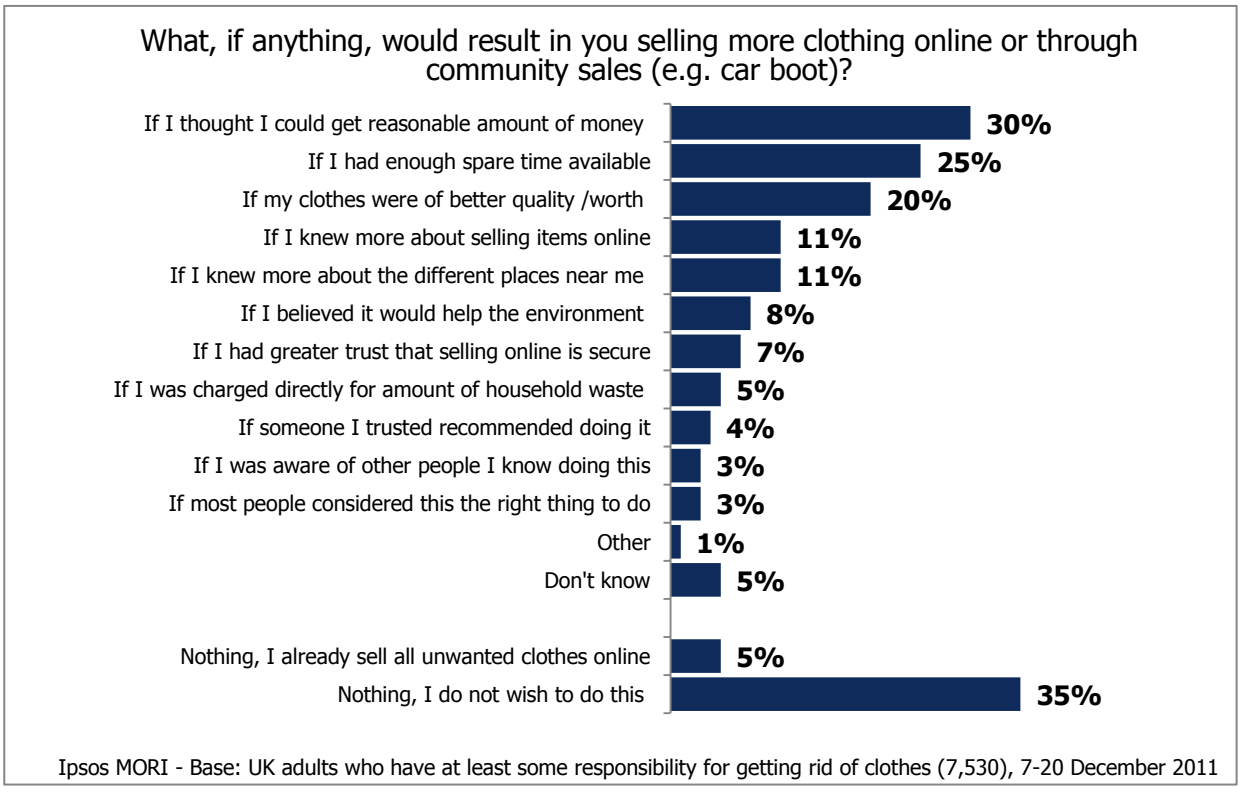


(Source: WRAP 2012e)

Almost a third of people would be incentivised to sell more clothes online or through community sales if they thought there was a sufficient financial reward for it (30%), while a quarter would sell more if they had more spare time (25%). One in five would do so if their clothes were of better quality or worth more (20%) and just over one in ten would do so if they knew more about selling items online (11%) or about facilities nearby (also 11%). (WRAP, 2012c)

Figure 38 shows motivations for potentially selling more pre-owned clothing.

