Volumes and destruction of returned and unsold textiles in Europe's circular economy

Authors:

ETC: Tom Duhoux (VITO), Dina Lingås (NORION)

EEA: Lars Fogh Mortensen

European Environment Agency
European Topic Centre
Circular economy and resource use

Contents

Acknowledgements

1 Introduction

Over the past years, various voices have revealed an inconvenient truth about the fashion industry: some brands, fast fashion as well as luxury ones, have been found to destroy large volumes of unsold or returned clothing (Deutsche Welle, 2020; Zazzara et al., 2020; FashionUnited, 2017). There are several reasons for this: on one hand, the current fashion retail system has built its business model to a large extent on fast-changing trends, cheap mass production and discounts, often creating overproduction; on the other, destroying unsold items keeps the value of luxury brands high as it prevents the emergence of an extensive discount market (Eco-Business, 2023; Nast, 2021).

Destroying unsold or returned textiles, including clothing, is a waste of value and resources, which has a significant negative impact on the environment. From the perspective of European consumption, textiles have been shown to cause on average the fourth highest negative lifecycle pressures on the environment and climate change, after food, housing and mobility (EEA, 2022). The practice of deliberate product destruction, through which consumer products are disposed of before use by retailers or manufacturers, is an expression of the take-make-waste logic of the current linear production-consumption system. The growth of e-commerce, especially during and after COVID-19, combined with lenient return practises, changes in consumer preferences and fast-fashion business strategies have resulted in an increased proportion of returns and unsold goods (Ader et al., 2021; Rödig et al., 2021).

With the rise of the ultra-fast fashion, in which the time to market is even more compressed (Dzhengiz et al., 2023), the problem is likely to further increase. It is clear that this trend contradicts the aim of a resource-efficient circular economy as stated in the European Green Deal and the EU's Circular Economy Action Plan that has identified textiles as one of the key value chains (EC, 2019; 2020).

One of the key actions identified in the EU Strategy for Sustainable and Circular Textiles, is to stop the destruction of unsold and returned textiles (European Commission, 2022). Concretely, as a disincentive under the Eco-design for Sustainable Products Regulation (ESPR), the Commission has proposed a transparency obligation mandating large companies to publicly disclose the quantity of products they discard and destroy, including textiles, and their strategies regarding preparation for reuse, recycling, incineration or landfilling. The proposed Regulation describes destruction as "*becoming a widespread environmental problem across the Union… [which] amounts to a loss of valuable economic resources as goods are produced, transported and afterwards destroyed without ever being used for their intended purposes*" (EC, 2022). Although the Commision proposed that bans on the destruction of unsold products would be implemented later, in May 2023, the European Council agreed that a ban on the destruction of unsold clothing should apply immediately (European Council, 2023). This direct ban was also part of an amendment on the proposal for a regulation of establishing a framework for setting eco-design requirements for sustainable products adopted by the European Parliament on 12 July 2023 (European Parliament, 2023b) and on which the European Parliament and the European Council reached a provisional political agreement on 5 December 2023. Alongside this, in the context of the Transition Pathway for the Textiles Ecosystem, the Commission will assess how emerging digital technologies could reduce the share of returns of clothing bought online in order to reduce the carbon footprint of e-commerce (European Commission, 2022).

Despite the policy interest and action on the topic, transparency around the handling of returned and unsold textile products in Europe is currently lacking, and the overall size and impact of textile products' destruction remains uncertain.

The aim of this report is to give the best possible overview of existing knowledge, data and trends on the volumes and destruction of returned and unsold textiles in Europe. This is to better understand the nature and driving forces behind product destruction and to provide options for addressing it from a regulatory, business and consumer perspective.

This report is a continuation of the work on textiles in a circular economy by the European Environment Agency (EEA) and its European Topic Centre on Circular Economy and Resource Use (ETC CE), which started with the EEA 2019 briefing document and underpinning ETC CE reports on textiles and the environment in a circular economy. These were followed by other reports and briefings, most recently the 2022 briefings and reports on design for circularity and microplastic from textiles consumption in Europe, and the 2023 EEA briefings and ETC CE papers on bio-based textiles and exports of used textiles. Together, these reports provide necessary knowledge for the transition to a circular textiles economy in the EU.

In this report, Chapter 2 presents an overview of current trends and data on online shopping for clothing and footwear in the EU and on product returns. This includes a description of what happens to returned goods. Chapter 3 summarises existing knowledge and data on unsold textiles; Chapter 4 describes the destruction of textiles and the underlying reasons for it. Chapter 5 provides insights into the environmental and social impacts of textile-product returns and destruction. Finally, Chapter 6 identifies possible ways to address the problem from a regulatory, business and consumer perspective.

1.1   Scope, method and limitations

Several reports, academic articles and investigations by journalists have been published about the practice of destroying returned and unsold textiles. These have, however, generally exposed the practice in very specific circumstances, such as a particular company or brand, or a certain country. This report, therefore, aims to 1) provide an estimate of the amount of returns and unsold textiles and how much is then destroyed on a European level; 2) summarise existing knowledge of the underlying reasons for this and the challenges it presents; 3) estimate the environmental impact of the practice; and 4) identify possible ways to address the issue.

The scope of the research is the volume of returns and of unsold textiles within the EU. As most textile products are manufactured outside Europe, a lot might be left unsold and destroyed before ever leaving the factory although it was produced for European customers. Limiting the scope to what has entered the EU therefore ignores possibly significant amounts of waste generated in the production phase outside Europe. Quantifying these volumes would, however, be very difficult, if not impossible, and is beyond the scope of this project.

The report has been based on a combination of a systematic literature review and desk research as well as primary data collection. The search covered literature published between 2015 and 2023. The primary data collection has been done through interviews with representatives of various actors within the value chain – producers of textiles (brands and retailers) and potential receivers of returned or unsold textiles (return management solution providers, charity organisations, recyclers, and waste handlers) – academia and national authorities. Due to the sensitivity of some of the information provided, some interviewed stakeholders requested anonymity.

This report primarily uses the description by Roberts et al. (2023) of types of products that are subject to product destruction (Table 1.1). Since returned products can also remain unsold and never reach a new end consumer, for the purpose of clarity, this report will treat returned and unsold products as separate topics.

Table 1.1 Products subject to product destruction

Term		Description
Returned products		Products which have been sold but have been returned by the customer to the retailer under their right to return. These products may be fully functional or damaged.
Unsold	Overstock	Products that are produced but have never been sold. These come straight from the production line.
	Obsolete products	Products for which there is no longer any demand.
	Damaged products	Products that have been damaged in transit or storage.
	Recalled/defective products	Products taken off the market due to a defect or quality issues.

Source: adapted from Roberts et al. (2023).

In this report, the destruction of returned or unsold products is considered as the discarding or intentional damaging of these products after which they become waste. As such, recycling is considered destruction, given the need to, for example, shred or dismantle products for this purpose. Considering recycling, incineration and landfilling of returned or unsold products as destruction also corresponds to how product destruction is defined in the ESPR proposal, i.e. products that are destroyed without ever being used for their intended purpose (EC, 2022). Also Roberts et al., (2023) define product destruction as "*a situation whereby consumer products are willingly disposed of before use*". Figure 1.1 illustrates the different types of products, how the different terms relate and how they are addressed in this report.

Figure 1.1 Different types of products and product flows
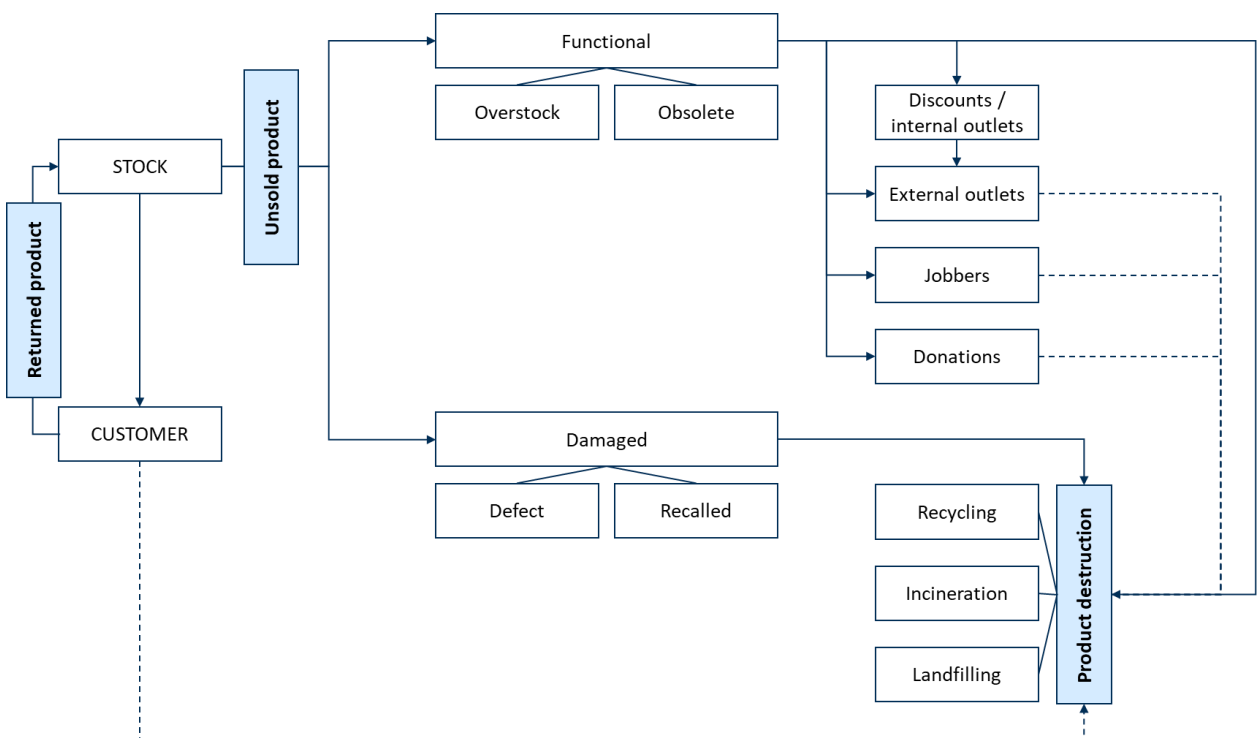
Source: Developed by ETC CE

2 Volumes and fate of returned textiles

The textiles industry is an important sector for the EU and the global economy. In 2022, the EU textile and clothing sector returned to its pre-pandemic level with a turnover of EUR 167 billion, an increase of 14 % compared to 2021. The EU textiles and clothing sector employs 1.3 million people across 192 000 companies, of which 67 % are clothing companies (EURATEX, 2023b). In 2020, the EU imported 8.7 million tonnes of textile products, representing a total value of EUR 125 billion. Clothing represents the largest share, both in volume (45 %) and value (56 %). Exports of clothing from EU to other countries amounted to 1.9 million tonnes in 2020 with a value of EUR 33 billion (ETC CE, 2022).

In 2022, EU households spent around EUR 282 billion on clothing, or EUR 630 per person, and EUR 68 billion on footwear, which in total is an increase of 15 % over the previous year (Eurostat, 2023b). The percentage of textile and clothing sales generated by online sales was 11 % in 2020, and more than doubled since 2009 when it was only 5 % (EURATEX, 2023b). It is clear that the importance of e-commerce for the industry is growing.

This evolution follows the trend of a growing proportion of online shoppers in the EU that grew from 55 % of internet users in 2012 to 75 % in 2022, an increase of 36 % in 10 years (Eurostat, 2023a), with the COVID-19 pandemic acting as an accelerator for consumers to go online (Karl and Asdecker, 2021). This situation incentivised companies to move their activities online, and fashion brands without an online presence before the pandemic established platforms to complement offline sales (Haukkala et al., 2023).

Clothing, including sportswear, shoes and/or accessories, is by far the most popular category of physical products purchased online in the EU, ordered by 68 % of internet shoppers in 2022. This category is followed by cosmetics, beauty and wellness products, bought by 27 % of online shoppers, and furniture, home accessories and gardening products by 26 % as second and third most common products purchased online (Eurostat, 2023c).

Figure 2.1 shows a steady increase in the percentage of individuals who purchased clothes and shoes online between 2020 and 2022. Although those aged 16–44 years had the highest shares of individuals purchasing online, up to 76 %, the increase of online purchasers of clothing and shoes is greater for the age groups between 45 and 74 years old. Of EU countries, Bulgaria has the highest share of individuals that purchased clothes and shoes online, 81 %, and Estonia the lowest, 55 % (Eurostat, 2023c).

Figure 2.1 Individuals in the EU who purchased clothes, shoes and accessories online, 2020– 2022, per cent
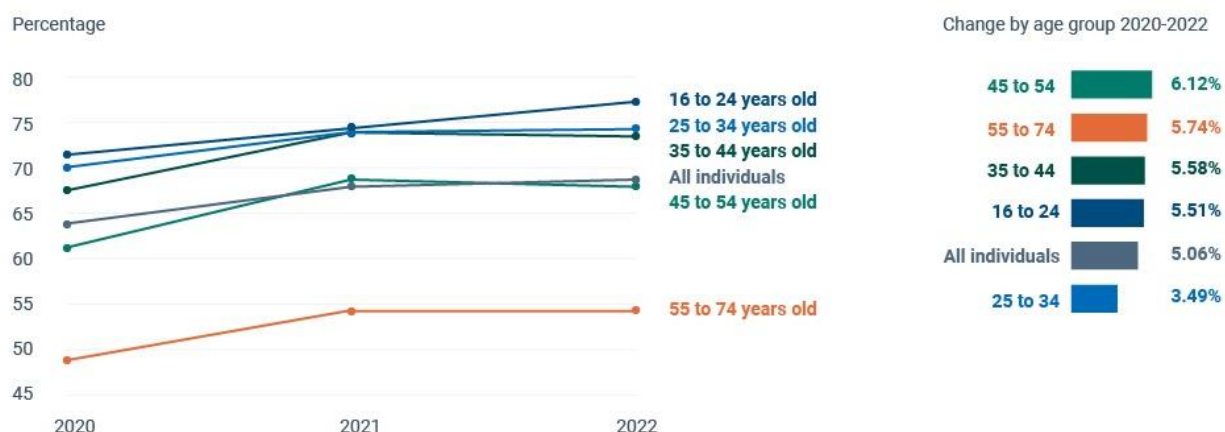
Note: 2020 data are estimated, break in time series in 2021 data
Source: Eurostat (2023c)

In the EU, consumers that have bought a product or service online, have the right to cancel and return their order within 14 days without justification, even when the product or service works as advertised (EU, 2023a). Retailers must refund them within 14 days of receiving the cancellation request, including the shipping costs made at the time of purchase (EU, 2023a). For products bought in a shop, there is no EU legal right to return the goods for exchange or refund, unless the item is faulty (EU, 2023a). Many shops, however, voluntarily allow customers to return or exchange goods within a certain period, provided they have kept the receipt, and in turn give a full or partial refund according to the retailer's specific return policy (EU, 2023a; Nestler et al., 2021). Lenient return policies improve reputation, engagement, revenues, purchase rates, experience and tend to encourage repeat buying among consumers (Kedia et al., 2019; Zomer and van Kempen, 2019). More than 80 % of online shoppers who returned a parcel checked the return policy before buying or during the purchase (DPD Group, 2022). The promise of free and easy returns has, however, inevitably, led with high return rates (Kedia et al., 2019).

