

ECAP

**Mapping  
clothing  
impacts  
in Europe:**  
the environmental  
cost

**December 2017**

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**Written by:** Sarah Gray

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# Executive summary

This report examines the global environmental impacts of clothing in Europe. It is the first report of its kind, and is part of a major initiative to reduce the impacts of the clothing industry.

This research is being developed to support the European Clothing Action Plan (ECAP). ECAP is an EU LIFE funded project which aims to reduce clothing waste across Europe and embed a circular economy approach.

To help ECAP achieve its mission, this report establishes how much is known about clothing sustainability and clothing waste in participating countries. The report gathers evidence about:

- levels of clothing consumption;
- the amount of clothing in household residual waste;
- the environmental footprints of clothing consumed; and
- consumer behaviour.

This report has found that:

- the garment industry has many sustainability challenges, as well as opportunities for change;
- behaviour change amongst consumers can make a big difference to the impact of clothing;
- reducing clothing in residual waste is a key area of focus;
- focusing on less wasteful practices in the supply chain can significantly reduce impacts;
- more than six million tonnes of clothing were consumed in the EU in 2015;
- the carbon footprint of clothing consumed in the EU in 2015 is 195 million tonnes CO<sub>2</sub>e; and
- the water footprint of clothing consumed in 2015 in the EU is 46,400 million m<sup>3</sup>.

## Method

The report used a variety of methods to develop an evidence base for ECAP and to establish baseline information. These are:

- An evidence review and gap analysis relating to clothing and sustainability in the EU.
- Quantification of the amount of clothing in residual waste in key countries.
- Measurement of the whole life cycle of clothing.
- Carbon, water, and waste footprints of clothing consumed in key countries.
- A behavioural and attitudinal questionnaire.

## Clothing in residual waste

France, Germany, Italy, and the UK have the highest levels of clothing in residual waste of participating ECAP countries. They also have the highest level of per capita clothing in

residual waste, with Italy being the highest. Italy had 440,170 tonnes of clothing going to residual waste in 2014, or 7.2kg per person.

### Global environmental impacts of clothing produced for the European market

The total quantity of clothing consumed in the EU in 2015 was 6.4 million tonnes. This has been calculated from the production and imports (though not exports) of clothing textiles. The clothing industry is vitally important in the EU, and the environmental impacts are very high, especially compared to other products.

The volume of clothing consumed in each country is used to calculate the total carbon, water and waste footprint. The whole life cycle of garments is included in the footprint calculations. The processes considered include production of the raw material, a range of production and factory processing stages, garment assembly, the clothing 'use phase' (when the garment is with the consumer), and re-use, recycling, and final disposal.

The carbon footprint of clothing consumed in one year, 2015, is 195 million tonnes CO<sub>2</sub>e. The use phase is shown to have the largest carbon impact for the EU as a whole, although production also accounts for nearly a third of CO<sub>2</sub>e emissions.

### Behavioural research

At the start of the ECAP project, a survey was conducted to understand behaviours and attitudes towards clothing in countries where ECAP is most likely to impact. Question topics included clothing care, purchasing behaviour, how long clothes are kept for (longevity), repair, re-use and disposal.

In terms of laundry behaviour, the most used wash temperature is 40°C, although many washes are also done at 30°C. This varies across countries; Italy is more likely to use both cold and 20°C settings, while Denmark and Germany are more likely to use 60°C and 90°C options.

In terms of purchasing preferences, the vast majority of purchases were of new clothes. Denmark is most likely to consider buying second hand clothes, but 83% still bought new clothes without considering this option.

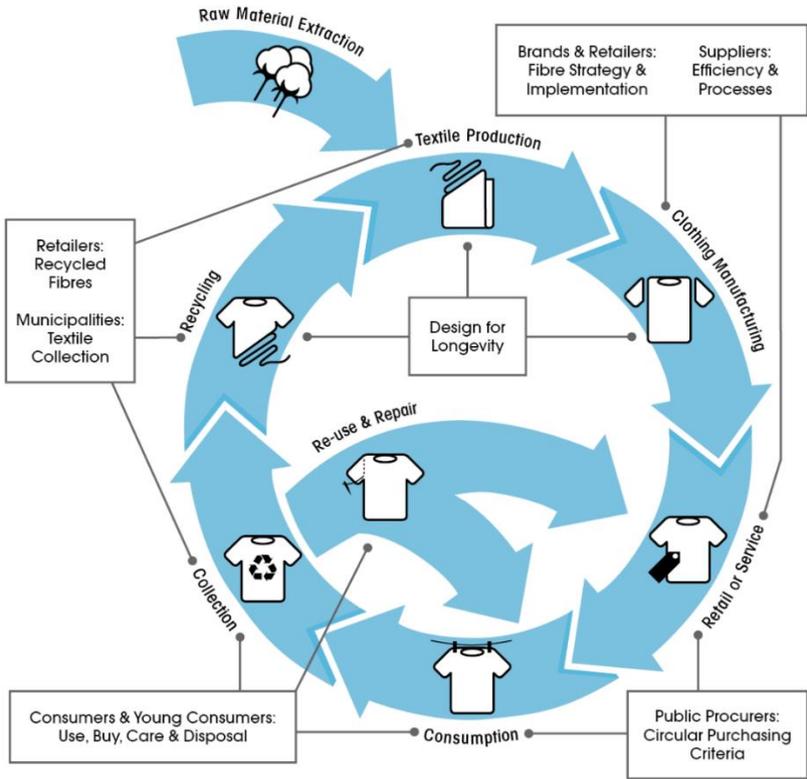
Households in Denmark have clothing with the longest expected longevity- significantly higher than all other nations for most items. The average active life of clothing across garment types varied from 3.8 years for Germany and Italy, 4.1 years for the Netherlands, and 5.0 years for Denmark. The UK has the lowest expected active life for clothing. A separate, but comparable survey, carried out by WRAP in 2015 found this to be 3.3 years.

### ECAP priorities

This report has found that large quantities of clothing end up in residual waste. One of ECAP's targets is to recover more material from this stream, and return value to the EU economy by growing opportunities for collection, repair, re-use, and recycling. ECAP's priorities are well positioned to tackle the issues of clothing sustainability and over-consumption of raw materials. This report provides background and context for measuring the outcomes of ECAP, as well as providing an evidence base for informed

decision-making at all stages across the clothing life cycle. Figure 1 demonstrates the actions included in the ECAP project, and at what stage they impact the life cycle of clothing.

**Figure 1:** ECAP actions to introduce a circular clothing system



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# Introduction

## 1.0 Introduction

This report demonstrates the case for improving the sustainability of the European clothing industry. It supports the work being done under the European Clothing Action Plan (ECAP), and provides context for each of the action areas in the project.

There are a number of actions under ECAP which are carried out by five project partners: the Danish Fashion Institute, the London Waste and Recycling Board, MADE-BY, Rijkswaterstaat, and WRAP:

- Development of a design portal to engage clothing designers in sustainability – the Danish Fashion Institute
- Work with retailers, brands and their supply chains to improve fibre choice – MADE-BY
- Bringing circular public procurement principles to work wear - Rijkswaterstaat
- Pilots to test innovative fibre-to-fibre recycling technologies - Rijkswaterstaat
- Work with consumers, including young people in London, to raise awareness and encourage collection of clothing for re-use and recycling - London Waste and Recycling Board
- Work with municipalities to develop and encourage uptake of best practice with clothing collections – Rijkswaterstaat
- Creating campaign packs to engage consumers in better ways to buy, use, and dispose of textiles - WRAP

These actions have been developed to:

- encourage innovation in resource-efficient design, recycling of textile fibres and service models to encourage business growth in the sector;
- prevent waste in the clothing supply chain;
- reduce the carbon, water and waste footprints of clothing in Europe;
- influence consumers to adopt more sustainable behaviours; and
- ensure that fewer low grade textiles go to incineration and landfill.

ECAP is focused on nine countries participating in the project. Several of them present opportunities to develop and grow existing networks, maximising the potential to create change. The others are countries where clothing consumption is very high, and where implementing ECAP's actions could have a big impact.

The countries are Denmark, Italy, Germany, Netherlands, Belgium, France, Spain, Sweden, and the UK.

The clothing industry has a significant impact on the environment. People are buying more clothes at an increasing rate, with fast fashion as a business model encouraging this. This model is affordable because clothing prices have remained static for years, and in some cases declined relative to earnings. Spending on clothes is high and sales in non-specialised stores, such as supermarkets, are growing, as is e-commerce. Clothing is the sixth largest expenditure item for households in Europe, and the environmental footprint of such a large quantity of clothing is extremely high. The industry creates a huge amount of waste, both in the supply chain, and at the end of clothing life, where it often gets thrown away.

There are solutions which can tackle this; some designs, fibres, methods of fibre production, methods of dyeing, and ways of looking after clothes are more sustainable than others. ECAP offers a variety of actions which contribute to a more sustainable textiles industry. This report helps to explain why these actions matter, and why ECAP is focussing its energy on them.