Figure 38: Motivations for potentially selling more pre-owned clothing

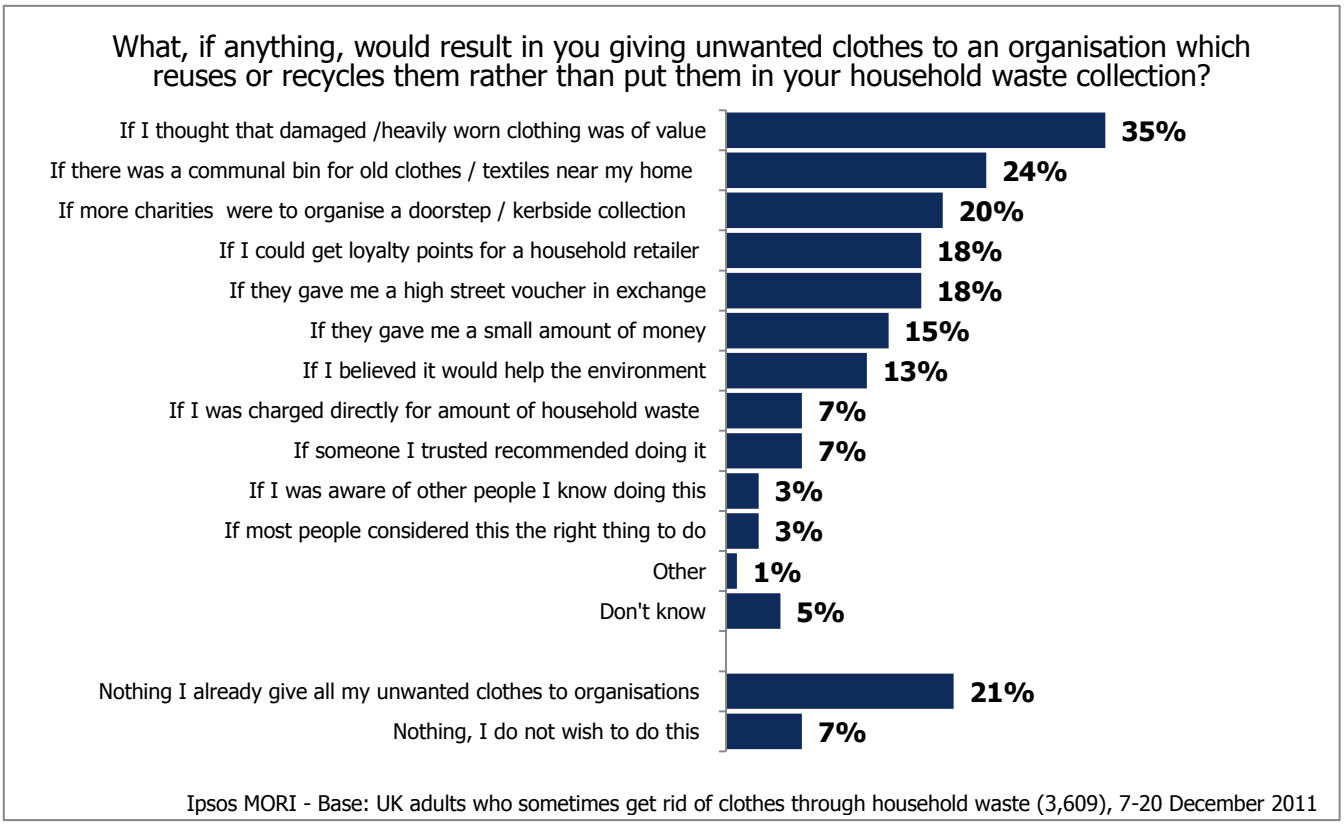


(Source, WRAP, 2012c)

Figure 39 illustrates motivations for potentially donating more unwanted clothing. Over a third of people would be happy to give clothes if they thought that they would be of value (35%). Many people appear to have a genuine desire to minimise waste, but, while attitudes are positive, appropriate behaviour does not always follow. Qualitative research suggests that this partly arises out of confusion between re-use and recycling, with poorer quality, often unbranded, clothing being binned despite having the potential to be recycled if not re-used (see for example, Morgan and Birthwistle, 2009, Morley et al, 2009)

Almost a quarter of people would donate more unwanted clothing if a facility for putting it in a bin was near to their home (24%), around one in five would if doorstep/kerbside collection by charities was extended (20%), or if they could get loyalty points for a household retailer (18%), a high street voucher (also 18%) or a small amount of money in return (15%). (WRAP, 2012c)

Figure 39: Motivations for potentially donating more unwanted clothing

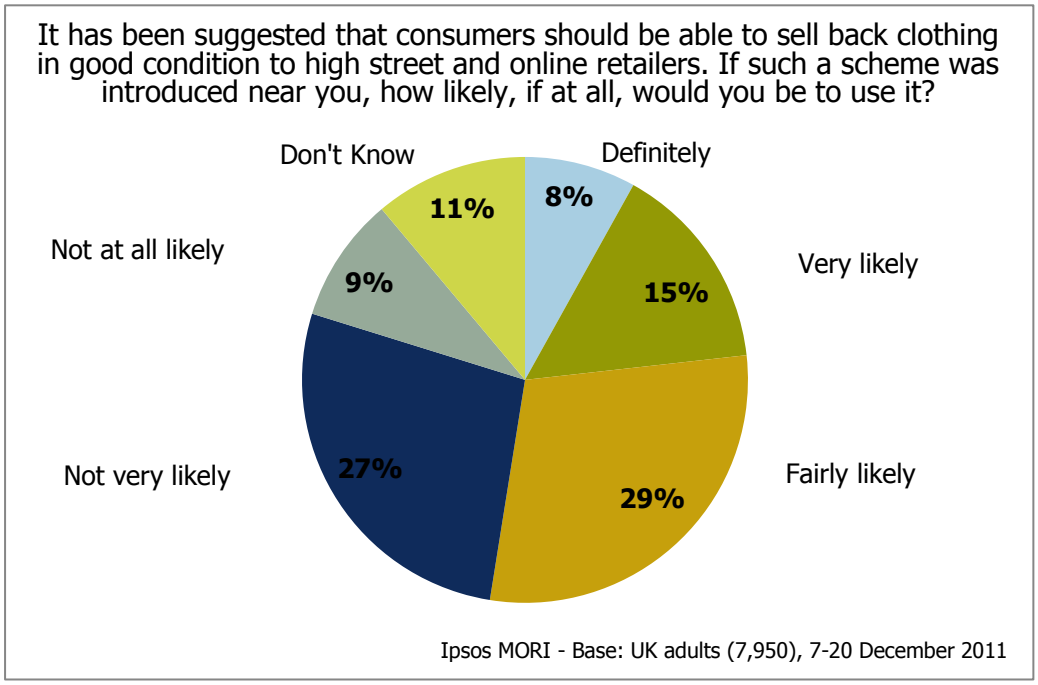


(Source, WRAP, 2012c)

(WRAP, 2012c)

Figure 40 shows that more than half of people would be at least fairly likely to use a buy-back scheme were it to be introduced; definitely (8%), very likely (15%) and fairly likely (29%). (WRAP, 2012c)

Figure 40: Interest in selling clothing back



(Source, WRAP, 2012c)

The type of clothes that adults would consider selling back if such a scheme was introduced would principally be formal wear (47%), clothes for going out and socialising (42%), and designer clothing (31%). Over a quarter of the population would consider selling back seasonal clothes (28%). (WRAP, 2012c)

Three-quarters of the population would consider selling back clothes even if the original buying price was as low as £15 (75%), rising to the vast majority for higher cost items (84% for an item originally worth £100). (WRAP, 2012c) The minimum amount expected in return for clothing is summarised in Figure 41.

Figure 41: Minimum amount expected to make the use of a buy-back scheme worthwhile to consumers

For each of the following items what would be the minimum amount you might expect to receive to make it worth your while to sell it back?