With the growth of online sales, return rates have also increased (Roland Berger et al., 2023; Nestler et al., 2021;). Among online shoppers in Europe, 14 % state that they have returned an item in the last month (DPD Group, 2022; Postnord, 2022). In interpreting return rates, it is important to note that different calculation methods can be used. These can, for example, be based on the number of returned items, on the returned products' revenue or profit contributions or on the number of online shoppers that have returned their last purchase. Although the return rates calculated using these methods differ and sometimes it is not clear which method had been applied, research suggests that return rates develop along the same pattern over time, regardless of the calculation method (El Kihal et al., 2021). Unless stated differently, in this report the return rate refers to the number of purchased items that are returned in relation to the total number of items sold.

Product return rates vary greatly among retail industries, categories, brands and distribution channels (Nestler et al., 2021). Most retailers do not understand the full economics of returns, how return rates and causes vary by product category, and what level of returns can be expected for a given product line (Ader et al., 2021). Returns rates for fashion and lifestyle products are significantly higher than those of other product categories (Ader et al., 2021; Nestler et al., 2021; WHY5, 2021; Zomer and van Kempen, 2019). This is mainly because fashion products are judged on the basis of a number of different parameters, such as general appearance, colour, fit and size, which cannot be fully evaluated through online channels. For consumer electronics, on the other hand, extensive information about their functionality can be found, making it easier to buy online (Makov, forthcoming).

In fashion, 70 % of returns are caused by poor fit or style (Ader et al., 2021). The inability to closely inspect or touch and feel products before purchase limits the amount of product information available (Nestler et al., 2021). This results in so-called product uncertainty, which is defined as "*the customer's experience of doubt as to whether a product physically fits*" (Gustafsson et al., 2021). Footwear and apparel products are goods that involve high product uncertainty. These products are especially prone to high return rates when purchased online since customers cannot physically try the products on before purchase (Gustafsson et al., 2021). As Nestler et al. (2021) point out, footwear and apparel suffer from significant sizing variations, due to different sizing systems (alpha, numeric, confection), uneven definition of size systems (S, M, L for garments), country conventions (EU, FR, IT, UK), different specifications for the same size according to the brand, different ways of converting a local size system to another and vanity sizing in which brands deliberately adapt their nominal sizes to target specific consumer segments (Nestler et al., 2021). Product uncertainty, combined with lenient return policies might encourage customers to overorder and return, i.e., customers ordering multiple products in different variants, such as the same product model in different sizes, with the intention of returning the variant(s) that do not fit. Ordering multiple products in different variants is often referred to as bracketing.

The return rate for products sold online is up to three times higher than for products sold in physical stores (Roland Berger et al., 2023; Graat, 2018). Micro to small web shops have a significantly lower return rate

than medium to large web shops (WHY5, 2021). Overall, young adults (18–24 years) have the highest product return rate (Postnord, 2022; Statista, 2021). After that, the proportion decreases with every age group. The main reason for this is that 18–24-year-olds have the highest share of individuals that purchase online and a greatest proportion of purchases are in the fashion segment, which is the product group that has the highest returns (Eurostat, 2023c; Postnord, 2022).

The average return rate for clothing bought online differs depending on the source used. The rates found in literature are sometimes country specific and sometimes cover a wider region or continent. Figure 2.2 gives a country specific overview of average return rates for clothing. The return rates found in literature range from 15–30 % for countries for which data have been found ([1]). The lowest return rates were found for Italy, 15 %, and Poland, 16 %. Germany, 30 %, and the Netherlands, 25 %, had the highest return rates.

Overall, in the EU, the average return rate for clothing is 20 %, which means that one in every five item of clothing bought online is being returned. For footwear, less data on product returns is available, although all sources agree that the return rates for online purchases are higher than those of clothing. Online returns for footwear range from 22–37 % (Asdecker et al., 2021; Gustafsson et al., 2021) and overall, the average return rate for footwear in the EU is 30 %.

According to Asdecker et al. (2022), the fact that the highest return rates were observed in Germany could be explained by the fact that retailers in Germany have very lenient return policies compared to the rest of Europe. For example, the average return period granted by the surveyed retailers in their study is 53 days compared to 30 days in the rest of Europe. Also returns are usually free of charge (89 % of the German retailers surveyed) which is less common in the rest of Europe (52 %), where customers must pay a fee (18 %) or have pay the return shipping costs (30 %).

---

[1]   A large European online retailer reports a return rate of 50 % for clothing and footwear. As the source cannot be disclosed, this figure is not included into the calculation of the average return rates.

Figure 2.2 Average return rates for clothing, Europe, per cent
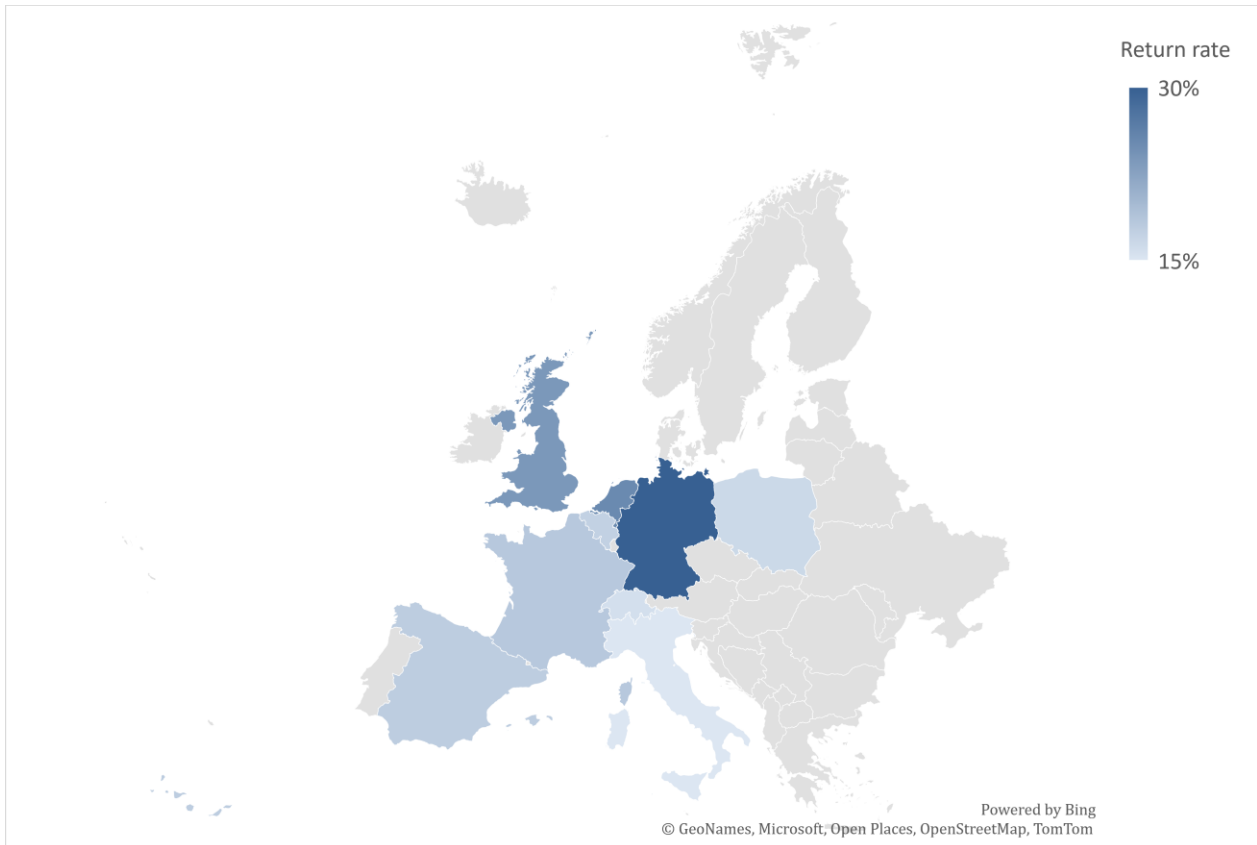
Sources: Roland Berger et al. (2023); Asdecker et al. (2022; 2021); WHY5 (2021); Whittaker-Wood, (2019); Martijn Graat, (2018); Ecommerce News, (forthcoming)
Note: only available data are mapped, countries with no data are in grey

Womenswear is the most frequently returned online clothing category (Roland Berger et al., 2023). Within the category, (casual) dresses have the highest product return rates (Postnord, 2022).

Galaxus, the largest Swiss online retailer with a range of over 5 million products, openly communicates product return rates to its customers showing how often a type of product from a given brand was returned in the last 12 months. Only brands that were sold at least 150 times during that time are displayed (Galaxus, 2023). An analysis of more than 1 200 product records that were retrieved from the website gives a unique overview and insight into product returns per category.

Table 2.1 gives an overview of the average return rate of different types of clothing and shoes retrieved from the Galaxus website. This analysis supports the fact that casual dresses are by far the most returned product category, followed by jackets, jeans and vests. For footwear, the overall return rates are higher compared to clothing, with winter shoes and boots the most returned product category. When retail price is included in the analysis, it seems that higher priced products are more likely to be returned. Also, within a product category, higher priced brands/products, were found to have a higher return rate than the average return rate of that product category. Product parameters, such as overall appearance, size and fit, seem to be of paramount importance for consumers when higher priced items are purchased online.

Table 2.1 Product return rates per product type, Galaxus, 2023

Clothing			Footwear		
Clothing type	Return rate (%)	Average price (EUR)	Footwear type	Return rate (%)	Average price (EUR)
Casual dresses	39.30	48.86	Winter shoes	28.54	142.05
Jackets	26.55	175.01	Boots	25.06	134.28
Jeans	25.11	72.63	Sandals	23.16	73.93
Vests	22.00	98.68	Sneakers	17.52	110.37
Shirts	17.02	40.80			
Shorts	15.92	50.34			
Casual trousers	14.94	53.52			
Sweaters	13.34	67.44			
Bras	10.97	42.54			
Polo shirts	10.88	41.37			
T-shirts	6.74	35.14			
Sleepwear	6.68	59.26			
Body	3.45	36.91			
Underwear	1.91	34.50			
Socks	1.25	21.12			

Source: ETC CE, based on the analysis of 1 237 data records retrieved from Galaxus (2023)
Note: the red cells indicate the highest priced items, the green cells the lowest priced items.

Product return processes are complex, involving multiple stages, players and channels, as can be seen in Figure . The complete return process usually spans different locations and can take weeks to complete (Frei et al., 2022). Especially for seasonal and fast fashion products, this has a significant impact on resale potential and could lead to significant reductions of the original selling price (markdowns) (Roland Berger et al., 2023; Frei et al., 2022; Ader et al., 2021). Winter garments, for instance, cannot be sold at full price in spring, and even non-seasonal articles are at risk of being out of fashion if it takes a long time to return them to the shelves (Frei et al., 2022). Moreover, products could get lost in the process or damaged during transport or storage (Makov et al., 2023; Rödig et al., 2021).

Retail has been optimised for forward logistics with demand that can be forecast and met in an efficient flow. Returns, however, remain difficult to predict; which products will be returned, when, in what quantity and in what condition. Moreover, products often come back in non-standard packaging (Ader et al., 2021). Despite this complexity and the challenges, minimum attention has been paid to reverse flows (Roberts et al., 2023). According to a McKinsey survey, "*managing returns is not among the top five priorities for a third of retailers—and a quarter of the retailers surveyed do not do so efficiently and effectively*" (Ader et al., 2021).

In recent years, a growing number of online retailers have started to rely on specialised third-party reverse-logistics providers to handle their returns. These return-management providers offer various services such as providing drop-off points, handling carrier contracts, collecting data on the quality of returns and how products are returned, and assessing whether the products can be sold again, based on a set of criteria received from the brand or retailer for cleaning, repairing, repacking or disposing products (ReBound Returns, 2023).