### 1.1 Aim of the report

To help ECAP achieve its mission, this report establishes how much is known about clothing impacts and clothing waste in participating countries. The report gathers evidence about:

- levels of clothing consumption;
- the amount of clothing in household residual waste;
- the environmental footprints of clothing consumed; and
- consumer behaviour.

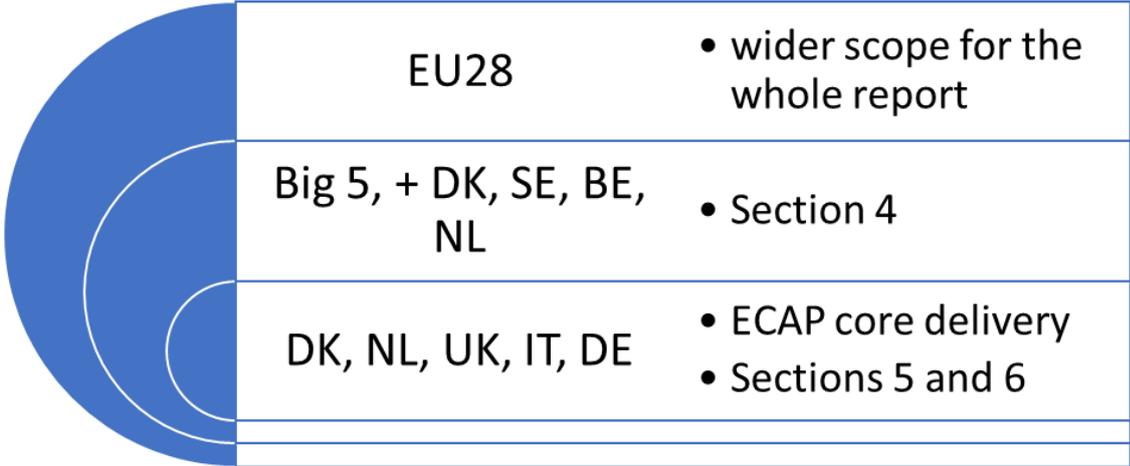
The motivation for the research is to provide an evidence base for ECAP, and to support the evaluation of the project by drawing together information about the context of the project's theory of change. Where possible, baselines will be established against which the project's performance can be measured.

### 1.2 Structure of the report

This report includes a literature review (Section 3.0); a study of the quantity of clothing that remains in residual waste in Europe (Section 4.0); quantification of the carbon and water footprints of clothing in Europe (Section 5.0); and findings from a survey in Denmark, Germany, Italy and the Netherlands about clothing purchasing, care and repair, and disposal (Section 6.0). The methodology for each section is first summarised in Section 2.0. Conclusions supported by the evidence base are provided in Section 7.0.

The report refers to the 'EU' throughout, meaning the EU-28, since there have been 28 member states during the time period covered by the report. Where possible, the whole EU has been included, but to improve the quality and accuracy of data reported, in most sections a focus on specific countries of interest to ECAP has been applied. Therefore, the sections of the report gradually narrow the scope to focus on the most relevant locations. The most relevant countries were strategically prioritised according to potential impact, and existing networks that enable efficient delivery of ECAP.

**Figure 2:** Gradually narrowing geographical scope of the research to focus delivery



# Methodology

## 2.0 Methodology

The research addresses economic, environmental, and social issues. Several different approaches have been taken to provide a better understanding overall.

### 2.1 Evidence review and gap analysis

A review (Section 3.0) was carried out to determine what existing evidence could be used. The approach involved drawing up a list of priority and desirable information and researching available databases and searching the internet. Evidence was also requested through the ECAP networks, including the Advisory Group.

Literature and secondary data that were recent and relevant were given priority. Peer reviewed sources which contained verifiable information, including details of the methodology used (which would enable replication of the study if desired) were also prioritised. One aim in selecting sources was to avoid potential bias which might arise from research paid for by specific economic interests. The following hierarchy was used to help inform the selection of sources:

1. Academic peer reviewed articles from recognised journals.
2. Reports published by government and government-funded agencies.
3. Reports from non-governmental organisations.
4. Literature and data available from industry-sponsored and other sources.

A gap analysis was carried out once the review was complete to identify areas where there was good existing data and knowledge, and areas where further research would be useful.

### 2.2 Quantifying clothing in residual waste

Research was carried out to discover the amount of clothing disposed of in household residual waste in a number of countries in Europe (Section 4.0). The financial year 2014/15 was taken as the most recent year for which accurate data would be available, and as an appropriate baseline year for ECAP. Several sources were reviewed during data gathering, with a view to achieving the most accurate estimates available. Where possible, these included country specific waste composition research reports, which use waste analysis to quantify different fractions in mixed waste streams. Where there was no specific waste composition data, Eurostat waste reports, and other sources of information, were used and verified using reliable sources.

### 2.3 Quantifying the environmental impacts of clothing in Europe

To measure the environmental impacts of clothing in Europe (Section 5.0), a footprint calculator, the ECAP Footprint Tool, has been developed. The tool will calculate the carbon, water, and waste footprints for clothing sold in the EU member states, for the first time. The tool is primarily intended for use by retailers and brands participating in ECAP, to measure the environmental impacts of clothing they sell. The whole life cycle of garments is measured by the tool. To calculate emissions factors associated with processes along the entire life cycle of clothing (from production of the raw material, through to final disposal of the garment at end of life), data is taken from published sources. The scope of the study was determined at the outset and applied to an agreed

list of garment fibre categories, for which data from life cycle analyses could be accessed.

In this report, environmental impacts have been calculated using the regionalisation settings of the ECAP Footprint Tool. The regionalisation settings are included so that it is possible to use the tool to calculate environmental impacts for Europe as a whole, using settings to represent the average for the EU, or for individual countries in the EU where clothing has been sold. In development of the tool, the need to be able to report clothing sales proportionately as they occur in one or more countries was recognised. The ECAP Footprint Tool has therefore been designed so that a user, such as a retailer, can select the proportion of clothes sold in each EU member state. The tool then calculates the cotton source countries and weighted average grid impact factors, to calculate the use phase of clothing.

Based on the quantity of clothing consumed in each of these regions in 2015, impacts are reported here as carbon, water, and waste footprints for the EU as a whole, and separately for Denmark, the Netherlands, Italy, the UK and Germany, the main countries in which ECAP is delivered.

#### 2.4 Survey research to understand behaviour and attitudes about clothing

Behavioural research was undertaken (Section 6.0) to support WRAP's consumer campaign 'Love Your Clothes', which encourages sustainable behaviours towards clothing. A questionnaire was first developed using questions about clothing behaviour that had been tried and tested in previous research. Translations were produced, and checked by the ECAP team, for each country in which the research was carried out. Fieldwork was undertaken in November 2016 by Icaro Research for WRAP. The overall samples were designed to be nationally representative with quotas on age and gender. A final sample size was set of 1,000 in each nation. A check on work status and number of children in the household was also used to confirm that the quotas achieved were reasonably representative for each nation. Additionally, a selection of questions was put to an omnibus for the EU with a final sample size of 10,737.



**Evidence review  
of clothing  
impacts in  
Europe**

### 3.0 Evidence review of clothing impacts in Europe

Clothing is a vitally important industry in the EU. The European Environment Agency (Reichel & Mortensen, 2014) found that clothing comes eighth in a list of household expenditure items, yet it is 'the fourth most significant consumption category in terms of environmental impacts, after housing, mobility and food'. Clothing prices have remained fairly static over the last decade, which is likely to increase sales volumes, supporting the trend for fast fashion. In terms of impact, however, there is a high price to pay.

Greater quantities of clothing are imported into the EU, and into each individual country included in the study, than are exported (Eurostat trade statistics). The majority of exports represent intra-EU trade where clothing is redistributed, for example, during different stages of the supply chain.

#### 3.1 Clothing consumption

A large amount of clothing is consumed in Europe. In the year before ECAP launched, this was estimated to be 6.4 million tonnes of clothing. Estimates of clothing consumption are taken from the report '[European Textiles & Workwear Market](#)' (European Clothing Action Plan, 2017) using PRODCOM data (Eurostat, 2015b), which compiles statistics on manufactured goods including production, exports and imports.

The data is used here with caution, to calculate environmental impacts and provide context for ECAP. Country-level information provides background to the measurement of the project's activities, but it is not intended to form part of the measurement itself. The level of accuracy of the PRODCOM database is uncertain (European Clothing Action Plan, 2017). In light of the uncertainties with the clothing consumption data, the estimates were checked using population estimates and the financial values for household expenditure per person, both taken from Eurostat. The estimated consumption for the Netherlands has been adjusted to reflect this and so is probably the least accurate.

Table 1 shows the largest consumer of clothing is Germany, which is also the most populous country in the EU. However, the data suggests that the UK consumes a greater quantity of clothing (PRODCOM) per person, and each person also spends more, according to the household expenditure survey (Eurostat, 2015a).<sup>1</sup>

To get to estimates of clothing consumption for each country, apparent consumption is based on production and imports, minus exports. The data used was for numbers of items, scaled up using average garment weights derived from the EU JRC report '*Impro Textiles*' (Beton et al., 2014).