	Mean value	Would not bother	Don't know
An item of clothing you had paid £15 for	£6.44	15%	9%
An item of clothing you had paid £50 for	£21.50	2%	8%
An item of clothing you had paid £100 for	£45.61	2%	12%

Ipsos MORI - Base: UK adults who would consider a buy0back scheme (5,172), 7-20 December 2011

(Source, WRAP, 2012c)

The average value at which people would be willing to sell back clothes is a bit less than half the purchasing price; £6.44 for an item originally costing £15, £21.50 for an item costing £50, and £45.61 for an item costing £100. While these values do not leave much room for a profit to be made, a substantial proportion were willing to accept rather less; one in five indicated that they would accept £10 or less for items that had cost £50 (22%) and a similar proportion that they would accept £25 or less for items that had cost £100 (21%). (WRAP, 2012c) Interest in purchasing pre-owned clothing was discussed in Section 2.0.

6.0 The big picture – impacts over the product life-cycle

Overall resource and cost implications of consumers' clothing related behaviour is presented in this section. As stated earlier, and detailed in the appendices, limitations of the evidence base must be acknowledged. Overall patterns of impact and potential cost and resource savings are presented, but the values given are not precise due to uncertainty in the estimates.

6.1 Total environmental impacts and split by life-cycle stage

Clothing has a significant impact on the environment globally. It is the most significant category for impacts after food and drink, housing and transport[36] (European Commission, 2006).

Table 6 presents an overview of the results from a hotspot analysis of the environmental impact of clothing at different lifecycle stages. This is based on analysis of secondary evidence.

Table 6: Environmental impact hotspots by lifecycle stage

[36] *Although the report notes uncertainties around the data – see page 18*

	Production		In-use	Discard
	Fibre Footprint	**Process Footprint**		
Carbon / energy **Total footprint 39 Mt CO_2e (~0.6 tonnes per person per year)** (WRAP, 2012a p.3)	**15% of carbon footprint**	**66% of carbon footprint, most notably including:** • ***yarn production (25%)*** • ***fabric production (33%)***	**26% of carbon footprint, most notably including:** • ***washing (15%)*** • ***drying (10%)***	
Water **Total footprint 6,300 Mm^3 ($100m^3$ per person per year)** (WRAP, 2012b p.17)	**87% of water footprint (often in countries and watersheds with water stress or water scarcity)**	**13% of water footprint**		
Waste **Total footprint 1.8 Mt (~28 kg per person per year)** (WRAP, 2012 p.52)		**32% of waste footprint**		**64% of total waste generation over the whole life cycle**

Key

Hotspot : lifecycle stage represents a significant proportion of the environmental footprint (approximately 10% or more of the total UK footprint)

Non-hotspot: lifecycle stage does not represent a significant proportion of the environmental footprint (approximately less than 10% of the total UK footprint)

6.2 Overall carbon footprint of UK clothing

The total carbon footprint of all garments purchased and in use in the UK in a single year is approximately 38 million tonnes of CO_2e (~0.6 tonnes per person per year)[37]. Because the majority of clothing is manufactured outside the UK it is estimated that ~32% occurs within the UK (contributing to the UK's direct carbon footprint) and 68% occurs abroad. Based on this estimate the direct impact of clothing in the UK can be estimated to be ~12 million tonnes of CO_2e per annum. (WRAP, 2012a p.34)

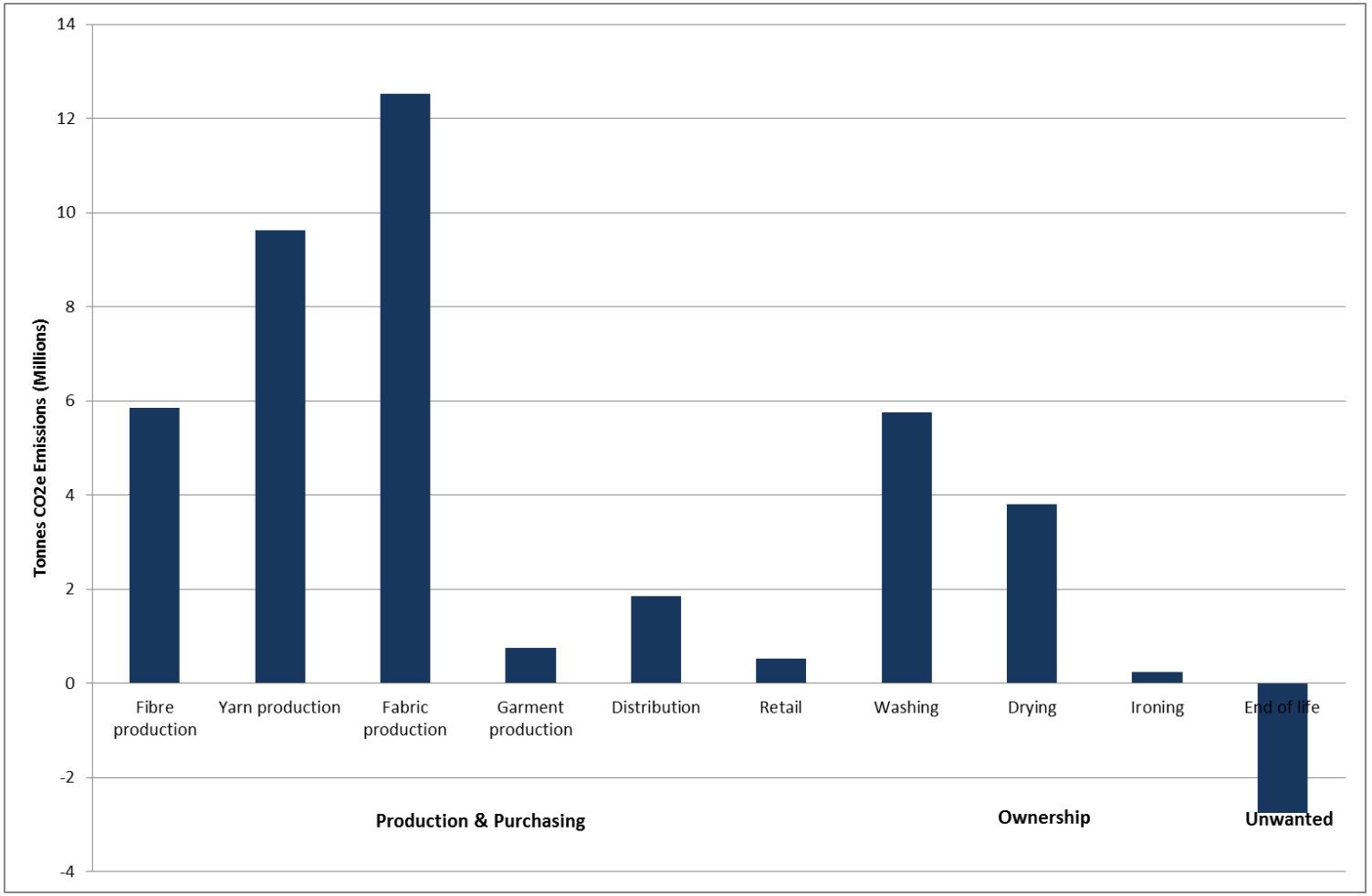
To put this carbon footprint of UK clothing into context, the total direct GHG emissions in the UK is 566 million tonnes of CO_2e (DECC, 2011)[38]. Therefore, the direct carbon footprint of clothing as a proportion of the UK's total direct carbon footprint is approximately 2%. (WRAP, 2012a)