Figure 2.3 Generic process flow of e-commerce returns
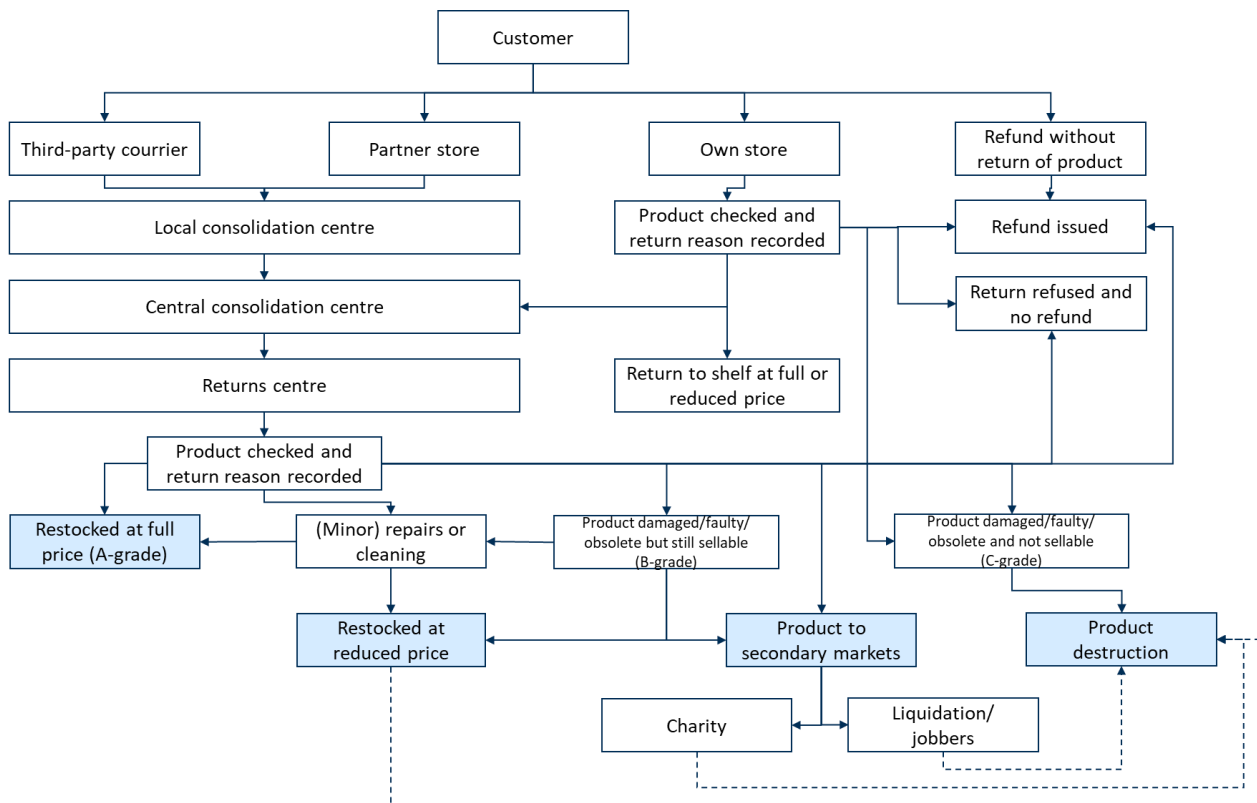
Source: adapted from Makov et al. (2023); Buldeo Rai (2022); Frei et al. (2022)

The costs of handling returns are substantial and include logistics, sorting and handling the returns, replacement costs or the cost of issuing a refund, the cost of customer care and asset depreciation costs in case of markdowns, liquidation or destruction (Roland Berger et al., 2023; Frei et al., 2022; Ader et al., 2021).

With the rapid growth of online shopping, leading to a higher than anticipated number of returns, many retailers are unaware of the true costs of returns. According to a British Fashion Council's Institute of Positive Fashion study, it costs a retailer approximately 55–75 % of a product's retail price to process each online return. mainly due to the number of labour-intensive steps (Roland Berger et al., 2023). Makov et al. (2023) estimate the cost of returns, without the cost of grading or destruction, at about EUR 10–15 each. This means that for products retailing for EUR 34 or less, including 21 % VAT and assuming a normal retail markup of 2.6, there would be no return on the retailer's purchase cost, even if the product were sold again at the full price (²). It is, therefore, not surprising that destruction is more likely for products of lower value or with short lifecycles that are returned (Bernon et al., 2018). The cost of returns has become highly significant, moving them from a cost of doing business to more serious erosion of profit margins (Frei et al., 2022).

As can be seen in Figure , there are various destinations for returned products. In the best case, they are restocked and sold again at full price (A grade). For various reasons, such as minor defects, being end- of-line or out of season or style products, some can only be resold at reduced price (B grade). Products that cannot be resold (C grade), are either donated to charity, liquidated or sold to middlemen, often referred to as jobbers – companies which that deal in clothes and textiles but not necessarily for sale to consumers

---

²   The purchase cost of the retailer (EUR 13.08) multiplied by 2.6 (markup) gives the retail price including 21 % VAT (EUR 34) at which the product is sold. In this example the margin of the retailer is EUR 15.03, which is calculated as the retail price excluding VAT (EUR 28.11), minus the purchase cost of the retailer (EUR 13.08).

– or are destroyed. However, some products that are restocked or go to secondary markets can end up being destroyed (Makov et al., 2023).

Figures on the volume of goods that can be restocked and sold as new are scarce. However, according to a study by the University of Bamberg carried out among German online retailers, an average 93.2 % of all returned items could be sold as new, while the share of returns subject to destruction was estimated to be only 1.3 % (Asdecker et al., 2022). This share of products destroyed is an underestimate as it does not include disposal by customers who received a refund without returning the item or sale/disposal through the secondary market (charities or jobbers). Although this seems low for Germany, in absolute terms it still means that some 17 million returned items were destroyed in 2021 (Asdecker et al., 2022).

These figures are in line with data received from Reboud Returns, one of the biggest return-management service providers in Europe that handles more than 12 million returned items per year, most of which are for clients in the fashion sector. According to this company, about 94 % of returns for their biggest clients are A-graded, repacked and returned to their clients for resale. However, 4 % cannot be resold and are subject to direct destruction. Due to current limitations of fibre-to-fibre recycling, these items go to incineration ([3]). The remaining 2 % are B-graded products, which require further treatment, such as stain removals or small repairs, before they could potentially be resold. Sometimes B-graded products are donated to charity. The reason why there are fewer B- than C-graded products is that often only a distinction is made between A- and C-grade ones (Rebound Returns, 2023).

Although 94 % of returned products could potentially be resold, whether this actually occurs is not clear as return-management service providers do not know whether all items deemed sellable are indeed returned to stock and reoffered for sale as their clients handle restocking (Rebound Returns, 2023). In a study by Makov et al. (2023), two scenarios representing best and conventional return-management practices were compared, using data covering more than 630 000 clothing returns in 2021 in the EU. In the best-case scenario, a scenario in which all returned items go through advanced grading and are carefully assessed according to a number of defined criteria, 77 % of all returned items reach a new end customer. When conventional return management is used, i.e., without light cleaning or mending that can occur in the advanced-grading scenario, only 54 % of restocked items find their way to a new end consumer. These figures also take into account the ultimate fate of returned items and products that are donated or sold to jobbers but eventually end up as being destroyed. This implies that even under the best return-management practices, almost one out of four returned clothes never reach another consumer. Figure 2.4 gives a breakdown of both scenarios.

---

[3]   This statement was confirmed by a large European online retailer

Figure 2.4 Comparison between best and conventional return-management practices, per cent
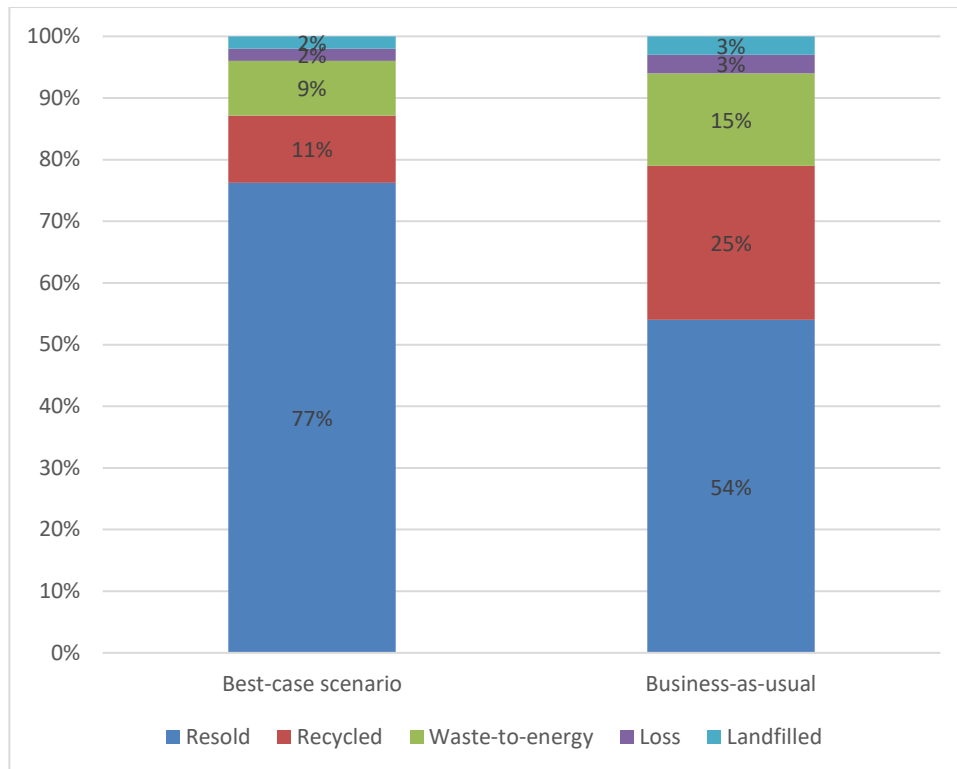
Source: Makov et al. (2023)
Note: The resold category includes resale by the original retailer and sales by secondary sellers.

3   Unsold textiles – existing knowledge and data

3.1   Causes of unsold textiles

The previous chapter detailed what is known about the share and fate of returned products from online sales. In addition, there are products which are never sold to a consumer by the retailer. As defined by Roberts et al. (2023), unsold products can be either *overstocks* (products that are produced but have never been sold), *obsolete products*, products for which there is no longer any demand; or products that are *damaged* or *recalled* by their manufacturer because of quality issues.

Overstock and obsolete products are the result of a mismatch between what is produced and demanded. As will be detailed in the following paragraphs, this mismatch can be due to difficulty in forecasting, market dynamics and a conscious business strategy.

Difficulties in forecasting is the challenge of knowing what and how much will sell. The fashion industry and particularly fast-fashion, is characterised by a large variety of goods produced, also called *product diversification,* both in terms of styles, colours and sizes, as well as differences between seasonal offerings (Elia, 2019; Tanaka et al., 2019). From a consumer's perspective, this diversity gives options and freedom of choice. But the more diverse the portfolio of products, styles, colours and sizes, the harder it is to correctly predict exactly how many of each will sell within the current season. If a brand orders more producs of a certain colour which turns out is not as popular as expected, these items become overstock. If the trend changes before these can be sold, the items can become obsolete. Conversely, products which are less subject to changing trends and appeal to a large part of the market are less likely to remain unsold. Basic garments such as white t-shirts, dark socks and blue shirts, for example, become overstock less often than vibrant coloured or special items (Tanaka et al., 2019). This also holds true for sizes, with less demand

for the smallest and the largest sizes, and it is challenging to accurately forecast the optimum combination of styles, colours and sizes. Stocking the same quantity of each size for all products is likely to result in overstocks of some, as the pool of costumers for the largest and smallest sizes is smaller than for medium ones. This can cause an interesting dilemma, as including a wider range is more size inclusive, but can also cause overproduction and subsequently unsold stock. Changing trends seasons also cause unsold stock. The sale of seasonal items is impacted by the weather conditions of that season, and forecasting for these types of products can therefore be challenging. In warm winters, for example, the sale of winter coats might be less than predicted (Elia, 2019). Because these items cannot necessarily be sold next season because of changing fashion, they may become obsolete.

Secondly, large geographical variations in consumption also makes sales challenging to predict. For physical stores, the challenge with forecasting is aggravated by physical conditions. Every store has limited storage capacity, and this is particularly true for smaller retailers. Stores, therefore, cannot accept all products at once, and need to remove unsold goods to make space for the next collection (Tanaka et al., 2019). This is also due to the fact that the items are predominantly sold within the first few weeks of being put on the market, meaning that if one store in a chain experiences less demand than predicted, there might not be time to relocate the items to another store (Tanaka et al., 2019).

The difficulties in forcasting are aggravated by market dynamics and the structure of purchasing. Because most production plans are made approximately six months before the start of the sales period, it is difficult for the industry to adapt production to keep up with the changes in demand, which then leads to a mismatch and ultimately to unsold goods (Tanaka et al., 2019). The time span between placing an order and receiving it can also contribute to something called the bullwhip effect – when sudden increase in customer demand leads to an increase in orders in the brand's supply chain but, because of the timelag involved in fulfilling orders, results in availabilty outstriping actual demand once the order has been produced, delivered and put on sale (Roberts et al., 2023).

The main issue is that within the current system, the challenge of forecasting is deemed acceptable and even makes economic sense, due to a combination of diversification as a business strategy, low production costs and economies of scale and scope.

In a hyper-competitive market such as the textiles and fashion industry, and particularly fast-fashion, brands often prefer overstocks to reduce lead times and avoid the risk of not being able to meet demand immediately (Roberts et al., 2023). Within consumer psychology, the current belief is the greater the choice offered to consumers, the better, meaning that it will attract both more consumers and that more of them will buy (Roberts et al., 2023; Grant and Schwartz, 2011). It thus becomes in the interest of the brands to continuously increase product diversification to attract more customers, and to incite buying through the creation of a sense of urgency with ever more collections, which are not offered for sale in the following season, leading to overstocks (Tanaka et al., 2019). This is made possible by the low cost of production.

Today's material sourcing requires global networks and a large portion of labour-intensive clothing production takes place in the global South where low wages are prevalent (Dzhengiz et al., 2023), making it more advantageous to produce too much than loose potential sales (Roberts et al., 2023). This is further aggravated because of economies of scale and scope. *Economies of scale* refers to the fact that it is cheaper per item to produce many rather than few of one product, whereas *economy of scope* means that it is cheaper per product to produce two or more different items at the same time than producing them individually (Investopedia, 2023). Consequently, not only is a diverse portfolio cheap to produce, but a wide range of products produced in large quantities is cheaper per item than producing smaller quantities and fewer types (Roberts et al., 2023; Singh et al., 2019). This then leads to overproduction of product types, styles, colours and sizes. Lastly, products might not be sold because they are damaged, faulty or have quality issues (Roberts et al., 2023).