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<sup>1</sup> A qualitative assessment is that we should have a medium level of confidence overall in the consumption and expenditure estimates. This is a judgement call, due to the way the data is gathered and reported which includes some variation from country to country and has been found to contain significant data gaps. However, the data providers, in the United Nations and the European Union, are recognised and authoritative sources who also provide guidance to countries on the data to be included and clear definitions of what is required, which should help to reduce somewhat the potential for inaccuracies.

**Table 1:** Household expenditure on clothing/person and clothing consumption/person and in total, 2015

	Netherlands	Denmark	UK	Germany	Italy	EU
<b>Population<sup>2</sup></b>	16 900 726	5 659 715	64 875 165	81 197 537	60 795 612	508 504 320
<b>Expenditure per person €<sup>3</sup></b>	732.57	738.29	1164.65	715.63	847.85	638.98
<b>Consumption per person kg<sup>4</sup></b>	13.66	12.86	15.29	13.83	14.50	12.66
<b>Total clothing consumed tonnes</b>	230 887*	72 801	992 040	1 123 210	881 811	6 435 933

\*estimated from average consumption pp / kg for the five largest clothing consumers in EU, scaled up by population

Using the total of 6.4 million tonnes, together with the average fibre split for clothing (Beton et al., 2014) the total quantities of a range of the main textiles fibres was calculated. These are presented in Table 2 and Figure 3.

**Table 2:** EU textiles fibre consumption used in footprint calculations for ECAP

EU fibre consumption in clothing textiles <sup>5</sup>	Tonnes (2015)	Fibre type
<b>Cotton</b>	2 767 450	Natural
<b>Wool</b>	579 236	Natural
<b>Silk</b>	64 357	Natural
<b>Flax</b>	128 720	Natural
<b>Viscose</b>	579 236	Cellulosic
<b>Polyester</b>	1 029 747	Synthetic
<b>Acrylic</b>	579 236	Synthetic
<b>Polyamide / Nylon</b>	514 874	Synthetic
<b>PU / PP / EA</b>	193 077	Synthetic
<b>Total</b>	6 435 933	ALL

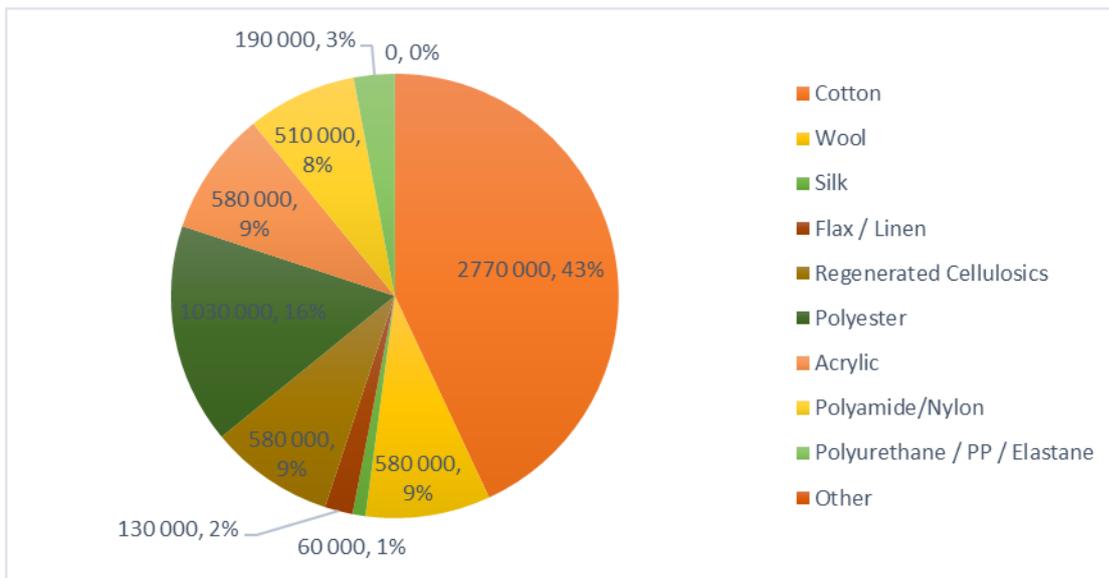
<sup>2</sup> [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo\\_pjan&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_pjan&lang=en) , accessed 12<sup>th</sup> October 2017

<sup>3</sup> Household expenditure by COICOP 3 digit code, clothing 03.1 downloaded from [http://ec.europa.eu/eurostat/web/products-datasets/product?code=nama\\_10\\_co3\\_p3](http://ec.europa.eu/eurostat/web/products-datasets/product?code=nama_10_co3_p3), last accessed 12<sup>th</sup> October 2017

<sup>4</sup> Calculated from total consumption, taken from PRODCOM, ECAP (2016) / total population

<sup>5</sup> Viscose consists of regenerated cellulosic fibres made from reconstituted plant fibres such as bamboo; PU / PP / EA are plastic polymers used in fabrics as follows: polyurethane / polypropylene / elastane

**Figure 3:** Fibres used in clothing purchased new in the EU in 2015, in tonnes, and as a percentage



### 3.2 Environmental impacts and clothing in residual waste from the literature

The literature review found that the amount of clothing in residual waste in Europe was not yet known. Information is available on the quantity of residual waste in each country (Eurostat, 2014), and textiles waste is separately reported within this. However, clothing is not separately reported and the data on textiles contained gaps.

A range of literature and data sources were reviewed to support measurement of environmental impacts. The SCAP Footprint Tool was developed for the [Sustainable Clothing Action Plan](#) (SCAP). Modifications to make it more accurate for use for other countries in Europe were identified as priority. Following the success of the SCAP Footprint Tool, an ECAP Footprint Tool has also been developed, see section 5.0. The data was updated for three areas of the tool:

- Garment and fibre sourcing – proportionate quantities sourced from different countries worldwide.
- Use phase electricity grids – the energy mix for the electricity grid in each country in the EU.
- Onward waste destinations – the landfill / incineration profile for waste for each country in the EU.

### 3.3 Literature review of consumer behaviour

The way that people shop for, wear, care for, and dispose of their clothing, makes a real difference to its impact. Despite greater interest in clothing sustainability in recent years, the consumer research available provides only part of the answers needed for a project such as ECAP. Existing research about clothing and sustainability in Europe focuses on specific demographics or localised geographical areas. This provides some insights for the project, but very little has been done to look across the EU and holistically examine behaviour and attitudes.

The image features a light blue t-shirt centered on a darker blue background. The t-shirt is a simple, short-sleeved design. The text is positioned on the front of the t-shirt.

# **Clothing in residual waste in Europe**

#### 4.0 Clothing in residual waste in Europe

In order to be able to understand the potential of diverting clothing from landfill and incineration, knowing the amount of clothing in residual waste is critical. WRAP commissioned Resource Futures to establish a baseline estimate for the amount of clothing disposed of as waste across European countries. This project focused on nine European countries of interest to the ECAP project: Denmark, Germany, Italy and Netherlands were included in a Tier One group (higher priority). The UK, as well as Belgium, Sweden, Spain and France were included in Tier Two. The countries were prioritised for one of two reasons:

- Tier One countries contain partners for the ECAP project, with the exception of the UK, for which good data already existed. Due to existing connections in each of these countries, they provide a fertile ground to identify and develop guidance and best practice.
- Tier Two includes the largest countries in Europe, by population and consumption as well as key markets for ECAP. The 'Big 5' combined, Germany, the UK, Spain, France, and Italy, produce and consume a much greater quantity of clothing than the rest of the EU, and as such they have a much higher environmental impact. The potential gains from fostering sustainability initiatives in each of these countries are therefore also greater. Best practice that develops elsewhere will be brought to these markets, with the view of spreading change as widely as possible.

Analysis of Eurostat waste data (Eurostat, 2014)<sup>6</sup> concluded that it is not robust enough to be used to establish a baseline for ECAP, without further work. Despite Eurostat guidance, the way data is reported is not consistent across the target countries, and reported figures are sometimes based on unrepresentative and incomplete statistical estimates or surveys.

Desktop research and use of contacts from within the nine target countries were used to find country bespoke reports and data. For each country, the government department responsible for environmental management was identified, including those responsible for waste and the organisation responsible for national statistics. Where available, contact was made with organisations delivering waste objectives on behalf of government, trade associations, and leading universities with waste-related research programmes in each country. Members of the ECAP Advisory Group were also invited to develop further contacts for the project.

It was important for the report to be able to produce comparable estimates for each of the nine target countries and a model was developed to estimate the baseline for each country. The country-specific data varied greatly in terms of scope and methodologies used by the responsible authorities in each country. Using the model developed, it became possible to produce estimates for clothing in household residual waste that are comparable and based on the best available data sources in each case. Germany and Spain are the countries where no waste composition data could be obtained. For both countries, Eurostat household residual data was used to produce an estimate for the

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<sup>6</sup> 2014 was the most recent year for which complete data was available. Waste statistics from Eurostat include textile waste, which is reported under code W076, as well as household residual waste, reported under code W101.

textile fraction of this stream. This was based on UK studies about the composition of residual waste, which analysed what is in household bins, reported by WRAP, 2012 <sup>7</sup> and WRAP, 2017c.