Figure 42 shows the carbon footprint of all clothing in use in the UK, by lifecycle stage. This shows the most dominant life cycle stage is fabric production (compromising weaving/knitting etc. and treatment of fabric), representing 33% of total life cycle GHG impacts (WRAP, 2012a).

[37] *Based on 2009 data*

[38] *It should be noted that this total for the UK does not include GHG emissions associated with imported goods or services or international travel.*

Figure 42: Carbon footprint of all clothing purchased and in use in the UK in one year[39]



(Source: WRAP, 2012a p.35)

[39] *Carbon footprint all clothing in use in the UK in 2009, whether manufactured in or imported to the UK, represented as a total for the UK, broken down by life cycle stage and fibre type. End-of-life is shown as having a negative impact, given the assumption that re-use and recycling activities (which are widespread) reduce the requirement for new clothing garment production and retail.*

Of all lifecycle stages garment production, distribution and retail contribute the least to the total carbon footprint: contributing 2%, 5% and 1%, respectively (WRAP, 2012a p.34).

6.3 Overall water footprint of UK clothing

The water footprint of clothing purchased and used in the UK in one year is estimated to be 6,300 million m^3 of water. The water footprint is estimated at 2,500 m^3 of water for every tonne of clothing used in one year. This comprises around 2,200 m^3/tonne at the raw materials stage, 300 m^3/tonne at the processing and manufacturing stage and 15 m^3 tonne from the UK consumer use stage (through the full life cycle of the clothing). The water footprint per person is on average, 100 m^3 per annum, nearly all as a result 'imported' water rather than direct use in the UK[40]. (WRAP, 2012b p.17)

Depending on the fibre type the water footprint per tonne of fibre is estimated to range from 80 m^3 per tonne (for man-made fibres) to 58,100m^3 (WRAP, 2012b p.19). (There are significant uncertainties in the water footprint data for various fibre types.)

The most significant element of the water footprint is the production (cultivation / rearing) and extraction and processing of raw materials and represents 87% of the total water footprint (WRAP, 2012b p.18).

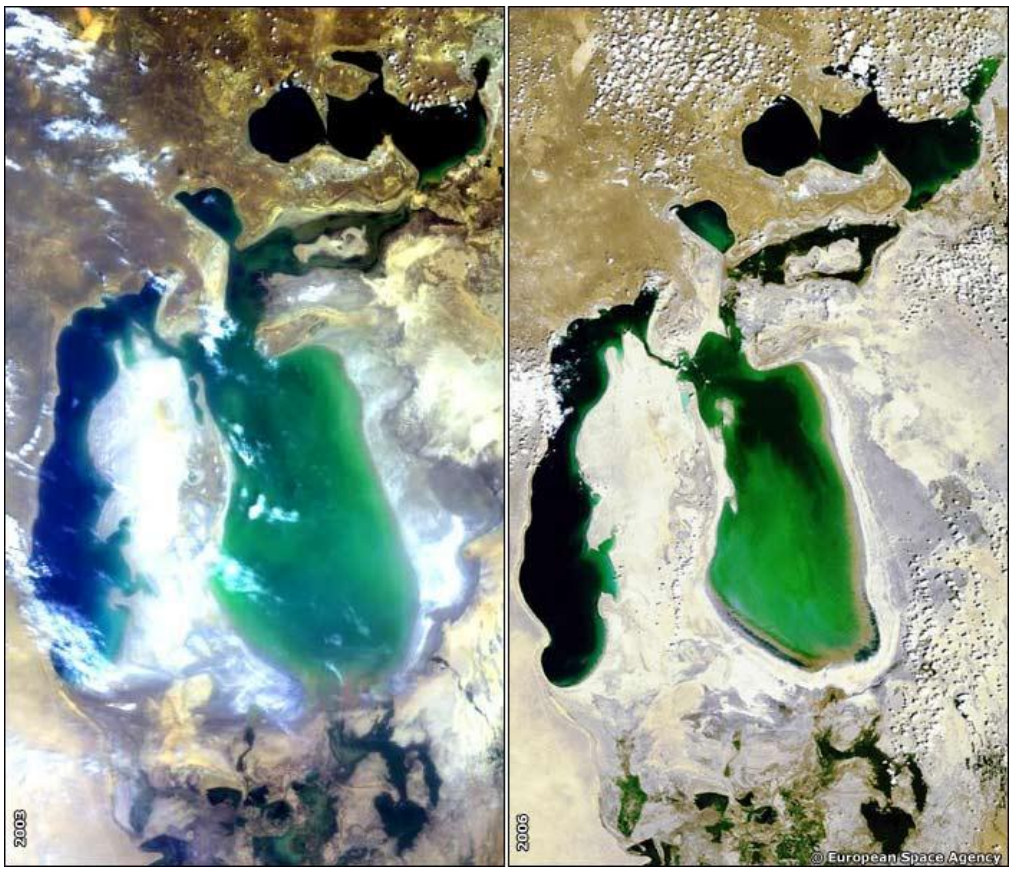
In terms of the three types of water, the footprint comprises (approximately):

- green (evapotranspiration during crop growth) – 3,460 million m^3 (55%);
- blue (net withdrawal from lakes, rivers and aquifers) – 1,100 million m^3 (17%);
  - 950 million m^3 in the irrigation of crops;
  - 110 million m^3 in the processing of raw materials and manufacture of clothes;
  - 40 million m^3 in consumer washing;
- grey (measure of pollution impact on freshwater resources) – 1,750 million m^3 (28%);
  - 1,070 million m^3 in fertiliser, pesticide and herbicide application; and
  - 680 million m^3 in the processing, dying and manufacture of clothes (WRAP, 2012b p.v).