3.2 A variety of data from different sources

There is little available information about the volume of textile products that are never sold. There is little academic research on the topic, and in one of few articles to be found, the authors note that "*fashion brands* may *hold large amounts of unsold products (25–40 %) at the end of a selling season*" (Niu et al., 2018). Further, few companies report on the volume of unsold items and the numbers that do exist are based on companies' own reporting and often lack transparency. According to Fashion Revolution, just 12 % of all brands globally disclosed the volume of post-production waste generated annually in 2022 (overstock, obsolete stock, etc.) – up from 6 % in 2021 (Fashion Revolution, 2022). The few numbers that were found, and are presented in Table 3.1, are therefore difficult to extrapolate to a European average, as they are not necessarily representative of different European countries, refer to different years and use different definitions of unsold items. Further, the reported end-of-life treatment is named differently, making it unclear what is meant. Some reports differentiate between recycling and incineration, whereas others combine these under the term destruction. Lastly, they mostly differ from the estimate by Niu et al. (2018) mentioned above.

Several leading German newspapers suggest that about 10 % of all clothing items, around 230 million pieces a year, remain unsold despite heavy discounting by retailers (Berner, 2021; Dowideit, 2019). These numbers are based on findings from Euromonitor International in 2019. Several other media refer to this number in the following years, but the original source has not been found. Other experts estimate that the amount is higher, up to 460 million pieces, corresponding to 20 % of all items (Dowideit, 2019). These figures have been contested by the German industry association Bundesfachverband Textileinzelhandel (BTE), stating that a survey amongst 9 000 of their members found that only 5-10 % of all pieces put on the market end up being passed on to third-party distributors, and that only a small fraction of new items are destroyed (Preuss, 2019). The German Environment Ministry (BMUV) states that only few credible numbers exist on the destruction of goods, because not all goods are recorded, and companies cannot be inspected comprehensively (Bundesumweltministeriums, n.d.).

According to a large study done in France on the fate of unsold non-food products, unsold clothing and footwear represents 4.1 % of the total turnover of the clothing and footwear sector in France (ADEME, 2021). In the context of that study, the term unsold is defined as "*all new non-food products, leaving the store or factory, which could not be sold through traditional sales channels, manufacturers and distributors, nor valued via their internal channels: seasonal sales, promotions, and product stickers, factory outlets and brand centers, clearance sales (event sales in their warehouses or nearby); sale or gift to employees*". The 4.1 % of total turnover these unsold goods represent correspond to an estimated market value of EUR 1.7 billion (ADEME, 2021). The respondents of the ADEME study indicate that the main reasons for the failure to sell clothing and footwear products are marketing obsolescence as a result of, for instance, new collections or a change in packaging (37 %); product defects (31 %) and over-production (27 %) (ADEME, 2021). For the unsold items, the sector mainly resorts to external outlets, which are stores selling heavily discounted items (65 %) and donations (20 %), 4 % is repared, whereas 6 % is recycled, 4 % incinerated and 1 % landfilled. Further, most recycling happens in Asia, and there is little transparency on how this is done and how much is ultimately recycled (ADEME, 2021). According to the actors interviewed, the the French Anti-Waste Law (AGEC law) was not expected to upset existing practices (ADEME, 2021). This was confirmed by French members of RREUSE, which stated that there was no augmentation of donations since the French ban on destruction of unsold and returned items came into place on 1 January 2023.

In the Netherlands, the number of clothing items mentioned in most articles comes from a study commissioned by MVO Nederland in 2016 investigating 2015. This states that 33 % of what was put on the market was only sold after being offered at a discount. About 6.5 %, some 21.5 million items valued at EUR 313 million remained unsold (Wijnia, 2016). The 6.5 % was split into 3 % sent for recycling, 2.7 % for incineration and 0.8 % were not accounted for in the article (Wijnia, 2016). The numbers are referred to in 2017 by Maldini et al. (2017); in 2020 by Nichols-Lee (2020) and Niinimäki et al. (2020); and in 2023 by

Schenkman (2023). The recurring referencing to these numbers also indicates that there have not been any new studies, and due to their age, these numbers are simply indicative.

A recent study in Norway, estimates that the total amount of unsold clothes, defined as "*clothing that the business is left with over time, and which they are not able to sell through own channels*", amounted to a minimum to 825 tonnes in 2021, which equals approximately 0.7 % of the textiles put on the market. Based on the estimates from the brands surveyed, however, 0.1–2.8 % remained unsold, but it could even be more due to differences in the definition of unsold. Both estimates should be treated with caution as they are based on self-assessment by brands, several large companies did not answer and the numbers do not include online trade (Samfunnsøkonomisk analyse AS, 2022). Regarding the paths of the unsold garments, the report estimates that in 2021 82 % of unsold garments were donated to charity, of which 98 % were exported to either Poland, the United Arab Emirates or Kurdistan as a first destination. The charities reported that the agreement with the brands often include a requirement to export the items beyond Europe, where the brand is not present, to avoid reducing its value. Around 17 % were sold to external outlets or jobbers (Samfunnsøkonomisk analyse AS, 2022) and the remaining 2 % was estimated to be directly destroyed. A Norwegian report investigating textile consumption in 2018, states significantly different proportions. Here, the surveyed brands reported that 82 % of unsold textiles were incinerated, 11 % donated to charity, 3 % sold through a discounting outlet, and that nothing was recycled. The fate of the remaining 4 % was reported as "other" (Watson et al., 2020).

In June 2022, the ReHubs Techno Economic Master Study analysed figures of all textile waste generated in the EU, including textile waste generated or consolidated at the retail level such as overstock, returns, damaged or defective goods, sample waste and other unsellable goods. This showed that 60–80 % of goods are sold by the original seller through its core channels. Of the unsold goods, 90 % are sold in redirected markets, i.e. through different channels or at different prices, and 10 % of unsold goods were "*available*" for recycling (EURATEX, 2023a).

Information from the Swedish multinational clothing company H&M does not detail how much of its stock remains unsold, but indicates the fate of these items. In 2019, the company reported that 74 % of unsold garments were donated to charity, and it destroyed 6 %. H&M established a collaboration with a platform solely selling secondhand clothes in 2021 and sold 83 % of its unsold items on this platform, only 5 % was donated to charity, 12 % was recycled, and none was incinerated or landfilled (Samfunnsøkonomisk analyse AS, 2022). The change, however, also highlights the issue of overproduction, as a large proportion of the overstocks was in fact fully usable and could be sold through the secondhand market.

In Belgium, VAT exemptions are granted to companies that donate certain unsold goods to charity organisations, associations or companies approved specifically for this purpose. According to RREUSE, a non-governmental organisation, however, outlets for brands absorb most of the unsold stock and donations are relatively low compared to the estimated total quantity of unsold goods ([4]). In Germany, companies need to pay VAT on in-kind donations, making it more expensive to donate products (KMLZ, 2021).

The relatively low quantity of donated goods was confirmed during conversations with charity organisations in Belgium, France and Germany that receive donated unsold goods from brands to redistribute ([5]). In France, women's clothing, summer fashion, sizes on each end of the spectrum and damaged or faulty products are donated, which does not fully match the actual needs of charity organisations. Although donated volumes fluctuate from year to year, there is a clear trend of decreasing volumes coming from traditional distributors of ready-to-wear cheap clothes. The main reason indicated

---

[4]   Personal communication with the the Project and Advocacy Officer of RREUSE, Marie-Jeanne Gartner, 21 August 2023.

[5]   Personal communications with Goods to give (Belgium), ADN (France) and Innatura (Germany) in April 2023

is that these players discount as much as needed to get rid of their products with some financial return. On the other hand, charity organisations also see an increase of volumes coming from luxury brands and brands that only sell online. What is left used to be destroyed before the application of the French AGEC law in 2023, but is now donated instead. Overall, French charity organisations see a slight decrease of quality of what they receive.

Table 3.1 Overview of unsold garments from different sources, per cent

	Sold at full price	Sold at discount / internal outlets	External outlets	Jobbers	Donations	Recycling	Incineration	Landfill
Germany[1]	80-90 %		10-20 %					
Netherlands[2]	61 %	33 %				3 %	2.70 %	
ReHubs[3]	60-80 %	20-40 %						
Norway[4]	97-99 %	1-3 %						
		Average share of unsold: 21 %						

Sources: (1) Berner (2021; Dowideit (2019); (2) Wijnia (2016); (3) EURATEX (2023a); (4) Samfunnsøkonomisk analyse AS (2022)

The overview presented in Table 3.1, shows that the numbers are rather divergent between different countries, years, and sources. For instance, the amount of unsold items varies from 20-40 % in the 2022 ReHubs study to 1-3 % in Norway in 2021. The average share of unsold textile products found in literature is 21 % ([6]).

Table 3.2 Fate of the unsold garments from different sources, per cent

	External outlets	Jobbers	Donations	Recycling	Incineration	Landfill	Other / unknown
France[1]	29%	36%	20%	6%	4%	1%	4%
ReHubs[2]	90%			10%			
H&M (2019)[3]			74%		6%		20%
H&M (2021)[3]	83%		5%	12%			
Norway[3]	17%		82%	2%			
Norway[4]	3%		11%		82%		4%

Sources: (1) ADEME (2021); (2) EURATEX (2023a); (3) Samfunnsøkonomisk analyse AS (2022); (4) Watson et al., (2020)

Note: The H&M data only refer to products put on the Norwegian market

Table 3.2 shows the fate of the unsold garments. The percentage of unsold that is donated to charity is found to be as low as 5 % from H&M in Norway in 2021, to an estimated 82 % across brands in Norway in

---

[6]   Data on unsold stock directly received from a limited number of European retailers indicate 10–27 % of products put on the market are not sold through their core channels. Although these figures align with the average share found in literature, as the sources can not be disclosed, the data are purely informative and were not used to calculate the average share.

2022. The volume of unsold items going to external outlets and/or jobbers varies between 65 % in France and 17 % in Norway. The difference can potentially be due to differences in the definition of unsold, both between the studies and the reporting brands. According to the German Federal Ministry for Economic Cooperation and Development (BMZ), ADEME in France, and Samfunnsøkonomisk analyse in Norway, unsold is defined as everything that is not sold through the brand's internal channels, including discounts, outlets and employee donations. The German industry association on the other hand, defines unsold as everything that is not sold even after discounting. Samfunnsøkonomisk analyse states that an important reason for the difficulties in measuring the amount of unsold goods comes from the fact that the surveyed brands did not necessarily have numbers that are comparable with their definition and that definitions varied across brands.

Further, there is an important question regarding whether donations can be considered as use of the products or as destruction. Recent studies have revealed that 46 % of exports of secondhand clothing from Europe end up in Africa where up to 50 % of the garments ultimately end up in open landfill or are burned on open fires. Preliminary studies also indicate that the 41 % of the used clothes from Europe that are exported to Asia, for the most part are recycled into industrial wipes, rags or filling (ETC/CE, 2023 and EEA 2023). Furthermore, when damaged products are exported, it is unclear whether they will in fact be used in the receiving countries or will end up as waste.

An important aspect of the discussion of how to define unsold is whether products sold at a discount meet a real demand or should be considered unsold. If a large part is only sold when the garment has been discounted, for instance, 33 % of all garments put on the market in the Netherlands, this might indicate that the production of the garment does not really match demand. This is particularly true for garments which are sold at internal and external outlets, donated to employees or sold to jobbers. As stated by Samfunnsøkonomisk analyse, everything can be sold if the price is low enough but that does not necessarily indicate a need for the product. This point can be supported by the fact that the amount of clothes donated by consumers to charities in Europe has tripled since 2000 (ETC CE, 2023). In 2020, the textile consumption in the EU per person averaged 6.0 kilograms (kg) of clothing, 6.1 kg of household textiles and 2.7 kg of shoes (EEA, 2022). Consumers, however, use clothes and shoes for much shorter periods than they did 20 years ago (Laitala and Klepp, 2015). This might indicate that consumers buy clothes which they do not really need, and then subsequently donate them or throw them away. From this angle, products sold at a discount might lead to indirect destruction.

4   Destruction of textiles

The practice of destroying clothing is something that has been happening in the fashion industry since at least the 1980s (Napier and Sanguineti, 2018). Investopedia, a financial media website highly rated in the financial world, states, "*a large inventory can however also be a liability, due to the risk of spoilage, theft, damage, or shifts in demand. In the case of the latter, it might have to be disposed of at clearance prices, or simply destroyed*" (Investopedia, 2023). As shown in Chapters 2 and 3, both returns and unsold products are subject to destruction, and these can be either fully useable or damaged.

Table 2.1 gives a summary of the data found in literature as described in the previous chapters and calculates out of the total volume of online sales and the total volume of products put on the market (stock) the proportion that is destroyed. As products sold online are part of products put on the market, there is a partial overlap in the data. This is because it is unclear what proportion of the unsold products are returned products. Nevertheless, from the available data, it can be estimated that 4–9 % of all textile products put on the market are destroyed without ever being used for their intended purpose.