There are differences between countries in clothing purchased by quantity and by cost per person (section 3.1). There are also differences in attitudes to clothing consumption and disposal (section 6.0), although most are not statistically significant. A ‘mass balance’ approach was considered as a way to check proportions of household textiles and clothing based on the UK studies. The proportions are important because they have been used to work out the amount of clothing in the household bin, from overall textiles in the household bin in Eurostat data. The Eurostat data reports textiles as one quantity, including clothing and household textiles combined. The mass balance approach would examine the relative quantities of household textiles and clothing consumed in other countries than the UK, and compare these to the estimates that had to be based on the UK composition studies. However, this approach to checking the results was rejected, since Eurostat data on household textiles consumption contains significant gaps.

#### 4.1 Estimates for clothing in residual waste in ECAP target countries

Estimates for the target countries are presented in Table 3 and Figure 4, below. Italy has the largest quantity of clothing in household residual waste, and a higher per capita estimate of clothing discarded at 7.2 kg per capita. Spending on clothing per capita is also highest in Italy (Reichel & Mortensen, 2014). The UK, Spain, and Germany follow, by total volume of clothing discarded in residual waste. In terms of per capita volumes, Spain throws away 6.6 kg compared with 4.7kg in the UK.

From these findings, Denmark, Belgium, France, and Sweden discard the least clothing in their household residual waste per person.

**Table 3:** Results – Clothing waste disposal in the nine target countries

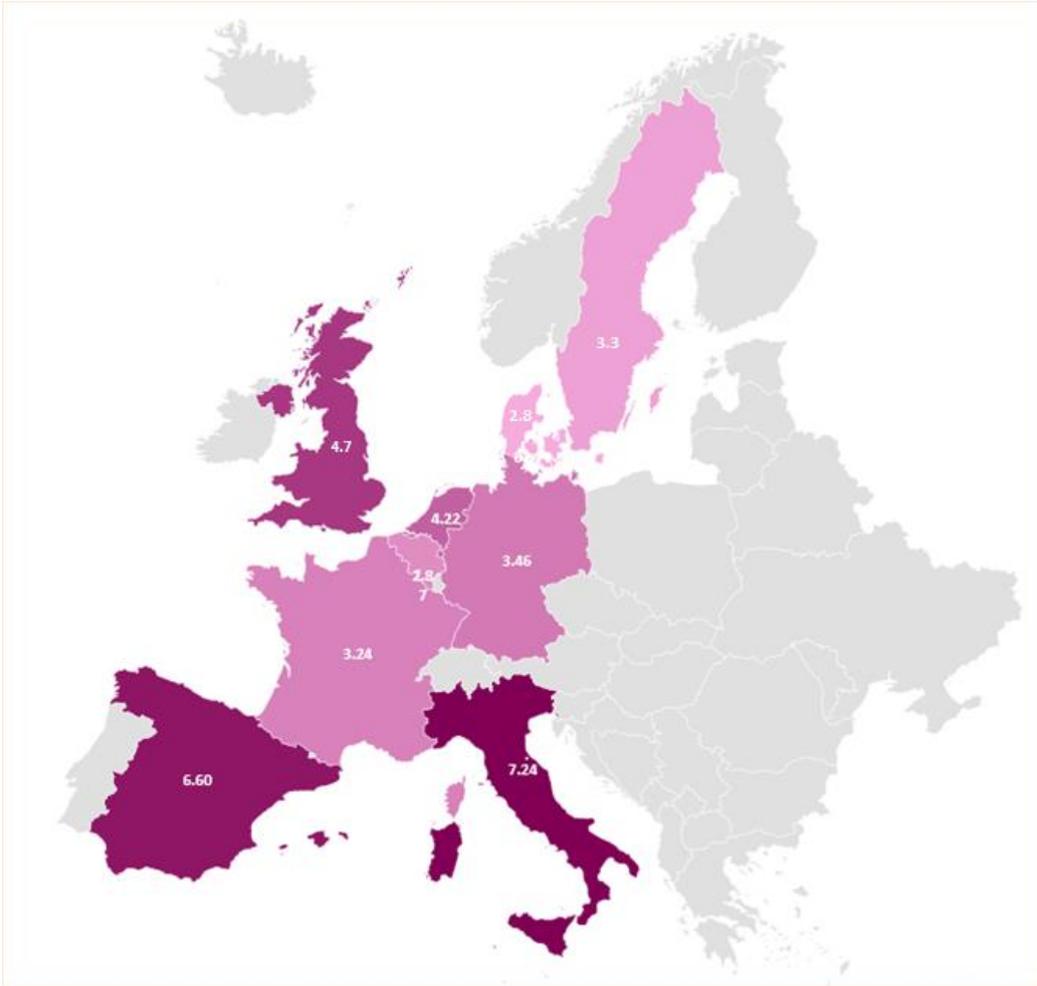
Tier 1 countries	Pop. (2014)	Quantity of clothing waste in residual		Tier 2 countries	Pop. (2014)	Quantity of clothing waste in residual	
		(tonnes)	(kg per capita)			(tonnes)	(kg per capita)
Denmark	5.7 m	15 735	2.8	Belgium	11.2 m	32 140	2.9
Germany	81.2m	280 972	3.5	Spain	46.5 m	306 744	6.6
Italy	60.8 m	440 179	7.2	France	66.4 m	214 920	3.2
Netherlands	16.9 m	71 374	4.2	Sweden	9.7 m	31 919	3.3
				UK	64.9 m	302,000	4.7

<sup>7</sup> WRAP (2012) *Textile flow and market development opportunities in the UK*. Available at: <http://www.wrap.org.uk/content/uk-textile-product-flow-and-market-development-opportunities>. Accessed January 2017.

Clothing is a high value material in terms of market recovery, and the high quantity appearing in the residual waste stream represents a significant market opportunity.

The price for UK used textiles has increased to £400 per tonne in August 2017 (equivalent to €440) (WRAP, 2016b). After a period of decline, market prices have returned close to where they were in 2013, looking at the average price between the charity shop textiles and recovered textiles collected from bring banks. While this is an encouraging sign, it is set against a backdrop of a declining market for used textiles, including a ban on imports of used clothing in East Africa, and competition for the market presented by increased export of used textiles from China. There are clearly challenges for the used textiles market, but there are also opportunities from the recovery of material. These include jobs for domestic recycling and reprocessing organisations, as well as opportunities to provide social return to local communities from, for example, the provision of good quality used clothing at a lower price than new.

**Figure 4:** ECAP countries and per capita clothing waste arisings (kg per year)



The countries with the highest per capita clothing in household residual waste are the darker shades in Figure 4. Italy, the UK, and Spain are all in the top five countries in terms of the level of clothing consumption, so their higher per capita figures of clothing waste arising are especially problematic. Clothing that ends up in residual waste is likely

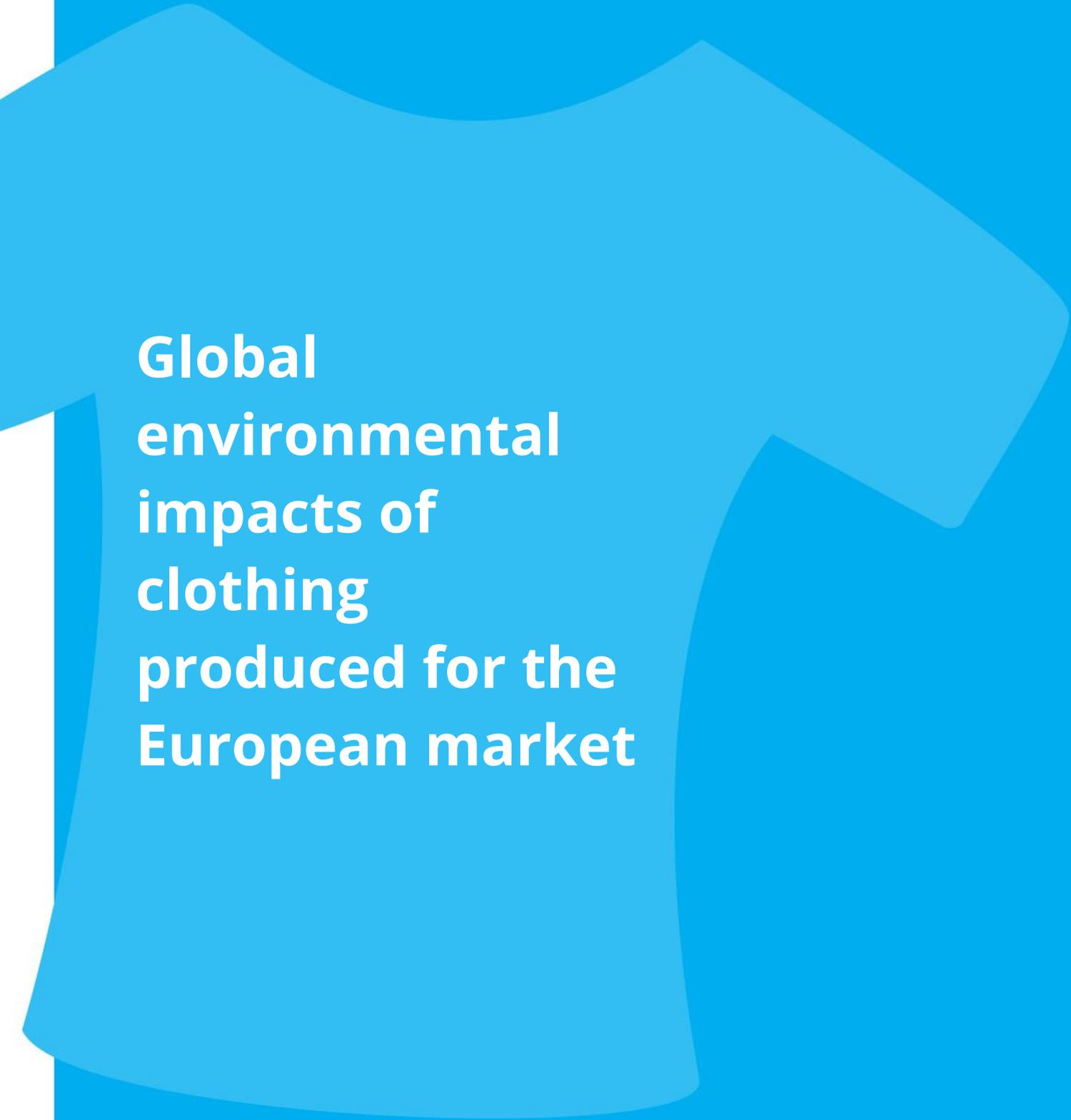
to become spoiled e.g. torn, stained or damaged in another way, if it was not already. Once in the bin, the opportunities to recycle or re-use it are few.