As noted earlier, unlike with carbon footprinting, the aim of a water footprint is not necessarily to reduce its size but to focus change in locations where water resources are already or are going to be scarce. As discussion in Section 2.2, at present much clothing fibre production takes place in areas of water stress and water scarcity. Past impacts are already evident, for example, the Aral Sea is now half its original size due to overuse for irrigation and has become a symbol of extensive water use in cotton production (Allwood, et al. 2006).

[40] *Based on a 2009 estimated population for the UK of 61.8million*

Figure 43: Size of the Aral Sea in 2003 and 2006



(Source: BBC, 2007)

Figure 43 provides a visual image of the damage associated with clothing fibre production. Any focus on water efficiency within the clothing lifecycle needs to focus on countries where most water is consumed and areas where water is scarce or in stress (see **Error! Reference source not found.**).

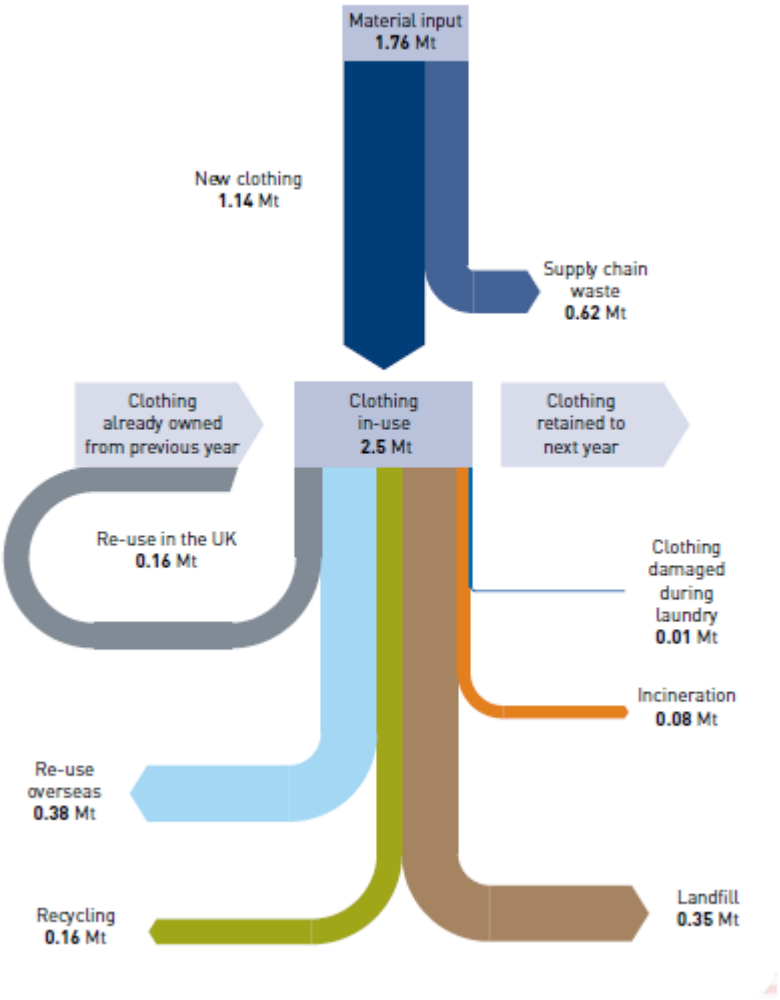
6.4 Overall production of waste

The total amount of waste related to all garments in use in the UK in 2009 (i.e. the volume of clothing consumed and the actively worn quantity, including waste associated with its production) was approximately 1.8 million tonnes (~28 kg per person per year). The material which garments are made of will eventually become waste but not until someone discards it. (WRAP, 2012d p.52)

The majority of clothing is manufactured outside the UK, so the majority of production waste occurs outside the UK. Overall, it is estimated that ~70% of waste[41] related to clothing occurs in the UK and ~30% occurs abroad. Based on this attribution, the total waste footprint of clothing occurring in the UK is estimated to be approximately 1.2 million tonnes of waste (including end-of-life post-consumer clothes, laundry-damaged clothes and waste from UK-based manufacturing). (WRAP, 2012d p.52)

[41] *In terms of garments discarded by the first user, which includes for re-use.*