Table 2.1 Proportion of textile products destroyed, per cent
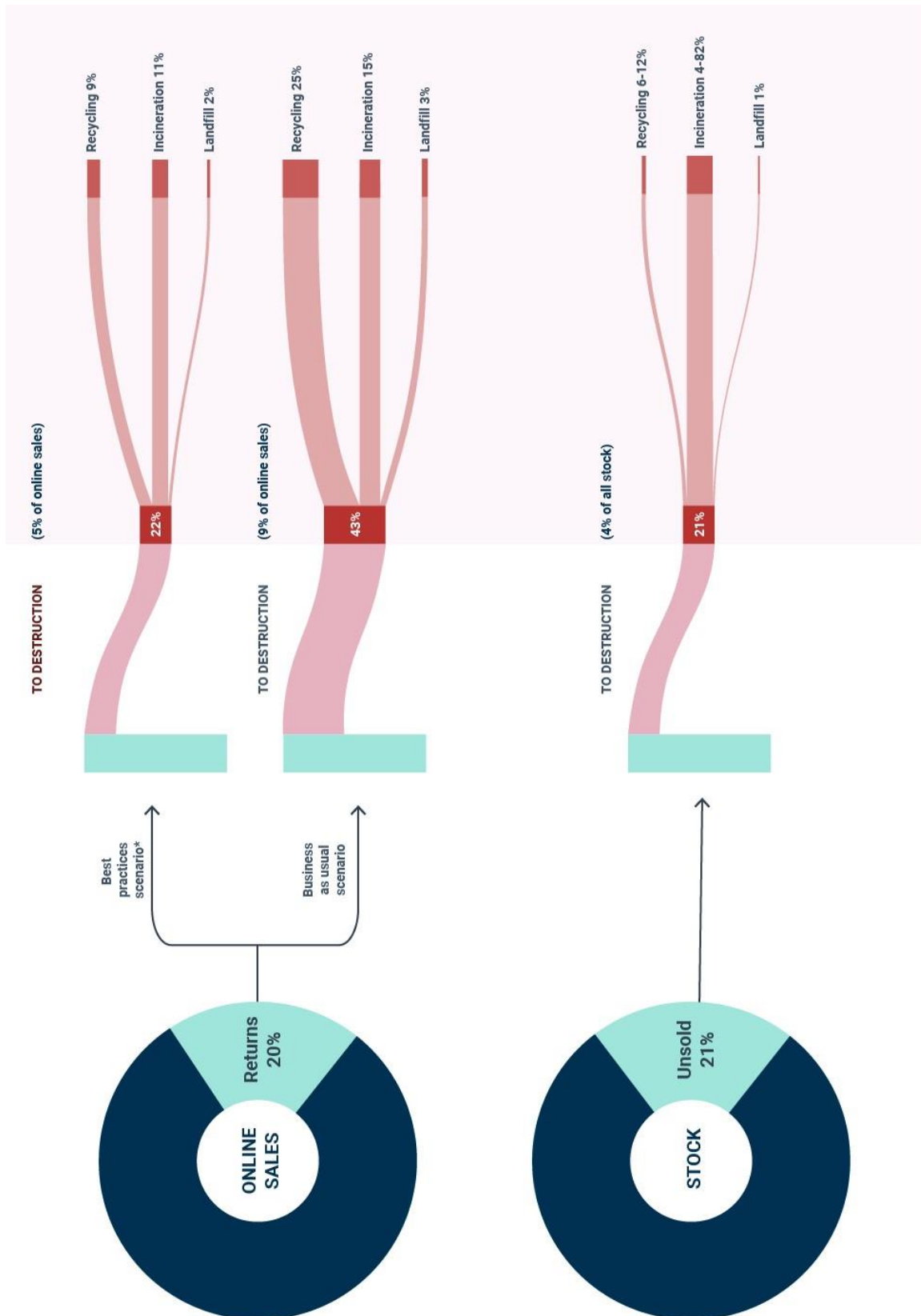
Sources: (left) Makov et al., (2023), (right) EURATEX, (2023a); Samfunnsøkonomisk analyse AS, (2022); ADEME, (2021); Watson et al., (2020)

Note: Under returns, the 'best practices' scenario is a scenario in which all returned items go through advanced grading and are carefully assessed according to a number of defined criteria.

The remainder of this chapter describes the reasons for destruction of both returned and unsold textile products, differentiated by whether they are useable or damaged.

Why functional products are destructed

For customer returns, the costs of handling are substantial, as shown in Chapter 2, and the potential earnings from putting items back on sale might not surpass the cost of processing. These fully functional items therefore end up as unsold and are sometimes destroyed.

Storing returned items is expensive for the company due to direct costs like rent, utilities, warehouse salaries and insurance, and indirect costs such as the opportunity cost, meaning that the storage space could be used for a new item which would potentially yield more revenue (Investopedia, 2023a; EMERGE, 2019). Hence, even fully functional clothes, both unsold ones and customer returns, might not be worth retaining and are therefore destroyed. This is particularly the case with low-price products for which the cost of finding other routes to their disposal, which takes time and resources to administer, is greater than destroying them (Elia, 2019).

This is further aggravated by tax laws. Companies have the right to deduct VAT if an item is destroyed (if duly proved and confirmed), but in most EU Member States, this is not the case if the item is donated (Rödig et al., 2021). This gives a monetary incentive to retailers to destroy rather than donate unsold stock to charities (Fitzgerald, 2023). Any effort spent on unsold or returned products, such as reprocessing or rebranding, negatively affects profit margins. As a result it is more lucrative to destroy low-value products with small profit margins than to making an effort to (re)sell or donate them (Rödig et al., 2021).

Lastly, the protection of intellectual property can be a reason for destruction, particularly for luxury brands. These typically do not place their items on sale or sell them at discount outlets, due to a fear of reducing the value of the clothes and thereby their brand. The items not sold within the season are therefore often destruced (Frei et al., 2020; Elia, 2019).

Why damaged products are destroyed

As described in Chapter 2, around 4 % of returns are C-graded and cannot be resold. Although the exact reasons may vary and depend on the used assessment criteria, it might be because of significant damage or defects (Rebound Returns, 2023). Sometimes items are destroyed because they are deemed a health risk. For instance, a large fast-fashion brand explained the destruction of 12 tonnes of denim jeans because of unsafe levels of lead in the paint in addition to mould on certain garments from water damage during transportation (Elia, 2019).

Another 2 % of returns are B-graded products which are products that require further treatment, such as the removal of stains or small repairs, before they could potentially be resold. Sometimes B-graded products are donated to charity, but some of them might also be destroyed. Small defects might also be the reason why some textiles are never sold in the first place, which according to a French Agency for Ecological Transition (ADEME) 2021 study, accounts for 31 % of unsold textiles. For both customer returns and unsold textiles, the damage might happen during transportation or storage, causing them to no longer meet quality specifications, be deemed unsellable and thus candidates for destruction (Roberts et al., 2023). Returned shoes in particular might also become unsellable as consumers have worn them ([7]).

Common to both unsold textiles and customer returns that are unsold because of minor defects and the need for treatment is the high cost of cleaning and repairing low-value goods, making destruction more cost effective (Roberts et al., 2023). This demonstrates an inherent flaw of the fashion industry, where

---

[7]   Personal communication via e-mail and phone on 9 June 2023

cleaning and repairing otherwise fully functional items is deemed less economic than destroying them (Roberts et al., 2023). Although the items could in theory be mended and cleaned, this is not necessarily done.

Lastly, there are important uncertainties regarding the data. Even though most unsold textiles are reported to be sold to external outlets, jobbers or donated to charity, lack of data makes it unclear what happens to these products. Some retailers or brands, for instance, are unaware of what the jobbers do with their items, and there is, therefore, a risk that at least some are destroyed without the brands' knowledge (Frei et al., 2020).

5   Impacts of destruction of returned and unsold textiles

The destruction of customer returns and unsold textiles have environmental and climate impacts. These arise from the processes of handling returns and unsold textiles and the destruction itself. Importantly, there are also the impacts from their original production even if they are never used.

Starting with the process of returns and unsold products, customer returns lead to a range of processes, which all imply resource and energy consumption, i.e., repackaging; transport; sorting, grading and other activities related to returns; and the use of space which requires heating and light (Frei et al., 2020). The distance returned goods travel could be well above 1 000 kilometres due to consolidation centres, advanced grading and restocking locations being spread over different countries (Makov et al., 2023). Only 3 % of the environmentally harmful emissions from textiles, however, come from distribution and retail (EEA, 2022), meaning that the additional transport and other activities involved in the return process need to be significant if their emissions are to surpass those from producing a new product, and the use of these resources is worthwhile if they lead to the products being sold.

All unsold textiles, of which customer returns might be a part of, are associated with environmental and climate impacts, namely energy related to storage and the additional transport at the end of a sales period when overstocks in stores are returned to warehouses, from where they are often transported again to be sold at discount in other channels or to be discarded (Tanaka et al., 2019). Lastly, destruction in the form of incineration not only releases carbon dioxide (CO_2) but also other air pollutants depending on how technically advanced the incineration is, meaning how much filtering occurs to reduce the release of toxins (Elia, 2019). For this report it has not been possible to calculate the exact environmental and climate impact of the processing of returns and unsold textiles, nor of the destruction of these, as there is not enough reliable data on quantities and the share of the different processing methods.

Even when overstocks are sold through external outlets, jobbers or are donated to charities, their production has had environmental and climate impacts and their existance is symptomatic of an industry which produces more than there is a demand for. This argument can be extended for products only sold when heavily discounted, although they are not strictly defined as unsold products. An important aspect when assessing the environmental impact of selling these items heavily discounted or donated is the concept of the replacement rate, defined as the degree to which their purchase replaces the purchase of similar new items (Nørup et al., 2019). It can be argued that textiles that are only sold when heavily discounted, either internally or through external outlets, jobbers or through charity shops, do not necessarily replace the purchase of new items but are additional sales. So, instead of avoiding environmental impacts, they add to the environmental impact of clothing consumption.

As mentioned in Chapter 3, a large proportion of unsold products is ultimately exported beyond Europe. The majority ends up in Africa and Asia for reuse or recycling (ETC CE, 2023). In Africa there are, however, indications that a large portion ends up as waste, mostly in landfills or incinerated in the open, releasing toxins directly without filtering (ETC CE, 2023). Although donations of unsold items are not likely those

that necessarily become waste, there is a risk that these donations are flooding an already saturated market for secondhand clothing and that they are not reused but end up as waste.

Although recycling is to be preferred over incineration or landfill, it is still considered destruction. Further, there is evidence that some of the imports are then re-exported to other countries. Consequently, the fate of donations is highly uncertain as and with little reliable data available on whether they are used or just destroyed.

The production process of textiles is often associated with unsafe working environments, long working hours and low pay, child labour and significant health and safety problems (Dzhengiz et al., 2023; Stringer et al., 2021). Destroying these very products not only means that the efforts as well as resources are wasted when these goods could be used by people in need, provided they actually meet those needs. This, however, does not solve the main issue of overproduction and is merely a way of making use of goods that exist.

Producing textiles is associated with a broad range of environmental impacts including high energy and water consumption levels, chemical pollution, soil degradation and a high carbon footprint (Dzhengiz et al., 2023; Niinimäki et al., 2020). As the largest carbon emissions are produced during the production of the textiles, destroying such products means that the emissions and resources are wasted (Niinimäki et al., 2020). Although the incineration of textiles can produce energy, and thereby replace other energy sources, it can be a net carbon emitter when avoided electricity production is accounted for depending on the garments and fibres (Makov et al., 2023), and energy recovery of clothing does not outweigh the energy used to produce the garments in the first place to any extent (Elia, 2019). According to the Ellen MacArthur Foundation (2021), the destruction of unsold goods generates 5–20 times more greenhouse gas (GHG) emissions than reuse – the foundation does not specify type of destruction.

The estimates of the environmental impact of the destruction of unsold products are based on the volume of textiles destroyed multiplied by the environmental impact of producing 1 kg of new textiles.

First, the volume of textiles destroyed is calculated based on the total amount of apparent consumption of textiles products in the EU in 2020 ([8]), 6.6 million tonnes (EEA, 2022), and the total share of destruction of the total volume of online sales and the total volume of products put on the market (stock), which, as shown in Chapter 4, ranges between 4 % and 9 %.

Table 5.1 Volume of textiles destroyed in the EU, 2020, tonnes

	Average	Total volume (tonnes)
Apparent consumption		**6 600 000**
Lowest estimated share of destruction	4 %	264 000
Highest estimated share of destruction	9 %	594 000

Source: ETC CE

Estimates of the climate impact of the destruction of these textiles is calculated based on the GHG emissions from textile production that originate from fibre production, and which varies between 0.5 and 9.5 kg of carbon dioxide equivalent per kilogam of fibre (EEA, 2022). The GHG impacts of the consecutive steps in the production process, i.e., spinning, weaving or knitting, dyeing, confection and finishing, are not included. This means that the calculations highly underestimate the total impact. The emissions are

---

[8]   Apparent consumption = production + import - export

combined with the volumes of textiles destroyed calculated in Table 5.1, giving a matrix which shows the range from lowest volume of textiles destroyed combined with the lowest estimates of GHG emissions, up to the highest volume of textiles destroyed combined with the highest estimates. This gives a significant range of the climate impacts of the destroying unsold textiles. As already mentioned, however, due to the fact that only the GHG emissions that originate from fibre production are used in the calculations, the calculated impacts are an underestimate.

Table 5.2 Greenhouse gas emission estimates for different combinations of volumes of unsold textiles, volumes of unsold textiles destroyed and different levels of emissions, carbon dioxide equivalent, tonnes

GHG emissions (kg CO_2-e/kg textiles)	0.5	9.5
Lowest estimated share of destruction (4 %)	132 000	2 508 000
Highest estimated share of destruction (9 %)	297 000	5 643 000

Source: ETC CE

As previously mentioned, approximately 20 % of the textiles put on the market are not sold at the original price but through a cascade of internal discounting, external outlets, donation to employees or sold to jobbers. It can be argued that these do not meet a real demand. Table 5.3 illustrates the climate impact of these textiles, which is naturally even higher.

Table 5.3 Greenhouse gas emission estimates for volumes of unsold textiles, carbon dioxide equivalent, tonnes

GHG emissions (kg CO2e/kg textiles)	0.5	9.5
GHG emissions from total unsold textiles (20 % of the total volume put on the market)	660 000	12 540 000

Source: ETC CE

6 Addressing the problems from a regulatory, business and consumer perspective

As previously explained, volumes of returns and unsold products can not only be seen as a forecasting challenge and a consequence of the market dynamics in the industry, but also as a symptom of an industry dependent on overproduction. Addressing the problem of destruction of unsold textiles can thus be done on two levels. From the perspective of the problem stemming from a forecasting issue, businesses can increase the efficiency and accuracy of the system and find alternative routes to higher levels of the waste hierarchy ([9]), such as prevention and reuse. Policy and regulatory efforts are, however, needed to address overproduction and the market dynamics causing overproduction and destruction.