#### 4.2 What we're doing about it

It is important to have alternative ways to exchange, sell, repair, donate, and recycle clothing. If implemented, ['Guidance on Clothing Collection for Local Authorities'](#) (WRAP, 2016a) could help reduce waste disposal costs, re-use organisations raise revenue, and households save money. Kerbside collection services, bring banks, and community re-use initiatives are the three main routes for increasing clothing collection. Retailers and brands can also play an essential role by providing a way for people to bring back clothes they no longer want in store. Encouraging second hand sale of their clothing, or even placing bring banks in their car parks, can help make a difference.

Best practice is being developed for municipalities for ECAP, to run events to share this advice. Information about this will be provided on the website at [www.ecap.eu.com](http://www.ecap.eu.com)

At the other end of the clothing life cycle, the way that clothes are designed can be improved to make them last longer. The ['Sustainable Clothing Guide'](#) (WRAP, 2017b) and the ['Clothing Knowledge Hub'](#) (WRAP, 2017a) share best practice on how to design, produce, and sell sustainable clothing that lasts longer, and that can easily be repaired and re-used. ECAP partner, the Danish Fashion Institute launched the [Design for Longevity](#) platform in September 2017, providing designers and product developers with inspiration and guidance to design clothes with materials and techniques that will last longer, and which are suitable for circular business models.

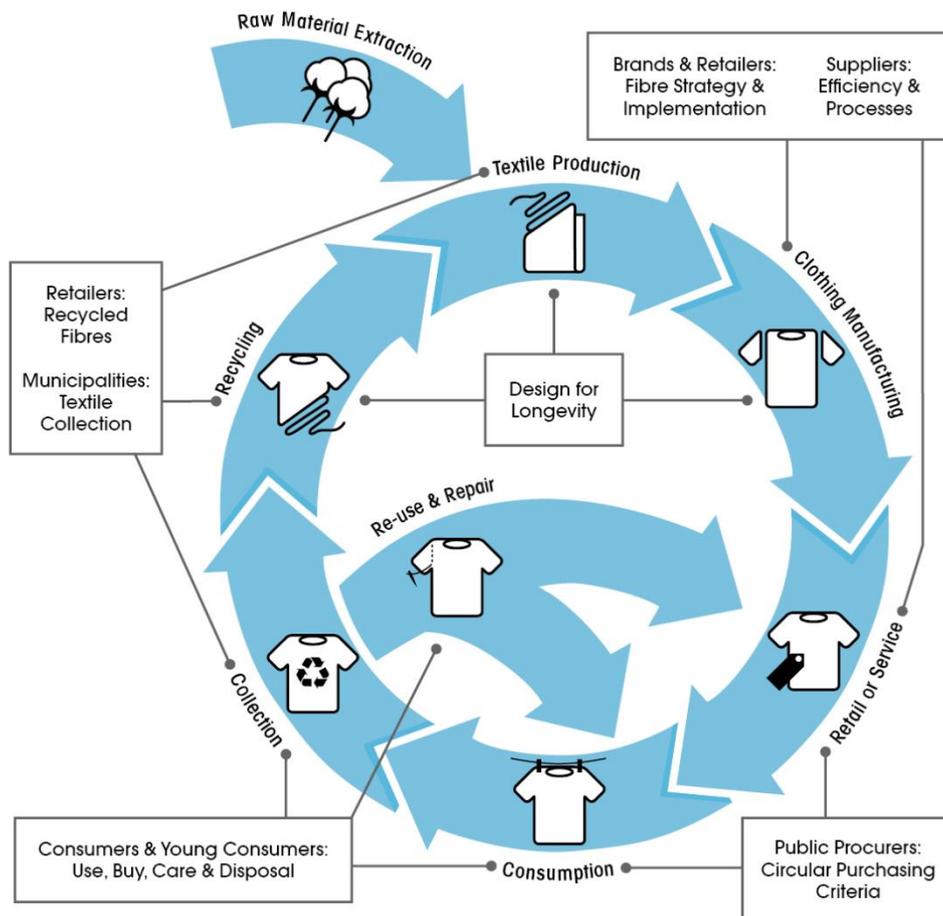
A stylized graphic of a t-shirt in two shades of blue, set against a solid blue background. The t-shirt is positioned centrally, with its sleeves and hem visible. The text is overlaid on the front of the t-shirt.

**Global  
environmental  
impacts of  
clothing  
produced for the  
European market**

## 5.0 Global environmental impacts of clothing produced for the European market

The actions undertaken by ECAP aim to reduce the global environmental impacts of clothing produced for the European market. ECAP takes a holistic approach to address the large impact. The project's actions introduce circular design, procurement principles, supply chain improvements driven by actions from retailers and brands, and they encourage people to better care for their clothes, re-using, repairing, and recycling them when they no longer need them.

**Figure 5:** A circular clothing system and ECAP's actions



Knowing which actions can make a difference is an essential part of delivering change. It is critical for ECAP to be able to identify the core environmental impacts of clothing and help businesses, organisations and people to make the right changes, based on good quality evidence. The ECAP Footprint Tool uses up-to-date information about the impacts of clothing to calculate the whole life cycle; carbon, water, and waste footprints of clothing that has been bought in Europe.

In the making of clothes, processes reported refer to 'conventional' methods of garment production as the default method. Improvements to these 'conventional' methods can be included to provide a means of calculating actions with the potential to provide the greatest savings. Conventional methods are used here to refer to existing production systems, taking levels of inputs and outputs that refer to unimproved methods of

cultivation and production. Conventionally grown cotton, for example, for the purposes of this report, is cotton grown using a global average amount of chemical fertilisers and pesticides as well as water, and can be compared to more sustainably produced cotton crops by its greater environmental impact.

The use phase plays a significant part in the environmental impact of clothing, reportedly accounting for around one-third of impacts (see Allwood, Bocken, Laursen, & Malvido de Rodríguez, 2006; (Maxwell, McAndrew, & Ryan, 2015); (Polizzi di Sorrentino, Woelbert, & Sala, 2016)), although there is recent evidence which suggests that it may be less than was previously thought (Van Der Velden, Patel, & Vogtländer, 2014). WRAP has found that reduced washing temperatures and machine drying and ironing frequency reduces the impact of the use phase, showing that actions taken by consumers can make a real difference to reducing greenhouse gas emissions (WRAP, 2017c). Recently, attention has also been given to plastic pollution caused by clothing shedding microfibres when they are washed. These plastic microfibres have caused some concern for manufacturers and retailers due to their accumulation in oceans, the potential long-term damage caused, and public attention around the issue.

Total volumes of clothing consumed were split into fibre quantities, using the average fibre composition reported above, in Section 3.0, Figure 3, for input to the tool. Fibre type is the primary determinant of the footprint of different kinds of textiles. While cotton has an extremely high water footprint due to the large quantities used to produce it (Maxwell et al., 2015) (Maxwell et al., 2015; PE International, 2012; PE INTERNATIONAL AG, 2014; Thylmann, Souza, Schindler, & Deimling, 2014) al., 2014), cotton and polyester are the most used fibres in clothing textiles produced for the EU, and as such, account for a large proportion of the footprint of clothing.

### 5.1 The footprint of clothing produced for the EU

The carbon footprint of clothing consumed in one year, 2015, in the EU is 195 million tonnes CO<sub>2</sub>e. The use phase is shown to have the largest carbon impact for the EU as a whole, although production also accounts for nearly a third of CO<sub>2</sub>e emissions.