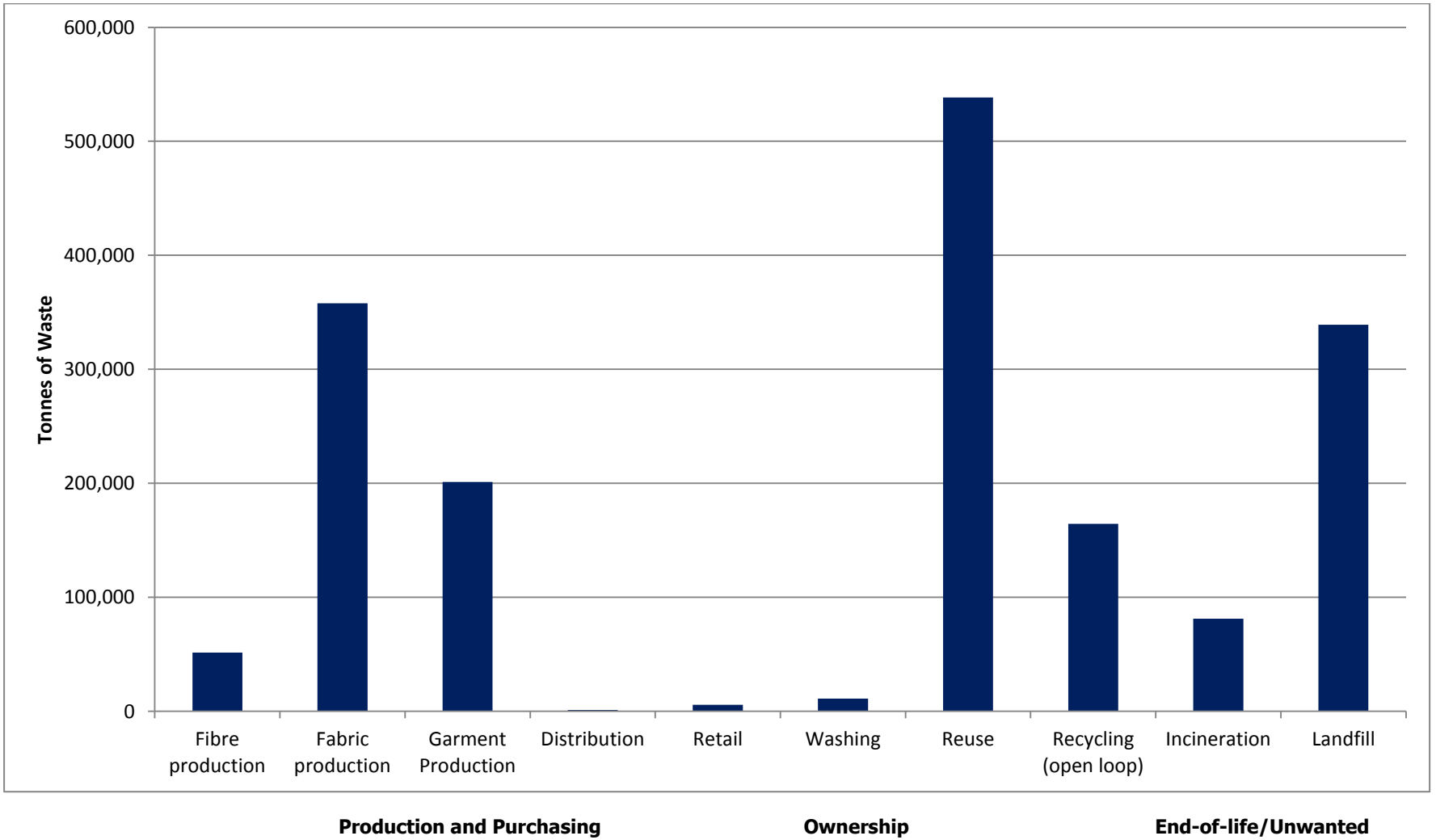
Figure 44: Material flows and waste in the clothing lifecycle (per annum)



To put the waste produced in the UK into context, it is estimated that 23 million tonnes of household waste was generated in England in 2009/2010 (Defra, 2011 Cited WRAP, 2012d p.52). The waste footprint of clothing as a proportion of the weight of UK household waste (general and mixed) collected by local authorities can be calculated to be approximately 5%. (WRAP, 2012d p.52)

Figure 45 shows the dominant life cycle stage is end-of-life, representing 63% of total waste generation over the whole life cycle (WRAP, 2012d p.45)

Figure 45: Amount of waste associated with clothing in use in the UK in 2009 (excluding production waste occurring overseas)



[Source: WRAP, 2012d p.51]

End-of-life is dominant in the lifecycle, and represents 64% of total waste generation over the whole lifecycle. Of the end-of-life cycle stage, re-use represents 48% of total waste, landfill represents 31% of total waste, open loop recycling represents 15% of total waste and incineration represents 7% of total waste (WRAP, 2012d p.52).

Putting natural fibres (e.g. wool and cotton clothes) into landfill produces methane – a gas 23 times more powerful at warming the atmosphere than carbon dioxide (BBC, 2012).

6.5 Comparison between fibres

The CO_2e emissions, water impacts and waste generation levels associated with a garment made of a certain fibre will vary widely depending on factors such as the production method and whether garments are segregated for washing and drying by fibre type. In broad terms, the footprint data indicate that some man-made fibres such as polyester and polyamide tend to have lower carbon and water footprints.

Table 7: Variations in impacts by fibre type

Fibre type	Estimated % use in clothing[42]	Average footprint per tonne of fibre in clothing[43]		
		Carbon[44] (tCO_2e)	Water (m^3)	Waste[45] (t)
Cotton[46]	43	28	3,100	1.6
Polyester	16	21	100	1.4
Viscose	9	30	3,850	1.6
Acrylic	9	38	150	1.4
Wool	9	46	2,250	1.6
Polyamide (nylon)	8	24	100	1.4
Silk	1	25	58,000	1.6

(Source: WRAP, 2012a p.37; WRAP, 2012b p.19; WRAP, 2012d p.56)

The footprint analysis shows small reductions in the overall footprint of UK clothing from switching towards man-made fibres might be possible (using cotton to 50:50 polycotton as an example); the estimated savings are 3% of water footprint (WRAP, 2012b p.32), 0.4% of the carbon footprint (WRAP, 2012a p.40) and 1.7% of the waste footprint (WRAP, 2012d p.67) . Man-made fibres may also offer additional savings associated with:

- increased garment durability, which extends average life and may also facilitate greater re-use; and
- lower water retention in washing and drying, which reduces energy consumption (see WRAP, 2012b).

There are also lower impact versions of conventional fibres available, such as recycled polyester, or cotton meeting the standards of schemes such as the Better Cotton Initiative, or the Global Organic Textile Standard.

In terms of in-use, certain fibre types require different treatments (e.g. wool should not be tumble dried as it is prone to shrinkage), as well as responding differently during the laundry process (e.g. man-made fibres dry very quickly). These factors influence behaviour and have associated cost and environmental implications.