---

[9]   The waste management hierarchy is a conceptual framework designed to guide and rank waste management decisions at both the individual and organisational level. It gives top priority to waste prevention, followed by re-use, recycling, recovery and finally disposal.

6.1   Reducing excessive returns and addressing forecasting challenges

6.1.1   Returned textiles

As described in Chapter 2, the reasons for the high quantities of returns can be found within the business dynamic and workings of the fashion industry, which both responds to and enables, the freedom for consumers to change their minds. Hence, a change of business practices could curb this practice.

Many companies are not adequately concerned with their reverse logistics compared to the magnitude of the practice, and returns constitute a cost for the company and planet. The way returns are typically processed often lacks internal visibility and might be too slow to effectively enable the products being resold (Frei et al., 2020). Relatively few retailers have adopted sophisticated strategies to tackle returns (Ader et al., 2021). Effective returns management includes *avoidance* – selling products in a way that minimises returns; *gatekeeping* – screening the return request and the returned product; and *disposition procedures* – what to do with returned products (Frei et al., 2022). Optimising the return strategy is important for companies to reduce (excessive) returns, and it has been suggested that this can done through the adoption of the following strategies (Frei et al., 2020).

Avoidance of returns strategy
Research has shown that companies can take several actions to avoid returns even before the items are sold. Conveying accurate product descriptions and providing size advice are key processes for reducing returns. Including customer reviews reduced the return rate by 49 % in Germany and providing product advice with sizeflags, which bring out recommendations based on the product's return history, reduced shoe returns by 3.8 % in Europe and has the potential to have greater impacts on products with a history of high returns (Buldeo Rai, 2022).

According to a large online European retailer, for items for which they offer size advice, i.e., using size flags and size recommendations, size-related returns have been reduced by 10 % compared to items that did not have size advice. Posting pictures of the products taken by customers can also increase accuracy (Buldeo Rai, 2022).

More sophisticated size advice could be provided by digital fitting technologies, for instance, by customers taking a picture of themselves with their smartphones which creates personalised measurements. This is already something that is seen in the industry with virtual reality (VR), smart gadgets, smart mirrors and various virtual garment-based information technology (IT), allowing consumers to try on garments and evaluate the style and fit virtually (Kuzmichev and Yan, 2022). There are several companies offering such technology, including Griddynamics (AI Body Measurement Application with Computer Vision, 2022) and Nettelo (Nettelo - 3D Body Scan and Analysis Mobile Application, 2021), although it has not yet become mainstream amongst brands.

From the consumers' side, a way to reduce returns would be to encourage their use of size charts when provided and being more selective about what to order. A large consumer study from Denmark found that an effective way to avoid regretting the purchase of a garment was to be aware of one's *favourite pieces*. Knowing which garments, styles, and colours are a customer's go-to in their wardrobe, reduces impulse purchases that are either returned or never used (Forbrugerrådet TÆNK, 2022). Trends such as snap-and-send-back, when customers buy garments simply to photograph themselves in for social media before returning them, should also be discouraged (Owen, 2022).

Gatekeeping returns strategy
Gatekeeping returns, meaning limiting returns through initiatives at the point of return, can also reduce them. This includes raising awareness about the economic and environmental costs associated with returns and not providing free returns on purchases made online (Frei et al., 2020). Although EU rules provide the consumer with the right to cancel and return the order within 14 days, for any reason and

without a justification for a product or a service purchased online, by telephone, mail order or from a door-to-door salesperson (EU, 2011), they also state that the seller can charge for the return and/or not cover the shipping cost of the return, as long as this is clearly stated at the time of purchase (EU, 2023b). Additionally, as was described in Chapter 2, the complete return process can take weeks to complete. Offering (free) returns up to 30, 50 or even more days after purchase has a significant impact on resale potential (Roland Berger et al., 2023; Frei et al., 2022; Ader et al., 2021). Limiting the return period can, therefore, have a positive impact on the probability of reselling it.

Gatekeeping could also include a more stringent review of returned products, as many items are returned broken or dirty (Owen, 2022). If the brand does not have sophisticated return-management systems in place, these clothes are easily accepted and refunded before the issues are discovered. A lack of systems for cleaning and repairing hinder these items being returned to stock.

Disposition procedures

Despite the above arguments, returns are not fundamentally the issue. Allowing for returns is important to ensure that customers only buy what is necessary, fits and will be used, and to allow the garment to be sold to someone else. In fact, several circular business models are based on frequent customer returns, such as rentals and leasing (Köhler et al., 2021), which are types of product-service systems (PSS), a sub-category of circular business models (ETC WMGE, 2021). For both circular and linear business models, disposition procedures, what is done with the returned product, are important to ensure that a product can be offered for sale again. This includes repackaging, cleaning, and repair. Returned items, for instance, might be stained and in need of thorough cleaning, or have buttons missing or be ripped and be in need of repair (Owen, 2022). Dealing with this, is a large and complex operation but it is needed to ensure that the returns can be resold. This also highlights to the role of consumers needing to take better care of clothes when trying them on at home.

6.1.2   Unsold textiles

The volume of overstocks and obsolete products could be reduced within the scope of the current system by increasing the accuracy of forecasting and improved *inventory management* – the process of ordering, storing, using, and selling a company's raw materials, components, and finished goods (Investopedia, 2023a). This can be done through digitalisation, sales channel variation and local production.

Digitalisation

The widespread use of social media and networks enables trends to move ever faster, complicating forecasting (Tanaka et al., 2019). Digitalisation can be used to optimise both forecasting and logistics, ensuring a better match between supply and demand, and making sure the right products are available in the right place and the right time.

As a response to the Covid-19 pandemic, many companies strengthened their online presence in the relationship with their value chain. In Finland, for example, 35 % of the small fashion companies reorganised their production processes to become more digital, using digital systems for manufacturing and more precise ordering, thereby having fewer unsold goods (Haukkala et al., 2023). Digitalisation can also be used to gather information more efficiently about customers and their preferences, prior to product ordering (Elia, 2019). The use of artificial intelligence (AI) to analyse fashion trends can further help match supply with demand, such as through image recognition where pictures on social media are analysed to identify trends (Elia, 2019) and big-data analysis using machine learning to improve forecasting in terms of quantities (Tanaka et al., 2019).

Online sales also enable business models such as made-to-order or mass customisation, a business production strategy that allows consumers to purchase products that are customised to their specifications. This model aims to ensure that only what is really wanted is manufactured, as the production of an item begins only after a confirmed customer order is received (Hayes, 2020).

However, the impact of *sustainable fashion design strategies,* such as product personalisation to reduce the volume of production, are only effective if they replace the production of other garments. Maldini et al. (2019) question the environmental impact of such strategies, as, when compared with ready-made garments, they found that personalised garments were neither kept for longer nor used more frequently than ready-made garments. Moreover, no evidence of their contribution to reductions in new product demand and waste was found (Maldini et al., 2019). As these items are personalised, they cannot be restocked and might have a less viable secondhand market.

Lastly, with the increase in online sales, fewer items need to be transported to different local stores around Europe, meaning that the diverse portfolio can be accessible to the total market simultaneously, decreasing the risk of a mismatch between supply and demand in physical stores.

Sales channel variation

After increased digitalisation in recent years, more and more fashion companies have several channels, including online and physical stores, potentially covering larger geographical areas. There are often differences in trends and styles in different places of which the brand should be aware to ensure optimised matchmaking. A brand can reduce the volume of unsold product by moving unsold items to a different location within the sales period if demand there is greater (Logiwa, 2023). Algorithms can also support the distribution process. The calculations support the most optimal distribution to increase the probability of (re)selling the corresponding items. Within such a system, the sales numbers of the past few weeks are taken into account for the respective item and, in a second step, combined with the stock numbers of this item in the logistics centres. As a result, the location with the highest (re)sale probability for an item can be chosen ([10]).

Local production

Production closer to the consumers can also help to ease the challenges of forecasting and overproduction by reducing the steps and actors between demand and production, and consequently make the production chain more flexible and responsive. During the Covid-19 pandemic, for instance, many Finnish companies localised production to reduce the length and complexity of their value chains, keep inventory low and only produce products with strong local sales potential. The latter was enabled by tight customer relationships, as the companies knew their clients' preferences (Haukkala et al., 2023). The tendency to find manufacturing locations closer to end markets is increasing globally (Haukkala et al., 2023). To be more flexible in the face of changing demand, the companies could benefit from owning their own production facilities and thereby communicate changes in demand upstream more easily and more rapidly. Owning the production could also make it easier to digitalise to further optimise the production to meet the correct demand (Elia, 2019).

6.2 Addressing the underlying systemic reasons

Reducing excessive returns and optimising forecasting could reduce the volumes of unsold goods, but does not effectively tackle the underlying systemic reason, namely that overproduction and destruction is deemed acceptable in the fashion industry and even makes economic sense. This could be tackled both through the introduction of new business models and policy measures.

Circular business models

Circular business models seek to decouple revenue from raw material use and product sales (EEA, 2022; ETC WMGE, 2021) and thus have the potential to reduce material use and overproduction. The EEA distinguishes between four types of circular business models, differentiated by how they contribute to a circular system, through 1) longevity and durability in products; 2) optimised product use; 3) collection

---

[10]   Information received from a large European online retailer

and reuse; and 4) recycling and material reuse (EEA, 2022), and has developed an EEA framework for circular business models identifying the role of innovation and enablers (ETC WMGE, 2021). An emerging trend in circular business models focusing on optimised product use is rental and sharing services, which aim to reduce overconsumption as consumers do not own products but purchase access to them, as well as services such as cleaning and repair services that extend the lifetime of the garments (EEA, 2022).

Only very limited research has been found that investigates the impact of rental and leasing on overstock and returns. An empirical case study of an everyday fashion-rental company, however, suggests that rental businesses have reduced stock requirements compared to traditional retail since every piece can be worn by multiple consumers, and overstock is thus less of an issue (Bodenheimer et al., 2022). This suggests that such models could significantly reduce the initial production of new products, thereby potentially considerably reduce the destruction of unsold textiles. Thus, rental and leasing services do not change consumers' practice of renewing their wardrobes but take advantage of this behaviour without the use of new materials and overstocking.

On the other hand, circular business models might not provide the full solution. Gyde and McNeill (2021) and Yin et al. (2019) found that customers take less care of rented items while still demanding a higher standard in what they rent – a standard, the companies studied cannot always meet. Another study also found that to provide customers with a wide selection of garments, the company it looked at had to overstock about 20 % at all times and that even if garments, such as winter clothes, could be in high seasonal demand, they would take up space in the inventory most of the year without creating revenue (Bodenheimer et al., 2022). This suggests that even though the stock in PSS businesses in real numbers may be significantly lower than in traditional retail, PSS could still face the same dilemma of overstock due to customer demand for wide selections. Further, the rental might not effectively avoid new product sales. Furthermore, due to additional operational requirements, such as shipping and cleaning, accessing garments through rental or sharing might not inherently have a lower environmental impact (Meshulam et al., 2023).

6.3   Policy options for reducing returns and overproduction

Although companies and consumers can contribute to reducing the volume of unsold textiles, it is difficult for single actors to have an impact on the whole system. According to Elia (2019), due to the market logic that is prevalent in the industry overall, most fashion companies require greater incentives than an appeal to act more responsibly to change their practices, such as pressure from governments or regulations. This can be a result of the brands neither wanting nor being able to counter the market logic that is prevalent in the industry overall. The established players in the industry are trying to combine the logic of market and sustainability in search of *eco-efficiency*, which means they try to "*either reduce resource use to produce the same output or produce more clothes with a given volume of resources as input*" (Dzhengiz et al., 2023). This approach, however, does not solve the intrinsic causes of unsold and returned stock – overproduction, fast-changing trends and a mismatch between demand and supply. To achieve an actual shift away from the large quantities of customer returns and unsold goods, both hard and soft policy interventions are needed. Hard policy instruments, such as laws and taxes, restrict choices and alter financial incentives, whereas soft policies typically include moral persuasion and educational campaigns, and more recently behavioural public policy approaches like nudges (Banerjee et al., 2021). Overarchingly, policy interventions could aim to increase the cost of production so that overproduction becomes a financial liability for brands and thus more in their interest to avoid and incentivise re-distribution.

This report focuses on a selection of policy options found in literature that address the destruction of returned and unsold products, and not how policy can impact the fashion industry towards a reduction in production volumes.

Some experts believe that forcing companies to publicly disclose the amount of unsold goods and returns will draw attention to the scale of the problem and indirectly force them to reduce their amounts due to

the danger of gaining an unwanted negative branding image (Roberts et al., 2023). In a Norwegian investigation into the volume of unsold goods, two large companies refused to disclose their volumes of unsold goods, arguing that this was a business secret. The Norwegian Consumer Council and the environmental non-governmental organisation (NGO) Fremtiden i Våre Hender (*The future in our hands),* chose to submit a formal complaint to Klagenemda for miljøinnformasjon, the Norwegian institution for complaints regarding disclosure of information related to the environment (Samfunnsøkonomisk analyse AS, 2022), on the basis of the law regarding businesses' duty to share information with significance to the environment (Lov om rett til miljøinformasjon og deltakelse i offentlige beslutningsprosesser av betydning for miljøet, 2004). This created negative media attention, potentially putting pressure on the brands to act. The case is unresolved at the time of writing.

The introduction of an extended producer responsibility (EPR) system for textiles could also enforce and enable moving unsold textiles up the waste hierarchy. The main purpose of an EPR scheme is to transfer the responsibility for waste management, i.e., collection and treatment, to the actors who put the products on the market. An interesting aspect of this, however, is how adequate collection and treatment are defined. A study in Denmark made calculations on the fees necessary to cover a traditional waste management system. As expected, waste collection followed by incineration is rather cheap, estimated to cost around DKK 456 or EUR 61 per tonne. Separate collection, detailed sorting, preparation for reuse, reuse, and recycling would be significantly more expensive, amounting to DKK 3 000 or EUR 403 per tonne (Miljøstyrelsen, 2023). Including these measures when calculating the fee in an EPR system would potentially increase it to a level which would result in textiles being noticeable more expensive, and thus could contribute to tackling the underlying cause of unsold textiles and the destruction of these being cheap. It would further contribute to a more efficient and developed value chain for reuse and recycling.