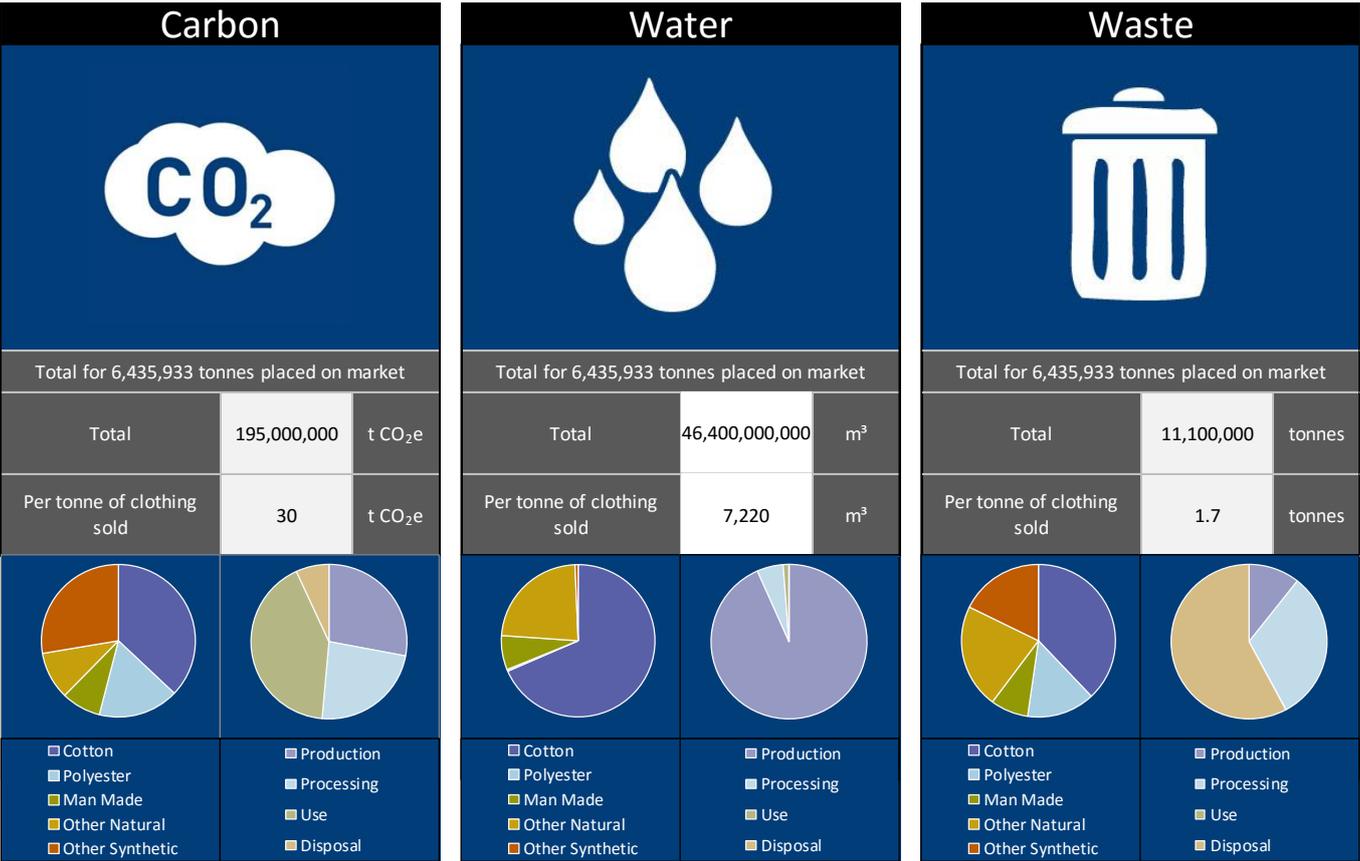
Production relates to the production of raw materials and includes embodied energy in processes from agriculture to polymer extrusion. Other fibre preparation and processing such as spinning to make yarn, fabric printing, and dyeing, all add to the carbon footprint. In particular, the heat setting in chemical and mechanical finishing has a significant effect. The high carbon impact associated with the use phase is mostly due to frequent washing, and carbon emissions from the use of energy for washing machines and tumble dryers.

The greatest amount of water is used in agriculture (the 'production' phase) with cotton having the largest impact of crops grown for clothing production. The total water footprint of clothing consumed in one year, 2015, in the EU is 46, 400 million m<sup>3</sup>.

The burden placed by crop production, especially cotton, is greater depending on where it is grown (WRAP, 2017c). Locations with water scarcity are not necessarily more careful with their water consumption, and the burden placed on natural resources is extreme due to the thirsty nature of the crop. This competes with other demands from drinking

and sanitation, to the production of other crops e.g. rice, as there are often two cropping seasons during the year. Availability may also be low while irrigation systems are not yet well established. The high costs of producing cotton increases pressure to maximise the yield per hectare for the volume of water available. This, in turn, incentivises fertiliser and pesticide use which further affects the water supply as the run-off pollutes local water sources. The global average water footprint for one kilogram of cotton – equivalent to the weight of one man’s shirt and a pair of jeans – is 10,000 – 20,000 litres (Maxwell et al., 2015), depending on where it is grown and the production methods used.

**Figure 6:** Carbon, water and waste footprints of clothing consumed in the EU in 2015



The waste footprint for the whole life cycle of clothing consumed in Europe is 11.1 million tonnes. This includes supply chain waste, as well as all garments disposed of at the end of their life. Disposal is therefore the most significant phase for the waste footprint, though processing is critically important when large quantities of supply chain waste are produced during preparation of yarn and fabrics, and during garment assembly.

A large quantity of fibre is lost during fibre and garment production due to shedding of natural fibres. Garment construction, including cutting and making up, also produces large quantities of fabric waste. This fabric can be re-used or recycled if it is taken into consideration by factories, and as long as suitable markets can be accessed. Existing routes to re-use and recycle ‘leftovers’ leave a lot of scope to capture more value and to reduce waste from the production process, thus reducing the demand for primary

resources. The [most recent research](#) by Castle & Runnel (2017) has identified the scale of the problem, and set out a number of approaches to tackle it as a priority.

## 5.2 Carbon, water and waste footprints for clothing in Denmark

The total clothing consumed in Denmark in 2015 was 72,800 tonnes. This produced:

- 1.8 million tonnes of CO<sub>2</sub>e;
- 532 million m<sup>3</sup> of water; and
- 126,000 tonnes of waste, including supply chain waste and final disposal.

The active life of clothing in Denmark has been established through consumer research (see Section 6.3) and is greater than for other countries, at five years. During the use phase, there are more washes at 40°C (59% of washes are at 40°C) than is the average for the EU, and fewer at 30°C (20% of washes), which puts pressure on the carbon footprint.

In Denmark, the CO<sub>2</sub> emission intensity of the electricity grid was 300g CO<sub>2</sub> / kWh<sup>8</sup> in 2015. This is lower than the other countries included here, and helps to reduce their overall carbon footprint. The majority of residual waste in Denmark (96%) goes to incineration or energy from waste, and the remainder goes to landfill.

The water footprint predominantly occurs during fibre production, and data for the fibre mix has been taken to be the same for each country. Any differences in preference between countries, e.g. for cotton or synthetic fibres, are therefore not included in this regional baseline.

## 5.3 Carbon, water and waste footprints for clothing in Germany

The total clothing consumed in Germany in 2015 was 1,123,210 tonnes. Germany is the largest country by population, and it also consumes more clothing than other countries. The environmental impact of more than one million tonnes of clothing which is purchased each year is extremely high. The amount of clothing consumed in one year in Germany has impacts across the whole life cycle, including:

- 28.5 million tonnes of CO<sub>2</sub>e;
- 8,140 million m<sup>3</sup> of water; and
- 1,940,000 tonnes of waste, including supply chain waste and final disposal.

Washing temperatures appear slightly higher in Germany than most other countries. There are no cold washes, and consumers are more likely to wash at 40°C and 60°C than reported in most other countries surveyed. On the other hand, less machine drying than the average for the EU (only 23% of washes are tumble dried in Germany) reduces energy consumption by consumers in Germany.

## 5.4 Carbon, water and waste footprints for clothing in the Netherlands

The total quantity of clothing consumed in the Netherlands in 2015 is estimated at 230,887 tonnes.

The environmental impacts from this volume of clothing are:

- 4.97 million tonnes of CO<sub>2</sub>e;

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<sup>8</sup> <https://www.eea.europa.eu/data-and-maps/daviz/co2-emission-intensity-1>

- 1,660 million m<sup>3</sup> of water; and
- 400,000 tonnes of waste including supply chain waste and final disposal.

The way that people look after their clothes, in terms of laundry behaviour, is very similar in the Netherlands and the UK (for example), but less similar compared to the other countries in the survey. Most washes are at 40°C, but over a third are at 30°C. Less than 30% of washes are machine dried, and 38% are ironed. For the Netherlands, the electricity grid mix enables a lower carbon footprint: 490g CO<sub>2</sub> / kWh.