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[42] *The % use of fibres is taken from the European IMPRO study (IMPRO, 2009). These were the most accurate data available, but may not be fully representative of the UK. The footprint reports therefore provide a sensitivity analysis for a different estimate of UK fibre split.*

[43] *Estimates assume that UK clothing follows global averages for the sourcing of different fibres.*

[44] *The carbon footprint does not take account of important differences in the way that clothes dry and are dried. For example, consumers may choose not to tumble dry garments made of wool or silk. Cotton has a relatively high water retention compared to man-made fibres – therefore cotton garments could have a higher carbon footprint depending on how a tumble drier is used.*

[45] *Natural fibres typically create more waste in the fibre and yarn production process than man-made fibres. The waste footprint data do not take account of differences in durability between fibres.*

[46] *There are various versions of cotton with lower environmental impacts, although the production capacity is limited at present.*

Raw materials are becoming more and more expensive. (Forum for the Future, 2010 p.24) As a result, the innovation and use of renewable, durable and recycled fibres is of interest to the industry: alternative man-made materials such as Ingeo are being increasingly used. A strategy of material diversity involves replacing some of the dominant or high impact fibres with alternatives, including low chemical and organic cotton, hemp, lyocell[47], wool and PLA. (Fletcher, 2008)

6.6 Overall, where and what is the potential for savings

Table 8 below provides examples, by life cycle stage, of actions that would lead to reduced environmental impacts, based on moderate action. Extending the lifetime of clothing offers the most significant savings across the carbon, water and waste footprint (primarily based on the assumption that the requirement to produce new garments will be reduced).

Table 8: Opportunities for environmental impact savings based on moderate action assumptions

[47] *Lyocell is a cellulose fabric that is obtained by an organic solvent spinning process*

	Production		In-use	Discard
	Fibre Footprint	Process Footprint		
Carbon / energy (WRAP, 2012a p. 40)		• **7.7% from extending active use of existing clothing** • **4.1% from eco efficiency across supply chain**	• **2.6% from cleaning clothes less** • **1.4% from washing at lower temperature** • **1.4% from increasing size of washing and drying loads** • **1.1% from less tumble drying**	
Water (WRAP, 2012b p. 32-35)	• **3% from shifting to a higher proportion of man-made fibres (e.g. polycotton)** • **1% from irrigation efficiency-cotton production**	• **10% by extending active use of existing clothing (longer life, better utilisation, leasing, hiring etc)** • **5% from eco efficiency across supply chain, including improved water treatment standards and dye practices**		
Waste (WRAP, 2012d p.67)	• **1.7% from shifting to a higher proportion of man-made fibres (e.g. polycotton)**	• **8.8% by extending active use of existing clothing (longer life, better utilisation, leasing, hiring etc)**		

Key

Lifecycle stages where opportunities for environmental impact savings have been identified that would lead to potential savings (above 1% of the footprint)

Lifecycle stages where opportunities for environmental impact savings are likely to have minor impact or have not been identified

6.6.1 Changing the carbon footprint

Measures aimed at reducing the impacts associated with the production of clothing (in design and eco-efficiency measures in the supply chain), and also the use phase (less and better washing and drying by the consumer), show the greatest potential for reducing the carbon footprint of clothing (WRAP, 2012a). This is not unexpected, since these life cycle phases currently contribute the greatest impacts.

Measures which would reduce the carbon footprint of clothing include:

- Design for durability (and product lifetime optimisation).
- Shift in market to higher proportion of low carbon fibres.
- Eco efficiency across supply chain (production, distribution and retail).
- Clean clothing less.
- Wash at lower temperature.
- Increase size of washing and drying loads.
- Use the tumble dryer less.
- Dispose less - re-use more.
- Start closed loop recycling of man-made fibres.
- Dispose less - recycle more (open loop). (WRAP, 2012a)

These measures were considered across the lifecycle of clothing, and the potential effect of these reduction measures calculated.

Table 9 below presents the estimated carbon savings, based on a moderate scenario[48] in comparison to the baseline established. Some of these reduction measures may not be possible in combination (e.g. washing in bigger loads and separating out lower temperature items), so the cumulative total reduction represents an upper limit.

[48] *Reductions appropriate for a moderate scenario were discussed and agreed with stakeholders (including some members of SCAP)*

Table 9: Savings achieved by each reduction measure in a moderate scenario[49]

Reduction measure	Baseline ($t CO_2e$)	Reduction ($t CO_2e$)	Reduction %
Eco-efficiency across supply chain (production, distribution and retail) – Central scenario - 5% reduction for all fibres across supply chain	38,175,293	1,563,219	-4.1%
Design for durability (and product lifetime optimisation) - Central scenario - 10% longer lifetime of clothing	38,175,293	2,941,203	-7.7%
Shift in market to higher proportion of synthetic fibres - Central scenario - replace 10% of cotton with 50:50 poly-cotton. (*Data exclude in-use savings*)	38,175,293	164,150	-0.4%
Clean clothing less – Central scenario - washes per year reduced by 10%	38,175,293	989,905	-2.6%
Wash at lower temperature – Central scenario - weighted average wash temperature of 39.3°C	38,175,293	549,604	-1.4%
Increase size of washing and drying loads – Central scenario - load increases to 3.7kg	38,175,293	531,538	-1.4%
Use the tumble dryer less - Central scenario – 30% reduction in tumble dryer use in summer	38,175,293	430,367	-1.1%
Dispose less – re-use more – Central scenario – 15.4% of clothing ultimately reused in the UK	38,175,293	272,063	-0.7%
Start closed loop recycling of synthetic fibres - Central scenario – 5% of all clothing is recycled (closed loop)	38,175,293	352,144	-0.9%
Dispose less - recycle more (open loop) - Central scenario – 38% of all clothing is recycled open loop	38,175,293	195,729	-0.5%
Cumulative reduction[50]		7,989,921	-20.9%

(Source: WRAP, 2012a p.40)

[49] *Figures have been rounded, as they are approximate. Further detail can be found in the appendix*
[50] *A cumulative reduction may not be feasible. One type of action may have an impact on the potential impact of another*

Table 9, the following points are evident:

- The largest carbon footprint reductions are achieved by extending product lifetime through design for durability/lifetime optimisation (keeping clothes in active use for longer) (8%), eco-efficiency across the supply chain (4%), cleaning clothing less (3% reduction).
- Smaller carbon footprint reductions are the result of encouraging a shift in market to a higher proportion of man-made clothing, increasing recycling rates of clothing (both closed and open loop recycling) and re-use (WRAP, 2012a p.40).