The German government introduced the German Due Diligence Act (*Obhutspflicht*) (BMUV, 2020) in 2020, constituting a new form of product responsibility. It focuses on returned goods from online purchases as a critical contributor to waste generation and refers to all consumer goods, and their entire distribution processes, including transport and storage. Reducing the destruction of unsold goods in the textile industry is a priority (Bundesumweltministeriums, 2022). Although the *Obhutspflicht* has been in effect since 2020, it has not yet been fully implemented due to a lack of necessary regulations through which the German government can determine who is responsible, which products are affected and what exactly must be done to comply with the law. Enforceable obligations only arise once they have been specified, but the BMUV believes that the new legislation has already influenced stakeholder decisions. Currently, the BMUV is examining how transparency can be created on the extent and reasons for the destruction of goods, in dialogue with trade associations, online retailers, third-party recyclers and other stakeholders (BMUV, 2020). Once these transparency measures have been implemented, the volumes of textile waste in Germany can be estimated.

Tax policy can incentivise reuse rather than destruction. As private companies base their decisions on profit maximisation, tax breaks or negative-impact taxes could help boost the competitiveness of products that conform to the principles of a circular economy (Hartley et al., 2020). Brands have stated that because donations do not attract VAT deductions, destruction, which does, becomes the cheaper option. In Belgium, the government has chosen to reduce VAT on donated non-food products to make it cheaper for companies to donate their unwanted goods to charity (Moniteur Belge, 2019). Additionally, the German government stated in its 2021 coalition agreement that it want to reduce the destruction of returned goods and committed to removing existing tax hurdles that prevent companies from donating unsold goods to NGOs (Bundesregierung, 2021). This has been followed by a joint communication from the German Ministry of Finance (BMF), together with the tax administrations of the federal states, to regulate in which cases companies are exempt from VAT for the donation of goods (Bundesfinanzministerium, 2021).

The European Commission reformed the EU VAT system in 2021, allowing Member States to implement lower VAT rates for environmentally friendly products and services. Although this also means Member

States can fully remove VAT on charitable donations, it is still up to Member States to decide (Fitzgerald, 2023). According to EU Commissioner Gentiloni, donations given free of charge are in principle outside the scope of VAT, however, retailers making donations can no longer claim back VAT on purchases of products that were later donated, "*as this would contravene the principle of tax neutrality and open the door for unlimited tax avoidance possibilities as well as tax fraud*" (European Parliament, 2023a). So far, a change of VAT rules is not included in the proposed ESPR framework (Roberts et al., 2023). Value-added tax exemption on donations could also lead to charities being unable to absorb the volumes of donated goods, which could lead to the increased export of donations and, in any case, they would not prohibit the destruction of unsold goods (Roberts et al., 2023).

Lastly, an absolute ban on the destruction is a direct way to end the practice. Currently, France and Germany are the only countries to ban the destruction of unsold goods. In 2020, France adopted *The law on the fight against waste and for the circular economy* (Loi relative à la lutte contre le gaspillage et à l'économie circulaire (AGEC)), which introduced a ban on the destruction of products subject to EPR schemes in 2021 and by the end of 2023 all other products. The ban aims to encourage companies to reconsider their stock management and production (Ellen MacArthur Foundation, 2021). As the French ban is relatively new, no evaluation has yet been done, though some preliminary research indicates that the ban is ineffective due to limited reporting obligations making enforcement and transparency difficult (Roberts et al., 2023). Furthermore, some researchers criticise the ban for equating reuse and recycling as well as making destruction legal if no recycling solution exists. The ban is also criticised for not including returns making their destruction still possible (Roberts et al., 2023).

On 5 December 2023, the Council and the European Parliament reached a provisional political agreement on the proposed regulation establishing a framework for setting eco-design requirements for sustainable products (ESPR). The new Regulation replaces the existing 2009 Ecodesign Directive and enlarges the scope beyond energy-related products to considerably enhance circularity, energy efficiency, resource effectiveness, and other environmental sustainability aspects for particular product categories placed in the EU market. Article 20 of the proposed ESPR, establishes a general obligation of transparency for economic operators who discard unsold consumer products, including disclosing information on the number of unsold consumer products discarded per year. The same article also opens to the possibility to adopt specific action to prohibit the destruction of specific groups of unsold consumer products. The provisions regarding destruction are currently under consideration for several proposed amendments in the co-legislative process. Notably, co-legislators are advocating for a direct prohibition on the destruction of unsold textile products. Small and micro companies would be exempted of this ban, while medium size companies would benefit of a 6-year exemption. This ban would be applicable two years after the entry into force of the Regulation (Council of the European Union, 2023).

Table 6.1 gives an overview of options for policy measures to avoid the destruction of unsold textiles.

Table 6.1 Overview of options for policy measures to avoid destruction of unsold textiles

Targeted actor	Manufacturer	Retailers	Consumers	Re-use/recycling actors
Policy instrument	• Reduced VAT on donations. • Tax rebate on products redistributed, recovered, or reused. • Minimum product standards; durability, repairability.	• Require public disclosure of returns and unsold products, as well as destruction. • Levy on unsold and returned volumes. • Reduced VAT on products donated to charity. • Tax rebate on products redistributed, recovered or reused. • Reduced taxation on labour involved in circular activities; reuse/repair. • Mandatory reporting on disposition routes. • Ban on destruction of unsold textiles.	• Economic incentives to buy secondhand or repaired goods. • Education on true cost of returns, benefits of reuse. • Incentives to limit excessive returns.	• Subsidies/government support to develop reuse infrastructure and capacity. • Tax rebates on volumes recovered and reused. • Tax reductions on labour involved in circular activities such as repair and reuse.

Source: Adapted from Roberts et al. (2023)

7 References

ADEME, 2021, *Etude des gisements et des causes des invendus non alimentaires et de leurs voies d'écoulement* (https://librairie.ademe.fr/dechets-economie-circulaire/5035-etude-des-gisements-et-des-causes-des-invendus-non-alimentaires-et-de-leurs-voies-d-ecoulement.html) accessed 12 May 2023.

Ader, J., et al., 2021, *Returning to order: Improving returns management for apparel companies*, McKinsey & Company (https://www.mckinsey.com/industries/retail/our-insights/returning-to-order-improving-returns-management-for-apparel-companies#/) accessed 8 March 2023.

Asdecker, B., et al., 2021, 'Retourenmanagement als Erfolgsfaktor des Handels', in: Schallmo, D. R. A. et al. (eds), *Digitale Transformation von Geschäftsmodellen: Grundlagen, Instrumente und Best Practices*, Schwerpunkt Business Model Innovation, Springer Fachmedien, Wiesbaden, pp. 605-622.

Asdecker, B., et al., 2022, *European Return-o-Meter - Results Part 1: Germany vs. Remaining EU*, University of Bamberg (http://www.retourenforschung.de/info-results-of-the-european-return-o-meter-published.html) accessed 9 March 2023.

Banerjee, S., et al., 2021, 'Public support for "soft" versus "hard" public policies: Review of the evidence', *Journal of Behavioral Public Administration* 4 (DOI: 10.30636/jbpa.42.220).

Berner, B., 2021, 'Warum unverkaufte Textilien oft einfach weggeworfen werden', tagesschau.de (https://www.tagesschau.de/wirtschaft/unternehmen/textilien-wegwerfen-101.html) accessed 28 February 2024.

Bernon, M., et al., 2018, 'Aligning retail reverse logistics practice with circular economy values: an exploratory framework', *Production Planning & Control* 29(6), pp. 483-497 (DOI: 10.1080/09537287.2018.1449266).

BMUV, 2020, Die Obhutspflicht im Kreislaufwirtschaftsgesetz.

Bodenheimer, M., et al., 2022, 'Drivers and barriers to fashion rental for everyday garments: an empirical analysis of a former fashion-rental company', *Sustainability: Science, Practice and Policy* 18(1), pp. 344-356 (DOI: 10.1080/15487733.2022.2065774).

Buldeo Rai, H., 2022, *Return to sender? Technological applications to mitigate e-commerce returns*.

Bundesfinanzministerium, 2021, Umsatzsteuer; Umsatzsteuerrechtliche Beurteilung von Sachspenden; Bemessungsgrundlage bei Sachspenden.

Bundesregierung, 2021, BÜNDNIS FÜR FREIHEIT, GERECHTIGKEIT UND NACHHALTIGKEIT.

Bundesumweltministeriums, 2022, 'Mode und Textilien', Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz (https://www.bmuv.de/WS5264) accessed 1 September 2023.

Bundesumweltministeriums, n.d., 'Warenvernichtung', Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz (https://www.bmuv.de/FQ222) accessed 15 June 2023.

Council of the European Union, 2023, 'Products fit for the green transition: Council and Parliament conclude a provisional agreement on the Ecodesign regulation' (https://www.consilium.europa.eu/en/press/press-releases/2023/12/05/products-fit-for-the-green-transition-council-and-parliament-conclude-a-provisional-agreement-on-the-ecodesign-regulation/) accessed 31 January 2024.

Deutsche Welle, 2020, 'Returned, as-new goods end up as trash – DW – 02/07/2020', dw.com (https://www.dw.com/en/destroy-packages-online-shopping/a-52281567) accessed 9 June 2023.

Dowideit, A., 2019, 'Bekleidung: Hunderte Millionen Textilien fabrikneu vernichtet', *DIE WELT*, 10 November 2019 (https://www.welt.de/wirtschaft/article203216646/Bekleidung-Hunderte-Millionen-Textilien-fabrikneu-vernichtet.html) accessed 15 June 2023.

DPD Group, 2022, *E-shopper barometer 2022*, DPD Group.

Dzhengiz, T., et al., 2023, '(Un)Sustainable transitions towards fast and ultra-fast fashion', *Fashion and Textiles* 10(1), p. 19 (DOI: 10.1186/s40691-023-00337-9).

EC, 2019, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS The European Green Deal.

EC, 2020, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Circular Economy Action Plan For a cleaner and more competitive Europe.

EC, 2022, Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC, (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A0142%3AFIN) accessed 25 October 2023.

Eco-Business, 2023, 'Explainer: Why fast fashion brands destroy unsold clothes', Eco-Business (https://www.eco-business.com/news/explainer-why-fast-fashion-brands-destroy-unsold-clothes/) accessed 1 September 2023.

Ecommerce News, 'Online returns in Europe', Ecommerce News (https://ecommercenews.eu/online-returns-in-europe/) accessed 14 June 2023.

EEA, 2022, *Textiles and the environment: the role of design in Europe's circular economy*, Briefing (https://www.eea.europa.eu/publications/textiles-and-the-environment-the/textiles-and-the-environment-the) accessed 9 May 2023.

El Kihal, S., et al., 2021, 'A Comparison of Return Rate Calculation Methods: Evidence from 16 Retailers', *Journal of Retailing* 97(4), pp. 676-696 (DOI: 10.1016/j.jretai.2021.04.001).

Elia, A., 2019, 'Fashion's Destruction of Unsold Goods: Responsible Solutions for an Environmentally Conscious Future', *Fordham Intellectual Property, Media & Entertainment Law Journal* 30, p. 539.

Ellen MacArthur Foundation, 2021, 'France's Anti-waste and Circular Economy Law' (https://ellenmacarthurfoundation.org/circular-examples/frances-anti-waste-and-circular-economy-law) accessed 12 June 2023.

EMERGE, 2019, '6 Best Practices for Fashion Inventory Management - EMERGE App', Best Inventory Management Software for Small Businesses - EMERGE App (https://emergeapp.net/inventory-reports/fashion-inventory-management/) accessed 12 June 2023.

ETC CE, 2022, *Textiles and the Environment - The role of design in Europe's circular economy* (https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-products/etc-ce-report-2-2022-textiles-and-the-environment-the-role-of-design-in-europes-circular-economy/@@download/file/ETC_design%20of%20textiles.pdf) accessed 5 September 2023.

ETC CE, 2023, *EU exports of used textiles in Europe's circular economy*, Eionet Report ETC/CE No 2023/4, European Topic Centre Circular Economy and Resource Use (https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-report-2023-4-eu-exports-of-used-textiles-in-europe2019s-circular-economy) accessed 12 April 2023.

ETC WMGE, 2021, *Business Models in a Circular Economy*, ETC/WMGE (https://www.eionet.europa.eu/etcs/etc-wmge/products/etc-wmge-reports/business-models-in-a-circular-economy) accessed 30 October 2023.

EU, 2011, Consolidated text: Directive 2011/83/EU of the European Parliament and of the Council of 25 October 2011 on consumer rights, amending Council Directive 93/13/EEC and Directive 1999/44/EC of the European Parliament and of the Council and repealing Council Directive 85/577/EEC and Directive 97/7/EC of the European Parliament and of the Council (Text with EEA relevance)Text with EEA relevance.

EU, 2023a, 'Guarantees, cancelling and returning your purchases', Your Europe (https://europa.eu/youreurope/citizens/consumers/shopping/guarantees-returns/index_en.htm) accessed 10 May 2023.

EU, 2023b, 'Guarantees, cancelling and returning your purchases', Your Europe (https://europa.eu/youreurope/citizens/consumers/shopping/guarantees-returns/index_en.htm) accessed 30 October 2023.

EURATEX, 2023a, Additional information provided to the draft ETC/CE report on 'volumes and destruction of returned and unsold textiles in Europe'.

EURATEX, 2023b, *Facts & Key Figures 2022 of the European Textile and Clothing Industry*, The European Apparel and Textile Confederation.

European Commission, 2022, EU strategy for sustainable and circular textiles (COM(2022) 141 final).

European Council, 2023, 'Ecodesign regulation: Council adopts position' (https://www.consilium.europa.eu/en/press/press-releases/2023/05/22/ecodesign-regulation-council-adopts-position/) accessed 12 September 2023.