#### 5.5 Carbon, water and waste footprints for clothing in the UK

The environmental impact of clothing consumed in the UK in 2016 was recently reported in [Valuing Our Clothes: the cost of UK fashion](#) (WRAP, 2017c). For this report, clothing consumption data from 2015 has been used because this is the baseline year for ECAP. The volume of clothing consumed in the UK increased from 2015 to 2016. The method used to estimate the amount of clothing manufactured in the UK varies between the two reports, so that in Valuing Our Clothes: the cost of UK fashion (WRAP, 2017c), over 1.1 million tonnes of clothes are reported. Based on comparative volumes to the other countries reported here, the UK consumed 992, 040 tonnes in 2015, with the following impacts:

- 23.6 million tonnes CO<sub>2</sub>e;
- 7,170 million m<sup>3</sup> water; and
- 1,710,000 tonnes waste from the supply chain and final disposal.

The UK still sends a large volume of clothing to landfill, and the majority of waste at final disposal still goes to landfill (66%) compared with incineration or energy from waste (34%). In 2015, the quantity going to landfill was estimated at over 300,000 tonnes from households, based on waste compositional analysis of local authority managed residual waste (WRAP, 2017c).

#### 5.6 Carbon, water and waste footprints for clothing in Italy

With a population of just over 60 million, and 881,811 of clothing consumed, Italy has the highest per capita consumption in the EU<sup>9</sup>. Behavioural research has confirmed that Italian attitudes and behaviour to clothing distinguish them from other countries involved in the project:

- The carbon footprint of clothing consumed in Italy in 2015 was 20.4 million tonnes CO<sub>2</sub>e.
- The water footprint was 6,440 million m<sup>3</sup>.
- The waste footprint was 1,520,000 tonnes including clothing disposed in general waste and also supply chain waste from fibre, and fabric production.

Italy still sends a large volume of clothing to landfill (68% of residual waste), similar to the UK. There is a greater quantity of clothing in the residual bin (at 7.2kg per capita) than for other countries analysed for this report (see Section 4.1). However, the carbon intensity of the electricity grid is lower than average for the EU, 360g / kWh, which will lower carbon impacts of the use phase.

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<sup>9</sup> This can be seen in EEA, 2014

- Italians are more likely to iron their clothes - 59% of the time clothes are ironed once they have been washed. As a comparison, Germany is the next most likely to iron, yet this is 19% less than Italy - at 40% of clothing washed
- Italians are less likely to machine dry clothes – they do so 13% of the time

### 5.7 What we are doing about it

The high environmental impact of clothing makes it a priority focus for the circular economy. Increasing opportunities to increase repair, re-use, and closed loop recycling is an important part of ECAP. Each of the ECAP actions works towards increasing these opportunities. For example, repair and re-use are focuses for the consumer-awareness raising campaign in London. Work to recover and redistribute work wear is one of the main solutions identified for more circular public procurement. The fibre-to-fibre recycling trials aim to discover and test the feasibility of closed loop recycling of textile fibres, encouraging uptake of new technologies and advancing what can be done in this area, if successful.

Much of the impact from clothing arises during production and processing. Extending the life of clothing through more durable design, and enabling re-use, repair and recycling, helps to reduce this impact, since production from virgin raw materials has a higher environmental burden than re-use or repair, which help to displace some of this primary production.

Work to improve the sustainability of clothing also targets improvements along the supply chain (see for example, (Textile Exchange, 2016; PE INTERNATIONAL AG, 2014; Shen, Worrell, & Patel, 2010; Thylmann, Souza, Schindler, & Deimling, 2014)) Improvement actions include the introduction of more sustainable fibres, including cotton produced under the Better Cotton Initiative, cotton that meets organic cotton standards under the Global Organic Trading Standard (GOTS), Cotton Made in Africa (CmiA), and cotton produced with the Cotton Reel programme. Other sustainable fibres include sustainably produced lyocell, modal, and the introduction of more recycled fibres, especially where possible providing a market for fibre-to-fibre technologies. Further improvements focus on garment production and opportunities to reduce emissions through cleaner, less resource-intensive colouring processes, (see, for example, Terinte, Manda, Taylor, Schuster, & Patel, 2014 and also [PaCT \(the Partnership for Cleaner Textiles](#) in Bangladesh)). These initiatives are addressed by the ECAP actions.



# **Behavioural research**

## 6.0 Behavioural research

The way that people buy, use, and dispose of their clothing has a big impact on the environment. Consumer behaviour during the use phase accounts for at least a third of the carbon impacts of clothing in the EU, mainly from laundry impacts.

Clothing sustainability issues have gained greater prominence in recent years. Despite this, existing consumer research provided only part of the answers needed for ECAP when the literature review was being carried out. Existing research about clothing and sustainability in Europe focussed on specific demographics or very localised geographical areas. This was able to provide some insights for the project, perhaps the best of which referred to laundry behaviour (AISE, 2013). However, very little had previously been done to look across the EU and examine behaviour and attitudes from a holistic viewpoint.

Survey research was devised which could be used to test behaviours at the start of the project in the countries where ECAP is most likely to impact. Questions were included about clothing care, purchasing behaviour, how long clothes are kept for (longevity), and about repair, re-use and disposal. Responses on laundry and clothing care are included in the ECAP Footprint Tool so that the modelling reflects behaviour of EU citizens.

### 6.1 Laundry and clothing care

Laundry methods and clothing care affect the carbon footprint of clothing. High frequencies of machine drying and higher wash temperatures both increase the energy consumption from laundry and impact on the carbon footprint of clothing in the use phase (see details for individual countries in Section 5.0).

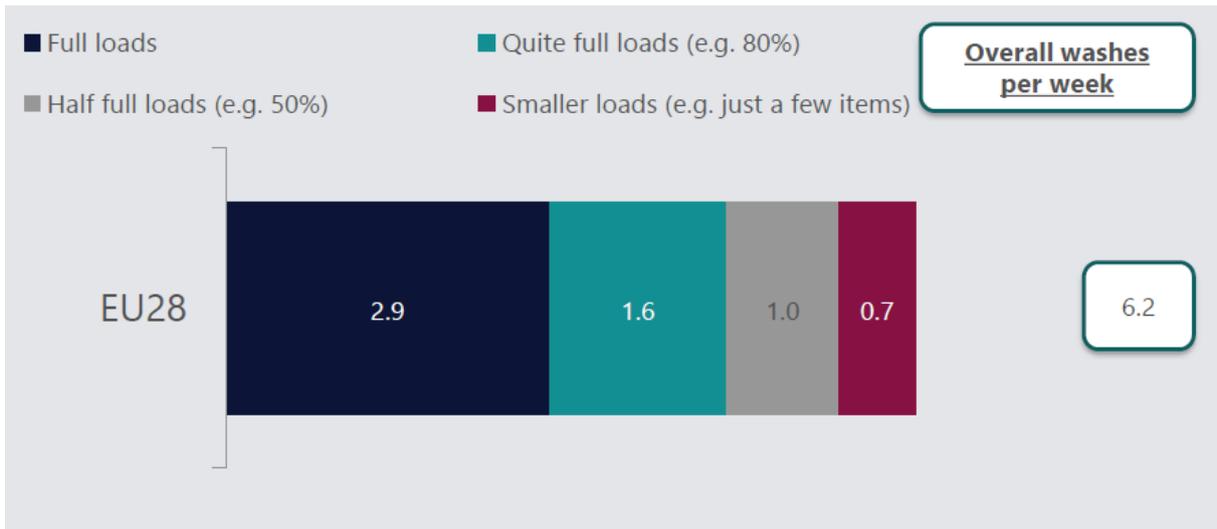
Washing frequency overall for the EU, was high, with an average of 6.2 washes per week (7). In Germany, however, only 4.4 wash loads per household per week were reported. Denmark, Italy, and the Netherlands reported fairly similar frequencies at 5.5, 5.7, and 6.0 respectively.

Overall, the survey found that:

- 43% wash most frequently at 40°C
- 24% wash most frequently at 30°C
- 12% are most likely to use 60°C

Italy is more likely to make use of both cold and 20°C settings, while Denmark and Germany are more likely to use 60°C and 90°C options. Preference for the 30°C setting puts the UK and the Netherlands on a par with the average for the EU as a whole.