The results of modelling different scenarios are presented in the full report on the carbon footprint in Appendix V.

6.6.2 Changing the water footprint

Measures which could improve the water footprint of clothing include[51]:

In terms of Green Water,

- The main influence in green water is by maximising yields of cotton, wool, flax and viscose fibres by improving farming practices. Retailers in the UK could have a strong influence along the supply chain to the farming communities if they can trace back from production through the manufacturing processes to the areas where the crops are grown.
- The substitution of natural fibres with man-made/synthetic fibres will also reduce the green, blue and grey water footprint. For example replacing 10% of cotton fibre with a 50% poly-cotton blended fibre would reduce the total water footprint by 3%.

In terms of Blue Water,

- Irrigation efficiency improvements, particularly in uncontrolled field flooding methods (as in cotton and fodder in many areas) are key to lowering the water footprint and conserving water for other crops or uses. For example as shown in Table 4.1, a 20% efficiency saving in the irrigation of cotton cultivation would reduce to total water footprint by 2%. More importantly it would make more than 150 million m^3 of water available in many parts of the world for other uses, social and economic.
- In many parts of the world, irrigation water efficiency is very poor (>50% losses) as a result of poorly maintained and out-dated systems. However, the cost of the more efficient systems (sprinkler and drip) is high and can often be unaffordable by farmers in the key countries where cotton and flax are grown
- Although water in the processing of raw materials and manufacture of garments, withdrawn from lakes, rivers and aquifers is a small proportion of the total water footprint (2%), efficient water management practices within the manufacturing facilities will lower water use. Global industry standards might be applied to clothing manufacture, possibly following the EU's Integration Pollution, Prevention and Control, or driven by the retailers through supply chain management.

In terms of Grey Water,

- With 28% of the water footprint being related to the pollution of water resources, considerable improvements are possible.
- In agriculture, better "sustainable" farming practices are required to reduce contamination from the leaching of fertilisers, pesticides and herbicides from the soil. For example a 20% increase in organic cotton i.e. reducing pesticides and chemicals used in cotton cultivation and in turn eliminating grey water footprint could reduce the total water footprint by 1%. (WRAP, 2012b p.30).

[51] *Comprehensive water footprinting comprises of three constituent elements: green, blue and grey water. Green and blue water are considered direct and indirect consumptive use while grey water is a measure of water pollution (for a more detailed definition of green, blue and grey water please see WRAP, 2012b p.2)*

6.6.3 Reducing the production of waste

The largest waste reductions could be achieved by extending product lifetime[52] (i.e. design for durability) (8.8%, effect on post-consumer waste, reducing consumption of clothing) and a shift to a higher proportion of synthetics (1.7% reduction, on production waste, based on introducing more polycotton) (WRAP, 2012d p.67). However, the assessment assumes that the lifetime a consumer actively uses the clothing for is extended in these strategies. Lack of evidence concerning the relative lifetimes of clothing and their potential for extension is a significant research limitation. (WRAP, 2012d)

In recent years technology has presented a number of opportunities. 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 (Defra, 2007 p.35). Seamless knitting, stitch-free seams, 3D weaving and 3D sewing technologies are automated systems that are relatively new in the textile and clothing sector (Allwood et al. 2006). 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. Production waste, from cutting parts out of flat fabric sheets, would also be reduced (Allwood et al. 2006).

For 200 years recycling technology has stayed the same[53]; fibres are extracted from used fabric by mechanically tearing the fabric apart using carding machines. The process breaks the fibres, producing much shortened lengths that tend to make a low quality yarn. Innovation to extract longer fibres and develop quality products could work to change this. (Fletcher, 2008)

[52] *This calculation is based on the assumption that this will delay the need for a new purchase*
[53] *With the exception of a modern Teijin process for polyester recycling back into fibre*

7.0 Conclusions

This report provides evidence on actions which could reduce the resource impacts across the three major life-cycle stages of clothing – materials and garment supply, in-use and end-of-life.

Specific opportunities have been identified which could deliver benefits to consumers and businesses while reducing environmental impacts. Extending the useful life of clothes (including greater re-use) and changing laundry practices has the potential to create the greatest resource and cost savings. Overall, moderate actions taken across the clothing life-cycle could reduce its carbon, water and waste footprints (by 21% (WRAP, 2012a p.40), 18% (WRAP, 2012b, Actions 1-10 in Table 4.1, p.32-34) and 13% (WRAP, 2012d p.67) respectively) (WRAP, 2012d p.62)[1].

Primary research into consumer behaviour has identified opportunities for retailers and other stakeholders which include:

- giving consumers more information about the environmental impacts and/or performance of clothing to reinforce brand reputation;
- exploiting consumer interest in buying longer lasting clothes using brand reputation;
- designing clothes to last longer, e.g. by providing a more versatile fit;
- offering guarantees on clothing looking good for longer;
- providing a wider choice in the pre-owned clothing market;
- exploring latent interest in easier high street access to hire of designer dresses and clothes for socialising;
- encouraging people to check wardrobes for unused items;
- increasing access to services and tuition for repairs and alterations;
- developing retailer 'buy back' schemes;
- increasing public awareness that nearly all discarded clothing has value to charities, local authorities and other collectors; and
- exploiting people's willingness to do more to reduce waste by providing nearby re-use/recycling bins and improving collections. (WRAP, 2012c)

[1] *Noting cumulative reductions within and across the footprint reports may not be possible.*

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