European Parliament, 2023a, 'Parliamentary question | Answer for question E-001740/23 | E-001740/2023(ASW) | European Parliament' (https://www.europarl.europa.eu/doceo/document/E-9-2023-001740-ASW_EN.html) accessed 12 September 2023.

European Parliament, 2023b, 'Texts adopted - Ecodesign Regulation - Wednesday, 12 July 2023' (https://www.europarl.europa.eu/doceo/document/TA-9-2023-0272_EN.html) accessed 24 October 2023.

Eurostat, 2023a, 'E-commerce continues to grow in the EU - Products Eurostat News - Eurostat' (https://ec.europa.eu/eurostat/web/products-eurostat-news/w/DDN-20230228-2) accessed 11 May 2023.

Eurostat, 2023b, 'Final consumption expenditure of households by consumption purpose' (https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_CO3_P3__custom_6483685/default/table?lang=en) accessed 8 June 2023.

Eurostat, 2023c, 'Internet purchases - goods or services (2020 onwards)' (https://ec.europa.eu/eurostat/databrowser/view/ISOC_EC_IBGS__custom_6164488/default/table?lang=en) accessed 11 May 2023.

Fashion Revolution, 2022, *Fashion Transparency Index 2022* (https://issuu.com/fashionrevolution/docs/fti_2022) accessed 15 June 2023.

FashionUnited, 2017, 'H&M accused of burning 12 tonnes of new, unsold clothing per year', FashionUnited (https://fashionunited.uk/news/fashion/h-m-accused-of-burning-12-tonnes-of-new-unsold-clothing-per-year/2017101726341) accessed 9 June 2023.

Fitzgerald, F., 2023, 'Parliamentary question | Removing VAT from donations | E-001740/2023 | European Parliament' (https://www.europarl.europa.eu/doceo/document/E-9-2023-001740_EN.html) accessed 9 June 2023.

Forbrugerrådet TÆNK, 2022, *Vejen til et tøjforbrug med mindre miljø- og klimaaftryk*.

Frei, R., et al., 2020, 'Sustainable reverse supply chains and circular economy in multichannel retail returns', *Business Strategy and the Environment* 29(5), pp. 1925-1940 (DOI: 10.1002/bse.2479).

Frei, R., et al., 2022, 'Mapping Product Returns Processes in Multichannel Retailing: Challenges and Opportunities', *Sustainability* 14(3), p. 1382 (DOI: 10.3390/su14031382).

Galaxus, 2023, 'Details on the warranty score and return rate' (https://www.galaxus.de/en/wiki/6174) accessed 14 June 2023.

Graat, M., 2018, 'All You Need to Know About e-Commerce Returns in Europe', Logistics Matter (https://logisticsmatter.com/need-know-e-commerce-returns-europe/) accessed 14 June 2023.

Grant, A. M. and Schwartz, B., 2011, 'Too Much of a Good Thing: The Challenge and Opportunity of the Inverted U', *Perspectives on Psychological Science* 6(1), pp. 61-76 (DOI: 10.1177/1745691610393523).

Gustafsson, E., et al., 2021, 'Reducing retail supply chain costs of product returns using digital product fitting', *International Journal of Physical Distribution & Logistics Management* 51(8), pp. 877-896 (DOI: 10.1108/IJPDLM-10-2020-0334).

Gyde, C. and McNeill, L. S., 2021, 'Fashion Rental: Smart Business or Ethical Folly?', *Sustainability* 13(16), p. 8888 (DOI: 10.3390/su13168888).

Hartley, K., et al., 2020, 'Policies for transitioning towards a circular economy: Expectations from the European Union (EU)', *Resources, Conservation and Recycling* 155, p. 104634 (DOI: 10.1016/j.resconrec.2019.104634).

Haukkala, T., et al., 2023, 'Fashion in turmoil: impact of the COVID-19 pandemic on Finland's textile and fashion industry', *Sustainability: Science, Practice and Policy* 19(1), p. 2173424 (DOI: 10.1080/15487733.2023.2173424).

Hayes, A., 2020, 'Make to Order (MTO) or Made to Order: Definition and Example', Investopedia (https://www.investopedia.com/terms/m/make-to-order.asp) accessed 12 September 2023.

Investopedia, 2023a, 'Inventory Management Defined, Plus Methods and Techniques', Investopedia (https://www.investopedia.com/terms/i/inventory-management.asp) accessed 12 June 2023.

Investopedia, 2023b, 'Understanding Economies of Scope vs. Economies of Scale', Investopedia (https://www.investopedia.com/ask/answers/042215/what-difference-between-economies-scope-and-economies-scale.asp) accessed 22 August 2023.

Karl, D. and Asdecker, B., 2021, *How Does the Covid-19 Pandemic Affect Consumer Returns: An Exploratory Study*, University of Bamberg (http://proceedings.emac-online.org/pdfs/A2021-94689.pdf) accessed 12 May 2023.

Kedia, S., et al., 2019, *Early Bird Catches the Worm: Predicting Returns Even Before Purchase in Fashion E-commerce*.

KMLZ, 2021, 'VAT also on discarded goods?' (https://www.kmlz.de/sites/default/files/VAT%20Newsletter%2010_2021.pdf) accessed 31 August 2023.

Köhler, A., et al., 2021, 'Circular Economy Perspectives in the EU Textile sector', *JRC Research Reports*.

Kuzmichev, V. and Yan, J., 2022, 'The Application of Digital Twins in the Field of Fashion', in: Lv, Z. and Fersman, E. (eds), *Digital Twins: Basics and Applications*, Springer International Publishing, Cham, pp. 45-57.

Laitala, K. and Klepp, I. G., 2015, *Age and active life of clothing* (https://vbn.aau.dk/ws/portalfiles/portal/242237356/PLATE_2015_proceedings.pdf#page=191).

Logiwa, 2023, 'The Retailer's Guide to Apparel Inventory Management', Logiwa Marketing (https://www.logiwa.com/blog/clothing-inventory-management) accessed 12 June 2023.

Makov, T., et al., 2023, *The hidden costs on consumer product returns* (https://www.researchsquare.com/article/rs-3355404/v1).

Makov, T., Why should we care about returns, (https://www.tamarmakov.com/podcast/episode/2269cd25/why-should-we-care-about-returns) accessed 14 June 2023.

Maldini, I., et al., 2017, *Measuring the Dutch Clothing Mountain*.

Maldini, I., et al., 2019, 'Assessing the impact of design strategies on clothing lifetimes, usage and volumes: The case of product personalisation', *Journal of Cleaner Production* 210, pp. 1414-1424 (DOI: 10.1016/j.jclepro.2018.11.056).

Meshulam, T., et al., 2023, 'The sharing economy is not always greener: A Review and consolidation of empirical evidence', in: *PROCEEDINGS 5th PLATE Conference*, Aalto University.

Miljøstyrelsen, 2023, *Økonomiske og miljømæssige konsekvenser ved at indføre et udvidet producentansvar for tekstilproducenter*.

Moniteur Belge, 2019, Loi modifiant le Code de la taxe sur la valeur ajoutée en vue d'exempter de la T.V.A. les dons de biens non alimentaires aux plus démunis.

Napier, E. and Sanguineti, F., 2018, 'Fashion Merchandisers' Slash and Burn Dilemma: A Consequence of Over Production and Excessive Waste?', *Rutgers Business Review* 3(2), pp. 159-174.

Nast, C., 2021, 'Why destroying products is still an "Everest of a problem" for fashion', Vogue Business (https://www.voguebusiness.com/sustainability/why-destroying-products-is-still-an-everest-of-a-problem-for-fashion) accessed 1 September 2023.

Nestler, A., et al., 2021, 'SizeFlags: Reducing Size and Fit Related Returns in Fashion E-Commerce', Proceedings of the 27th ACM SIGKDD Conference on Knowledge Discovery & Data Mining, New York, NY, USA, 14 August 2021.

Nichols-Lee, D., 2020, 'Nine change makers in the Netherlands making fashion more sustainable', *DutchNews.nl*, 8 June 2020 (https://www.dutchnews.nl/2020/06/nine-change-makers-in-the-netherlands-making-fashion-more-sustainable/) accessed 15 June 2023.

Niinimäki, K., et al., 2020, 'The environmental price of fast fashion', 1(4), pp. 189-200 (DOI: 10.1038/s43017-020-0039-9).

Niu, B., et al., 2018, 'Does buy-back induce more fashion sub-sourcing? Contract property and performance analysis', *Transportation Research Part E: Logistics and Transportation Review* 113, pp. 22-37 (DOI: 10.1016/j.tre.2018.02.010).

Nørup, N., et al., 2019, 'Replacement rates for second-hand clothing and household textiles – A survey study from Malawi, Mozambique and Angola', *Journal of Cleaner Production* 235, pp. 1026-1036 (DOI: 10.1016/j.jclepro.2019.06.177).

Owen, L., 2022, 'What really happens to your internet shopping returns?', ACS Clothing (https://www.acsclothing.co.uk/what-happens-to-your-internet-shopping-returns/) accessed 31 August 2023.

Postnord, 2022, *E-Barometer Q2 2022* (https://www.postnord.se/siteassets/pdf/rapporter/e-barometern-q2-report-2022.pdf).

Preuss, S., 2019, 'BTE: „Kaum Warenvernichtung im Modefachhandel"', FashionUnited (https://fashionunited.de/nachrichten/business/bte-kaum-warenvernichtung-im-modefachhandel/2019112633792) accessed 15 June 2023.

ReBound Returns, 2023, 'Home | ReBound', ReBound Returns (https://www.reboundreturns.com/) accessed 15 June 2023.

Rebound Returns, 2023, Interview with sustainability & projects manager.

Roberts, H., et al., 2023, 'Product destruction: Exploring unsustainable production-consumption systems and appropriate policy responses', *Sustainable Production and Consumption* 35, pp. 300-312 (DOI: 10.1016/j.spc.2022.11.009).

Rödig, L., et al., 2021, *Prohibiting-the-destruction-of-unsold-goods-Policy-brief-2021.pdf*, European Environmental Bureau (https://eeb.org/wp-content/uploads/2021/10/Prohibiting-the-destruction-of-unsold-goods-Policy-brief-2021.pdf) accessed 6 February 2023.

Roland Berger, et al., 2023, *Solving fashion's product returns*, The British Fashion Council's Institute of Positive Fashion (https://instituteofpositivefashion.com/uploads/files/1/Report---Solving-fashion's-product-returns-March-2023.pdf) accessed 20 April 2023.

Samfunnsøkonomisk analyse AS, 2022, *Overskudd av klær fra klesbransjen i Norge*, Samfunnsøkonomisk analyse AS.

Schenkman, L., 2023, 'An unglamorous solution to fashion's sustainability problem: make less stuff', Fashion Dive (https://www.fashiondive.com/news/fashion-sustainability-problem-too-much-clothes-and-destroying-unsold-goods/647748/) accessed 15 June 2023.

Singh, P. K., et al., 2019, 'Fashion Retail: Forecasting Demand for New Items', arXiv (http://arxiv.org/abs/1907.01960) accessed 13 June 2023.

Statista, 2021, 'Europe: leading product returners online 2021', Statista (https://www.statista.com/statistics/1257082/average-return-rates-among-digital-shoppers-in-europe/) accessed 4 May 2023.

Stringer, T., et al., 2021, 'As cheap as humanly possible: why consumers care less about worker welfare', *Journal of Fashion Marketing and Management: An International Journal* 26(4), pp. 717-737 (DOI: 10.1108/JFMM-06-2021-0158).

Tanaka, R., et al., 2019, 'Determination of Shipping Timing in Logistics Warehouse Considering Shortage and Disposal in Textile Industry', *Procedia Manufacturing* 39, pp. 1567-1576 (DOI: 10.1016/j.promfg.2020.01.285).

Watson, D., et al., 2020, *Kartlegging av brukte tekstiler og tekstilavfall i Norge*, Planmiljø.

Whittaker-Wood, F., 2019, 'What Country Has the Highest Online Shopping Return Rate?', PaymentsJournal (https://www.paymentsjournal.com/highest-online-shopping-return-rate/) accessed 14 June 2023.

WHY5 Research, 2021, *Belgian online sustainability barometer 2021* (https://www.safeshops.be/app/uploads/2021/10/SAFE-21054_Safeshops-sustainability_report-25102021_compressed.pdf).

Wijnia, G., 2016, *Mapping obsolete inventory in the Dutch apparel industry - A qualitative and quantitative analysis of discounted and unsold volumes in apparel*, Wageningen University.

Yin, J., et al., 2019, 'From value co-creation to value co-destruction? The case of dockless bike sharing in China', *Transportation Research Part D: Transport and Environment* 71, pp. 169-185 (DOI: 10.1016/j.trd.2018.12.004).

Zazzara, L., et al., 2020, *Burberry Burning Backlash*.

Zomer, G. R. and van Kempen, E. A., 2019, *Get rid of returns. Analyse van retouren van online aankopen in fashion en schoenen en verkenning van oplossingsrichtingen*, TNO en Topsector Logistiek (https://repository.tno.nl/islandora/object/uuid%3A3dc5829d-99a4-4fce-a6e0-4ebca52fb905) accessed 8 March 2023.

2004, Lov om rett til miljøinformasjon og deltakelse i offentlige beslutningsprosesser av betydning for miljøet (LOV-2003-05-09-31).

2021, 'Nettelo - 3D Body Scan and Analysis Mobile Application', Nettelo (http://nettelo.com/nettelo-app/) accessed 30 October 2023.

2022, 'AI Body Measurement Application with Computer Vision', Grid Dynamics Blog (https://blog.griddynamics.com/body-measurement-app-computer-vision/) accessed 30 October 2023.

European Topic Centre on
Circular economy and resource use
https://www.eionet.europa.eu/etcs/etc-ce

The European Topic Centre on Circular economy and resource use (ETC CE) is a consortium of European institutes under contract of the European Environment Agency.

European Environment Agency
European Topic Centre
Circular economy and resource use