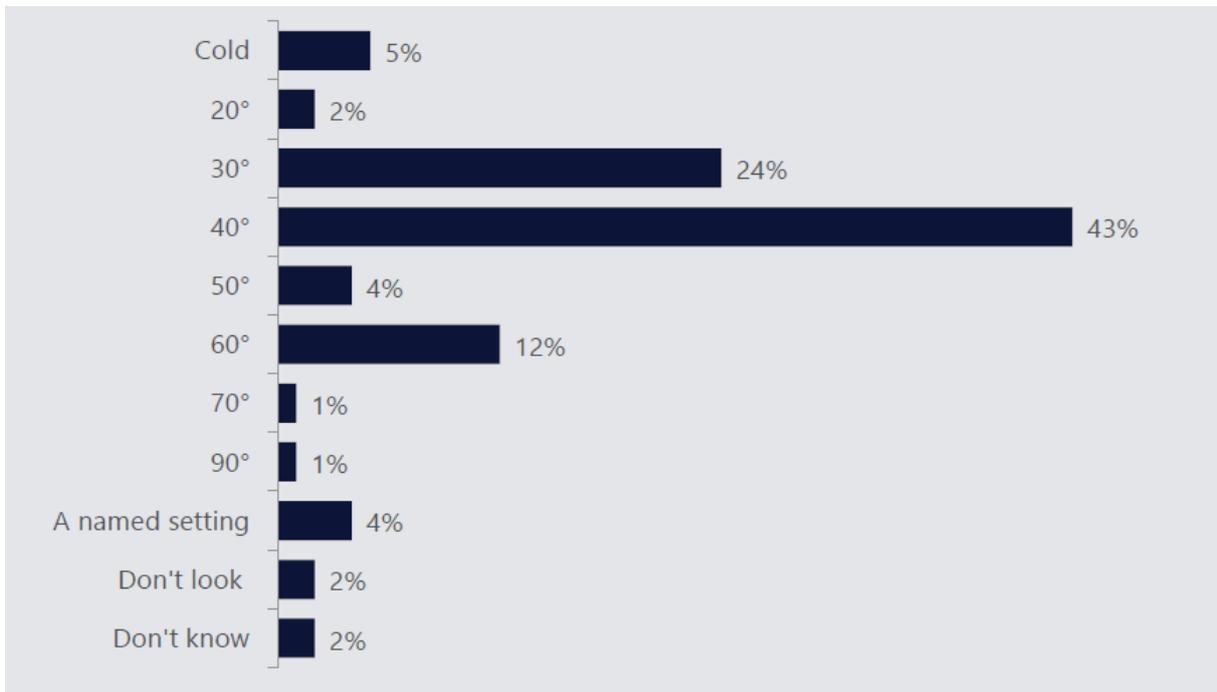
**Figure 7:** Number and size of wash loads for the EU



**Q: In a typical week (i.e. 7 days) how many of the following types of washing loads will your household do? [Graph shows average number given in each category]** Base: Those with at least some laundry responsibility and a washing machine / washer drier at home (EU28:7,981)

Figure 6 shows results for the EU, using the ECAP Footprint Tool to calculate the carbon and water footprints of clothing, described in Section 5.0.

**Figure 8:** Temperature settings used most often when washing clothes, EU



**Q: Which temperature do you most frequently use when washing clothes?** Base: Those with at least some laundry responsibility and a washing machine / washer drier at home (8,359)

## 6.2 Clothing purchases

Survey participants were asked about the last three items of clothing they had bought and whether these were second hand or bought new, as well as whether they considered buying new or second hand at the time. The vast majority of purchases were

of new clothes. Denmark was most likely to consider second hand when buying clothes, but 83% still bought new without considering this option. Only Denmark had a significant difference compared to other countries, with fewer people buying new and not considering buying second hand, and more people buying second hand and not considering buying new (see Figure 9).

**Figure 9:** New and second hand clothing purchasing decisions



**Q: Think about the last three items of clothing you bought (excluding anything that was handed down to you / you received for free). Please tell us about them...** Base: All items bought (D:2,438; G:2,556; H:2,410; I:2,531)

### 6.3 The active life of clothes

In terms of longevity, participants were asked about the items they had last worn, for a range of different garment types, how long ago it had been acquired, and how much longer they expect to continue to wear it (keeping it in active use). Garment types asked about included t-shirts and short-sleeved tops, jumpers, sweaters and hoodies, underwear, smart and casual trousers and skirts, and outerwear.

Generally speaking, people living in Denmark say they keep clothing in active use the longest. They keep their clothing significantly longer than the other countries included in the survey for most garment types. The overall average active life across garment types varied from 3.8 years for people living in Germany and Italy, 4.1 years for the Netherlands, and 5.0 years for Denmark. The UK currently has the lowest expected active life for clothing of countries that have been surveyed, from a separate but comparable survey carried out for WRAP in 2015 and reported in (WRAP, 2017c). This has been determined as 3.3 years.

# Conclusions

## 7.0 Conclusions

Clothing consumption levels are high in Europe. The cost of new clothing is not increasing, and some large retailers and brands have adopted fast fashion business models to turn over greater volumes of products, at a lower cost to their customers. This approach to selling clothing is not preferred by all, and a number of retailers and brands are looking for alternatives. Policy-makers and influencers have put sustainable fashion high on their agenda for reducing the environmental impact of the current economic model of consumption and production. ECAP is one of the projects leading the way in Europe to find ways to achieve the change that is needed.

At the start of the project in 2015, between a quarter and a half of the clothing bought in Europe is likely to end up in residual waste. This represents a huge quantity of clothing; given the total consumption of clothing is over six million tonnes. There is a clear opportunity to collect and recover more of these items, and to find opportunities to recycle, repair, and re-use them.

The quantity of clothing in residual waste has been measured at country level to provide context for this report and to inform the project's activities so that they can be targeted to areas with the greatest potential to divert material from landfill and incineration. The countries found to be discarding the greatest quantities of clothing, per capita, are Italy, Spain, the UK and the Netherlands.

ECAP has actions focussed on clothing waste, including increasing clothing collections, and recycling more clothes. Before the clothing gets to this stage, there are significant opportunities in the production of fibre and fabrics, to reduce supply chain waste. ECAP is working with retailers, brands, and the supply chain, to identify opportunities to eliminate waste from production and higher value uses for the fabric losses that are currently an expense for the industry. The project will work with retailers and brands to support introduction of more sustainable fibres, such as sustainable cotton, lyocell, and recycled fibres. Environmental footprinting of these activities will identify potential savings and be used to report on change during the course of the project.

This report has found that clothing consumed in the EU in 2015 has a carbon footprint of 195 million tonnes CO<sub>2</sub>e, and a water footprint of 46,400 million m<sup>3</sup>. Targeted action presents an opportunity to reduce these. The evaluation of ECAP will take measurements from specific activities undertaken on the project and the savings that these achieve. Monitoring before and after the delivery of actions including fibre-to-fibre trials, growth in the use of more sustainable fibres, and work to increase collections, for example, will be used to evaluate progress against indicators. This will be compared to the background footprint of clothing consumed in the EU to help explain changes due to the project in comparison to the context provided by examining the clothing industry as a whole.

ECAP is working to introduce a circular fashion system. The actions interact with all stages of the clothing life cycle:

- An online design platform encourages more sustainable design practice, with expected impacts throughout the life cycle of clothing.

- Work with garment manufacturers, the supply chain, and retailers, addresses the way that clothes are produced, seeking to reduce impacts by introducing more sustainable fibres and methods of production.
- Guidelines are shared with public procurement professionals to demonstrate what is possible with circular purchasing criteria.
- Work with consumers and young consumers targets clothing purchase, use, care and disposal.
- Municipalities and clothing collectors are encouraged to provide enhanced clothing collection services and to provide communications to increase quantities collected.
- Development of new technologies will produce and sell more clothes with recycled fibre.

Each of the main activities of ECAP is being evaluated to assess progress made to deliver a more sustainable and circular fashion system. The context provided by this report shows the scale of the challenge. It identifies where the main opportunities exist, and where there are actions which contribute to reducing waste, and the carbon and water footprint of clothing.

ECAP also invites supporters to help by promoting the project resources and materials. Networking activities designed to maximise the reach of the project, as well as work with other initiatives on sustainable clothing can help to drive a more powerful message to a wider audience.

This report shows that ECAP's priorities are well-aligned to the main issues of clothing sustainability and over-consumption of raw materials. It also provides background and context for measurement of the project, when it ends in 2019. The main findings identify a set of key issues for sustainability of clothing in Europe and quantify the scale of the problem in a way that enables more targeted action. The key findings show:

- The environmental impact of clothing in Europe is high. These impacts arise during production, processing, and the use phase. The environmental footprint of clothing is driven mainly by the types of fibre in garments, and the way consumers behave. The nature of processes can be improved to reduce carbon and water impacts substantially.
- Italy has the largest quantity of clothing in household residual waste, and a higher per capita estimate of clothing discarded at 7.2 kg per capita. The UK, Spain, and Germany follow, by total volume of clothing discarded in residual waste. In terms of per capita volumes, Spain throws away 6.6 kg compared with 4.7kg in the UK, and 4.2kg in Northern Ireland.
- More than six million tonnes of clothing were consumed in the EU in 2015.
- The carbon footprint of clothing consumed in the EU, in 2015, is 195 million tonnes CO<sub>2</sub>e.
- The total water footprint of clothing consumed in 2015, in the EU is 46,400 million m<sup>3</sup>.
- Clothing longevity varies between countries in the EU. The overall average across garment types varied from 3.8 years for Germany and Italy, 4.1 years for the

Netherlands, and 5.0 years for Denmark. The UK has the lowest expected active life for clothing of these five countries, at 3.3 years.

- Consumer behaviour around clothing and sustainability is only partially understood. It has been researched for certain circumstances and in some locations but, other than behaviour around laundry, there is no comprehensive review of clothing and sustainable behaviours for Europe, or in a global context.



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